GET-3383C

GE PAC* 4000

COMPACT COMPUTER FOR PROCESS CONTROL

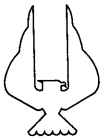
SITE PREPARATION MANUAL

GENERAL ELECTRIC

SITE PREPARATION MANUAL

GE/PAC 4000

PROCESS COMPUTER



SITE PREPARATION MANUAL

- SELECTION AND LAYOUT OF THE COMPUTER ROOM
- SIGNALS, SENSORS, AND CABLES
- INSTALLATION

PROCESS COMPUTER BUSINESS SECTION
PHOENIX, ARIZONA

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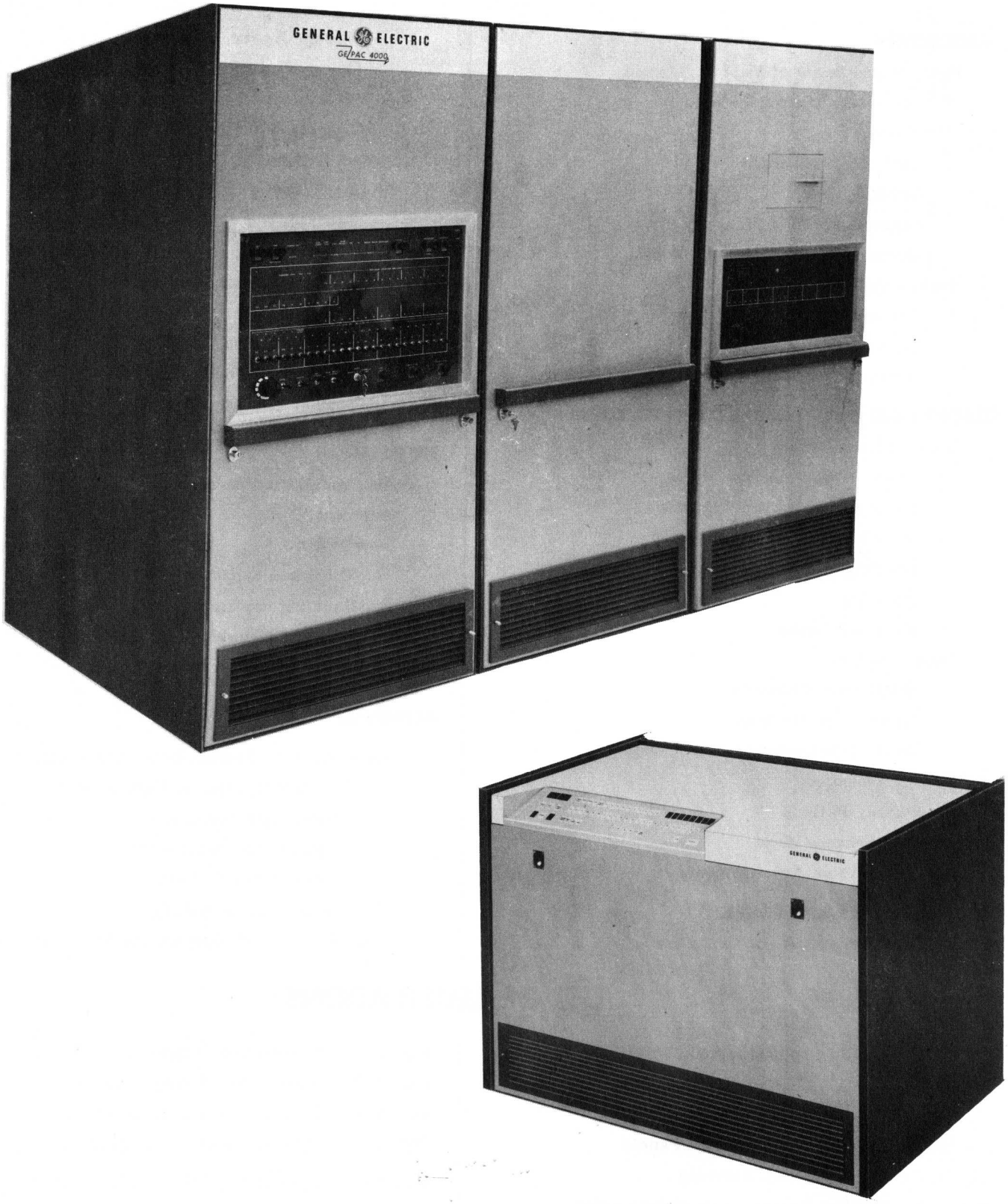

Fig. 1.1 GE-PAC 4000 Computer Systems

INTRODUCTION

PURPOSE AND SCOPE OF MANUAL

The installation and implementation of a process computer system is an intricate, manifold task, whether the application be a simple data logger or an extremely complex process control. The General Electric Company, through its past experience with process computer installations, stands ready to make this task as simple, economical, and effective as possible.

The purpose of this manual is to provide guide lines and reference material to assist our customers through the installation phases of their GE-PAC* 4000 Computer System. The material presented herein is, of necessity, very general but it is the responsibility of your local GE Utility Sales or Industrial Sales representative to answer any specific questions you may have. His sources of information include the General Electric Product Departments and the General Electric Process Computer Business Section.

GE/CUSTOMER COMMUNICATIONS

During the course of designing and building the computer system for a particular application, the programming and engineering groups of the General Electric Company require certain definitive information from the purchaser. Similarly, the purchaser, while designing and building his computer room and while training his maintenance and operating personnel, requires information from the General Electric Company. Fig. 1.2 shows, in the order they occur, common information transfers between the purchaser and the General Electric Company.

From Fig. 1.2, it is seen that the bulk of the data from the General Electric Company to the customer consists of installation reference drawings and tool, test equipment, and spare parts recommendations. This data is basically the same as that given in portions of this manual. See the Table of Contents for specific headings. The installation drawings are first sent to the customer for approval. They are then returned to GE, either approved or approved with comments. After making any necessary modifications, the final drawings are returned to the customer and are considered as approved for construction.

The data transfers from the customer to the General Electric Company are primarily definitions of the interface between the computer system and the process:

- Preliminary System Definition.
- Console Arrangement and Contents.
- Cable Lengths (added to Master Cable Index).
- Complete Input/Output Point Summaries.

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The Preliminary System Definition is a standard form for listing enough data to begin the engineering design phase. This form, in conjunction with the final Bid Specification and Proposal, is the basis for the hardware portion of the system. A typical Preliminary System Definition form is included in Appendix A.

As soon as the hardware requirements are firm, the System Block Diagram, Master Cable Index, and installation drawings (showing equipment size, jack locations, etc.), are sent to the customer. Using these documents and the Selection and Layout of the Computer Room section of this manual as reference material, the computer room is planned and a Site Arrangement drawing is sent to the General Electric Company for review. Cable lengths are added to the Master Cable Index, which is returned to GE to initiate the fabrication of system cables.

Finally, one of the most important operations required of the customer is the complete listing of all analog and digital inputs and outputs. The identification, function, and characteristics of each input or output must be listed. For analog signals, the range, impedance, and common mode, if known, must also be tabulated. Refer to the Signals, Sensors, and Cabling section for reference data and to Appendix A for typical Point Summary forms. The computed Point Summary is sent to the General Electric Company where internal system inputs, outputs, termination points, wiring points, and simplified connection diagrams are compiled and the final Input/Output Information Summary is generated.

The procedures and requirements given in the foregoing pertain primarily to systems sold on a hardware, rather than on a functional basis. If the General Electric Company is responsible for the design of a complete function (for example, to automate a hot strip mill), much of the input and output definitions, etc., are performed by GE system design and application engineers. Conversely, for a strictly hardware sale, the customer must furnish the data on which the system design is based. Most systems fall somewhere between these extremes.

In the early stages of system development, all data transmittals are routed through your local GE sales engineer. Later, direct communications channels are established between General Electric Company's and your engineering, sales, and executive personnel.

MAINTENANCE

The maintenance of a process computer system is extremely important, and the subject must not be approached lightly if the full benefits of the system are to be realized. The General Electric Company, through its contract maintenance service, offers a complete maintenance package to its customers.

Contract maintenance is the easiest and most efficient method of assuring a high degree of system availability. If you desire to maintain your own equipment, perhaps by using existing personnel, the General Electric Company will assist in establishing a maintenance program through its training, documentation, and spare parts services.

Contract Maintenance

Contract maintenance, purchased directly from the General Electric Company, provides our customers with a high degree of system availability at reasonable cost. Under such an agreement, the customer gains full benefit of GE's extensive experience in process computer installations.

Three categories of contract maintenance are available:

- Class I - Resident Maintenance.
- Class II - Periodic, Fixed Rate (includes on-call emergency service).
- Class IIA - Periodic, Fixed and Variable Rate (emergency service after 5:00 p. m. and before 8:00 a. m. extra).
- Class III - Periodic, Variable Rate (on-call service extra).

Resident maintenance provides a qualified Field Engineer on an 8-hour day, 5-day week basis with on-call emergency service outside the normal working hours. The other maintenance categories offer a fixed schedule of periodic service calls during which preventive and corrective maintenance are performed as required. A maintenance contract normally runs for a minimum period of one year with optional termination thereafter on 60-day notice.

GE provides the necessary test equipment required for system maintenance. Spare parts may be purchased by the customer if he maintains his own equipment. Similarly, replenishment parts for the spare parts inventory may be included in the maintenance contract. In any case, the spare parts inventory can be kept to a minimum because of the Field Engineer's intimate knowledge of the parts system and his more direct connection with the General Electric Parts Depot. Other advantages of contract maintenance are:

- Experienced Personnel: General Electric Field Engineers are among the best qualified in the industry to perform system maintenance. In many cases, the same individual who assisted in the installation phase will stay on to perform system maintenance, thus assuring even greater familiarity with the specific application.
- System Improvement: Drawing on his experience and knowledge of the equipment, the Field Engineer may develop special diagnostic techniques tailored to the particular application. The Field Engineer may also point out problems and solutions in the areas of spare parts, operating procedures, and input/output communications.

Leased or rented systems normally include Class IIA Maintenance. Classes I or II Maintenance are available at extra cost.

Training

Training courses in the fundamentals and maintenance of process computers and peripheral devices and in user programming are conducted at the headquarters plant of the Process Computer Business Section in Phoenix, Arizona. The GE-PAC 4000 training program includes the following courses:

PI-1 4040, 4050, and 4060 Central Processor Preparatory Course - Home Study. Prerequisite: BS degree or equivalent.

PI-2 4020 Central Processor Preparatory Course - Home Study. Prerequisite: BS degree or equivalent.

04 4040 Product Service Training - 9 weeks. Prerequisites: BS degree or two years formal electronics training plus two years related maintenance experience. Completion of PI-1.

05 4050 and 4060 Product Service Training - 11 weeks. Prerequisites: Same as 04.

06 Peripheral Device Training - 2 weeks. Prerequisite: Course 04, 05, or 07.

07 4020 Product Service Training - 10 weeks. Prerequisites: Same as 04 except that completion of PI-2 is required.

08 Teletype Printer Training - 1 week. Prerequisite: Course 04, 05, or 07.

09 Card Reader and Card Punch Training - 2 weeks. Prerequisite: Course 04, 05, or 07.

10 Disc Memory Training - 3 weeks. Prerequisite: Course 04, 05, or 07.

11 Line Printer Training - 1 week. Prerequisite: Course 04, 05, or 07.

12 Remote Scanner Controller Training - 2 weeks. Prerequisite: Course 04, 05, or 07.

100 Standard User Programming Course - 4 weeks. Intended for students with little prior computer experience.

200 Accelerated User Programming Course - 3 weeks. Intended for students with prior computer and FORTRAN experience.

The courses are presented in modern, air-conditioned classrooms, using the latest in visual aids and teaching devices. Hardware in various stages of construction is nearby, and operating systems are available for demonstration. All texts and classroom materials are provided. Two 3-hour sessions, with recesses, make up the classroom day; the pace is intensive, and outside study and preparation are required.

Complete course outlines, schedules, registration information, and other details are available from your nearest Industrial Sales or Electric Utility Sales office.

Spare Parts

A list of recommended spare parts for each GE-PAC Process Control System is compiled three weeks before shipment of the system. The recommended spare parts list is carefully tailored to the specific system, based on failure rate statistics of previous systems, and includes both complete replacement assemblies and individual electrical and mechanical components. The completed list is sent to the user, who may add or delete items at his discretion, then returned to General Electric for use in the accumulation of the final inventory of spare parts.

The user may, if he desires, have the recommended spare parts quoted as part of the original system requisition. Since the actual hardware involved in the system is not completely defined at this time, the price of such a spare parts quotation can be considered only as a target value. Under no circumstances can an itemized list of recommended spare parts be provided with the original requisition.

In addition, when the recommended spare parts are quoted separately from the requisition, the initial inventory is usually offered at a substantial discount. If spare parts are included in the system requisition, these parts are considered as the initial purchase and no further discounts will apply to subsequent spare parts procurements.

Recommended Test Equipment

Oscilloscope, Hewlett-Packard HP-180A, or equivalent.

- Dual Trace Vertical Amplifier, Hewlett-Packard HP-1801A, or equivalent.
- Sweep Delay Generator, Hewlett-Packard HP-1821A, or equivalent.
- Oscilloscope Probe 10:1, Hewlett-Packard HP-10001B, or equivalent.
- Oscilloscope Probe 10:1, Hewlett-Packard HP-10001D, or equivalent.
- Current Probe, Hewlett-Packard HP-1110A, or equivalent.
- Voltage Divider Kit, Hewlett-Packard HP-10035A, or equivalent (4 required).

VOM, Simpson 260RT, or equivalent.

DC Voltmeter, Calibration Standards DC200B, or equivalent.

The following items are optional:

- Polarized Viewing Hood, Hewlett-Packard HP-10180A, or equivalent.
- Test Mobile, Hewlett-Packard HP-1118A, or equivalent.
- Oscilloscope Panel Cover, Hewlett-Packard HP-10166A, or equivalent.

These items are listed for convenience in specifying test equipment. The General Electric Company suggests that the customer order directly from a vendor of his choice but will quote and supply test equipment on request.

Quotations for test equipment must be separate from computer system equipment even if specified as part of the customer's original quotation request. The optional items are available through General Electric only when the standard list of test equipment is purchased at the same time.

DOCUMENTATION

The detailed documentation required to understand and maintain a process computer system is provided by the various engineering drawings and instruction books. Upon system acceptance, the customer is furnished two copies of each applicable engineering drawing. Additional copies or reproducibles are available at extra cost. Six sets of instruction books are provided with purchased systems. Rented or leased systems are provided with one set of instruction books. The categories of documentation are discussed in the following text.

System Drawings

System drawings are those which pertain to the system as a whole, rather than to specific items of

hardware within the system. It is the function of these drawings to specify the overall organization of the system and to act as a guide in the installation phase. The drawings which fall within this category are as follows:

- System Block Diagram: Shows the major components, cabinets, peripheral units, and connecting cables supplied by GE.
- Outline Drawings: Show overall dimensions and mounting details, cable entries, clearance requirements, and approximate weight of each item of equipment.
- Installation Outline Index: A complete listing of the above outline drawings, cross-referenced to the System Block Diagram.
- Special Console Panel Layouts: Shows the arrangement and nameplate identification of each device on all GE furnished control stations and display panels.
- Master Cable Index: A list of the interconnecting cables between all major GE furnished units, giving the cable assembly drawing number, description, diameter, length and cable routing classification.
- I/O Information Summary: Includes a description and identification number of each analog or digital input or output to the computer system, wiring and termination information, typical signal routing schematics, and programming address information.

Equipment Drawings

The documentation of the actual hardware is accomplished on a modular basis using two main categories of drawings: Schematic and Wiring. The specific items within this classification are as follows:

- Logic Schematics: Show, by means of graphic symbols, the electrical connection and function of the computer logic.
- Circuit Schematics: Show the actual electrical schematics of the various printed circuit boards, along with circuit parameters, function, and other pertinent information.
- Wire Lists: Provide a tabulation of all point-to-point wiring within the cabinets and consoles of the system.
- Cable Drawings: Show the destination, length, pin location, wiring, and signal assignment for each cable on the Master Cable Index.

Instruction Books

A standard issue of six sets of Instruction Books is provided with each GE-PAC Process Control System sold. These books contain detailed theory of operation and maintenance information written to the level of a skilled electronics technician who has attended the GE-PAC Training Courses. Each set of Instruction Books is comprised of four volumes, arranged as follows:

- Volume I - System Power, and Central Processor.
- Volume II - Process Communication.
- Volume III - Data I/O and Storage.
- Volume IV - Operating Instructions and System Programming.

Each book is made up of "standard writing", which describes the standard modular building blocks of the system, and "special writing", which describes the various interface areas, special equipment, and special modifications to standard equipment. The price of the standard writing is included in the basic price of the system. Special writing is quoted separately, however, since it varies considerably with the size and complexity of the system.

The initial shipment of Instruction Books is made up of all the standard writing, plus as much of the special writing as has been completed at the time of shipment; the remainder of the special writing is shipped and collated into the books at a later date. Of the six sets of books in the standard issue, one set is shipped with the equipment for use in the installation phase; this set is placed permanently in the maintenance area, becoming the marked-up "working document" of the maintenance personnel. The remaining five sets of Instruction Books are shipped separately and their distribution left to the customer's discretion. One set of standard books is furnished with rental systems.

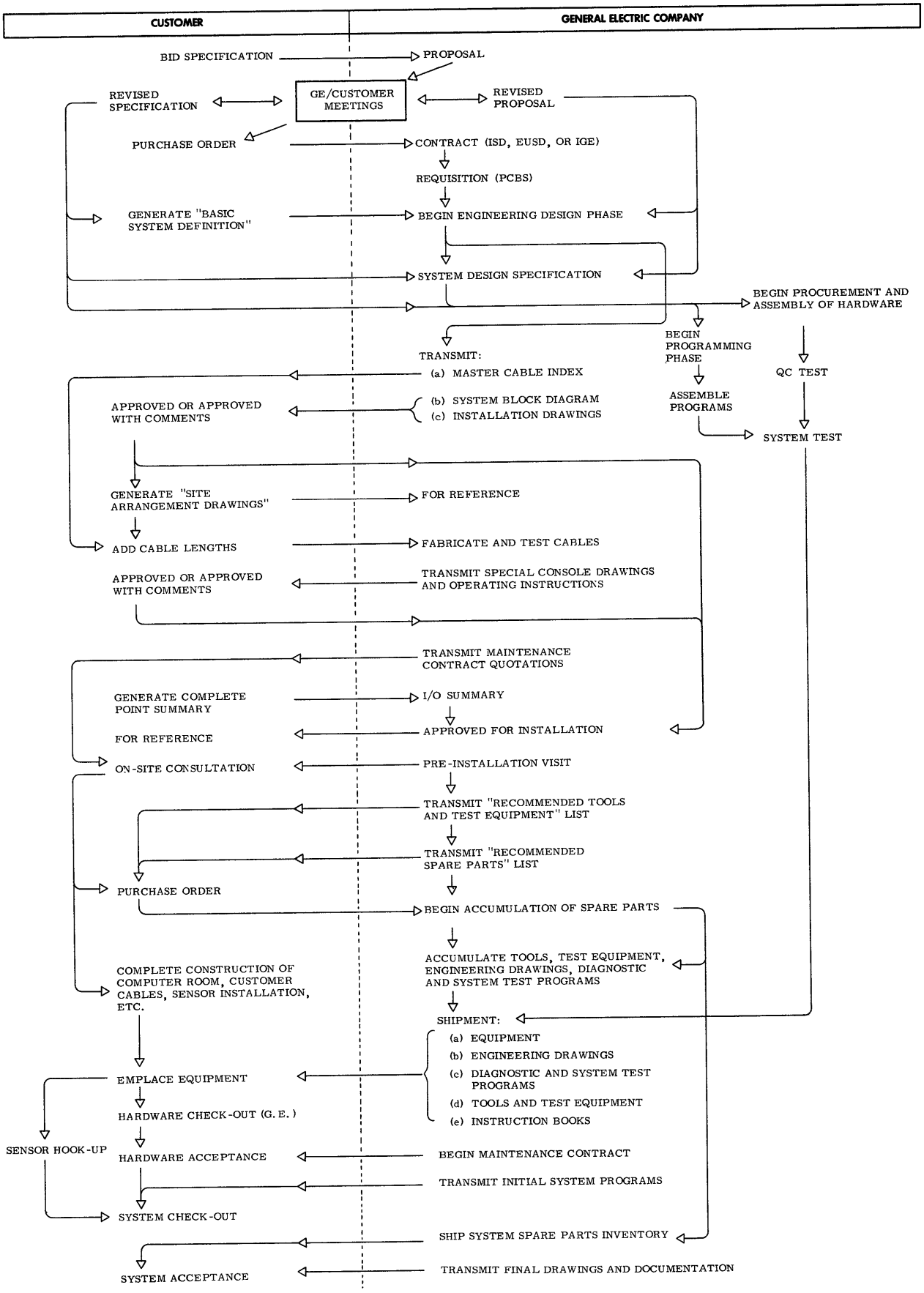


Fig. 1.2 Typical Design and Installation Flow Chart

SELECTION AND LAYOUT OF THE COMPUTER ROOM

Another important job to be accomplished by the customer is the design of the computer room. Although this task requires only a short period of time compared to the overall life of the system, the quality (or lack of quality) of the result will be felt every minute the system is in use. The three main objectives of computer room design should be:

- Utility - First and foremost, arrange your equipment for ease of operation and maintenance.
- Expansion - Build in a flexible expansion capability to allow for the future planned growth of your system.
- Appearance - Your computer room will often be a focal point of interest to employees as well as to visitors - keep it uncluttered, modern, and attractive.

The remainder of this chapter is devoted to the various aspects of room selection and arrangement; further references are found in Appendix B.

GENERAL INFORMATION

Power Requirements

The basic line input to a GE-PAC system is 115/230V AC $\pm$10%, 60 Hz $\pm$1 Hz (50 Hz optional), 3-wire single phase with grounded neutral. The input power requirements vary with the size of the computer system. A typical 2-cabinet system, excluding peripheral devices, might require 6 KVA. However, the power requirements for special systems could approach 25 KVA. Power for peripheral devices (115V AC) is normally taken from the standard wall outlets near the peripheral stations and runs approximately 50 - 1500 watts per device.

With the exception of AC for peripheral devices, all power for a GE-PAC system is routed through the Main AC Distribution Panel which is optionally located in either the Central Processor cabinet or the Power Distribution cabinet. Typical panel assemblies are shown by Fig. 2.1. The main circuit breaker is rated at 30A, 50A, or 100A, corresponding to 7 KVA, 12.5 KVA, or 25 KVA maximum system power consumption.

Throughout the AC distribution circuitry, great care is taken to eliminate any transient noise which might appear on the input lines and to prevent any 50 or 60 Hz radiation from coupling to the logic wiring. Transients are eliminated by RF filters in both the primary power input and branch distribution circuits. AC coupling is eliminated by twisted-pair wiring and solder-finish ground planes inside the distribution panels, and by the use of shielded power cables external to these panels.

Shielding of the primary input lines is very important and is the responsibility of the customer. Power input shielding is accomplished by routing the lines through conduit all the way from the AC source to the Main AC Distribution Panel in the computer. The conduit is referenced to earth ground at the source but is isolated from computer ground at the computer to prevent ground loops (system grounding is discussed in the next section).

Although extensive measures have been taken to make the system insensitive to line conditions, system performance depends on the quality of the primary power input. While RF filtering techniques eliminate normal noise on the input lines, it is not possible to store sufficient energy within the system to compensate for significant line transients. Quantitative description of acceptable and unacceptable transients is impractical since this is a function of many uncontrollable variables such as amplitude, frequency, and phase. If there is significant doubt as to the condition of the input line, however, there are several corrective methods that can be employed:

- A motor-generator with a large flywheel as a transient buffer.
- A static inverter as a transient buffer.
- Use of the Automatic Restart option to allow controlled shutdown on large line transients and automatic resumption of operation after the transient has passed. (This is not always a practical solution on lines with frequent large transients because of the excessive time lost in startup and shutdown.)

Prior to the installation of the main branch lines for the computer power input, the customer should consult the GE System Engineer to determine the total power requirements of his system (including future expansions). At this time, it should also be established if some form of emergency power such as the GE Model 4795A Auxiliary AC Source is warranted.

Environmental Specifications

Through careful engineering and the exclusive use of solid state devices, the electronic components of a GE-PAC Process Computer system will operate satisfactorily over the wide range of environmental conditions found at industrial and utility sites. The acceptable limits of environment include any combination of the following:

- Temperature

  During Storage: -40° F to 158° F.

  Operational Ambient: 32° F to 131° F (see Audible Noise Suppression).

  Operational Transient: 0.45° F/minute.

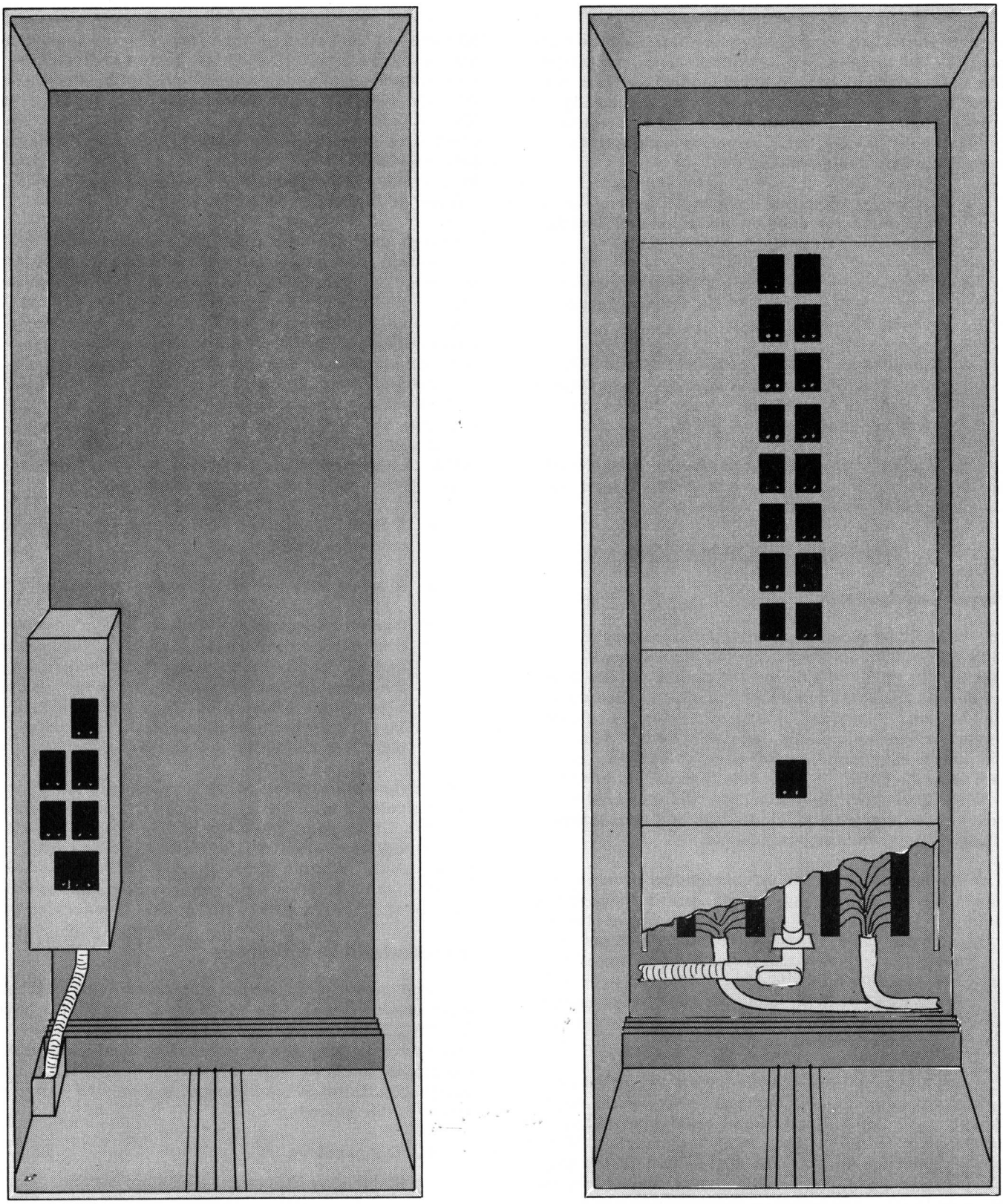


Fig. 2. 1 Main AC Distribution Panels

- Relative Humidity: 5 to 95% (see exception below).

- Vibration

  During Shipment: 1g ±0.2g at 5-60 cps.

  Installed: 1g ±0.2g at 15-120 cps and 0.07 inches peak-to-peak displacement at 5-15 cps.

- Shock: 15g's for 2 milliseconds.

- Atmosphere

  Dust from material such as steel scale, coal, cement, paper, and lint. Particles 10 microns and larger are removed by internal air filters.

  Corrosive atmospheres containing normal concentrations of salt, chlorine, sulfur gases, oil mist, and gas by-products from natural gas or coal furnaces. Normal concentration of the more common contaminants are defined as not more than 10 parts per million of chlorine, hydrogen sulfide, sulfur dioxide, and sulfuric acid (aerosol vapor), and not more than 0.1 ppm of chlorine dioxide. (Note: These are the lethal dose parameters for human beings.)

In those systems which use an analog scanner, some degradation of the analog performance specifications occurs with relative humidities in excess of 60%. In addition, the various items of peripheral equipment, due to their electro-mechanical nature, are more susceptible to atmospheric dust and corrosive substances than the electronic computer hardware. Thus, in a dusty or corrosive environment, peripheral equipment should be protected by one of the enclosed peripheral stations discussed later in this section. Overall room air conditioning and filtering is not necessary except for the comfort of operating personnel or for the removal of excessive atmospheric contaminants, although the user should note that the GE-PAC System will add considerable heat to its area, which should be removed somehow.

Audible Noise Suppression

The suppression of audible noise is not a major factor in the planning of the computer room. No noise, other than that generated from the blowers, may be expected from the computer cabinets. The various peripheral units (e.g., typewriters, paper tape punches, line printers, etc.) generate about the same noise level as the average electric typewriter. Thus the primary source of noise to be considered is the activity of the process machinery near the computer area. In most instances, standard hollow-wall and acoustical ceiling construction is more than sufficient to compensate for plant noise. It should be noted that the computer and associated equipment are not affected by audible noise in any way. The equipment operators, however, should be given the same protection as office workers in the area.

The amount of audible noise generated by the GE-PAC blowers can be reduced substantially by specifying the low speed blower option provided that the computer room environment can meet a reduced maximum operational ambient temperature. Since noise reduction is accomplished by reducing blower RPM which in turn reduces the cooling air volume flow rate, this option should not be specified if the maximum room temperature exceeds 113°F (45°C).

Lighting

Good lighting in the computer area is an important factor in reducing operator fatigue and in enhancing the appearance of the installation. An average illumination of 60 foot candles measured 30 inches above the floor is usually sufficient. Diffused fluorescent lighting is recommended because it is free of shadow and glare and relatively economical to maintain.

Flooring

The flooring used in GE-PAC Process Control installations is selected primarily for its practicality and durability. The following factors enter into its selection.

- Floor Loading: Must support a maximum of about 200 lbs/sq. ft. under the computer cabinets.

- Cabling: Must provide for dry, protected cable runs and for easy cable entrance into the various cabinets.

- Equipment Mounting: Must provide a means of rigidly securing the computer cabinets.

- Cleanliness: Must have a smooth, level surface which is easily kept free of dust, grease, etc.

Probably the most common flooring used in process installation is the concrete slab with or without a tile surface. This type of flooring is economical to install and maintain but poses problems in cable routing and system expansion. In most cases, recessed cable troughs, with metal risers and drainage outlets to prevent moisture from contacting the cables, are used (see Fig. 2.2). If noise pickup is a problem, the cable troughs must be lined with metal sheeting (see Cabling Practices in the next section). Because of the permanent nature of concrete flooring, the dimensions and layout of the recessed cable troughs should be compatible with any planned expansion of the computer system. Alternately, cables can be run in suspended troughs either overhead or, if possible, underneath the floor.

Noise pickup can be eliminated by fabricating the troughs from expanded metal.

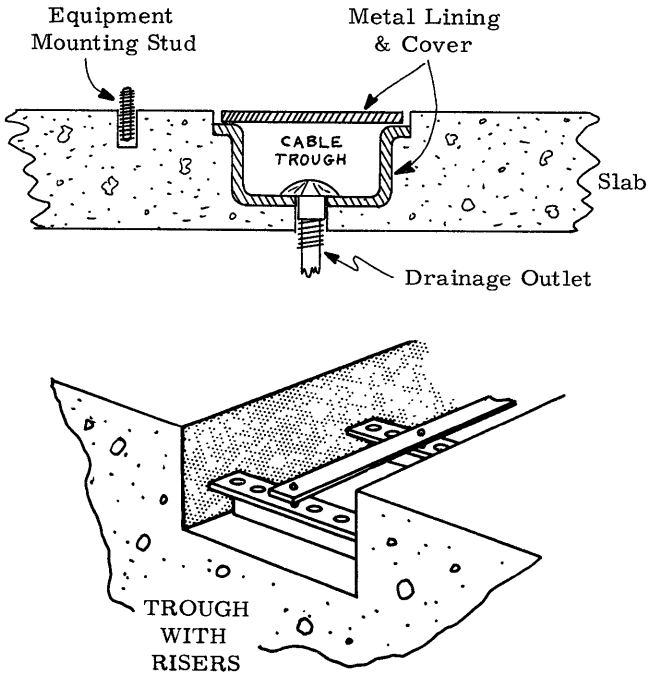


Fig. 2.2 Concrete Slab Flooring

The best all-round flooring for GE-PAC Process Computer installations is the false, or raised, floor shown by Fig. 2.3. Although somewhat more expensive than the concrete floor, raised-floor construction offers several very real advantages.

- Ease of Installation: The floor is easily and quickly installed by means of individual leveling jacks, bolt-on beams, and removable floor panels.
- Simplified Hardware Installation: The computer cabinets are easily secured by simply bolting to the floor panels.
- Simplified Cabling: Cables are laid directly underneath the floor. Since the entire subfloor area is accessible when the floor panels are removed, the initial cabling job is accomplished with a minimum of time and effort. Also, since no pre-determined cable paths are necessary, shorter, point-to-point cabling is possible.
- System Expansion: The addition of new hardware, with its associated cabling, is greatly simplified.

Several manufacturers offer complete raised-floor installations. For further details, contact your nearest Industrial Sales or Electric Utility Sales office.

Floor covering is not required in process computer installations, although it does much to augment the general appearance of the area. As a rule, any fairly smooth surface which can be easily cleaned will suffice. If a floor covering is to be used, vinyl or vinyl-asbestos tile provides an attractive, durable surface. Asbestos tile chips easily with wear and is therefore not recommended. Rugs or carpeting, because of their dust-retention properties, are similarly not recommended.

Keys and Locks

The computer room, maintenance area, peripheral rooms, spare parts rooms, etc., should be provided with key-lock doors to prevent the entry of unauthorized personnel. For maximum efficiency and convenience, one key should fit all the locks and all personnel should have their own key.

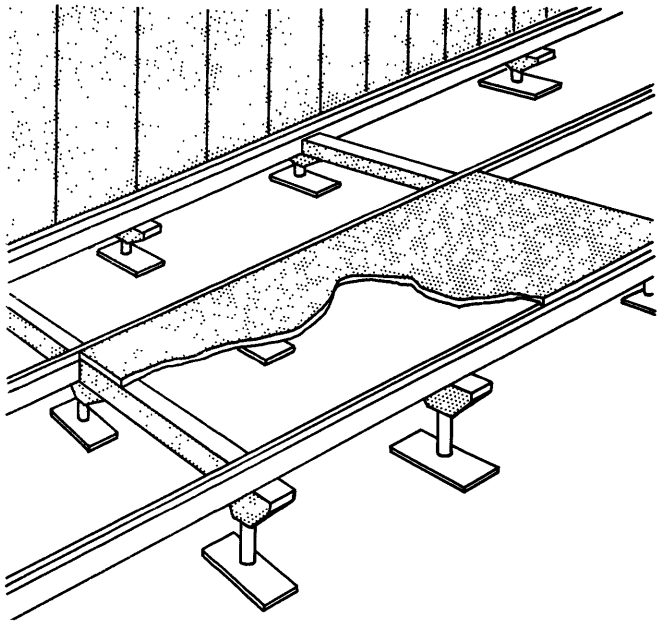


Fig. 2.3 Typical Raised Floor Construction

MAJOR CABINETS

All the electronic circuitry of a GE-PAC Process Control system is housed in heavy-duty industrial-type cabinets. The packaging technique, unique to the process control field, allows complete and easy access to all components, devices, and terminations from the front of the cabinet.

All cabinets are fabricated from 0.105-inch steel. The interior and front panels are painted light gray (ASA 61) and the remainder of the exterior is textured dark gray (ASA 33). Other colors are available

on special order. All printed wiring boards are contained in hinged panels called pages because of their resemblance to pages of a book. Termination strips, power supplies, and other devices are mounted on the side and back walls inside the cabinet. Cable entry points are provided at the bottom rear of each cabinet. Cabinets can be bolted to the floor and shims used for leveling. No special foundations are required. A ground connection is provided within each cabinet to provide for adequate protection of operating and maintenance personnel. Equipment installation outline drawings are provided in Appendix B.

Multi-Page Cabinets

Multi-page cabinets, shown by Fig. 2.4, are used to house the majority of the electronic system hardware. Access to interior components is obtained by unlocking a front-panel latch and pulling the roll-out assembly straight forward; ball-bearing wheels and mechanical guide assemblies assure easy and positive movement. All electrical connections from the roll-out assembly to the cabinet are made by means of cables strung on a flexible gate; this gate physically limits the travel of the roll-out assembly.

Three card pages are mounted vertically on the roll-out assembly. Hinges are provided on the left- and right-hand pages, allowing them to swing out for complete access to both sides of all pages; the center page is fixed. Each page is approximately 6 1/2 inches deep and holds up to 10 rows of printed-wiring boards; each row accommodates a total of 18 printed-wiring boards, one of which is a connector board, giving a maximum of 170 working boards per page. Other devices, such as maintenance test panels, core memories, etc., can be mounted on these panels if desired.

Signal termination "sticks" and the majority of all power supplies and other devices (other than printed-wiring boards) are mounted on the left-hand and rear interior walls of the cabinet. Cable ports are provided at the rear of the bottom, right- and left-hand cabinet panels.

When required, the roll-out assembly houses an easily-removable blower and plenum which distributes 200 cfm of ambient air to each of the three pages and an additional 100 cfm of air to components mounted on the side walls. Air is drawn into the cabinet through the frontal grillwork and is exhausted through drip-proof louvers in the top of the cabinet.

The overall dimensions of this cabinet are 76 inches high, 32 inches wide, and 36 inches deep. With the roll-out assembly fully extended, the depth is increased to about 81 inches. With the pages swung out, the width is increased to about 46 inches. The cabinet may be mounted against a wall or flush with equipment on either side. To allow easy movement of the roll-out assembly, the floor should be flush and level to $\pm 1/4$ inch for three feet in front of the cabinet.

Single Page Designs

Three options are available for housing small groups of components and/or printed-wiring boards:

- Free-standing single page cabinet.
- Single page - hinged.
- Single page - fixed.

The free-standing cabinet is identical in construction to the multi-page cabinet described previously. A front cover and a full-sized page are hinged at the right front corner of the cabinet. Space is available between the back wall and the hinged page for mounting power supplies and other devices, and a large cable opening takes up the bottom of the cabinet. The overall dimensions of the cabinet are 76 inches high, 32 inches wide, and 36 inches deep. Digital and analog input/output cabinets measure 44 inches wide and 36 inches deep.

It is also possible to mount a full-sized page, with supporting hinge, in existing structure or cabinets within the plant or, if the mounting is accessible from both sides, the page may be mounted without its hinge (fixed mounting). The dimensions of this package are 24 inches wide, 10 inches deep, and variable height.

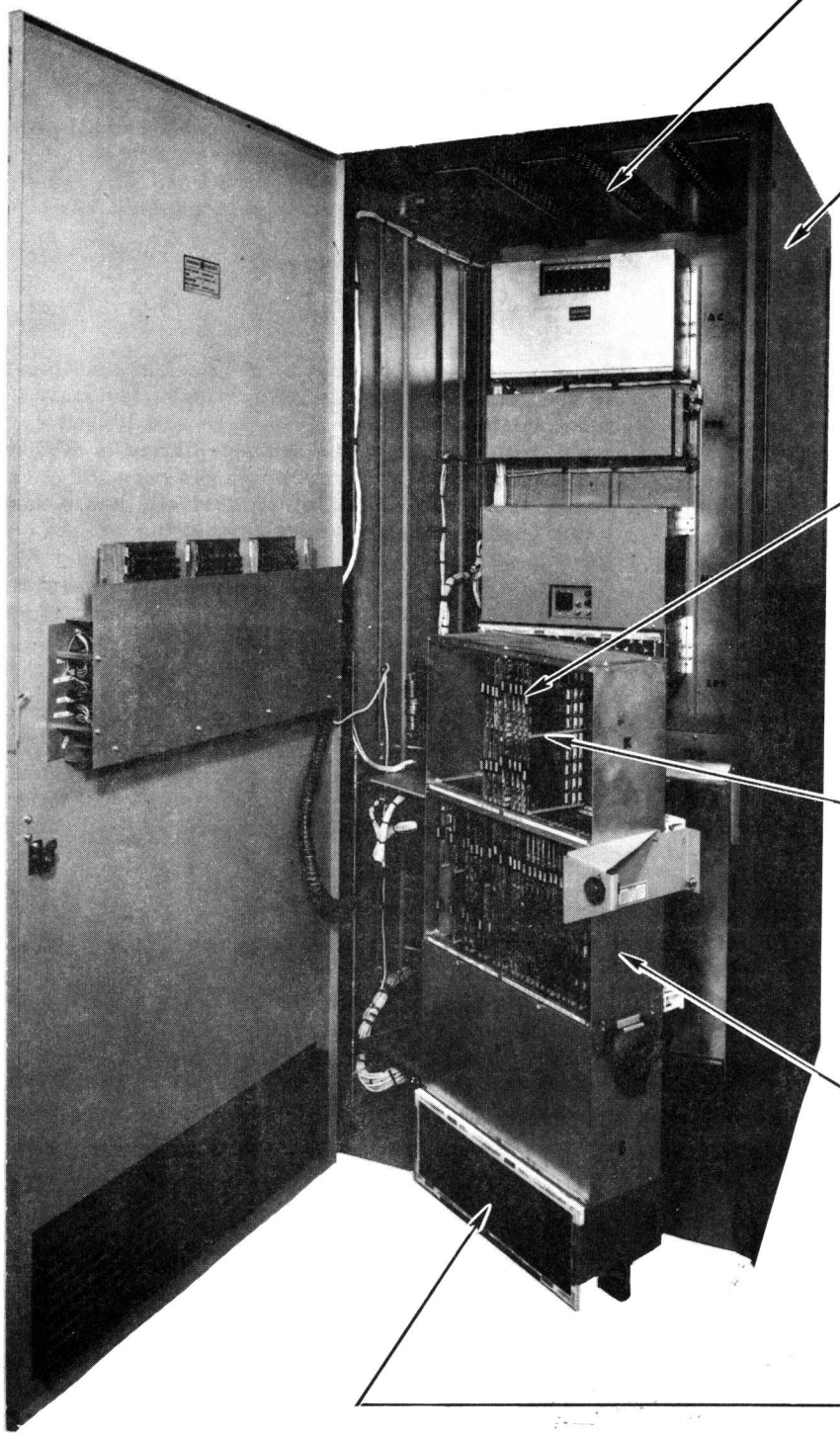
Desk Style Designs

The central processor for a GE-PAC 4020 System is also available in a desk style cabinet that measures 35 inches high, 60 inches wide, and 35 inches deep. Circuit card panels, power supplies, blowers, and the core memory unit are mounted on three, easily accessible pages. Each logic panel accommodates 32 circuit cards.

SYSTEM CONSOLES

In addition to the standard computer cabinets and consoles, a typical system contains one or more special consoles that implement the vital interface between operating personnel and the computer system. Through these consoles the computer can display the state of the process, warn of alarm or error conditions, and output visual data to the operator. Conversely, the operator can manually request logs, change limits, and enter process data into the computer program. Communications with these consoles is normally implemented by the computer's Digital Input/Output logic.

Figs. 2.5 and 2.6 show examples of typical system consoles. The basic panel components include:



DRIP-PROOF LOUVERS

Allow air exhaust but prevent condensation or external moisture damage.

INDUSTRIAL CONSTRUCTION

Sturdy, yet lightweight unit is built to withstand a wide range of environments. Small systems in a single cabinet (32" wide x 36" deep x 76" high) save space This cabinet meets NEMA I standards for industrial use.

PRINTED WIRING BOARDS

Boards are mounted in panels of up to 32 cards per panel. Each board slides in and is held by its mating connectors. Interconnections between boards are on the back of each page.

INTEGRATED CIRCUITRY

Monolithic integrated circuits reduce the number of active components, connections, and wiring, improving system reliability.

HINGED PAGES

All printed wiring boards are mounted in pages. This provides easy access to all components.

BLOWER AND VENTILATION SYSTEM

Internal air flow through vent in front, in and around pages, and out the top eliminates need for special cooling in applications up to 131° F.

Fig. 2.4 4020 System Single Page Cabinet

- Switches: Pushbutton (including mechanical interlock and holding coil types), rotary, thumbwheel.
- Indicators: Color-coded, single or double display, engraved markings.
- Indicator Switches: Combination pushbutton switch and single or double color-coded display.
- Decimal Displays: 12 characters per display; any number of displays in a bank; +, -, 0-9 standard; any letter or symbol optional.

Other devices such as intercoms, alarm horns or buzzers, strip-chart recorders, etc., can be added at the customer's discretion.

These components are usually grouped into functional areas on the console panel, with engraved name tags and painted flow markings added as operator aids. In addition, the indicators and indicator switches are color-coded to allow quick visual interpretation of the displayed information. A typical color-code would be:

- Red - Warning, error, or alarm.
- Yellow - Operator's attention.
- Green - Normal or data.
- Clear - Off.

The physical construction of a system console varies with the environment in which it is to be used. It can be free-standing, mounted on top of a table, or rack-mounted, with or without a dust- and gas-proof enclosure. Consoles used in the computer room are of modernistic design and are usually painted to match the other computer equipment. Consoles used on a factory floor are often simple, rugged panels of anodized aluminum with heavy-duty switches and with displays that can be read from a distance.

All consoles are fitted with jacks to receive data cables from the computer. Any necessary 115V AC input will be taken from a nearby convenience outlet. A grounding stud for the console cabinet must also be provided.

The design of a special system console is usually a joint GE/customer effort with the original rough layout and parameters generated by the customer. For further details, consult your local Electric Utility Sales or Industrial Sales representative.

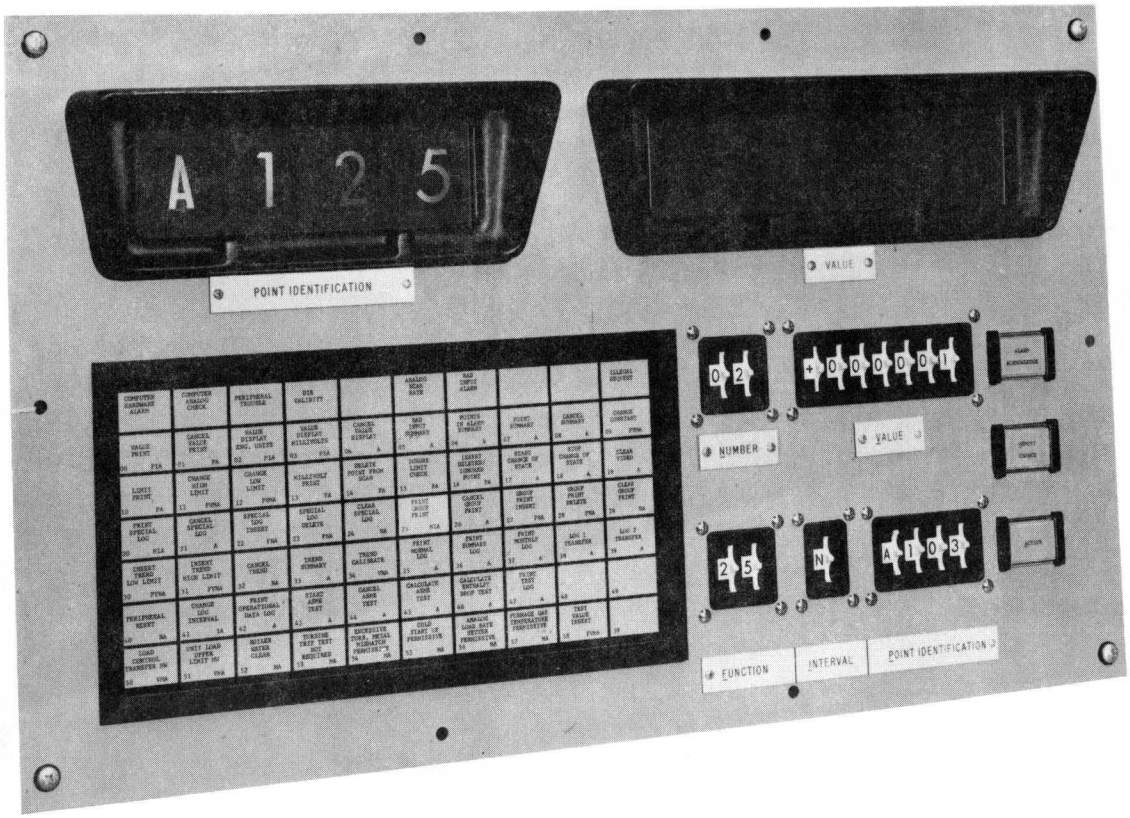
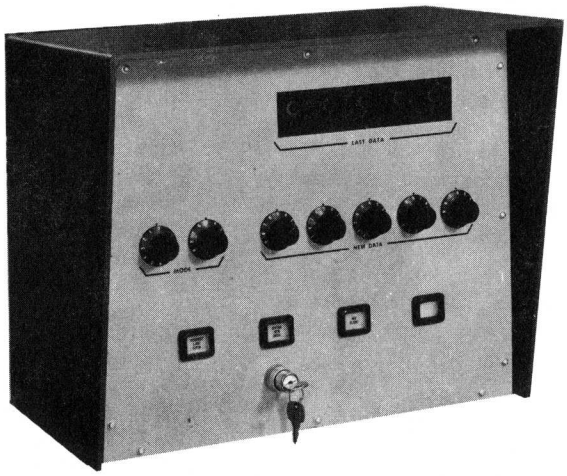
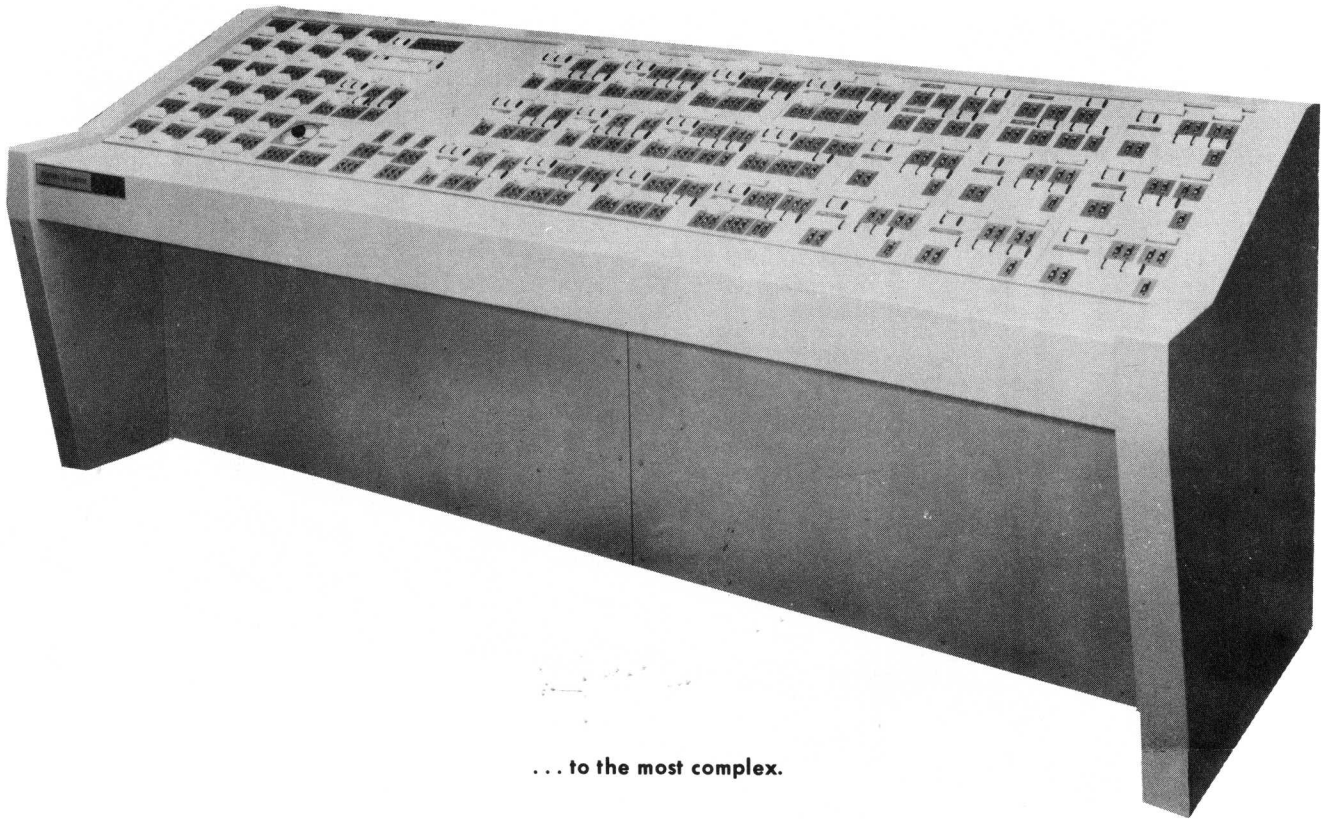


Fig. 2.5 Typical Console Panel Arrangement

Special system consoles . . .



. . . range from the simplest . . .



. . . to the most complex.

Fig. 2. 6 Typical System Consoles

PERIPHERAL STATIONS

The typewriters, paper tape readers and punches, and card readers of a GE-PAC system are complex electro-mechanical devices that are designed to be operated in a somewhat protected environment. Excessive dust, temperature variation, and high humidity have a detrimental effect on the operation and overall life of these devices.

The General Electric Company offers a line of attractive dust-proof enclosures to protect the system peripheral devices from environmental extremes. As shown by Fig. 2.7, these enclosures consist of a hinged, transparent cover mounted on a matching table. These tables are also available separately for use in the computer room or other protected area. The enclosures are available in four lengths (30, 42, 60, and 72 inches), allowing a variable number of devices to be mounted. Hinged doors provide access to shelves inside the tables. The shelves can be used for storing paper, rolls of tape, maintenance supplies, etc. A continuous paper feed option is available for the fan-fold paper used by typewriters. Data cables are routed through cut-outs in the bottom of the table and then through holes in the tabletop to the peripheral devices. Convenience outlets for the necessary 115V AC inputs to each device can be mounted inside the tables. Installation outlines for the various enclosures are included in Appendix B.

THE MAINTENANCE AREA

The maintenance area is used primarily as a storage area for tools, test equipment, prints, and spare parts and as a work station for the off-line repair of peripheral units, instruments, etc. A traffic-free, uncluttered area about 6 x 12 feet in size is suggested. The area should have good lighting and convenient access to the computer equipment. The various items that go into the maintenance area, shown by Fig. 2.8, include:

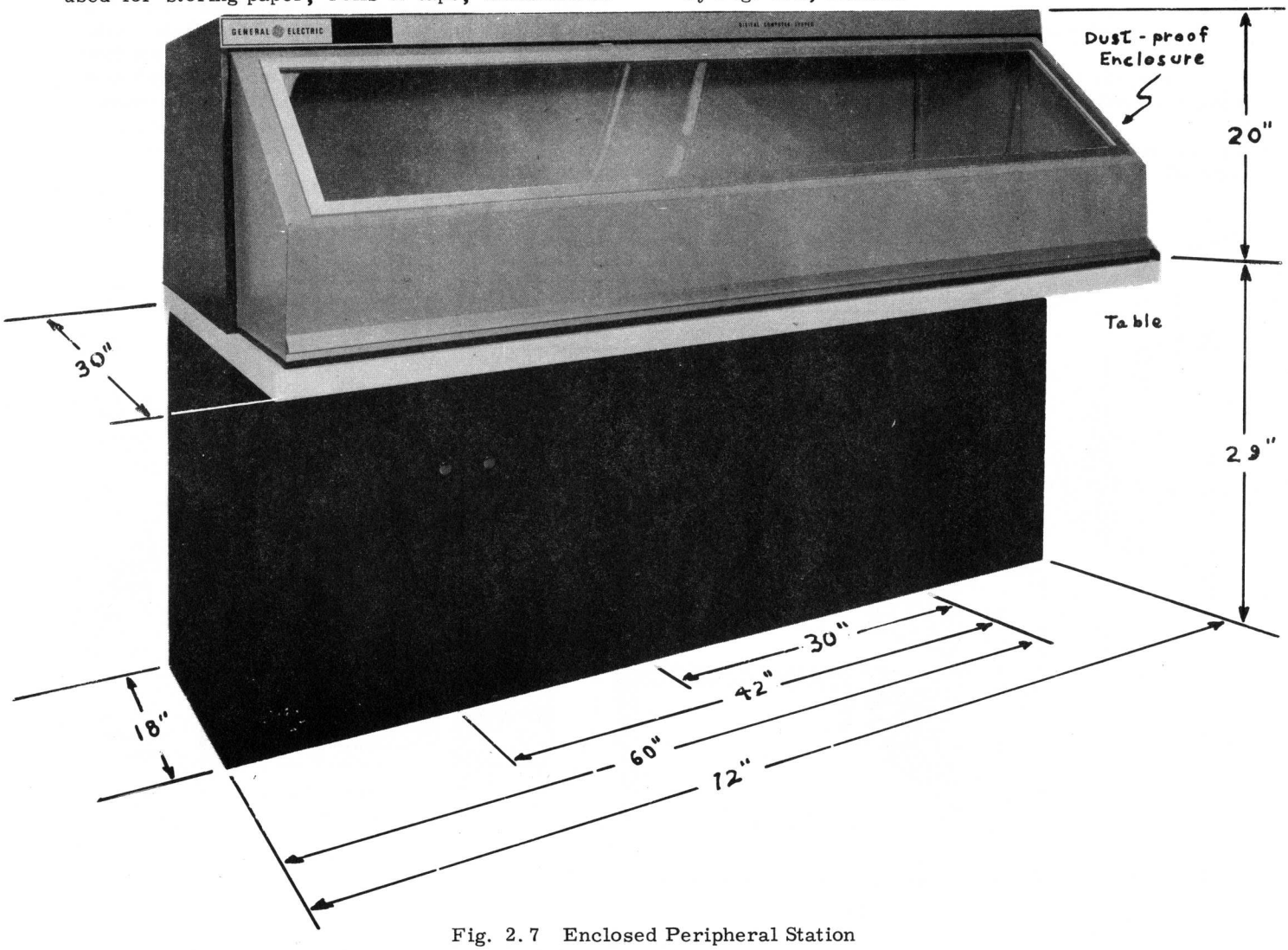


Fig. 2.7 Enclosed Peripheral Station

- A 4- or 5-drawer file cabinet for prints, etc.
- A 1 x 5-foot shelf for instruction books and test equipment.
- A 5-foot (minimum) workbench with a durable non-conducting working surface.
- A rubber floor mat that extends the full length of the workbench.
- A minimum of three duplex, grounded 115V AC outlets.
- A #6 AWG (minimum) solid copper ground bus stretched tightly just above, and the full length of, the workbench. The bus should connect to AC safety ground by clamping or silver-soldering it to the outlet boxes.
- A spare parts storage area.
- A parking place for the oscilloscope cart.

If possible, the maintenance area should also include a standard office type desk and chair.

For spare parts storage, the General Electric Company offers a special two-door storage cabinet fitted with circuit board racks, parts drawers, and a bulk storage area. This cabinet is shown by both Fig. 2.8 and Fig. 2.9. For further information, contact your local Industrial Sales or Electric Utility Sales office.

SUGGESTED ROOM ARRANGEMENTS

Two typical computer installations, one large and one small, are shown by Figs. 2.10 and 2.11. Although no two systems will be arranged alike, these typical systems give some insight into the problem of room and equipment arrangement.

The small installation, shown by Fig. 2.10, is laid out with the stress on future expansion. Ample space is allowed for additional cabinets adjacent to the existing two-cabinet complex. Additional peripheral stations or cabinets could be placed in the center of the room without obstructing access to the instrument panels. A 4-foot wide, unobstructed path is available for moving equipment into the room. The maintenance area is situated near the main work area and is not visible from the observation windows near the computer. Notice the movable desk and chair, which can be placed either in front of computer console or against the wall next to the computer cabinet. The total area of this room is about 900 square feet.

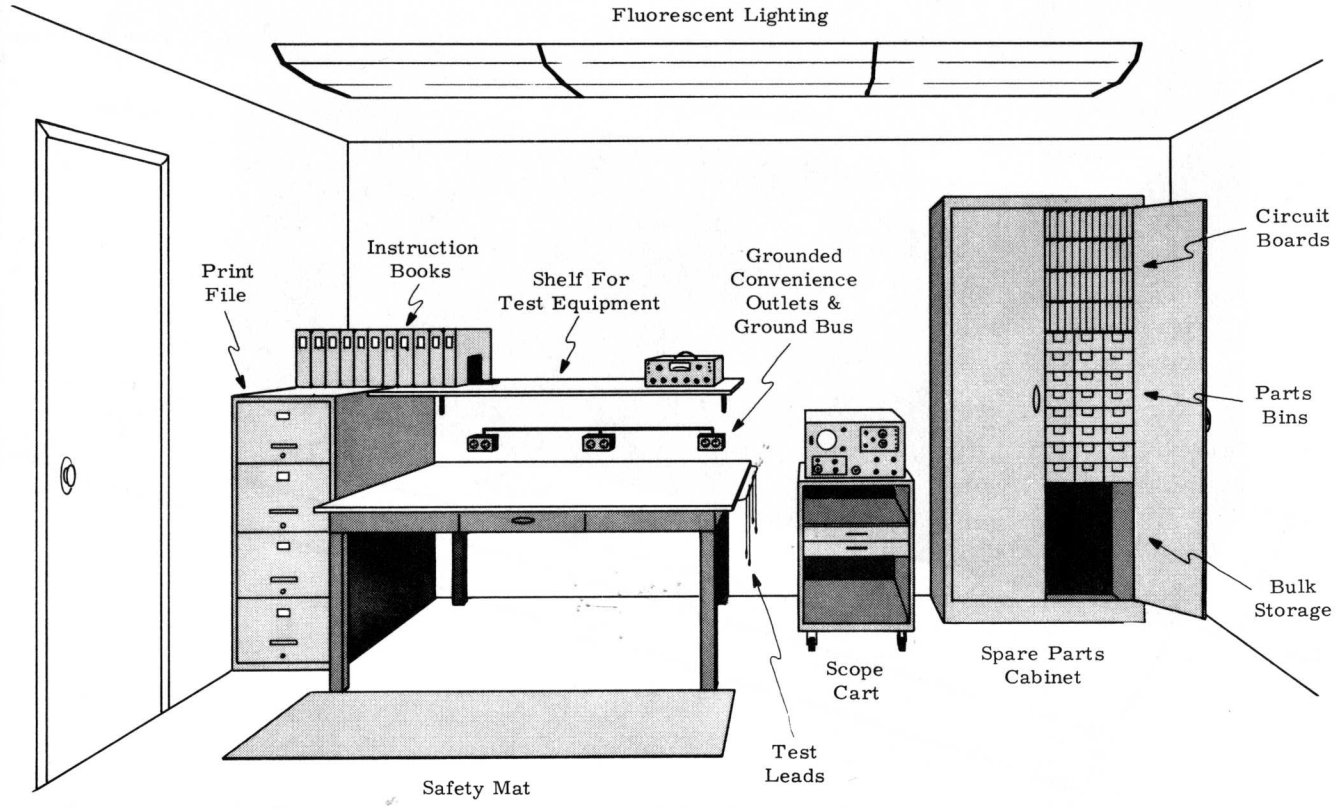


Fig. 2.8 A Desirable Maintenance Area

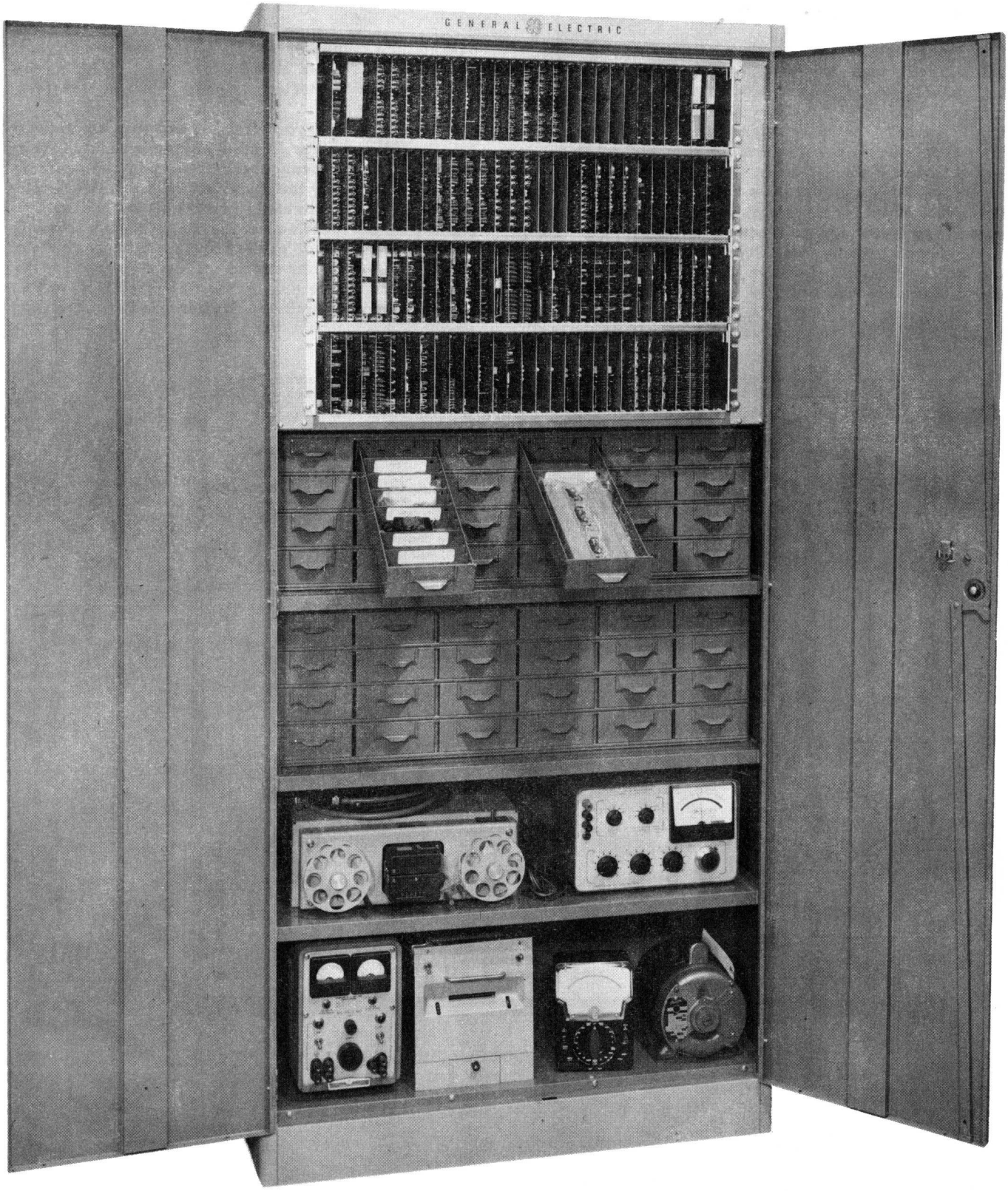


Fig. 2.9 Spare Parts Storage Cabinet

The large installation, shown by Fig. 2. 11, is laid out with emphasis on the functional requirements of the installation, stressing work flow to and from the main operator' s station. System expansion is not a factor since the system begins at or near its maximum size. The basic features of this system (i. e. , 4-foot access path, adjacent maintenance area, observation windows, etc.) are essentially the same as those described for the small system. Notice that the spare logging and alarm typewriters are located close to the operator' s station. Trend recorders, indicator lights, decimal displays, and manual switches may be mounted on both the main operator' s panel and on the instrument panels. Annunciator panels can be mounted above the observation windows on the wall between the computer room and the operator' s station. The overall size of this installation, including the main operator' s station, is about 1500 square feet.

Prepare a room layout drawing showing the relative location of remotely located equipment and, if possible, the route over which the equipment will be transported during the installation. A separate plan view should be provided, preferably to the same scale and perspective as the room layout drawing, showing locations of cable troughs, air ducts, etc. After completing the layout of the room, a copy of the plans should be sent to the General Electric Process Computer Business Section for inspection and possible suggestions.

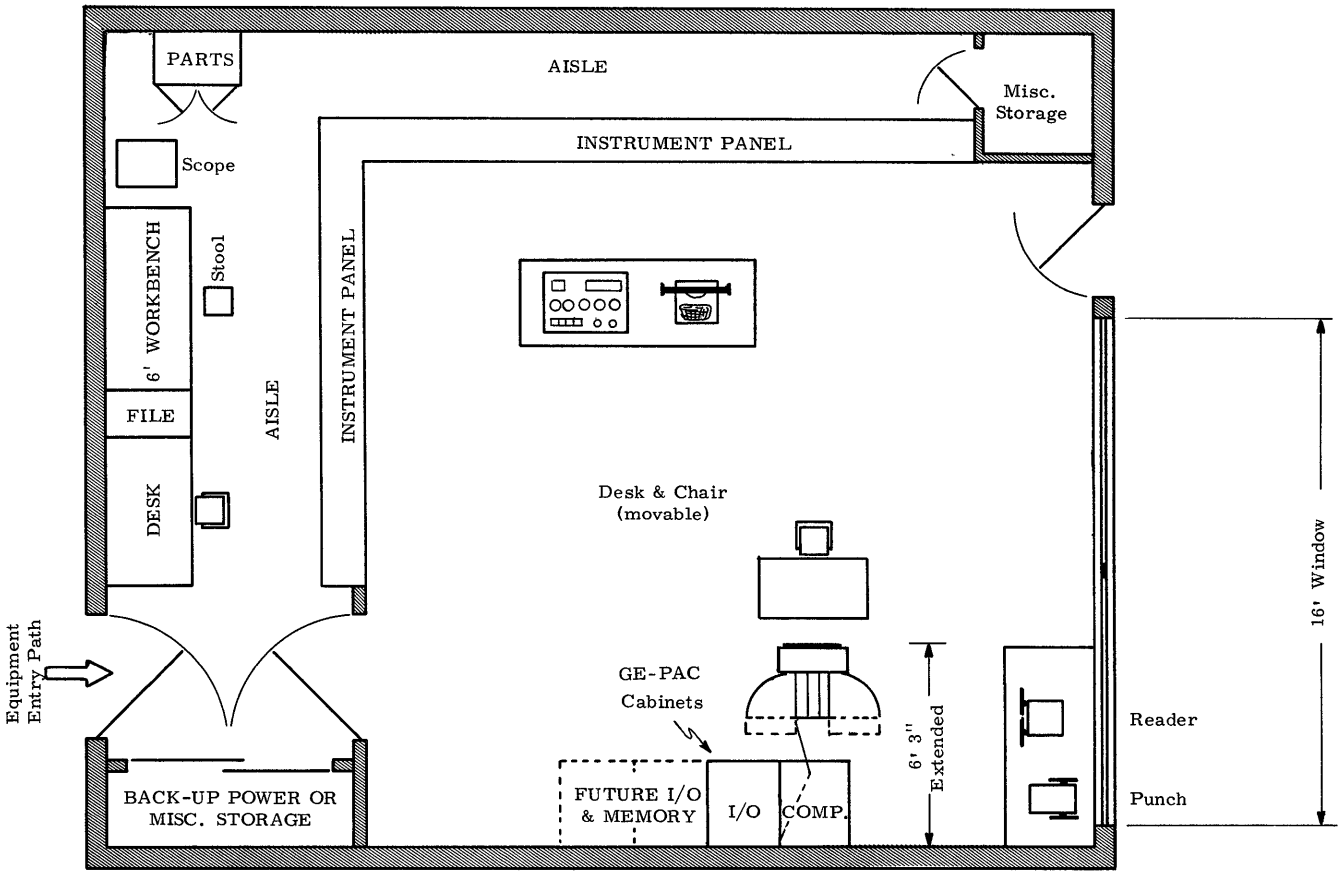


Fig. 2. 10 Typical Small Installation

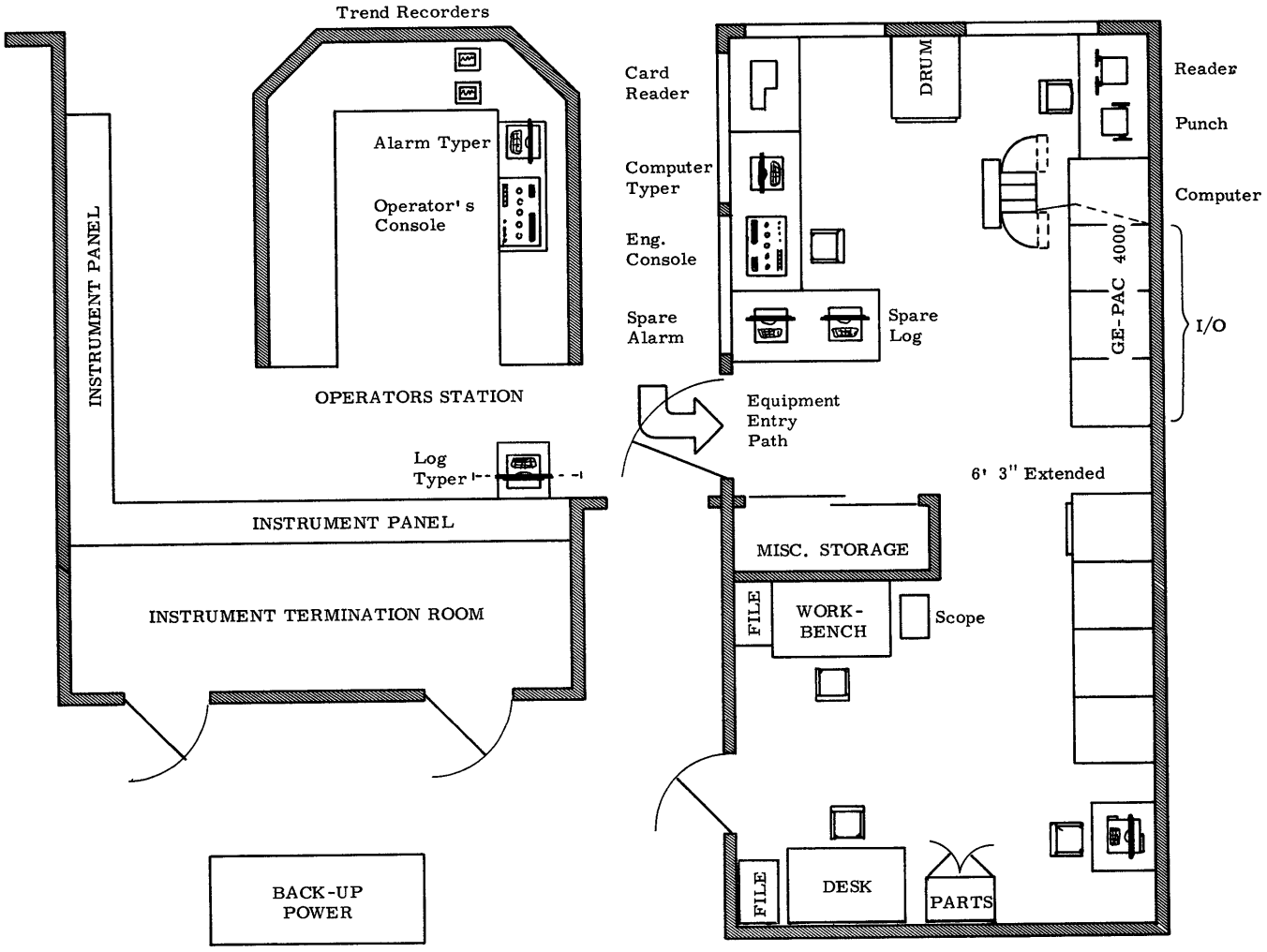


Fig. 2.11 Typical Large Installation

SIGNALS, SENSORS, AND CABLES

In this era of modern technology, some degree of instrumentation exists in almost every manufacturing process. Thus, a GE-PAC process control system is often called on to work in conjunction with existing sensors, recorders, closed-loop analog controllers, indicating devices, etc.

It is often difficult for our customers to understand why General Electric suggests reviewing existing instrumentation schemes: perhaps modifying the sensors or even replacing them with new devices, running new cables, grounding only in a certain way, etc.

The answer is, of course, that a process control computer system is a much different device than that normally encountered in a non-automated or partially-automated process. It is, to be specific, faster, much faster.

The essentially electro-mechanical nature of a typical recording instrument tends to mask any noise or random signals at its input; the response of a pen on a strip-chart recorder or of the needle on an indicating meter are good illustrations of this point. In contrast to these devices, however, the computer does not monitor a single input over a long period of time; rather, the computer looks at hundreds of inputs, each for an extremely short period of time, (e.g., 700 μsecs). Any noise, fluctuations, or random signals which may exist on the signal lines during this "read" period are recorded by the computer, which is helpless to do otherwise, as part of the signal input.

Thus, in the computer-automated application, the philosophy of instrumentation must change somewhat. However, because of the sophisticated design of the GE-PAC Analog Scanner, the restrictions are not excessive. One of the most important factors is the careful grounding and shielding of signal lines to reduce or eliminate noise. Sensor selection is also very important; any questions in this area should be referred to your local Industrial Sales or Electric Utility Sales office.

The remainder of this section is devoted to a general definition of the more common types of signal inputs and to the recommended techniques and procedures used to apply these signals to the computer. Cabling, which is an intrinsic part of the overall discussion, is also discussed separately and in greater detail.

SIGNAL TERMINATION & CONDITIONING

Analog input cables to the system are terminated on "sticks" at the back and sides of the system cabinets. These sticks provide terminal board connection points for the various signal inputs as well as the point-select relays and signal conditioning circuitry. The various categories of signal inputs, and the signal conditioning and connection procedures which apply to each type, are discussed in the following text.

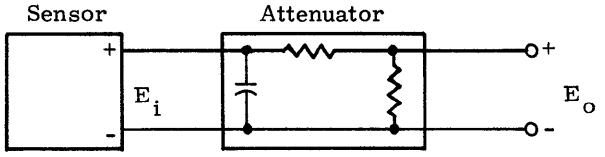
Voltage Inputs

Voltage inputs are the most common type of analog inputs in most process control systems. Included in this category are:

- Thermocouples.
- Slide-wires and other potentiometers.
- Tachometers.
- Strain Gauges.
- Thermal Converters.
- Generator Field Shunts.
- Thickness and Width Gauges.

Thermocouples are specialized forms of voltage inputs and are described separately at the end of this section. Included in this category are thermal converters which convert AC power to heat. The heat, in turn, is sensed by thermocouples.

Voltage inputs within the range of 0-80 mv are brought directly to the analog amplifier. No signal conditioning is required unless AC ripple is present, in which case filters are inserted in the signal line. Voltage inputs above the 80 mv range are routed through fixed attenuator circuits which may also include 60 cps AC filters:

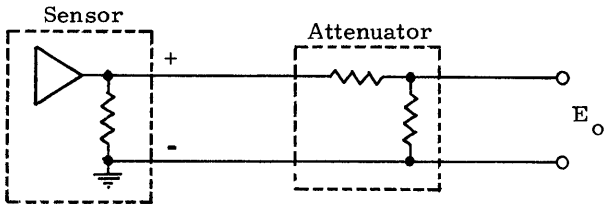


Voltages larger than 500V DC, AC voltages, and voltages with relatively large common mode require additional circuitry. Common mode is defined as voltage that appears at both input terminals with respect to a common reference point.

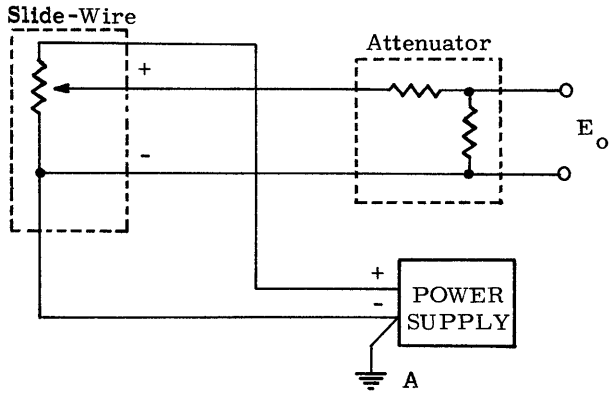
The preferred output impedance of the sensor is a maximum of 2.5 ohms per 10 mv of signal. Regardless of the signal's magnitude, however, an output impedance greater than 1000 ohms produces detrimental loading and noise effects. Sensors with a high output impedance can usually be modified by the manufacturer, often at no cost. For example, a sensor with an output of 5V across 5K can be changed to produce 5V across 4.92K and 0.08K in series. If the signal is now taken across the smaller resistor,

the range changes to the acceptable value of 80 mv across 80 ohms.

The most common form of voltage sensor is a combination of transducer, amplifier, and power supply. This type must often be referenced to ground at the sensor:



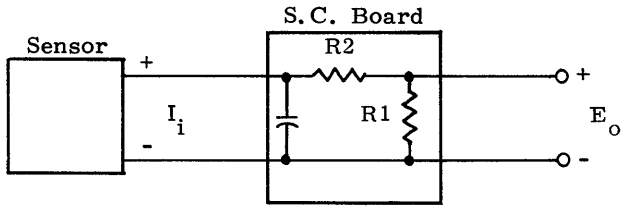
If the amplifier and power supply are floating above sensor ground, however, or if the input is of the isolated slide-wire type, it is preferable to connect the ground reference to analog ground at the computer:



Slide-wire connections such as those shown above are commonly used to monitor the mechanical result of signals applied to other devices (e.g., strip-chart recorders, position controllers, etc.), providing an inexpensive method of sharing the signal and eliminating loading, ground loop, and noise problems. This type of connection is known as a retransmitting slide-wire.

Current Inputs

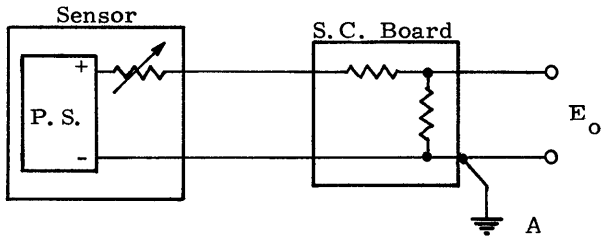
Current inputs are usually from pressure-to-current transducers or similar devices with outputs ranging up to 50 ma. The current output is usually rated for a maximum load resistance. Current inputs are always applied to the computer through resistance-current signal conditioning boards. These boards may also include 60 Hz AC filters:



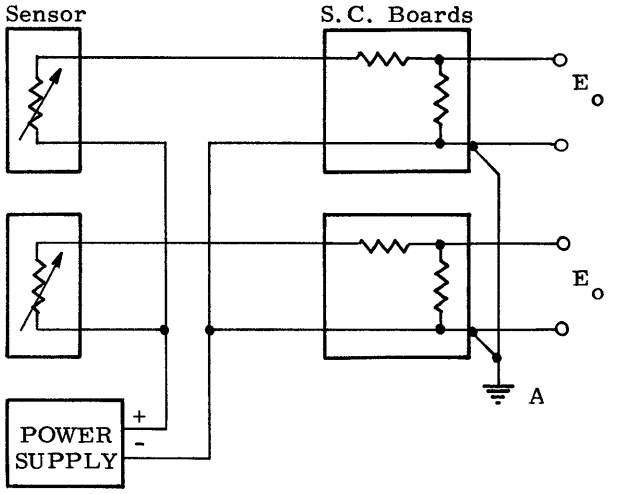
Resistor R1 is chosen so that the maximum current input causes a millivoltage output at or near the top of the standard input ranges. Resistor R2 is chosen to meet the load requirements of the sensor.

If a minimum load requirement is given but cannot be met by the standard signal conditioning board, it will sometimes be necessary to connect an additional series resistor at the sensor to make up the deficiency. If an exact load requirement is specified (including line resistance), the preferred solution is to convert the signal to millivolts at the sensor with the proper value of parallel resistance.

Current transducers with their own power supply should preferably be referenced to analog ground at the computer:

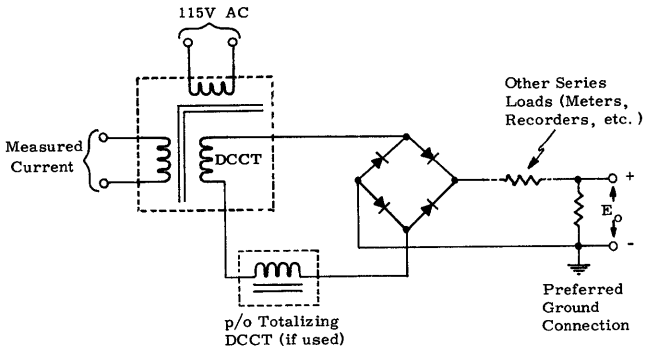


Transducers which share a common power supply should also be referenced to analog ground at the computer. The following circuit is typical of the force-balance current inputs most often encountered in industry:



Notice that the ground is not applied at the power supply and that the (-) output of the power supply is routed directly to the (-) input terminal of each signal conditioning board. This procedure helps prevent sensor inter-action and noise problems.

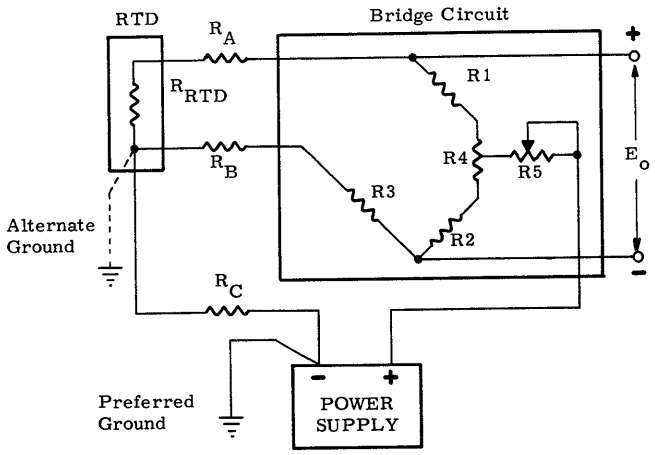
Larger DC currents, up to several thousand amperes, can be handled either by shunt resistors or by DC Current Transformers (DCCT). The shunt resistor converts the large current to millivolts which must then be applied to the computer through a separate amplifier to limit common mode and noise interference. A DCCT is a saturable core reactor that is excited by an external AC source:



The alternating current output of the DCCT is rectified and converted to millivolts in the customer's instrumentation and then sent to the computer. The preferred ground connection is the negative signal lead. Alternately, one output of the signal transformer can be grounded. Totalizing DCCT's cannot be grounded because of ground loop problems.

RTD Inputs

Linear and highly accurate measurements of temperature are normally accomplished by means of RTD's (resistance-temperature detectors sometimes called resistance thermometers). The electrical resistance of these devices varies as a function of temperature. By connecting an RTD as the remote fourth leg of a Wheatstone bridge, changes in temperature can be interpreted in terms of a millivoltage output. The bridge circuit is contained on a resistance-temperature signal conditioning board:



The R1 and R2 legs of the bridge are trimmed to identical resistance by R4. R3 is a high precision resistor whose value is equal to the reference value of the RTD (e.g., 32 ohms for a 32-ohm RTD, etc.). R5 is adjusted to compensate for line resistance R_C. Line resistances R_A and R_B cancel each other since they are equal and are in opposite legs of the bridge.

As with other input signal categories, proper grounding of RTD inputs greatly reduces noise pickup. The preferred method is to connect the minus output of the power supply directly to analog ground. If an RTD is tied directly to ground, then the associated power supply and all other RTD's must be ungrounded to avoid ground loops. If more than one RTD must be referenced directly to ground, separate power supplies must be used. It is a common practice to supply power to slide-wire sensors from the RTD power supply. The only restriction is that the slide-wires must be ungrounded.

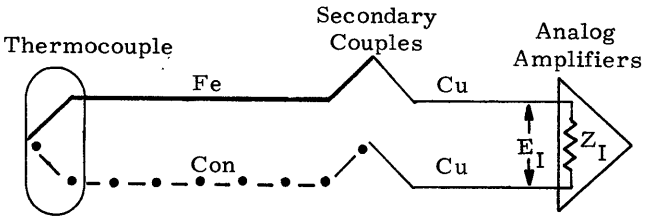
Thermocouple Inputs

The junction of two dissimilar metals at a given temperature, when connected in series with a like junction at a different temperature, constitutes a temperature sensitive device known as a thermocouple. In the stated circuit, a small emf is produced which is proportional to the difference in temperature between the two junctions. In practice, the measuring junction is placed in the temperature environment to be measured while the reference junction is located in a known environment at or near the measuring instrument. By convention, only the measuring junction is referred to as the thermocouple. The characteristics of some of the more common types of thermocouples are as follows:

Type	Junction	Range (°C)	mv/°C*
E	Chromel-Constantan	0 - 1000	.071
J	Iron-Constantan	0 - 870	.060
K	Chromel-Alumel	0 - 1370	.040
S	Platinum-Plat./ 10% Rhodium	0 - 1769	.011
T	Copper-Constantan	0 - 400	.051

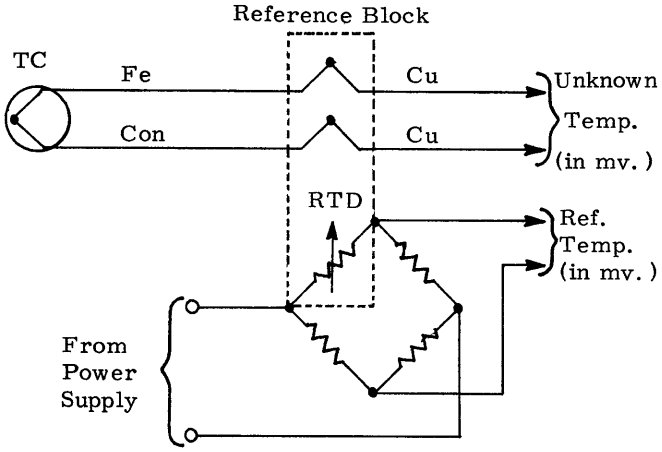
* Average values.

A simplified schematic of a typical thermocouple input to the analog scanner is shown by:



$$E_I = E_{Fe-Con} + E_{Fe-Cu} + E_{Con-Cu}$$

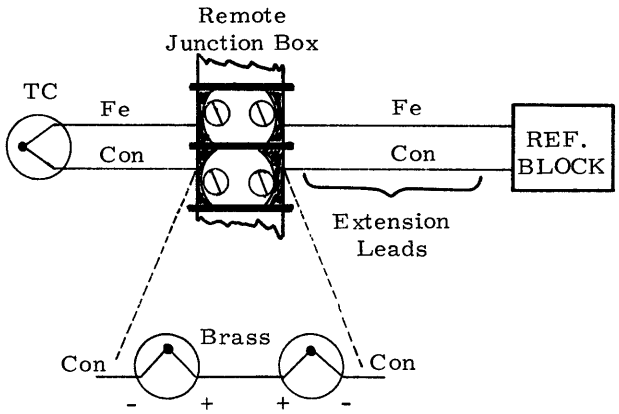
Notice that the necessary transfer from the exotic metal conductors to the more conventional copper wiring introduces secondary couples that add to the total input signal. Thus, in order to determine the temperature of the measuring junction, the effect of the secondary couples must first be calculated. This is accomplished within the computer program by using a stored table of millivoltage inputs versus temperature of the measuring junction, all calculated at a given reference temperature of the secondary couples. The secondary couples thus become the reference junction mentioned above. The only additional function required is the ability to measure the actual temperature of the reference junction. This is accomplished by the Thermocouple Reference Block circuitry:



The reference block is essentially a heat sink with a stable, measurable internal temperature. The temperature of the reference block, as indicated by the output of the associated RTD bridge, is calculated once per scan cycle and used to correct the readings received from system thermocouple inputs. The conversion equation is of the form:

$$T\,(°C) = C_1 \cdot E_i + C_2 + T_{\text{Table Ref.}} \; T_{\text{Ref. Block.}}$$

Thermocouple extension leads of the same material as the thermocouple prevent the existence of any secondary couples in an unknown temperature environment. The secondary couples created by joining the actual thermocouple leads to the extension leads (usually done via brass terminal boards) have no effect because the couples are always self cancelling:



In practice, the point-select matrix relays are placed in series with the thermocouple input leads in front of the reference block. The inputs are grouped by type and by the correct metal or alloy leads used to route the signals from the relays to the reference block.

The secondary couples within the matrix relays are self-cancelling in the same manner as described for terminal boards.

SYSTEM GROUNDING

The proper grounding of the computer system is necessary both for the protection of personnel and for the reliable operation of the system. Although the general principles of grounding are easily understood and readily agreed upon by all, the precise definition of grounding details is a very controversial matter. Thus, this section merely attempts a general definition of the problem. Each particular application has to be studied on an individual basis.

The basic objective of good system grounding is the elimination of ground loops, defined for our purposes

as low resistance conduction paths, other than the primary conductor, between two ground points. If the ground points in a loop are at different potentials, as they often are in plant ground systems, large currents flow in the loop inducing electrical noise into the circuitry of the computer.

The ground loop problem is solved primarily by using separate, isolated ground systems for the various categories of circuitry (e.g., the inherently noisy peripheral device and relay ground system is separate from the sensitive analog ground system). As shown by Fig. 3.1, personnel protection is provided by tying these ground systems together at only one point. Although the different ground systems are tied to one another at this point, there is no return conduction path between systems and thus no ground loop current.

Fig. 3.2 shows a simplified pictorial version of a typical system ground scheme. Notice that all power supply grounds are referenced to chassis grounds through separate conductors and that chassis grounds are tied to plant ground in only one place. Notice also that the table and console chassis at the remote station are referenced to ground to protect the operator from shock hazards. The safety ground for the peripheral device is taken from the ground connection at the convenience outlet.

A fairly common problem, especially in electric utility installations, is that the floor of the computer room is of a conductive material (e.g., steel plates) at plant ground potential. To prevent the creation of a ground loop with the computer resting on such a surface, it is very important that the computer cabinet be at exactly the same potential as the floor.

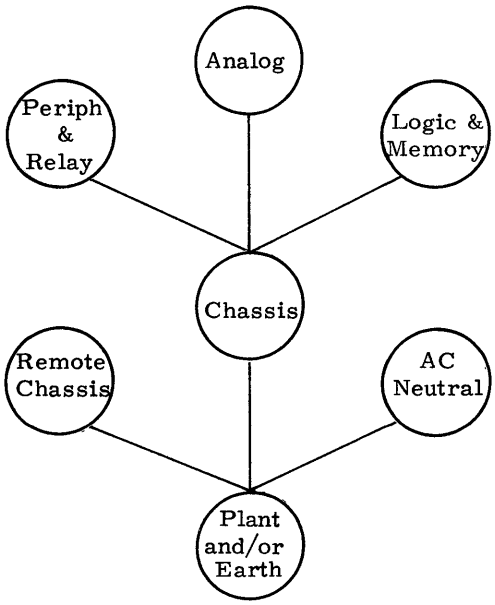


Fig. 3.1 Typical GE-PAC Ground Systems

All ground connections between the various cabinets and local stations of the system are made with 1/2-inch minimum copper braid. This braid is provided with an insulated sheathing to prevent contact with other grounds along its length. The earth ground connection may be made with braid of this type or with AWG 4, or larger, wire; either is provided by the customer.

CABLING PRACTICES

General Electric Process Computer Systems are designed for operation at industrial sites. Filters are included on all analog inputs to attenuate electrical noise, but to obtain the ultimate benefits of accuracy, cabling to and from the system should be given the same care and forethought as for any highly accurate process instrument. The most successful process computer installations are made by adhering to stringent intercabling practices to minimize electrical noise in the system. Use of filtering in the presence of noise is a feasible solution where inherent degradation of accuracy and response speed can be tolerated. Filters will be used where necessary. In addition, competent intercabling specialists are available for consultation in designing wiring layouts that find the most economical balance of cabling practices and filtering systems. The following cabling practices are offered as a guide.

General

It is of utmost importance that all cabling be installed in a manner that protects it from excessive heat, moisture, and mechanical damage. Cables should be completely supported and not subjected to excessive flexing or bending. Metal conduit is preferred but expanded metal troughs are acceptable. Conduit runs must be laid out to avoid low points where moisture can accumulate. Covered expanded metal troughs provide better shielding for low level analog signals than solid trays with no cover. All computer components and cabling should be carefully located to avoid coupling to sources of high intensity electric transients such as thyratrons, ignitrons, and silicon-controlled-rectifier equipments.

CATEGORIES OF CABLING

Intercabling is divided into five major categories. Each may require somewhat different treatment and will require isolation from other categories to avoid interference problems. These categories are:

- Power Wiring.
- Control and Intrasystem Wiring.
- Digital Input Wiring.

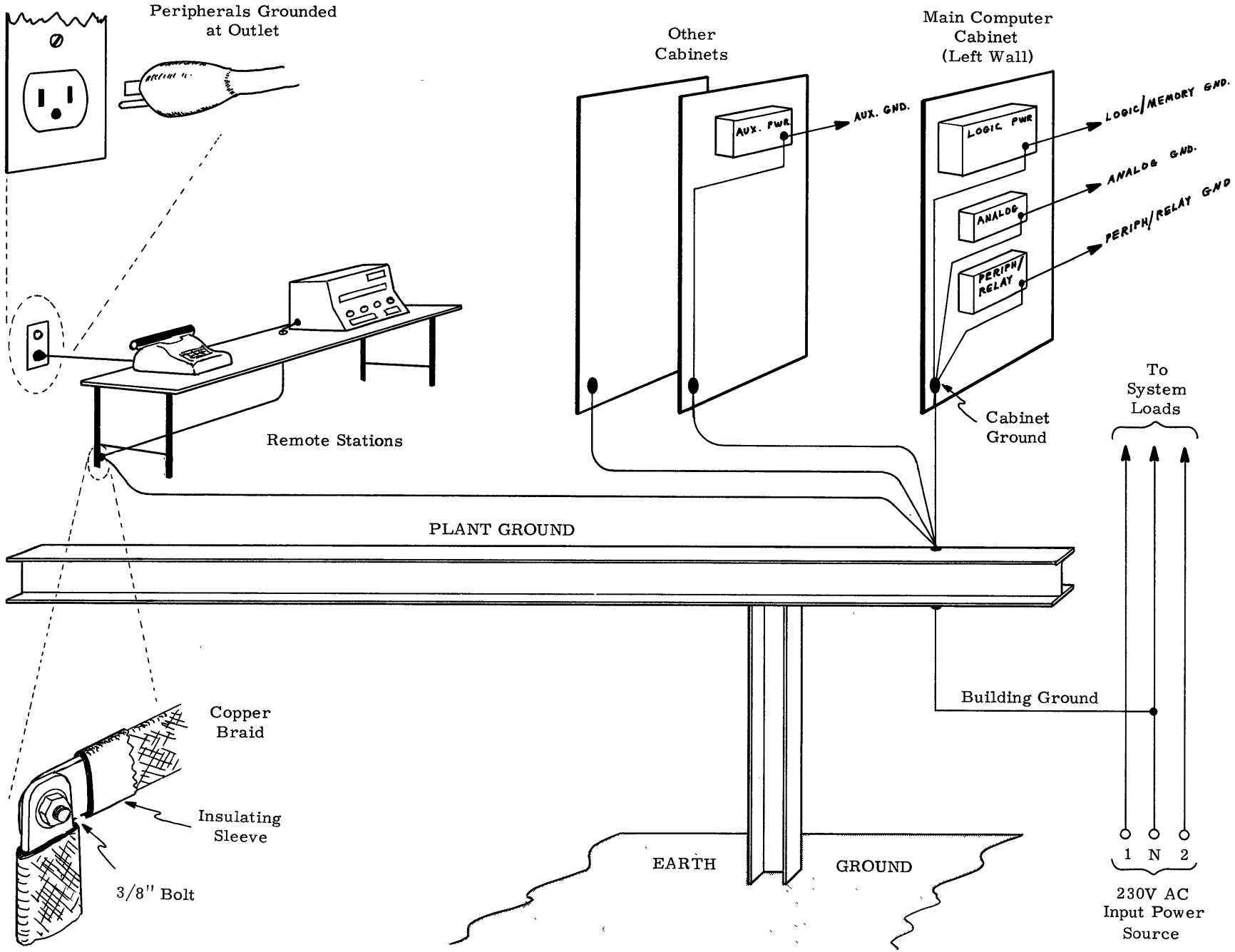


Fig. 3.2 Typical System Grounding

- Digital Output Wiring.
- Analog Data Wiring.

SHIELDING

It is important that the shields of all cables be insulated from ground and other potentials at all points except for a single tie to a common ground. The location of this ground point is noted on each specific cable description. Effective shielding requires an unbroken electrical path from the ground point to the opposite end of the cable run. Single braid copper shielding with 85% or greater coverage or copper tape shielding are considered adequate. Metalized "Mylar" polyester film shielding tape can also be used if an uninsulated bleed wire is run in contact with the tape to enable making a satisfactory electrical connection to the shield ground point. All shielding should be covered with an insulated sheath appropriate for the environment to which each cable is exposed.

EQUIPMENT GROUNDING

All cabinets, consoles, and data presentation cabinets are connected to industrial or building ground. The grounding connnection is made with 1/2-inch minimum copper braid strap. The actual ground point for each cabinet is determined at the time of installation or as noted on installation drawings. All troughs or conduits must be bonded together with good, low resistance joints and connected also to the industrial or building ground system.

Where sensors must be grounded, any shielding on signal wires associated with that sensor is grounded at the sensor. In the case of thermocouples, it is generally best to ground solidly at the junction rather than attempt to insulate. Resistance temperature detectors, other than generator and large motor RTD's, normally are not grounded, but these types can be accommodated. In general, grounded and ungrounded sensors can be accommodated equally well provided the status of each is known so that no other ground occurs in the active circuit.

CABLE ENTRANCES

Exact equipment configurations are subject to individual requirements and cables are frequently prepared by the customer or at the job site. Therefore, the exact cable entrance to each equipment is determined at the time of installation. The bottom of each cabinet has an area available for cable entrance. After installation, each cable entrance can be sealed off to minimize the infiltration of dust. A cable trench under each electronic equipment cabinet is recommended to facilitate cable handling.

Power Wiring

The cabinet or cabinets that will be wired to power mains is specified. The volt-ampere requirements and other characteristics are also specified. Power wiring will be in accordance with applicable local and national codes. However, in planning the layout of cabling, it must be understood that power wiring is capable of inducing noise and interference into the low level analog data wiring and, to a degree, into digital control wiring. Therefore, it is imperative that power wiring be run in separate conduit and in separate cable entrances.

Control and Intrasystem Wiring

All control and intrasystem wiring must be isolated from power lines with voltages greater than 115V AC or 150V DC and from lines with currents greater than 5 amperes AC or DC to avoid inductive or capacitive coupling of transients into the system. Specific cable types are:

DIGITAL INTERCONNECTIONS

For multiple wire interconnections between data presentation cabinets and control consoles, use multipair cables with twisted pairs and shielding as required for the application. Use wire listed under Items D and E, Standard Cables. Since these cables are often used in relay and indicator lamp circuits, it is necessary to limit the lengths or increase the wire sizes. Since the resistance of many relays and some lamps is between 300 and 500 ohms, use of #16 AWG at 100F, considering a 5% reduction in output due to line drop, limits the cable to 2300 feet (20-ohm loop impedance). Other indicator lamps may be as low as 100 ohms. Using #16 AWG at 100F and again considering a 5% reduction in output due to line drop, the limit is 580 feet of cable (5-ohm loop impedance).

HIGH SPEED DIGITAL DATA

In cases of high speed digital information transfers within the system it is necessary to limit the wire sizes and lengths to reduce the capacitances which the logic circuits must drive. These special cases are handled by system design engineers.

Digital Inputs

The digital input circuits of the computer have been specifically designed to be noise tolerant. Therefore, digital input wiring can be run in conduit or wiring trays along with plant power and control wiring carrying up to 480V AC, 60 Hz. Specific digital input cables are:

CONTACT STATUS CIRCUITS

For contact closure circuits where the status of a device is indicated by means of limit switches, pressure switches, auxiliary contacts, etc., use wire listed under Item A, Standard Cables. Where physical proximity of contacts and computer program grouping allow, multiple-conductor cables with overall shields such as Items B, C, and E, Standard Cables, may also be used. To minimize noise pickup in digital circuits involving several, widely separated sets of contacts in series, a twisted pair, as shown in Fig. 3.3, must be used instead of a single wire loop. Since the current used to interrogate this type of circuit is less than 10 ma, voltage drop associated with long leads is no problem.

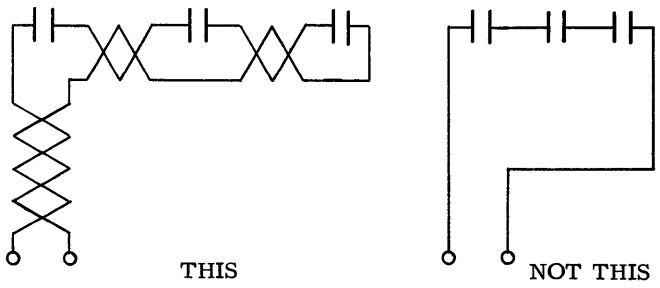


Fig. 3.3 Wiring of Contacts in Series

PULSE RATE CIRCUITS

For contact closure circuits where the rate of opening and closing or the total number of closures is the information being transmitted, such as in contact tachometers and kilowatt meters, use wire listed under Item A, Standard Cables, for each input. These signals can be buffered in the computer with mercury-wetted contact relays.

Digital Outputs

Digital outputs are relay contacts that operate powered devices supplied by the customer. The contact ratings vary depending on the application and care must be taken to ensure that the contacts being supplied have the proper rating. The contacts of mercury-wetted relays must be suppressed with suppression networks dependent upon voltage and current. However, the heavy duty contacts of mercury plunger relays do not require suppression circuits.

In general, the ratings of the contact output circuits should be limited to a maximum of 150 volts or five amperes, AC or DC. Cables for these circuits may be run in the same trays and conduit with power, plant, and control wiring carrying up to 480 volts. Care must be taken to isolate these circuits from computer system cables (analog inputs and intra-system wiring). However, digital inputs as mentioned under Digital Inputs may be run with digital output wiring. The cable used for these circuits may be any standard plant, supervisory, control, or power cable necessary for the length and load except that size must be limited to #12 AWG. This limitation is due to termination requirements and larger sizes can be accommodated only when planned in advance.

Analog Data Wiring

In order to avoid erroneous signals due to ground loops or resistive coupling due to multiple currents in a common ground, the analog input channel uses a two-wire, differential input system for all voltages. The levels of analog signals vary considerably from sensor to sensor making it necessary to classify them by signal level.

- Low Level - Defined as approximately less than 100 millivolts full scale. This category includes such sensors as thermocouples, strain gauges, radiation pyrometers, and thermal converters.
- Medium Level - Defined as greater than 100 millivolts but less than 20-30 volts full scale.
- High Level - Defined as all signals which have full scale voltages exceeding 30-50 volts.

PRECAUTIONS FOR LOW LEVEL ANALOG DATA WIRING

The layout and arrangement of conduits for all low level analog data wiring must be given careful consideration. The conduit routes should avoid strong magnetic fields such as power transformers and motors and must not run in parallel or in close proximity to power wiring.

Low level analog data signals are wired using twisted pairs to minimize induced pickup and are shielded to minimize capacitive pickup. The two wires must stay in close proximity to each other and pass through adjacent points on terminal strips or connector pins to avoid thermally-induced voltages. Terminal boards and junction boxes must be kept clean and dry to prevent corrosion voltages due to voltaic action between dissimilar materials exposed to electrolytes.

In low level analog wiring, it is very important that the shields of all cables be insulated from ground and other potentials at all points except for a single reference point. It should be noted that the shields of low level analog signals are sometimes at a common mode voltage other than ground. The location of the reference point is noted on each specific cable description.

CABLES FOR LOW LEVEL ANALOG WIRING

- Thermocouples (also refer to ISA RP1.1 - 1.7*) - The extension wire must be of the same material as the thermocouple used. Polarity of leads must be strictly observed throughout the run of the thermocouple circuit. Extension wiring should be twisted pairs with a single braid shielding around the pair and an insulating layer surrounding the shield. In cases where the physical layout permits multiple-pair extension leads, a common shield can be used. Reference blocks accept up to size #16 AWG wire.

- Thermal Converter Outputs - Use individual twisted, shielded pairs for each converter per Item A, Standard Cables.

- Strain Gauge Bridge Outputs - Use individual twisted, shielded quads for each sensor per Item C, Standard Cables.

- Two-Wire Miscellaneous Low Level Signals - Use individual, twisted, shielded pairs for each transducer per Item A, Standard Cables.

CABLES FOR MEDIUM LEVEL ANALOG SIGNALS

- Resistance Temperature Devices (RTD's) - A three-wire connection is used in all cases. Because balance of lead wire resistances is important, all leads must be the same length. Use wire per Item B, Standard Cables.

- Retransmitting Slidewires, Manual Potentiometers, or Other Isolated Potentiometers Used as Inputs to the System - Usually a three-wire connection is applicable. In cases of very long lines, a four-wire connection is necessary. For example, for a 500-ohm slidewire using #16 AWG wire that undergoes a temperature change of 50°F, a four-wire connection should be used above 1000 feet. Use wire per Item B or C, Standard Cables.

- Current Inputs - Most transducers of this type operate over a reasonably wide resistance range or have lead wire and load compensation potentiometers. Therefore, wire size is not a significant factor. Twisted pairs, not necessarily shielded, are generally used. Where physical layout permits, multiple pairs with a common shield are also practical. Use wire per Item A or D, Standard Cables.

- Others (Analytical X-Ray Gauges, Operational Amplifiers in Other Control Equipments, and Other Two-Wire Inputs) - Use individual, twisted, shielded pairs in general. Multiple conductor cable can be used in cases where a large number of inputs come from one equipment. Use wire per Item A, Standard Cables and consult Engineering regarding cables to be used in special cases.

* Available from ISA, 313 Sixth Avenue, Pittsburgh, Pennsylvania 15215, for $3.00.

CABLES FOR HIGH LEVEL ANALOG WIRING

Signals in this category require shielding to prevent coupling to medium level and low level signals rather than to reduce pickup into the high level signal.

Many signals in this category are derived from sources having high power capabilities. Therefore, it is necessary to fuse all inputs of this type at the source to prevent damage in computer electronics cabinets. The input impedance to signals below 256 volts full scale is somewhat greater than 100,000 ohms. Therefore, when a point is scanned, the input current is less than 2.5 ma. Fast-action instrument fuses may be used, noting that their maximum rating is 250 volts.

In cases of higher voltages, it is desirable to install special high impedance dividers at the source to reduce the voltage and limit the power capability.

Signals in this category are not usually affected by drops in common ground paths. However, as a precaution and to preserve the symmetry of the already established pattern, two-wire circuits are used. Use wire per Item A, Standard Cables.

Standard Cables

This is the list of standard instrumentation and control cables referred to in previous sections. It is highly recommended that these standard cables be used wherever possible. If the wiring between two devices requires more than one of these cables, the specific cable description might specify that several cables be run in the same conduit.

A. Single Shielded Twisted Pair

Two-conductor, #16 AWG (19/.0113) tinned copper, 0.025-inch VULKENE insulation colored one black, one white, twisted with fillers, tinned copper wire wrapped shield, jacket 0.045-inch black polyvinyl chloride, 600 volts, AOD 0.310-inch GE Wire and Cable Department - CW-1370, Type III.

B. Single Shielded Twisted Triple

Three-conductor, #16 AWG (19/.0113) tinned copper, 0.025-inch VULKENE insulation colored one black, one white, one red, twisted with fillers if required, tinned copper wire wrapped shield, jacket 0.045-inch black PVC, 600 volts, AOD 0.033-inch. GE Wire and Cable Department - CW-1437, Type III.

Alternate: Same except #20 AWG (19/.008) tinned copper, AOD 0.290-inch.

C. Single Shielded Twisted Quad

Four-conductor, same as in B except colors, one black, one white, one red, one green. AOD 0.355-inch.

Alternate: Same except #20 AWG (19/.008) tinned copper. AOD 0.317-inch.

D. Multiple Twisted

Conductors #16 AWG (19/.0113) tinned copper, 0.025-inch VULKENE insulation. Fully color-coded twisted pairs with pitches of pairs systematically varied, binder tape over-all, shield 3 mil bare copper tape spirally applied over binder, over-all PVC jacket.

#16 AWG	3 pr.	AOD 0.570"
	7 pr.	AOD 0.730"
	12 pr.	AOD 0.990"
	19 pr.	AOD 1.150"
	27 pr.	AOD 1.370"

GE Wire and Cable Department - CW-1437, Type I.

Alternate No. 1: Same construction as #16 AWG except #20 AWG (19/.008).

#20 AWG	3 pr.	AOD 0.480"
	7 pr.	AOD 0.650"
	12 pr.	AOD 0.870"
	19 pr.	AOD 1.010"
	27 pr.	AOD 1.200"

Alternate No. 2: Same as above except tinned copper shield braid over each pair. No over-all shield.

#16 AWG	3 pr.	AOD 0.610"
	7 pr.	AOD 0.800"
	12 pr.	AOD 1.100"
	19 pr.	AOD 1.290"
	27 pr.	AOD 1.550"

GE Wire and Cable Department - CW-1437, Type II.

Alternate No. 3: Same as above except each pair colored one conductor black and one white, tinned copper wire shield wrap over each pair with fully color coded 0.025-inch PVC jacket over each pair shield. No over-all shield.

#16 AWG	3 pr.	AOD 0.680"
	7 pr.	AOD 0.950"
	12 pr.	AOD 1.250"
	19 pr.	AOD 1.470"
	27 pr.	AOD 1.830"

GE Wire and Cable Department - CW-1437, Type III.

Alternate No. 4: Same construction as alternate No. 3 except #20 AWG (19/.008).

#20 AWG	3 pr.	AOD 0.620"
	7 pr.	AOD 0.820"
	12 pr.	AOD 1.120"
	19 pr.	AOD 1.320"
	27 pr.	AOD 1.580"

E. Multiple Conductor, Over-all Shield

Conductors #16 AWG (19/.0113), 0.025-inch VULKENE insulation, fully color coded, tape binder, 3 mil bare copper tape spiral wrapped over binder, black PVC jacket over-all 600 volts.

#16 AWG	7 conductors	AOD 0.450"
	12 conductors	AOD 0.600"
	19 conductors	AOD 0.690"
	27 conductors	AOD 0.810"
	37 conductors	AOD 0.940"

GE Wire and Cable Department - CW-1437, Type IV.

F. Multiconductor Logic Cable

Conductors #20 AWG (10- #30), 0.016-inch extruded plastic insulation, color coded pairs, over-all shield of #34 tinned copper braid to provide 80% coverage, tan PVC overall jacket, 33 pf per foot nominal capacitance between basic wires in a pair with all other wires open circuited and shield grounded.

10 pr. cable	AOD 0.525"
20 pr. cable	AOD 0.708"
30 pr. cable	AOD 0.850"

Similar to GE Wire and Cable Department Drawing #12A8494. In many cases, Cable Type D, Alternate No. 1 can be used for this application.

INSTALLATION

The physical installation of a GE-PAC System involves many details. Lack of attention to these details can cause needless delays, with a resultant waste of both time and money. Thus, the last section of this Site Preparation Manual is devoted to the scheduling, responsibility assignments, and execution of a GE-PAC installation.

PRE-INSTALLATION SERVICES

An experienced Headquarters Engineer is assigned to each system long before the actual installation is to occur. This individual follows the system through the design, manufacturing, and quality control testing phases, during which time he:

- Becomes familiar with the special features of the system.
- Participates in the development of special hardware and software, thus gaining a thorough understanding of the application and its problems.
- Where possible, makes a pre-installation visit to the customer's site, offering assistance with:
  1. Wire and cable routing.
  2. Grounding practices.
  3. Access routes for moving equipment into place.
  4. Installation drawings.
  5. Environmental conditions.
  6. Electrical noise conditions.
  7. Primary power requirements.
  8. Other detailed installation considerations.
- Reviews system and component drawings.
- Prepares recommended spare parts list.
- Accumulates tested spare parts.
- Assembles the necessary computer diagnostic programs.
- Monitors the packing, loading, and shipping of the system equipment.
- Develops a detailed installation schedule.

SHIPMENT

At an appropriate time before the actual delivery date, the computer system is removed from factory test floor and put through a Pre-Shipment phase. This phase includes painting, final lacing of wires, minor furniture adjustments, etc. The equipment is then moved to the Shipping Department, where it is readied for the trip to the customer's site.

As shown by Fig. 4.1, the major cabinets of the system are mounted on reinforcing skids, wrapped with padding and waterproof plastic, and banded with steel bands. Multi-cabinet complexes (up to four cabinets bolted together) are mounted on a skid, and secured and wrapped in a similar manner as the single cabinet. Skid dimensions as well as attachment methods are shown by GE Drawing 68A987265, included in Appendix B.

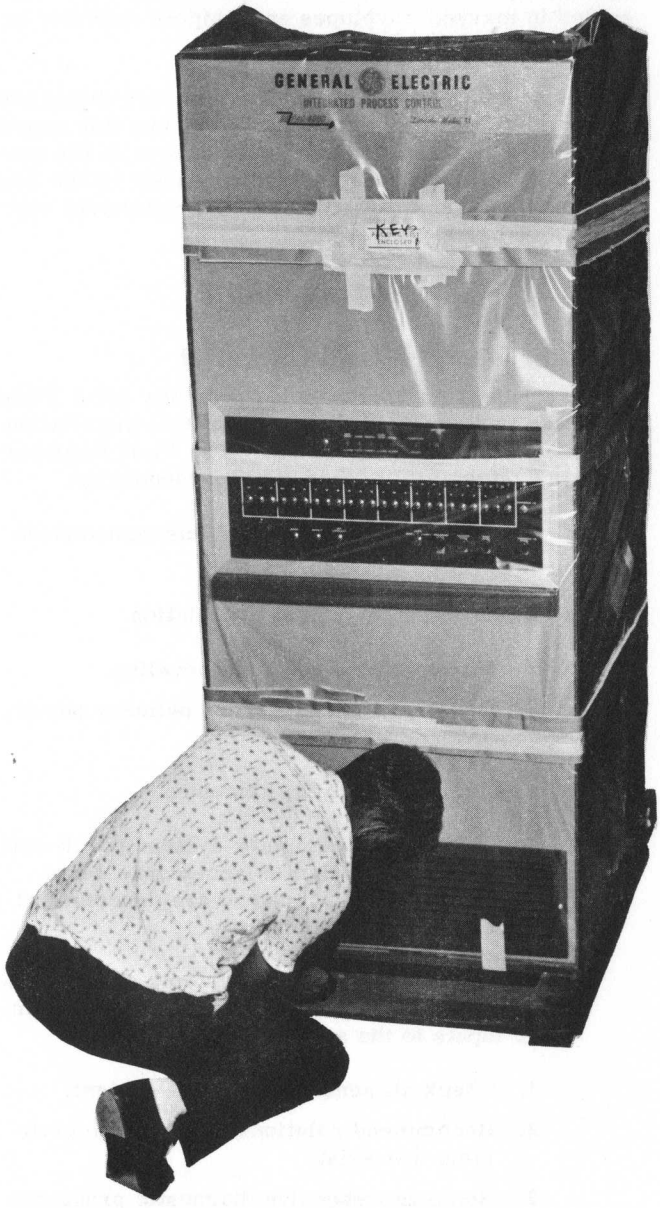


Fig. 4.1 A GE-PAC Cabinet Being Prepared For Shipment

The prints, test equipment, cables, and smaller items of hardware are boxed or crated in an appropriate manner, with heavier items mounted on standard pallets.

The Recommended Spare Parts Inventory is shipped as soon as it can be accumulated (normally two to four weeks after the spare parts requisition is received). All spare parts are carefully packed to avoid damage in transit. Circuit boards are shipped in modules, which are later returned to the factory. Larger assemblies are packed in padded cardboard or wooden cartons, with the GE part number clearly marked on the outside. Individual components are sealed in marked envelopes and shipped together in cardboard cartons.

The computer equipment and all accessory items are normally shipped by moving van. Sea van (for export shipments) and air freight (at extra cost to the customer) may also be used. Title passes to the customer at the time of shipment; the equipment warranty also begins at this time.

INSTALLATION

Technical Support & Field Check-Out

The Technical Support service provides for a Field Engineer to be present during the actual installation and check-out of the equipment. The Field Engineer assists customer-furnished craft personnel by:

- Reviewing routing of plant instrumentation cables.
- Assisting in the actual installation.
    1. Physical placement and leveling.
    2. Check of standby power, primary power, and ground wiring.
- Applying power to the computer.
- Performing the complete system check-out including the customer acceptance tests (Check-out and Acceptance are described at the end of this section).
- For closed-loop control systems only, checking and verifying the acceptability of customer inputs to the system:
    1. Check all sensors for noise content.
    2. Recommend solutions to any noise problems that exist.
    3. Run comprehensive diagnostic programs to verify the correct operation of all input/output equipment used to connect the computer and the process.
    4. Check contact closure, digital input/output, and any other special equipment in the system.

Under the basic 40-hour week provided by the Technical Support service, the normal non-control installation should require two to six weeks. If the installation is performed on an overtime basis, the user will be charged for the overtime.

The Field Engineer, when he arrives at the site, should be provided with all the necessary door keys, gate passes and badges, parking spots, and other items required to gain access to the computer equipment. Gate passes should, if possible, be permanent or semi-permanent and good on week-ends and at night. The Field Engineer may have to carry material (test equipment, parts, drawings, etc.) into or out of the site from time to time; provisions should be made for clearing this material at the gate in as simple a manner as possible. Close attention to detail in these matters can eliminate a major cause of installation delay.

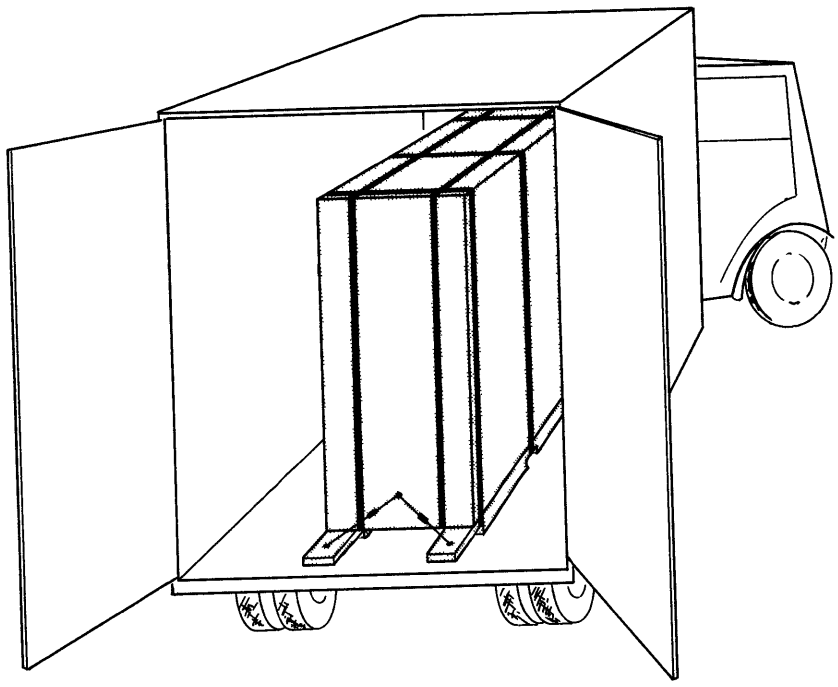
Handling the Equipment

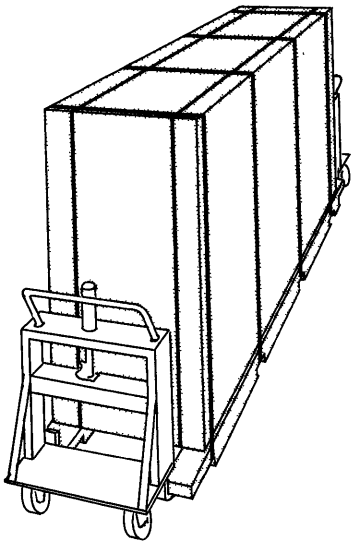
The customer, unless otherwise specified in the contract, provides riggers and equipment for moving the equipment from the transporting van to the computer room. Customer-supplied personnel also place, align, and level the computer equipment at the specified locations. The following points should be considered:

- A suitable dock or platform must be available for removing the equipment from the van.
- Door clearances must be large enough along the route from the unloading dock to the computer room.
- Adequate turning room must be provided where necessary (corners, aisles, etc.).
- All elevators, ramps, lifts, and platforms to be used must be capable of supporting the weight of the computer equipment (1000-2000 lbs. per cabinet) plus that of the moving device.

GE-PAC single cabinets are most easily moved with a forklift truck; the shipping skid is designed especially for this purpose. After reaching the computer room, the cabinet may be removed from the skid by the following procedure:

- Insert a four-foot length of 1-inch pipe or rod through the angle brackets at the top left-hand and right-hand sides of the cabinet.
- Raise the fork-lift to contact the pipe.





- For multi-cabinet complex, attach a ROL-A-LIFT rolling hoist truck at each end, secure straps, and roll onto dock or suitable ramp.
- Or uncrate complex, remove lag screws from bottom of cabinets (minimum of two per cabinet). Remove air grills. Tilt complex and install angle iron runners per GE drawing 68A987265. Roll onto ramp or dock using pipe rollers. Alternately, with the angle iron runners installed, the complex may be partially removed from van and rigged for lifting as shown.
- For single cabinets use fork lift, being sure that tines are properly positioned.

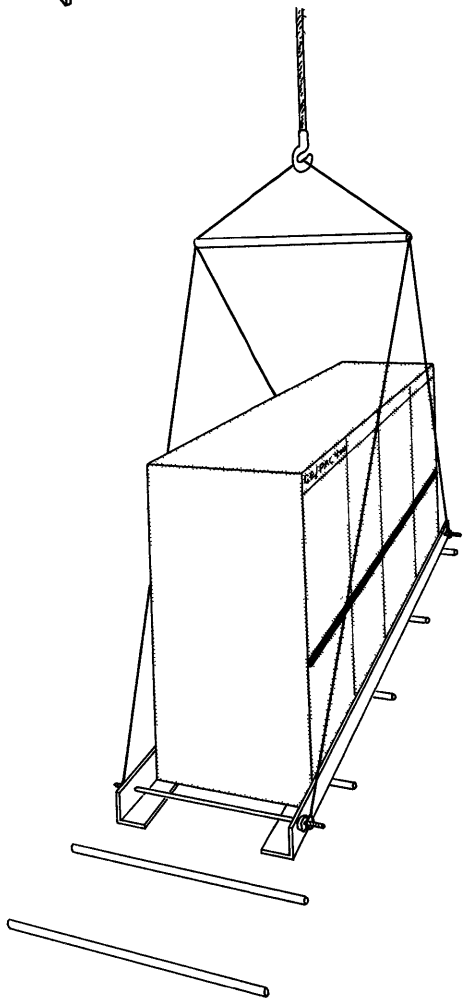


Fig. 4.2 Installation (Typical)

- Carefully block the cabinet to prevent excessive tipping (the front of the cabinet tips upward); the ideal lifting angle is with the front of the cabinet slightly higher (3-4 inches) than the back.

- Remove the nuts which fasten the cabinet to the skid.

- Lift the cabinet just enough to allow the skid to be pulled out.

- Move the cabinet to its final position and lower it to the floor.

Multi-cabinet complexes may be moved by means of an overhead crane or by rolling on dollies or other rollers (see Fig. 4.2). If dollies are used, some means of lifting the cabinets off the skid must be provided in the computer room; a chain hoist, attached in the same manner as shown for the overhead crane, is a typical solution to this problem. If rollers (pipes, etc.) are used, the load on the bottom of the cabinets must be distributed either by leaving the cabinets on the skid or by bolting angle iron runners on the bottom edges of the cabinets, as shown by GE Drawing 68A987265, which is included in Appendix B.

No matter what method is used to move the equipment, the skid, padding, and wrapping bands should be left on as long as possible to prevent damage to the cabinets. In addition, the wrapping bands provide an additional safety measure to prevent the rollout assembly from sliding open if the cabinet is tipped.

Cable and Power Connections

Once the computer equipment is set in place, leveled and secured to the floor, customer-supplied personnel begin the task of connecting data, power, and ground cables. Unless otherwise specified by the contract, all cabling is the responsibility of the customer. The GE Field Engineer will be available to answer any questions that may arise. The GE "System Block Diagram", "Master Cable Index", and "I/O Information Summary" should be used for reference throughout the cabling phase of the installation.

Power and ground connections are usually made first. The power wiring is installed "cold" (e.g., main breakers off), checked for shorts, then left off and tagged until the GE check-out phase begins. This does not apply to any wall outlets for peripheral equipment, which may be left on or off at the discretion of the customer, nor to any interconnecting AC cables within the computer system. To eliminate AC radiation inside the computer cabinets, the primary power input should be brought in grounded conduit all the way to the computer input terminals. The conduit must be electrically isolated from the computer cabinet to prevent detrimental ground loops.

With the exception of the earth ground connection, all grounds are connected with GE-supplied insulated copper braid. The braid must not contact any building, earth, or cabinet ground except at the tie-points provided in each cabinet and/or peripheral station.

The earth ground connection is made either with insulated braid or with AWG 4 wire provided by the customer, and is terminated at only one point in the computer system (usually the main GE-PAC cabinet).

Data cables fall into two distinct categories: interconnecting cables, which run between cabinets and peripheral stations of the computer system, and sensor/instrumentation cables, which connect the computer system to sensors, recorders, annunciators, etc., in the customer's plant. The interconnecting cables are furnished by GE and are plainly marked with the appropriate jack or terminal board designations. The sensor/instrumentation cables, normally furnished by the customer, should be installed per the following guidelines:

- Insure that cable shields are connected the full length of the run.

- Insure that cable shields do not touch ground other than at the specified point. (This sometimes occurs when the outer insulation is torn while pulling cables through conduit, etc.).

- Insure that no cable shield touches any other shield (as may happen in intermediate junction boxes, etc.).

- All stranded wire and cable shields should be terminated in solderless lugs.

- Solid wire, including thermocouple leads, may either be wrapped under the terminal screws or terminated in solderless lugs.

Any wires which must be left disconnected should be wrapped with insulating tape and clearly marked with an identifying name or code and the number of the associated terminal connection. After all cables are pulled, the cable entry ports should be sealed with Duct Seal sealing compound to eliminate unfiltered external air and contaminants from the cabinets. Finally, the cable groups are laced and tied in a manner which allows free access to all terminal boards and wall-mounted components inside the cabinets. Nylon cord or strap is usually used for this purpose.

CHECK-OUT AND ACCEPTANCE

The GE check-out phase begins as soon as possible after the physical installation of the system is completed. Although the exact techniques vary with each application, the following procedures comprise a typical check-out:

- Check entire grounding system and eliminate any deficiencies.
- Check Central Processor, Core Memory, and Drum Memory with appropriate diagnostic routines.
- Check all peripheral equipment with 15-minute error free diagnostic runs.
- Check digital inputs by simulating contact closures at the customer's termination points.
- Check digital outputs with an ohmmeter at the customer's termination points.
- Check console switches, lamps, displays, etc.
- Check and adjust all analog outputs.
- Check the accuaracy and repeatability of the Analog Scanner on every range of every channel, using calibrated reference voltages applied to randomly selected matrix points.
- Check compatibility of signal conditioning boards and plant sensors, using operating sensors and one of each type of signal conditioning board.
- Check and adjust all RTD bridges.

Any special equipment in the system must also be checked in an appropriate manner. The actual acceptance of the hardware normally occurs after the foregoing items have been satisfactorily demonstrated to the customer. At this time, the customer accepts full responsibility for maintenance.

If GE programming services have been purchased, the programming personnel arrive at about this time and begin loading and testing their routines. It is not possible in a manual of this type to define the procedures and duration of program check-out. Final acceptance of the system hardware and software relies on the fulfillment of all phases of the contract.

APPENDIX A

PRELIMINARY SYSTEM DEFINITION

1. Core Memory: 4020 System 1.6 μs _____K (4 to 32K).
   4040 System 5.0 μs _____K (4 to 16K).
   4050, 4060 System 1.7 μs _____K (4 to 64K)
   3.4 μs _____K (4 to 64K)
   5.1 μs _____K (4 to 64K).

2. Drum Memory: 16K, 32K, 64K, 96K, 128K, 160K, 192K, 224K, 256K, expandable to _____K.

3. API Inputs: _____.

4. Thermocouple Inputs:
   _____ Type E (Chromel-Constantan).
   _____ Type J (Iron-Constantan).
   _____ Type K (Chromel-Alumel).
   _____ Type S (Platinum vs. Platinum-10% Rhodium).
   _____ Type T (Copper-Constantan).
   _____ Other.

5. RTD Inputs: _____.

6. Other Analog Inputs:

Mfr./Model	#	Output Range

7. Pulse Inputs (number and maximum repetition rate):
   _____ at _____; _____ at _____;
   _____ at _____; _____ at _____.

8. Contact Inputs: _____.

9. Timed Contact Outputs: _____.

10. Bi-stable Contact Outputs: _____.

11. Momentary Contact Outputs: _____.

12. Decimal Contact Outputs: _____.

13. Analog Outputs:

    _____ at _____ to _____V with _____-bit resolution.

    _____ at _____ to _____V with _____-bit resolution.

    _____ at _____ to _____V with _____-bit resolution.

14. Fixed Carriage Typewriters:

    _____ with 11-inch carriage.

    _____ with 15-1/2-inch carriage.

15. Long Carriage Typewriters:

    _____ with 12-inch carriage.

    _____ with 16-inch carriage.

    _____ with 20-inch carriage.

    _____ with 24-inch carriage.

    _____ with 30-inch carriage.

16. Tape Preparation Typewriters: _____.

17. Card Readers: _____.

18. Paper Tape Readers: _____.

19. Paper Tape Punches: _____.

20. Line Printers: _____.

21. Other Information: Provide a general description of each proposed console, giving its functions, approximate size, and the arrangement of lettering. Provide detailed schematic drawings of existing plant equipment that is to be controlled by the computer system.

DIGITAL INPUT SUMMARY

Customer _____ Sheet _____ of _____

Prop. or Reqn. No. _____ Rev. _____ Dated _____

Point No.	Description	Code			Contact Data		Notes
		Dec.	Bin.	BCD	Form	Rating	

DIGITAL OUTPUT SUMMARY

Customer _____ Sheet _____ of _____.
Prop. or Reqn. No. _____ Rev. _____ Dated _____.

Point No.	Description	Type		Form	Rating		Code		
		Timed	Bistable		ma	V	Dec.	Bin.	BCD

ANALOG OUTPUT SUMMARY

Customer _____ Sheet _____ of _____.

Prop. or Reqn. No. _____ Rev. _____ Dated _____.

Point No.	Description	Resolution	Range			Load Impedance	Notes
			0%	100%	ma/mv		

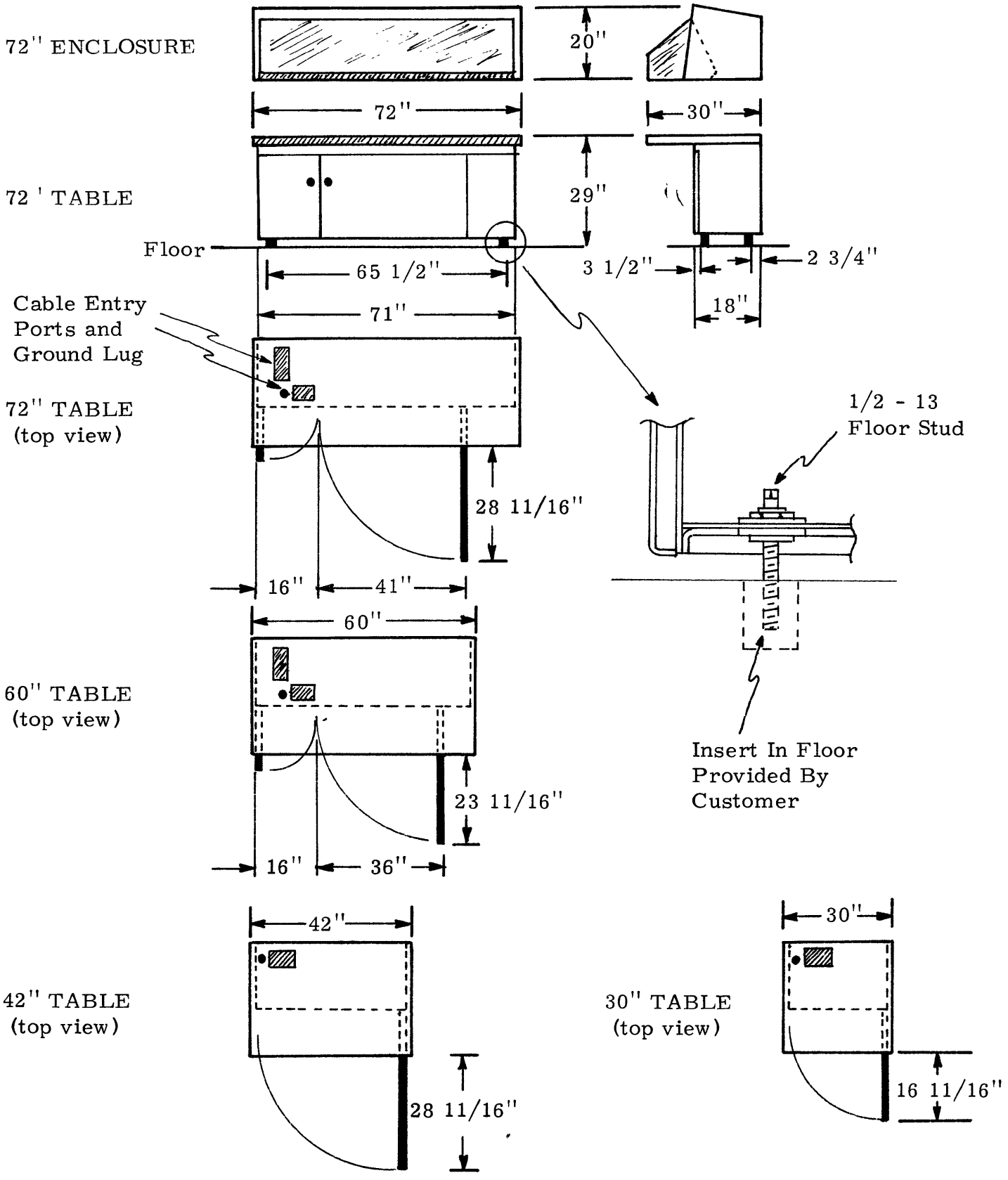
ANALOG INPUT SUMMARY

Customer _____ Sheet _____ of _____
Prop. or Reqn. No. _____ Rev. _____ Dated _____

Point Number	Measured Variable			Sensor						Notes
	Description	Range	Units	Mfr. & Type	Output			Common Mode	AC Ripple	
					Range	Units	Z			

APPENDIX B

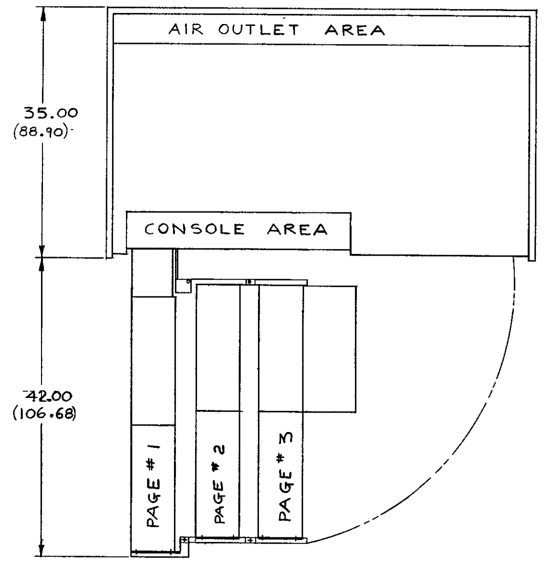
PERIPHERAL ENCLOSURES

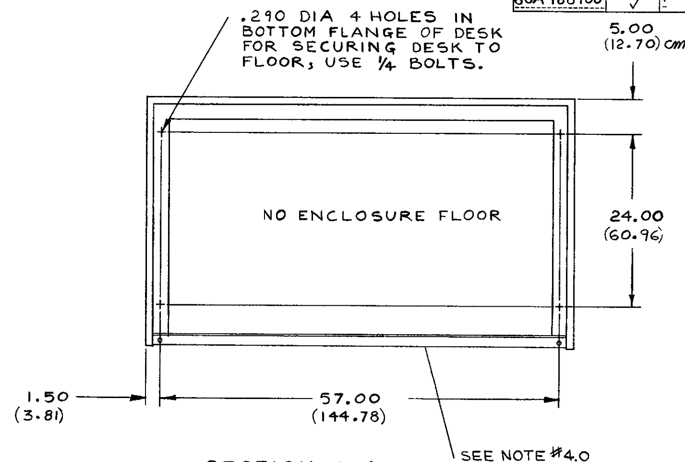


GENERAL ELECTRIC STD 68D974076

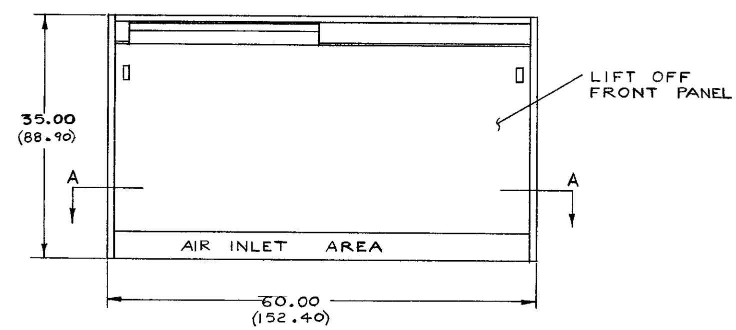
TITLE INSTALLATION OUTLINE
SMALL COMPUTER (DESK)
FIRST MADE FOR SYS STD
FCF ON

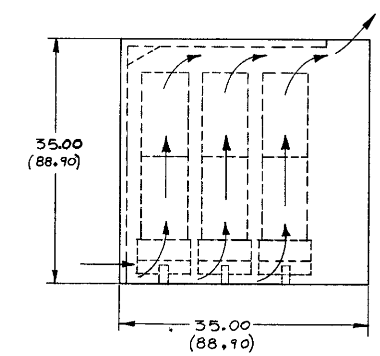
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING — APPLIED PRACTICES 68A988900 SURFACES ✓





SECTION A-A





NOTES:

1.0 ELECTRICAL REQUIREMENTS
VOLTAGE: 115/230 VOLTS NOMINAL ± 10%, SINGLE PHASE.
FREQUENCY: 50 OR 60 CYCLE OPERATION ±3%
SYSTEM POWER REQUIREMENTS: 6.2 KW MAX.

2.0 SHIPPING AND STORAGE REQUIREMENTS.
2.1 TEMPERATURE-HUMIDITY
-40°C (-40°F) TO +70°C (+158°F) 5-95% RH
2.2 SHOCK-VIBRATION
A. SHOCK IN ANY DIRECTION DURING SHIPMENT AND INSTALLATION 15 G'S FOR 2 MILLISECONDS.
B. VIBRATION IN ANY DIRECTION 5 TO 60 CPS, 5G.

3.0 OPERATING CONDITIONS
3.1 TEMPERATURE, HUMIDITY AND ALTITUDE
A. EXTERNAL TEMPERATURE
OPERATIONAL AMBIENT 0° TO 55°C
OPERATIONAL TRANSIENT ± 15°C AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C/MINUTE)
B. EXTERNAL RELATIVE HUMIDITY. 5 TO 95% (AIR SURROUNDING ENCLOSURES @ ANY OF THE ABOVE TEMPERATURE CONDITIONS)
C. ALTITUDE UP TO 5,000 FEET.
3.2 VIBRATION
EXTERNAL SOURCE-INSTALLED
5 TO 20 CPS 0.05" PEAK-TO-PEAK DISPLACEMENT.
20 TO 120 CPS, 1G.

4.0 ANGLE BRACE IS USED ONLY FOR SHIPPING & TO SUPPORT DESK FOR FLOOR MOUNTING. UPON COMPLETING INSTALLATION, SCRAP THIS PART.

5.0 WEIGHT 1,000 POUNDS (453.6 KG) APPROX

6.0 DIMENSION SHOWN IN PARENTHESIS ARE IN CENTIMETERS.

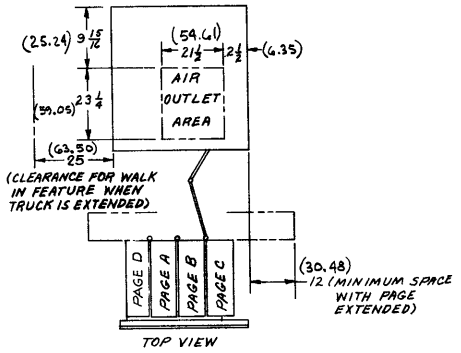
DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
	A ... K6-14	
	B CXII-40-181 ...	
	ANGMB-20477	

MADE BY ... APRIL 1966 — ISSUED May 5, 1966 — PROC. COMPUTER — PHOENIX — 68D974076

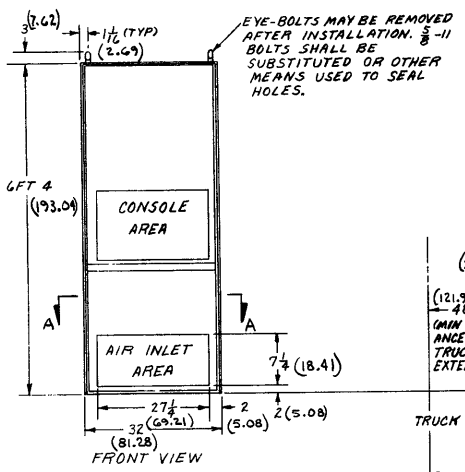
GENERAL ELECTRIC 68D998707

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —
APPLIED PRACTICES | SURFACES ✓ | TOLERANCES OR IGNORED DIMENSIONS: FRACTIONS, DECIMALS, ANGLES

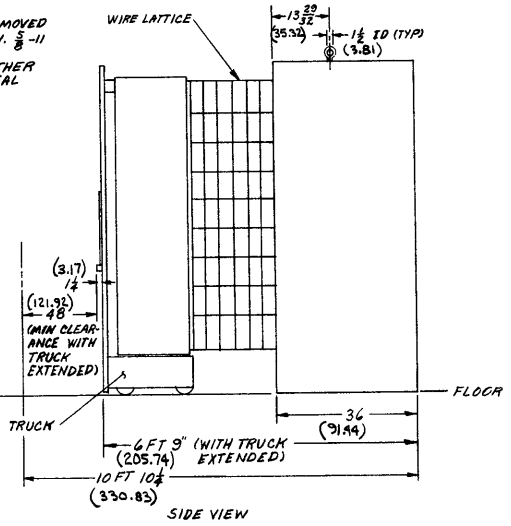
TITLE INSTALLATION OUTLINE
GE PAC COMPUTER CABINET (AU2)
FIRST MADE FOR SYS STD BOTTOM ENTRY



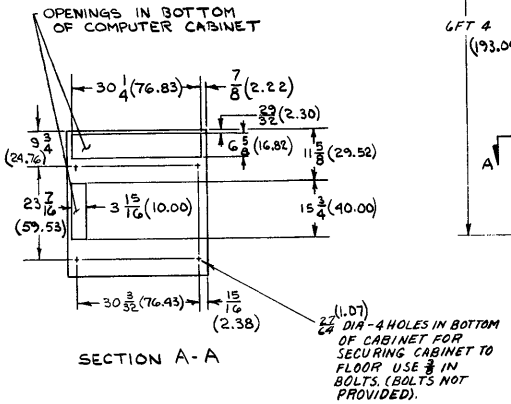
TOP VIEW



FRONT VIEW



SIDE VIEW

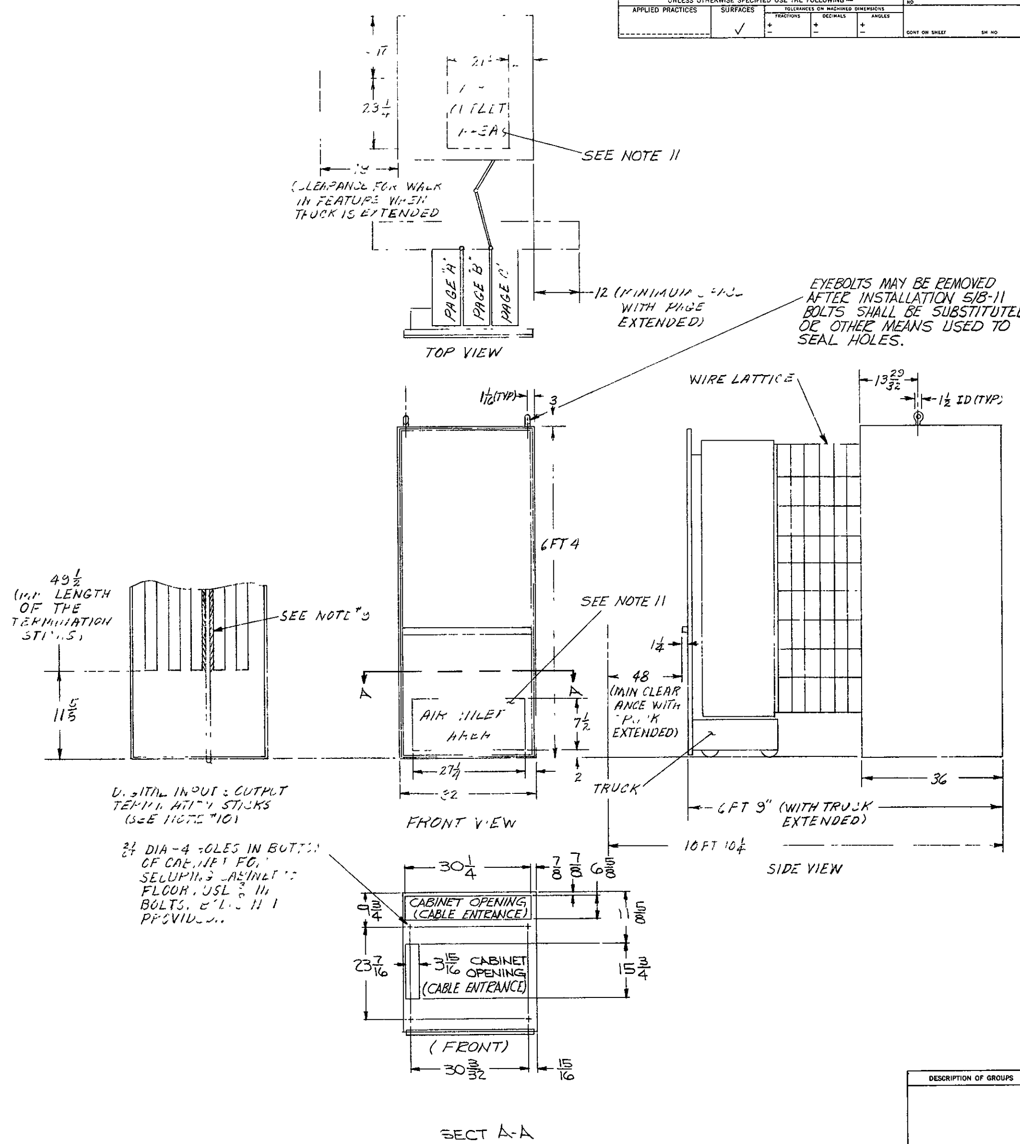


SECTION A-A

NOTE:
1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE.
2. TEMPERATURE
   OPERATIONAL AMBIENT:
   0°C TO 55°C (+32°F TO 131°F).
   OPERATIONAL TRANSIENT:
   ± 15°C (± 27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C OR .45°F PER MINUTE).
   STORAGE:
   -40°C TO 70°C (-40°F TO 158°F).
3. RELATIVE HUMIDITY
   0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS - AIR SURROUNDING CABINET AT ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION (ANY DIRECTION)
   a. EXTERNAL SOURCE - INSTALLED
   5 TO 15 CPS. 07IN (.17) PEAK TO PEAK DISPLACEMENT.
   15 TO 120 CPS 1G.
   b. EXTERNAL SOURCE - SHIPMENT
   5 TO 60 CPS 1G.
5. SHOCK (ANY DIRECTION)
   DURING SHIPMENT AND INSTALLATION 15 G'S FOR 2 MILLISECONDS.
6. CLEARANCE:
   FRONT: SEE SIDE VIEW
   REAR: NONE
   SIDE: SEE TOP VIEW
   TOP: 30 IN. (76.20)
7. ESTIMATED WEIGHT: 1500 LBS. (682 KG)
8. FLOOR AREA IN FRONT OF CABINET MUST BE FLAT AND WITHIN THE SAME PLANE AS THE AREA TO WHICH THE CABINET IS MOUNTED TO 1/4" (63) IN 3FT (91.44) FOR TRUCK EXTENSION
9. DIMENSIONS IN PARENTHESES ARE IN CENTIMETERS.

DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
	A GAAB-20-134	K6-14
	B GAAB-20-177	

DRAWN BY Leona Rafferty NOV 15 1965
ISSUED Nov. 17, 1965
APPROVALS CHKD. Nov 16, 1965
PROJECT ENGINEER PHOENIX
68D998707



GENERAL ELECTRIC

TITLE: GE/PAC CABINET (32" W/TRUCK)

NOTES:

1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE.
2. TEMPERATURE
   - OPERATIONAL AMBIENT: 0°C TO 55°C (+32°F TO 131°F)
   - OPERATIONAL TRANSIENT: ±15°C (±27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C OR .45°F PER MINUTE).
   - STORAGE: -40°C TO 70°C (-40°F TO 158°F)
3. RELATIVE HUMIDITY
   0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS - AIR SURROUNDING CABINET AT ANY OF THE ABOVE TEMPERATURE CONDITIONS).
4. VIBRATION (ANY DIRECTION)
   a. EXTERNAL SOURCE - INSTALLED
      5 TO 15 CPS .07 IN. PEAK TO PEAK DISPLACEMENT.
      15 TO 120 CPS 1G
   b. EXTERNAL SOURCE - SHIPMENT
      5 TO 60 CPS 1G
5. SHOCK (ANY DIRECTION)
   DURING SHIPMENT AND INSTALLATION 15 G'S FOR 2 MILLISECONDS.
6. CLEARANCE
   - FRONT: SEE SIDE VIEW
   - REAR: NONE
   - SIDE: SEE TOP VIEW
   - TOP: 30 IN.
7. ESTIMATED WEIGHT: 1200 LBS.
8. FLOOR AREA IN FRONT OF CABINET MUST BE FLAT AND WITHIN THE SAME PLANE AS THE AREA TO WHICH THE CABINET IS MOUNTED TO ¼ IN. IN 3 FT FOR TRUCK EXTENSION.
9. CUSTOMER CABLING IS DIRECTED TO THE ASSIGNED CABLING DUCT FOR ROUTING TO ITS ASSIGNED TERMINATION LOCATION.
10. TYPICAL TERMINATIONS THAT CAN BE EXPECTED FOR INCOMING CABLES THESE DIGITAL TERMINATION STICKS MAIEE MOUNTED ON EITHER THE LEFT SIDE, REAR OR BOTH WALLS.
11. VENT COVERINGS:
    a. AIR INLET AREA COVERED WITH GRILL.
    b. AIR OULET AREA COVERED WITH EXPANDED METAL.

PROPRIETARY INFORMATION OF GENERAL ELECTRIC COMPANY

REVISIONS: A — TITLE WAS ... IO CABINET (32" W/TRUCK) ADDED SECT A-A REC CHANGE 777; B — AW9HVJ-80-050

ISSUED May 11, 1965 — PROCESS COMPUTER DEPT — PHOENIX

68D998631

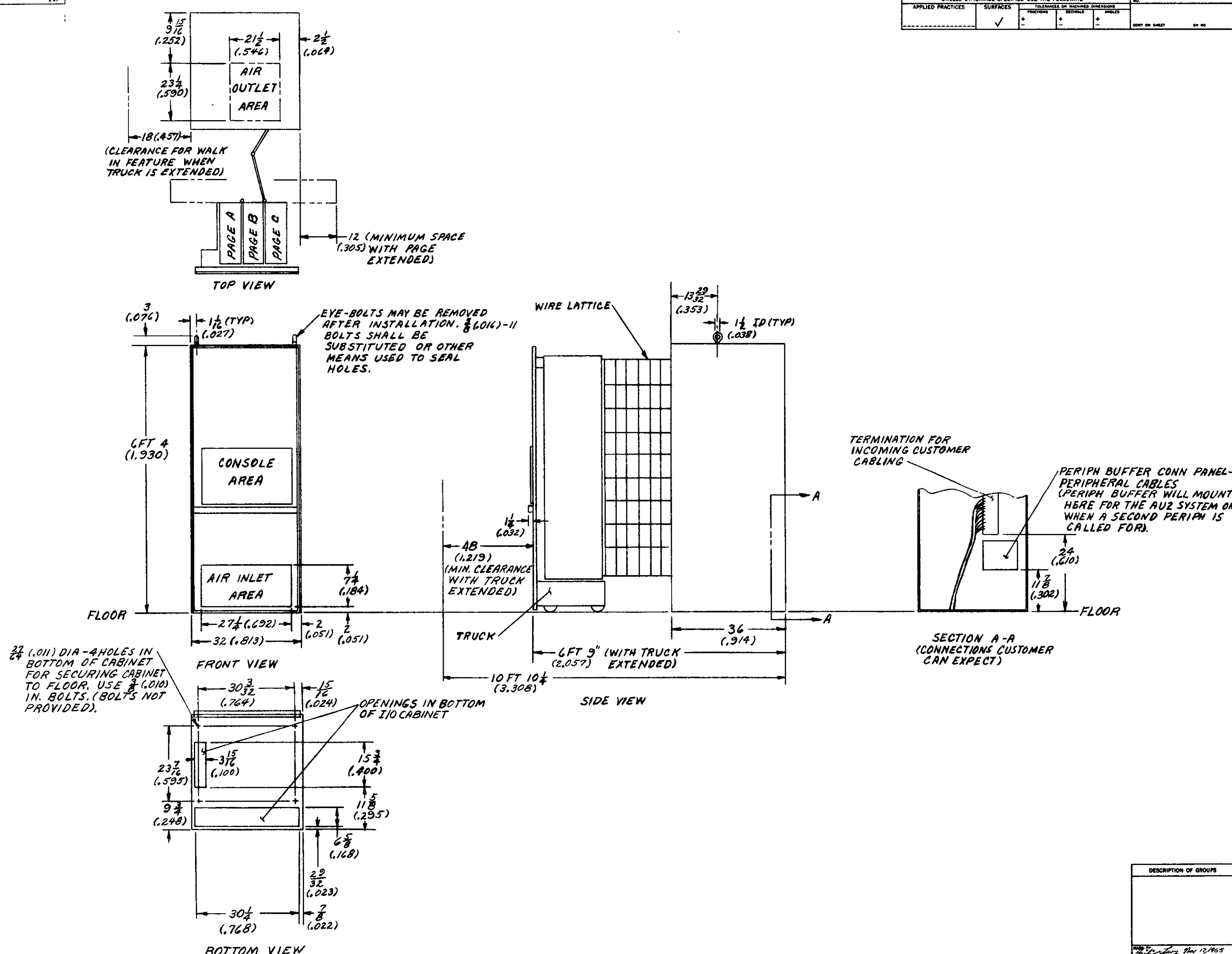
GENERAL ELECTRIC 68D998706

TITLE INSTALLATION OUTLINE

G E PAC I/O CABINET

FIRST MADE FOR SYS STD

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING— APPLIED PRACTICES / SURFACES ✓ / TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± DECIMALS ± ANGLES ±



AIR OUTLET AREA
21½ (.546)
2½ (.064)
9 15/16 (.252)
23¼ (.590)
18 (.457)
(CLEARANCE FOR WALK IN FEATURE WHEN TRUCK IS EXTENDED)
PAGE A
PAGE B
PAGE C
12 (.305) (MINIMUM SPACE WITH PAGE EXTENDED)
TOP VIEW
3 (.076)
1 1/16 (TYP) (.027)
EYE-BOLTS MAY BE REMOVED AFTER INSTALLATION. 5/8 (.016)-11 BOLTS SHALL BE SUBSTITUTED OR OTHER MEANS USED TO SEAL HOLES.
6 FT 4 (1.930)
CONSOLE AREA
AIR INLET AREA
7¼ (.184)
FLOOR
27¼ (.692)
32 (.813)
2 (.051)
2 (.051)
FRONT VIEW
WIRE LATTICE
13 29/32 (.353)
1½ ID (TYP) (.038)
1¼ (.032)
48 (1.219) (MIN. CLEARANCE WITH TRUCK EXTENDED)
TRUCK
36 (.914)
6 FT 9" (2.057) (WITH TRUCK EXTENDED)
10 FT 10¼ (3.308)
A
A
SIDE VIEW
TERMINATION FOR INCOMING CUSTOMER CABLING
PERIPH BUFFER CONN PANEL-PERIPHERAL CABLES (PERIPH BUFFER WILL MOUNT HERE FOR THE AU2 SYSTEM OR WHEN A SECOND PERIPH IS CALLED FOR).
24 (.610)
11 7/8 (.302)
FLOOR
SECTION A-A (CONNECTIONS CUSTOMER CAN EXPECT)
27/64 (.011) DIA-4 HOLES IN BOTTOM OF CABINET FOR SECURING CABINET TO FLOOR. USE 3/8 (.010) IN. BOLTS. (BOLTS NOT PROVIDED).
30 3/32 (.764)
15/16 (.024)
OPENINGS IN BOTTOM OF I/O CABINET
23 7/16 (.595)
3 15/16 (.100)
15 3/4 (.400)
9¾ (.248)
11 5/8 (.295)
6 5/8 (.168)
29/32 (.023)
30¼ (.768)
7/8 (.022)
BOTTOM VIEW

NOTE:

1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE.
2. TEMPERATURE
   - OPERATIONAL AMBIENT: 0°C TO 55°C (+32°F TO 131°F)
   - OPERATIONAL TRANSIENT: ±15°C (±27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C OR .45°F PER MINUTE).
   - STORAGE: -40°C TO 70°C (-40°F TO 158°F).
3. RELATIVE HUMIDITY
   0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS - AIR SURROUNDING CABINET AT ANY OF THE ABOVE TEMPERATURE CONDITIONS).
4. VIBRATION
   a. EXTERNAL SOURCE - INSTALLED 5-15 CPS .07 IN. PEAK TO PEAK DISPLACEMENT. 15 TO 120 CPS 1G
   b. EXTERNAL SOURCE - SHIPMENT 5-60 CPS 1G
5. SHOCK (ANY DIRECTION) DURING SHIPMENT AND INSTALLATION 15G'S FOR 2 MILLI-SECONDS.
6. CLEARANCE
   - FRONT: SEE SIDE VIEW
   - REAR: NONE
   - SIDE: SEE TOP VIEW
   - TOP: 30 IN (.762)
7. ESTIMATED WEIGHT: 1500 LBS. (680.40 KG)
8. FLOOR AREA IN FRONT OF CABINET MUST BE FLAT AND WITHIN THE SAME PLANE AS THE AREA TO WHICH THE CABINET IS MOUNTED TO ¼ IN. (.006) IN 3 FT (.914) FOR TRUCK EXTENSION.
9. ALL DIMENSIONS SHOWN IN PARENTHESIS ARE IN METERS.

DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
		K6-14

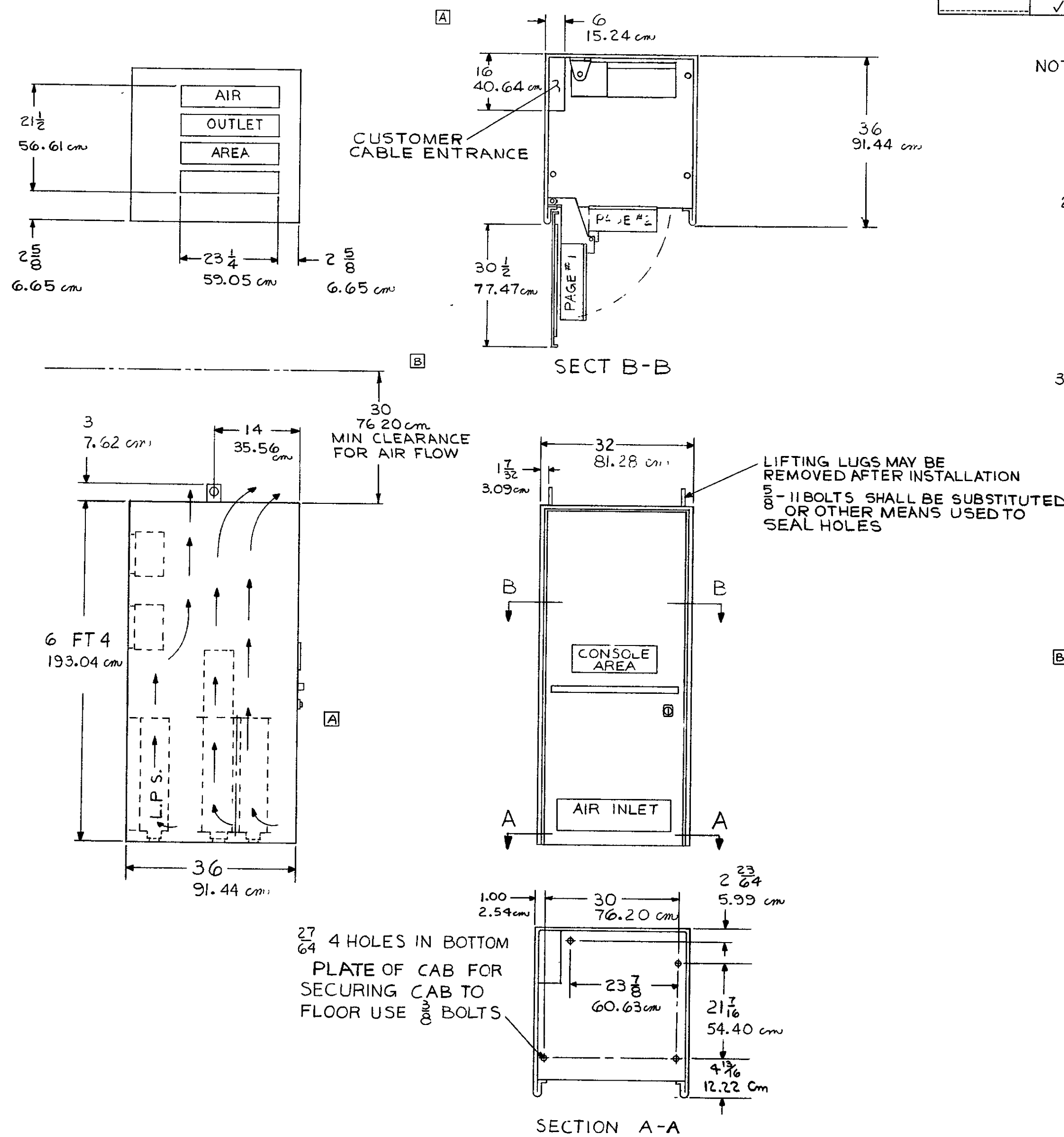
Nov 12 1965 · Nov. 18 1965 · C.B.G. Nov. 17 65 · PROC COMPUTER · PHOENIX · 68D998706 · SH NO 1

GENERAL ELECTRIC 68D974078

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING — APPLIED PRACTICES | SURFACES | TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± | DECIMALS ± | ANGLES ±

TITLE INSTALLATION OUTLINE SMALL COMPUTER (INDUSTRIAL CABINET)

FIRST MADE FOR SYS STD



NOTES:

PROPRIETARY INFORMATION OF GENERAL ELECTRIC COMPANY

1.0 ELECTRICAL REQUIREMETS
VOLTAGE: 115/230 VOLTS NOMINAL ± 10%, SINGLE PHASE.
FREQUENCY: 50 OR 60 CYCLE OPERATION ± 3%.
COMPUTER CABINET POWER REQUIREMENTS 6.2 KW MAX.

2.0 SHIPPING AND STORAGE REQUIREMENTS
2.1 TEMPERATURE – HUMIDITY
-40°C(-40°F) TO +70°C (+158°F) 5 - 95 % RH
2.2 SHOCK - VIBRATION
A. SHOCK IN ANY DIRECTION DURING SHIPMENT AND INSTALLATION -15 G'S FOR 2 MILLISECONDS.
B. VIBRATION IN ANY DIRECTION 5 TO 60 CPS. 5 G

3.0 OPERATING CONDITION
3.1 TEMPERATURE, HUMIDITY, AND ALTITUDE
A. EXTERNAL TEMPERATURE-OPERATIONAL AMBIENT 0° TO 55°C OPERATIONAL TRANSIENT ± 15°C AT A LINEAR RATE OVER A ONE-HOUR PERIOD (.25° C/MINUTE)
B. EXTERNAL RELATIVE HUMIDITY, 5 TO 95 % (AIR SURROUNDING ENCLOSURE @ ANY OF THE ABOVE TEMPERATURE CONDITIONS)
C. ALTITUDE UP TO 5,000 FEET

3.2 VIBRATION
A. EXTERNAL SOURCE-INSTALLED
5 TO 20 CPS 0.05" PEAK TO PEAK DISPLACEMENT
20 TO 120 CPS, 1G

3.3 WEIGHT: 1000 POUNDS (453.6 KG) APPROX.

PROPRIETARY INFORMATION OF GENERAL ELECTRIC COMPANY

DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
	A AN 5XTJ-40-6-12	K6-14
	B AN 6XTJ-40-105	ALC
	C AN 7XTJ-40-155	
	D 8XTJ-40-213	

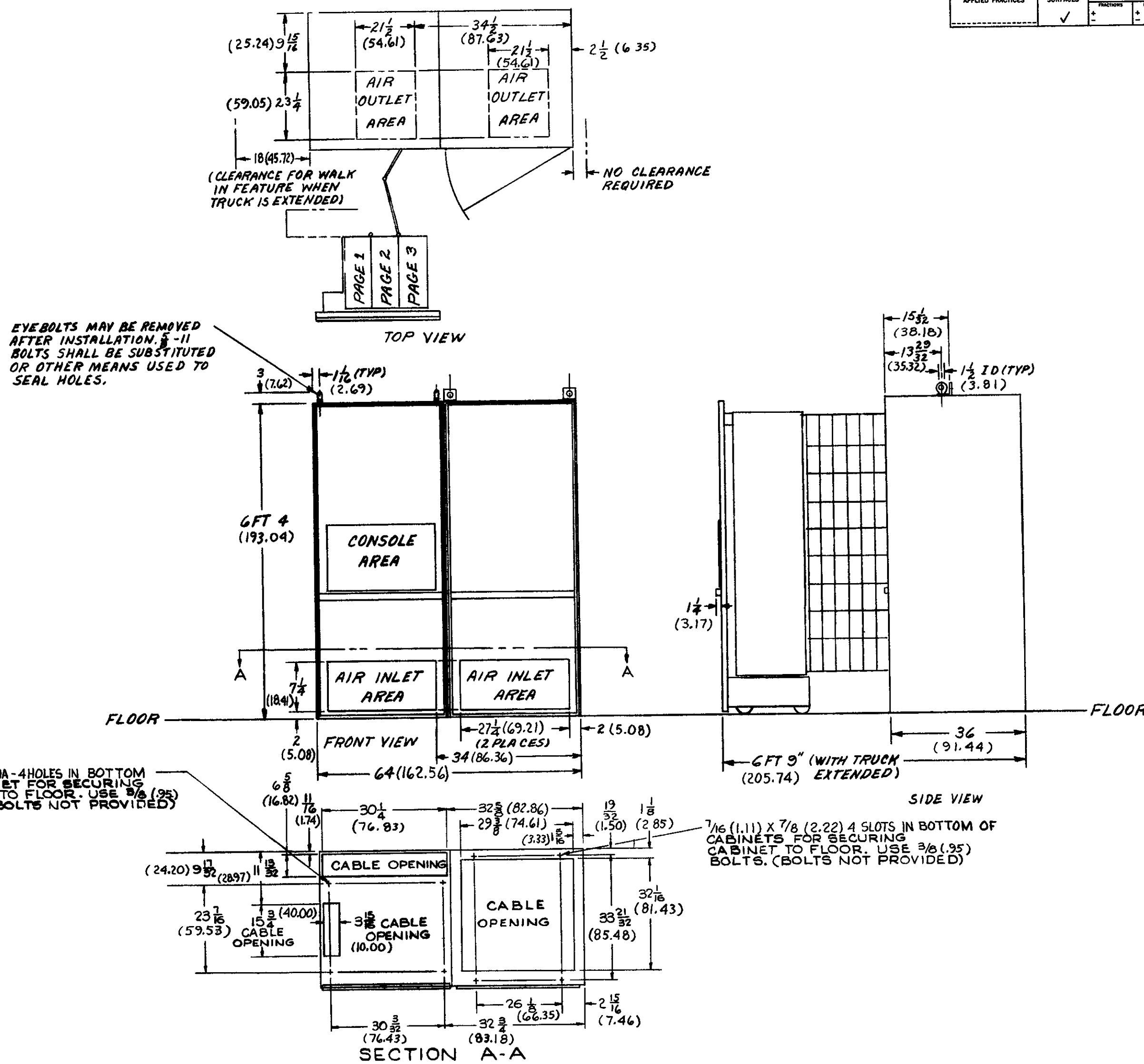
APRIL 28, 1966 — May 5, 1966 — 5-4-66 — PROC COMPUTER — PHOENIX — 68D974078 — STD

GENERAL ELECTRIC 68D998823

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING—

TITLE INSTALLATION OUTLINE

GE/PAC TWO CABINET COMPLEX



TOP VIEW
AIR OUTLET AREA
AIR OUTLET AREA
(CLEARANCE FOR WALK IN FEATURE WHEN TRUCK IS EXTENDED)
NO CLEARANCE REQUIRED
PAGE 1
PAGE 2
PAGE 3
EYEBOLTS MAY BE REMOVED AFTER INSTALLATION. 5/8-11 BOLTS SHALL BE SUBSTITUTED OR OTHER MEANS USED TO SEAL HOLES.
CONSOLE AREA
AIR INLET AREA
AIR INLET AREA
FLOOR
FRONT VIEW
6FT 4 (193.04)
64 (162.56)
SIDE VIEW
6FT 9" (WITH TRUCK EXTENDED) (205.74)
36 (91.44)
27/64 (1.07) DIA - 4 HOLES IN BOTTOM OF CABINET FOR SECURING CABINET TO FLOOR. USE 3/8 (.95) BOLTS. (BOLTS NOT PROVIDED)
7/16 (1.11) X 7/8 (2.22) 4 SLOTS IN BOTTOM OF CABINETS FOR SECURING CABINET TO FLOOR. USE 3/8 (.95) BOLTS. (BOLTS NOT PROVIDED)
CABLE OPENING
CABLE OPENING
CABLE OPENING
SECTION A-A

NOTE:

1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE. MAXIMUM SHOCK LOAD IS 15 G'S FOR 2 MILLISECONDS DURATION. MAXIMUM VIBRATION AMPLITUDE IS: 5-15 CPS AT .07 TOTAL EXCURSION OR 15-120 CPS AT 1 G ± .2G.
2. AMBIENT CONDITIONS: TEMPERATURE RANGE FOR EQUIPMENT: 0°C TO 55°C (+32°F TO 131°F) WITH A MAXIMUM RATE OF CHANGE OF ± 15°C (±27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C OR 45°F PER MINUTE). RELATIVE HUMIDITY RANGE IS 0% TO 95%.
3. CLEARANCE:
   FRONT: SEE SIDE VIEW
   REAR: NONE
   SIDE: SEE TOP VIEW
   TOP: 30 IN. (76.20)
4. ESTIMATED WEIGHT: 2200 LBS. (1000 KILO)
5. DIMENSIONS IN PARENTHESES ARE IN CENTIMETERS.

PROPRIETARY INFORMATION OF GENERAL ELECTRIC COMPANY

REVISIONS

A CHANGE TITLE, WAS GE/PAC COMPUTER & I/O CABINET REC CHANGE 598

B AN 6AAB-20-134

PROCESS COMPUTER PHOENIX

68D998823

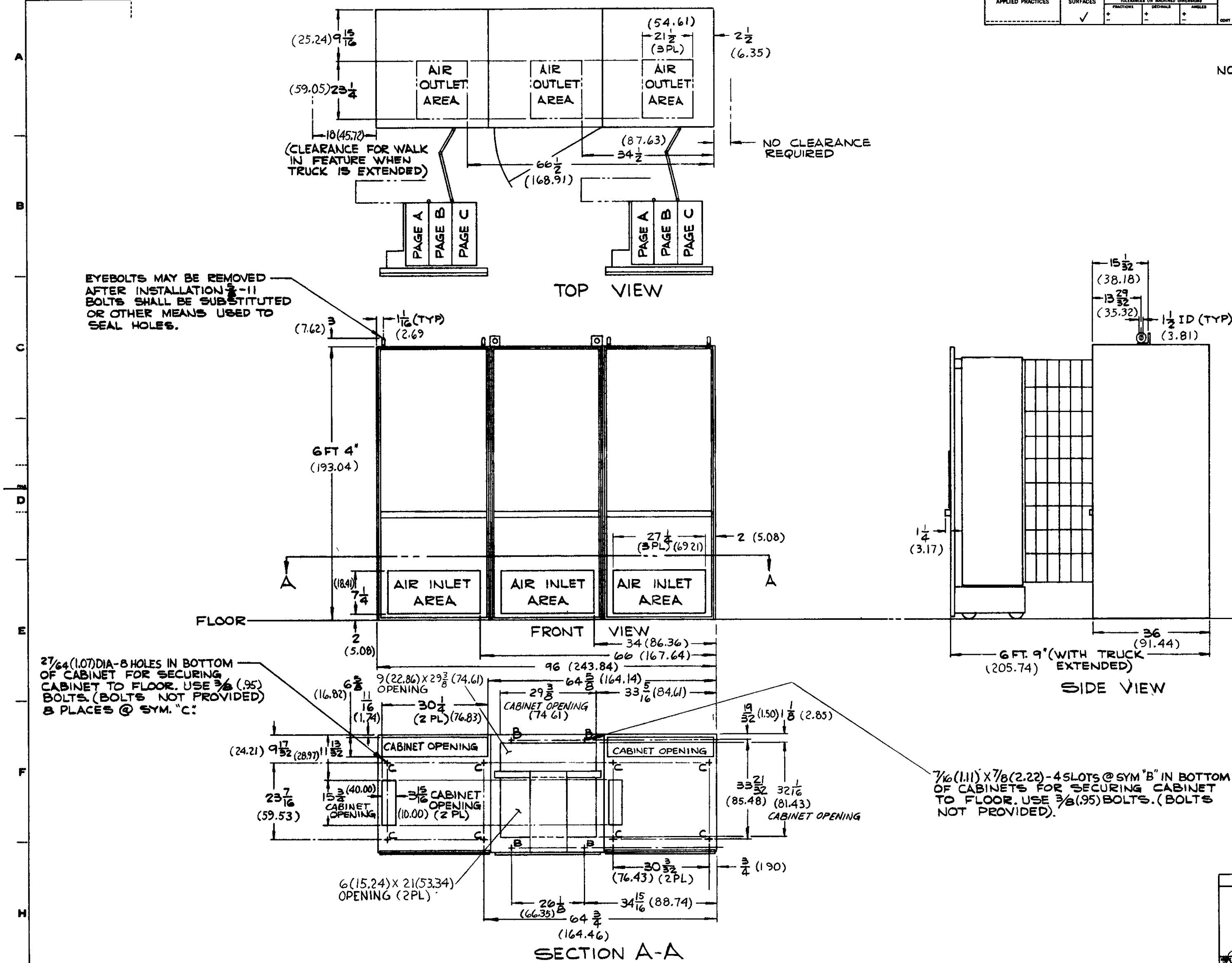
GENERAL ELECTRIC 68D998893

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING—

TITLE INSTALLATION OUTLINE

GE/PAC THREE CABINET COMPLEX

FIRST MADE FOR SYS. STO.



(25.24) 9 15/16
(59.05) 23 1/4
(54.61)
21 1/2
(3 PL)
2 1/2
(6.35)
AIR OUTLET AREA
AIR OUTLET AREA
AIR OUTLET AREA
18 (45.72)
(CLEARANCE FOR WALK IN FEATURE WHEN TRUCK IS EXTENDED)
(87.63)
34 1/2
66 1/2
(168.91)
NO CLEARANCE REQUIRED
PAGE A
PAGE B
PAGE C
PAGE A
PAGE B
PAGE C
TOP VIEW
EYEBOLTS MAY BE REMOVED AFTER INSTALLATION. 5/8-11 BOLTS SHALL BE SUBSTITUTED OR OTHER MEANS USED TO SEAL HOLES.
(7.62) 3
1 1/16 (TYP)
(2.69)
6 FT 4"
(193.04)
27 1/4
(3 PL) (69.21)
2 (5.08)
A
A
(18.41) 7 1/4
AIR INLET AREA
AIR INLET AREA
AIR INLET AREA
FLOOR
FRONT VIEW
2
(5.08)
34 (86.36)
66 (167.64)
96 (243.84)
27/64 (1.07) DIA - 8 HOLES IN BOTTOM OF CABINET FOR SECURING CABINET TO FLOOR. USE 3/8 (.95) BOLTS. (BOLTS NOT PROVIDED) 8 PLACES @ SYM. "C".
6 5/8
(16.82)
11/16
(1.74)
30 1/4
(2 PL) (76.83)
9 (22.86) X 29 3/8 (74.61) OPENING
29 3/8
CABINET OPENING (74.61)
64 5/8 (164.14)
33 5/16 (84.61)
19/32 (1.50)
1 1/8 (2.85)
(24.21) 9 17/32
(28.97) 11 13/32
CABINET OPENING
CABINET OPENING
23 7/16
(59.53)
15 3/4 (40.00)
CABINET OPENING
3 15/16 CABINET OPENING
(10.00) (2 PL)
33 21/32
(85.48)
32 1/16
(81.43)
CABINET OPENING
7/16 (1.11) X 7/8 (2.22) - 4 SLOTS @ SYM "B" IN BOTTOM OF CABINETS FOR SECURING CABINET TO FLOOR. USE 3/8 (.95) BOLTS. (BOLTS NOT PROVIDED).
30 3/32
(76.43) (2 PL)
3/4 (1.90)
6 (15.24) X 21 (53.34) OPENING (2 PL)
26 1/8
(66.35)
34 15/16 (88.74)
64 3/4
(164.46)
SECTION A-A
15 1/32
(38.18)
13 29/32
(35.32)
1 1/2 ID (TYP)
(3.81)
1 1/4
(3.17)
FLOOR
36
(91.44)
6 FT. 9" (WITH TRUCK EXTENDED)
(205.74)
SIDE VIEW

NOTES:

1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE. MAXIMUM SHOCK LOAD IS 15G'S FOR 2 MILLISECONDS DURATION. MAXIMUM VIBRATION AMPLITUDE IS: 5-15 CPS AT .07 TOTAL EXCURSION OR 15-120 CPS AT 1G ± .2G.
2. AMBIENT CONDITIONS:
   TEMPERATURE RANGE FOR EQUIPMENT: 0°C TO 55°C (+32°F TO 131°F) WITH A MAXIMUM RATE OF CHANGE OF ± 15°C (± 27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C OR .45°F PER MINUTE). RELATIVE HUMIDITY RANGE IS 0% TO 95%.
3. CLEARANCE:
   FRONT: SEE SIDE VIEW
   REAR: NONE
   SIDE: SEE TOP VIEW
   TOP: 30 IN. (76.20)
4. ESTIMATED WEIGHT: 4500 LBS. (2045 KILO)
5. FLOOR AREA IN FRONT OF CABINETS WITH TRUCKS MUST BE FLAT AND WITHIN THE SAME PLANE AS THE AREA TO WHICH THE CABINET IS MOUNTED TO 1/4 (.63) IN 36 (91.44) FOR TRUCK EXTENSION.
6. DIMENSIONS IN PARENTHESES ARE IN CENTIMETERS.

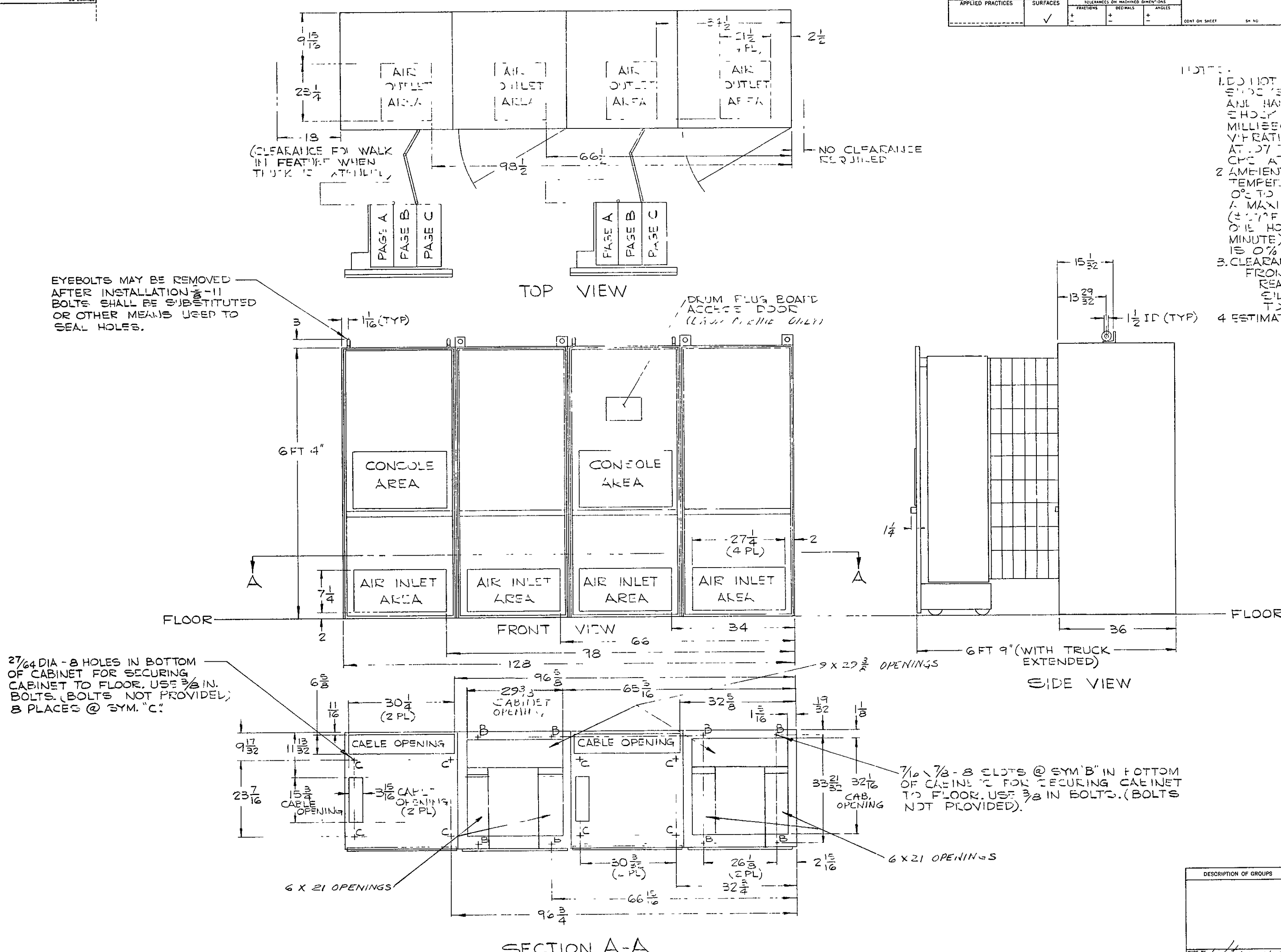
DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
	C RECORD CHANGE. DELETED CONSOLE AREA & DRUM PLUG BOARD, ADDED NOTE 5, CHANGED WEIGHT FROM 2700 TO 4500	
	D AN 6AAB-20-134	

JAN 4 '65 — PROC. COMPUTER — PHOENIX — 68D998893

GENERAL ELECTRIC 63D998853

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —				
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS — FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

TITLE INSTALLATION DIAGRAM
GE PAC FOUR CABINET COMPLEX
FIRST MADE FOR



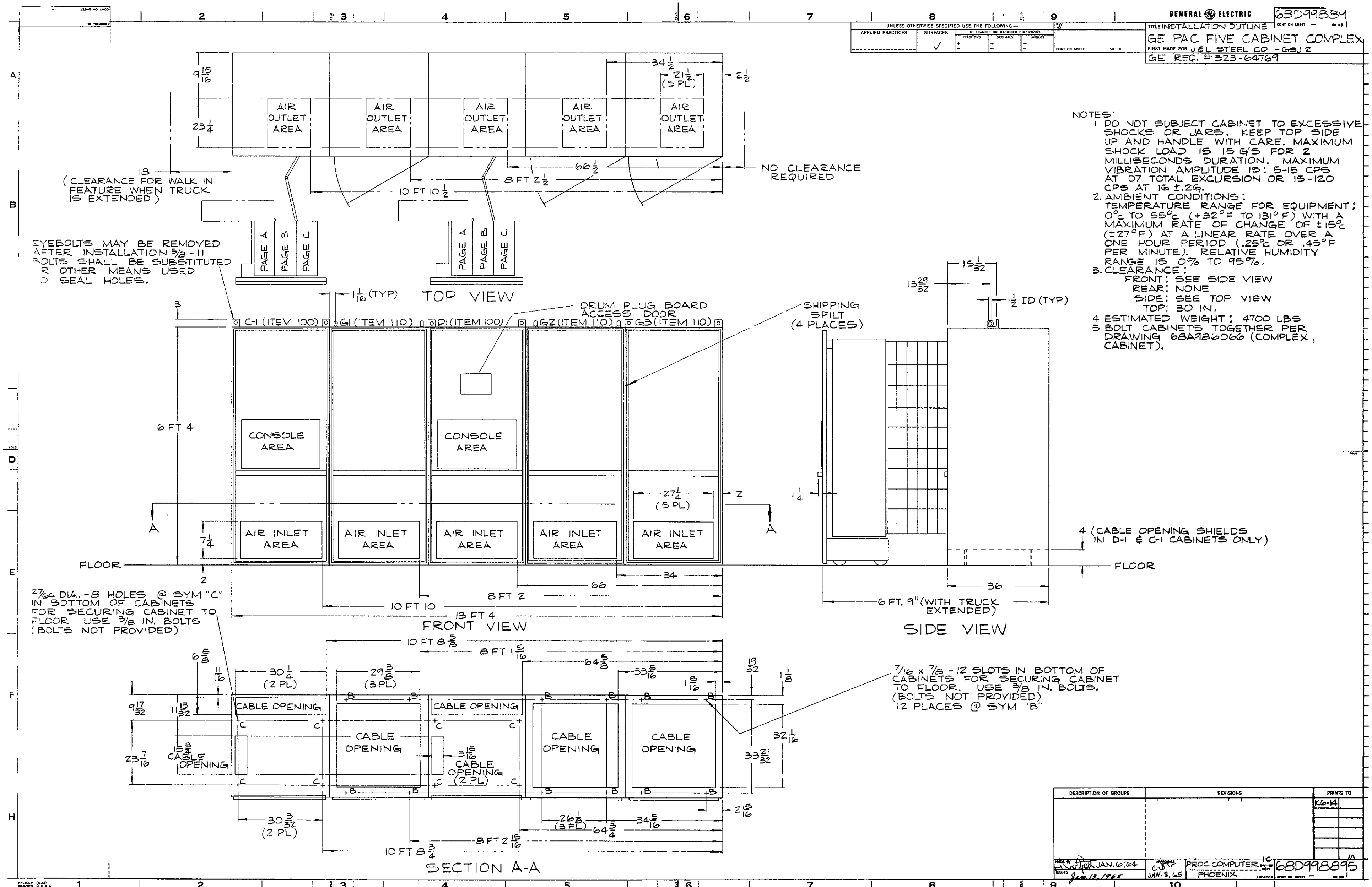
AIR OUTLET AREA
PAGE A
PAGE B
PAGE C
(CLEARANCE FOR WALK IN FEATURE WHEN TRUCK IS ATTACHED)
NO CLEARANCE REQUIRED
TOP VIEW
EYEBOLTS MAY BE REMOVED AFTER INSTALLATION 3/8-11 BOLTS SHALL BE SUBSTITUTED OR OTHER MEANS USED TO SEAL HOLES.
DRUM PLUG BOARD ACCESS DOOR
6 FT 4"
CONSOLE AREA
AIR INLET AREA
FLOOR
FRONT VIEW
1 1/2 ID (TYP)
6 FT 9"(WITH TRUCK EXTENDED)
SIDE VIEW
27/64 DIA - 8 HOLES IN BOTTOM OF CABINET FOR SECURING CABINET TO FLOOR. USE 3/8 IN. BOLTS. (BOLTS NOT PROVIDED) 8 PLACES @ SYM. "C"
9 X 29 3/4 OPENINGS
CABLE OPENING
CAB. OPENING
7/16 X 7/8 - 8 SLOTS @ SYM "B" IN BOTTOM OF CABINET FOR SECURING CABINET TO FLOOR. USE 3/8 IN BOLTS. (BOLTS NOT PROVIDED).
6 X 21 OPENINGS
SECTION A-A

NOTES:

1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE. MAXIMUM SHOCK LOAD IS 15 G'S FOR 2 MILLISECONDS DURATION. MAXIMUM VIBRATION AMPLITUDE IS 5-15 CPS AT .07 TOTAL EXCURSION OF 15-120 CPS AT 1G ±.25.
2. AMBIENT CONDITIONS: TEMPERATURE RANGE FOR EQUIPMENT: 0°C TO 52°C (+32°F TO 131° F) WITH A MAXIMUM RATE OF CHANGE OF ±15°C (±27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (25°C OR 45°F PER MINUTE). RELATIVE HUMIDITY RANGE IS 0% TO 95%.
3. CLEARANCE:
   FRONT: SEE SIDE VIEW
   REAR: NONE
   SIDE: SEE TOP VIEW
   TOP: 30 IN
4. ESTIMATED WEIGHT.

DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
	A — REDRAW CHANGE; Dec 2,1964	K6-14
	B — EPA CHG; ADDED SIZE OPENING; Sept 9, 1965	
		M

MADE BY — ISSUED Aug 27, 1964 — APPROVALS — PROC COMPUTER DEPT. PHOENIX — 63D998853

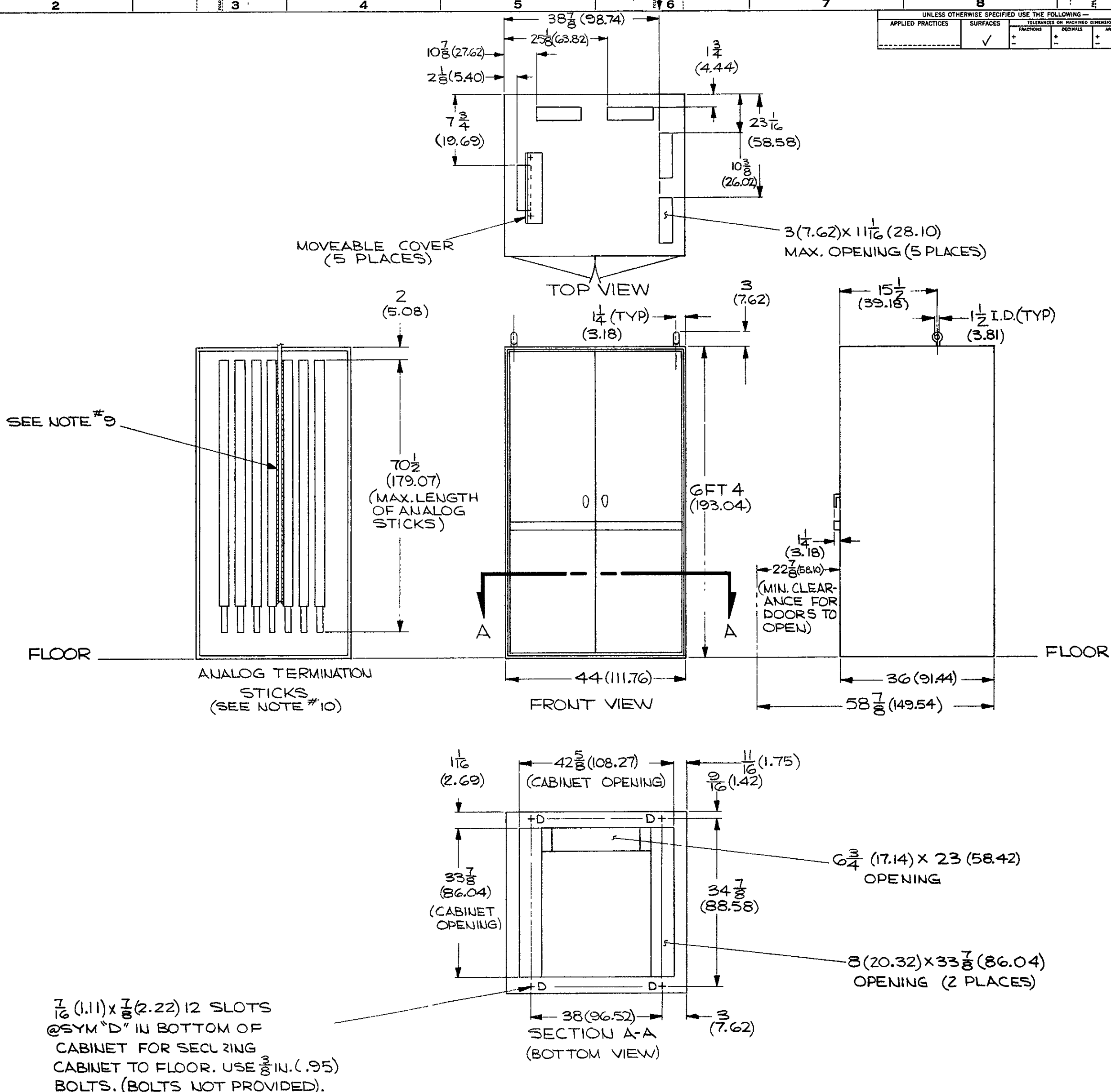

GENERAL ELECTRIC 63D99854
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —
APPLIED PRACTICES
SURFACES
TOLERANCES ON MACHINED DIMENSIONS
FRACTIONS
DECIMALS
ANGLES
TITLE INSTALLATION OUTLINE
GE PAC FIVE CABINET COMPLEX
FIRST MADE FOR J & L STEEL CO - GSJ 2
GE REQ. #323-64769
NOTES:
1 DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE. MAXIMUM SHOCK LOAD IS 15 G'S FOR 2 MILLISECONDS DURATION. MAXIMUM VIBRATION AMPLITUDE IS: 5-15 CPS AT .07 TOTAL EXCURSION OR 15-120 CPS AT 1G ±.2G.
2. AMBIENT CONDITIONS: TEMPERATURE RANGE FOR EQUIPMENT: 0°C TO 55°C (+32°F TO 131°F) WITH A MAXIMUM RATE OF CHANGE OF ±15°C (±27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C OR .45°F PER MINUTE). RELATIVE HUMIDITY RANGE IS 0% TO 95%.
3. CLEARANCE:
FRONT: SEE SIDE VIEW
REAR: NONE
SIDE: SEE TOP VIEW
TOP: 30 IN.
4 ESTIMATED WEIGHT: 4700 LBS
5 BOLT CABINETS TOGETHER PER DRAWING 68A986066 (COMPLEX, CABINET).
AIR OUTLET AREA
18 (CLEARANCE FOR WALK IN FEATURE WHEN TRUCK IS EXTENDED)
NO CLEARANCE REQUIRED
10 FT 10 1/2
8 FT 2 1/2
66 1/2
34 1/2
21 1/2 (5 PL)
PAGE A
PAGE B
PAGE C
TOP VIEW
EYEBOLTS MAY BE REMOVED AFTER INSTALLATION 5/8-11 BOLTS SHALL BE SUBSTITUTED OR OTHER MEANS USED TO SEAL HOLES.
1 1/16 (TYP)
DRUM PLUG BOARD ACCESS DOOR
SHIPPING SPLIT (4 PLACES)
C-1 (ITEM 100)
G1 (ITEM 110)
D1 (ITEM 100)
G2 (ITEM 110)
G3 (ITEM 110)
6 FT 4
CONSOLE AREA
AIR INLET AREA
27 1/4 (5 PL)
FLOOR
8 FT 2
10 FT 10
13 FT 4
FRONT VIEW
15 1/32
13 29/32
1 1/2 ID (TYP)
4 (CABLE OPENING SHIELDS IN D-1 & C-1 CABINETS ONLY)
36
6 FT. 9" (WITH TRUCK EXTENDED)
SIDE VIEW
27/64 DIA. -8 HOLES @ SYM "C" IN BOTTOM OF CABINETS FOR SECURING CABINET TO FLOOR USE 3/8 IN. BOLTS (BOLTS NOT PROVIDED)
7/16 x 7/8 - 12 SLOTS IN BOTTOM OF CABINETS FOR SECURING CABINET TO FLOOR. USE 3/8 IN. BOLTS. (BOLTS NOT PROVIDED) 12 PLACES @ SYM "B"
10 FT 8 3/8
8 FT 1 5/16
CABLE OPENING
30 1/4 (2 PL)
29 3/8 (3 PL)
30 3/32 (2 PL)
26 1/8 (3 PL)
8 FT 2 15/16
10 FT 8 3/4
SECTION A-A
DESCRIPTION OF GROUPS
REVISIONS
PRINTS TO
K6-14
JAN. 6 '64
JAN. 13, 1965
JAN. 8, 65
PROC COMPUTER
PHOENIX
68D998895

GENERAL ELECTRIC 68D998667

TITLE INSTALLATION OUTLINE, GE/PAC I/O CABINET (44") (TOP ENTRY)

FIRST MADE FOR SYS STD

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING — APPLIED PRACTICES / SURFACES ✓ / TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± / DECIMALS ± / ANGLES ±



38 7/8 (98.74)
25 1/8 (63.82)
10 7/8 (27.62)
2 1/8 (5.40)
1 3/4 (4.44)
7 3/4 (19.69)
23 1/16 (58.58)
10 3/8 (26.02)
MOVEABLE COVER (5 PLACES)
3 (7.62) x 11 1/16 (28.10) MAX. OPENING (5 PLACES)
TOP VIEW
2 (5.08)
1/4 (TYP) (3.18)
3 (7.62)
15 1/2 (39.18)
1 1/2 I.D. (TYP) (3.81)
SEE NOTE #9
70 1/2 (179.07) (MAX. LENGTH OF ANALOG STICKS)
6FT 4 (193.04)
1/4 (3.18)
22 7/8 (58.10) (MIN. CLEARANCE FOR DOORS TO OPEN)
A
A
FLOOR
FLOOR
ANALOG TERMINATION STICKS (SEE NOTE #10)
44 (111.76)
FRONT VIEW
36 (91.44)
58 7/8 (149.54)
1 1/16 (2.69)
42 5/8 (108.27) (CABINET OPENING)
11/16 (1.75)
9/16 (1.42)
6 3/4 (17.14) x 23 (58.42) OPENING
33 7/8 (86.04) (CABINET OPENING)
34 7/8 (88.58)
8 (20.32) x 33 7/8 (86.04) OPENING (2 PLACES)
7/16 (1.11) x 7/8 (2.22) 12 SLOTS @SYM "D" IN BOTTOM OF CABINET FOR SECURING CABINET TO FLOOR. USE 3/8 IN. (.95) BOLTS. (BOLTS NOT PROVIDED).
38 (96.52)
3 (7.62)
SECTION A-A (BOTTOM VIEW)

NOTES:

1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE.
2. TEMPERATURE
   OPERATIONAL AMBIENT: 0°C TO 55°C (+32°F TO 131°F).
   OPERATIONAL TRANSIENT: ±15°C (±27°F) AT A LINEAR RATE OVER A ONE HOUR PERIOD (.25°C OR .45°F PER MINUTE).
   STORAGE: −40°C TO 70°C (−40°F TO 158°F).
3. RELATIVE HUMIDITY
   0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS — AIR SURROUNDING CABINET AT ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION (ANY DIRECTION)
   a. EXTERNAL SOURCE - INSTALLED 5 TO 15 CPS .07 IN. PEAK TO PEAK DISPLACEMENT. 15 TO 120 CPS 1G
   b. EXTERNAL SOURCE - SHIPMENT 5 TO 60 CPS 1G
5. SHOCK (ANY DIRECTION)
   DURING SHIPMENT AND INSTALLATION 15 G'S FOR 2 MILLISECONDS.
6. CLEARANCE
   FRONT: SEE SIDE VIEW
   REAR: NONE
   SIDE: NONE
   TOP: 30 IN. (76.20)
7. ESTIMATED WEIGHT: 750 LBS.
8. DOORS TO OPEN 90° FOR ACCESS TO CABINET INTERIOR.
9. CUSTOMER CABLING IS DIRECTED TO THE ASSIGNED CABLING DUCT FOR ROUTING TO ITS ASSIGNED TERMINATION LOCATION.
10. TYPICAL TERMINATIONS THAT CAN BE EXPECTED FOR INCOMING CABLES. THESE ANALOG TERMINATION STICKS MAY BE MOUNTED ON ANY OR ALL OF THE CABINET THREE WALLS.
11. ALL DIMENSIONS SHOWN IN PARENTHESES ARE IN CENTIMETERS.

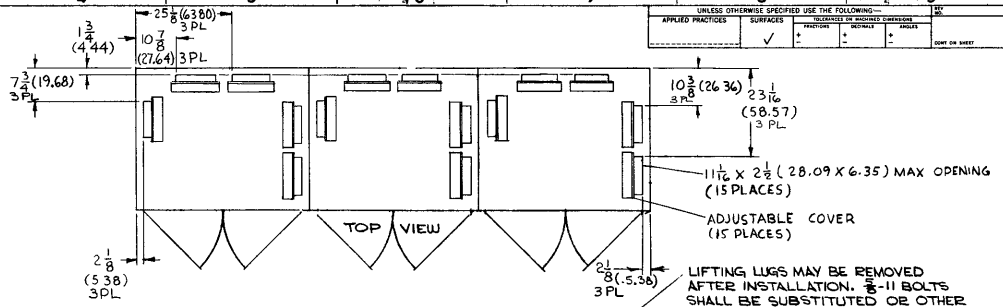
DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
		KG-14

MADE BY A. Flore OCT 10, '66 — ISSUED Oct 25, 1966 — APPROVALS C.G. OCT-14, 66 — PROCESS COMPUTER PHOENIX — 68D998667

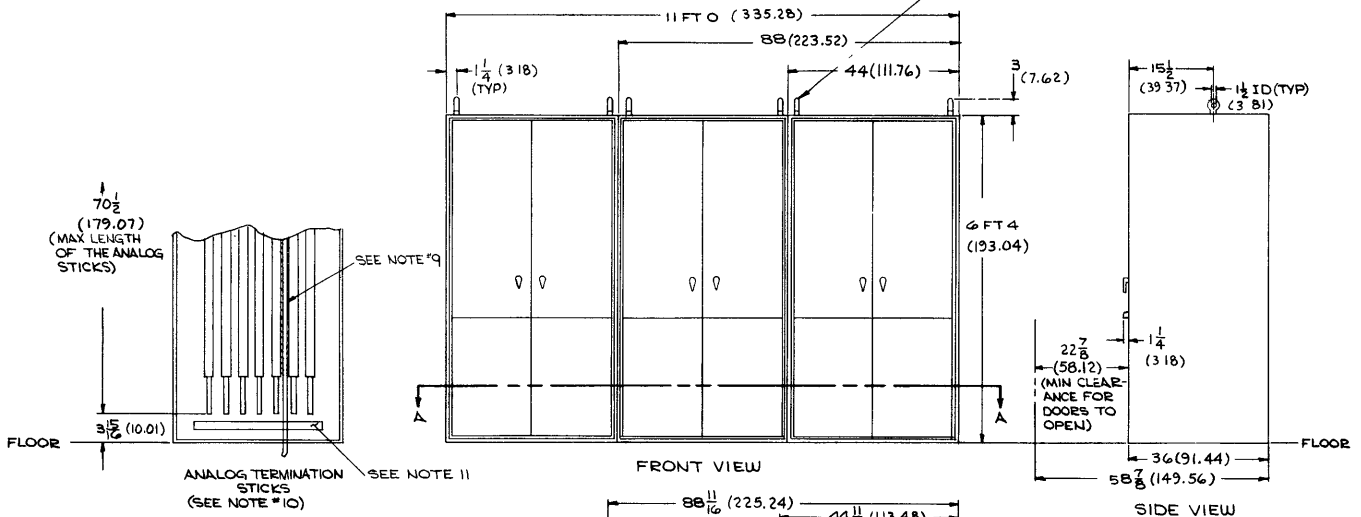
GENERAL ELECTRIC 68D974258

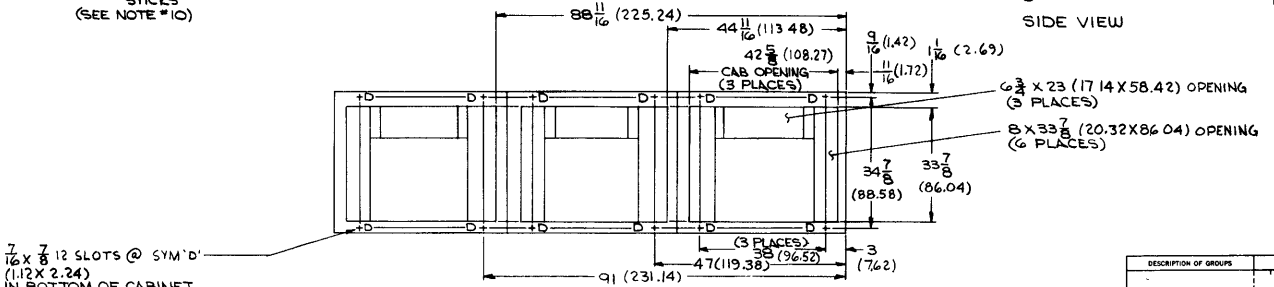
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING — APPLIED PRACTICES | SURFACES ✓ | TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± | DECIMALS ± | ANGLES ±

TITLE INSTALLATION OUTLINE
GE/PAC THREE CABINET COMPLEX
FIRST MADE FOR SYS STD
FCF ON



LIFTING LUGS MAY BE REMOVED AFTER INSTALLATION. 3/8-11 BOLTS SHALL BE SUBSTITUTED OR OTHER MEANS USED TO SEAL HOLES.





SECTION A-A
(BOTTOM VIEW)

NOTES:
1. DO NOT SUBJECT CABINET TO EXCESSIVE SHOCKS OR JARS. KEEP TOP SIDE UP AND HANDLE WITH CARE.
2. TEMPERATURE
   OPERATIONAL AMBIENT:
   0°C TO 55°C
   OPERATIONAL TRANSIENT:
   ±15°C AT A LINEAR RATE OVER A ONE HOUR PERIOD (25°C OR 45°C PER MINUTE).
   STORAGE:
   -40°C TO 70°C
3. RELATIVE HUMIDITY
   0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS-AIR SURROUDING CABINET AT ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION (ANY DIRECTION)
   a. EXTERNAL SOURCE-INSTALLED
      5 TO 15 CPS .07 IN. PEAK TO PEAK DISPLACEMENT. 15 TO 120 CPS 1G.
5. SHOCK (ANY DIRECTION)
   DURING SHIPMENT AND INSTALLATION 15G'S FOR 2 MILLI-SECONDS.
6. CLEARANCE
   FRONT: SEE SIDE VIEW
   REAR: NONE
   SIDE: NONE
   TOP: 30 IN.
7. ESTIMATED WEIGHT: 2250 LBS.
8. DOORS TO OPEN 90° FOR ACCESS TO CABINET INTERIOR.
9. CUSTOMER CABLING IS DIRECTED TO THE ASSIGNED CABLING DUCT FOR ROUTING TO ITS ASSIGNED TERMINATION LOCATION.
10. TYPICAL TERMINATIONS THAT CAN BE EXPECTED FOR INCOMING CABLES. THESE DIGITAL & ANALOG TERMINATION STICKS MAY BE MOUNTED ON ANY OR ALL OF THE CABINET THREE WALLS.
11. CLAMP AREA FOR INCOMING CABLES. (TYPICAL FOR THREE SIDES)
12. ALL DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS.

DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
		K6-14

DRAWN OCT 18,66 | APPROVED 4PM 24,66 | PROCESS COMPUTER PHOENIX | 68D974258
DATE ISSUED NOV 25,1966

PRINT DIST.		CONT. ON /	SH. NO. 0
K6-8	LIFTING & SKID REQUIREMENT		

GENERAL NOTES

F.C.F.
FMF: SYS STD

APPROVED BY: [illegible] DATE: 12/8/65

REVISION STATUS

REV.	RECORD OF CHANGE	REV. DATE & NAME	REV.	RECORD OF CHANGE	REV. DATE & NAME

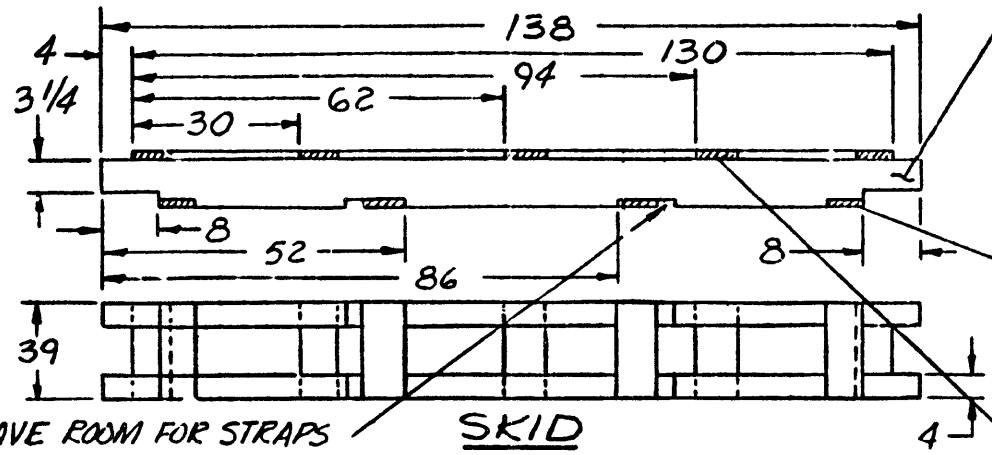
REISSUED

Made By Philip Lewis June 14, 1965	Issue Date Dec 9, 1965	PROCESS I-C COMPUTER DEPT. PHOENIX, ARIZ.	Dwg. No. 68A987265 Cont. on / Sh. No. 0

LIFTING & SKID REQUIREMENT

CONT ON SHEET SH NO.

FIRST MADE FOR SYS STD



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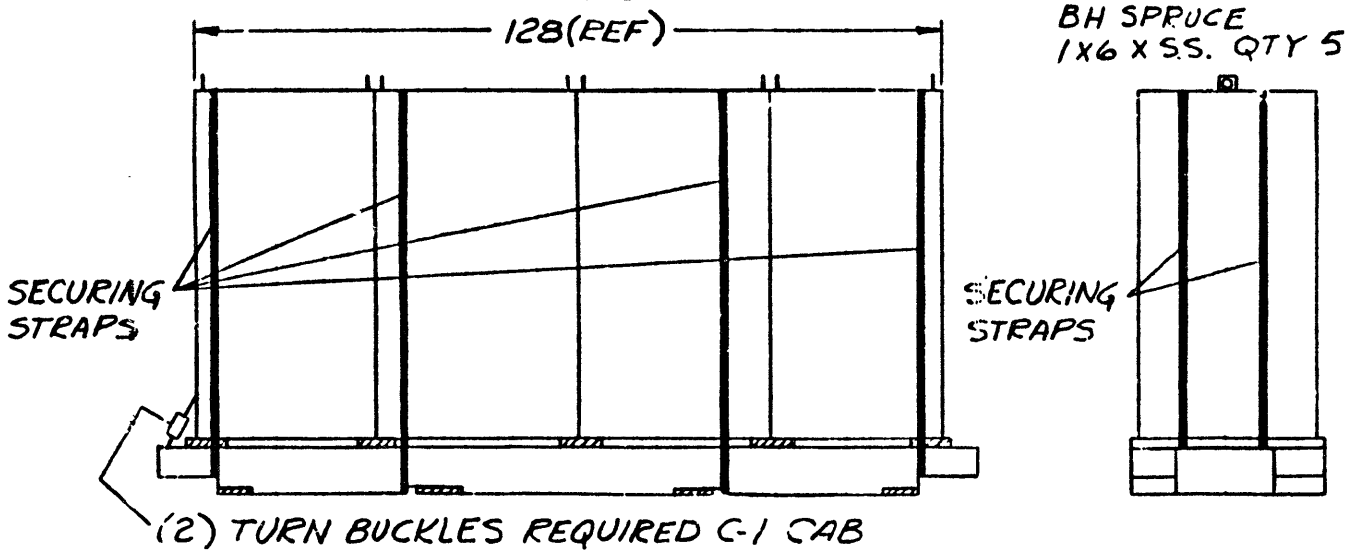


NOTE:
EACH DOOR TYPE CABINET IS TO BE SECURED TO THE SKID WITH A MIN OF (2) 3/8"X 2" LAG SCREW. THESE SCREWS WILL MOUNT THRU THE CABINETS MOUNTING HOLES IN THE BASE - USE OPP CORNERS.

ALL DIM ARE IN INCHES

UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
	K4951991	✓	±	±	±

REVISIONS

PRINTS TO

MADE BY	APPROVALS			
Philip Lyng June 11, 1965	12/8/65	PROC COMPUTER	I.C. ~~STRUCTURE~~ DEPT.	68A987265
ISSUED Dec. 9, 1965	[illegible]	PHOENIX	LOCATION	CONT ON SHEET 2 SH NO. 1

REV NO.

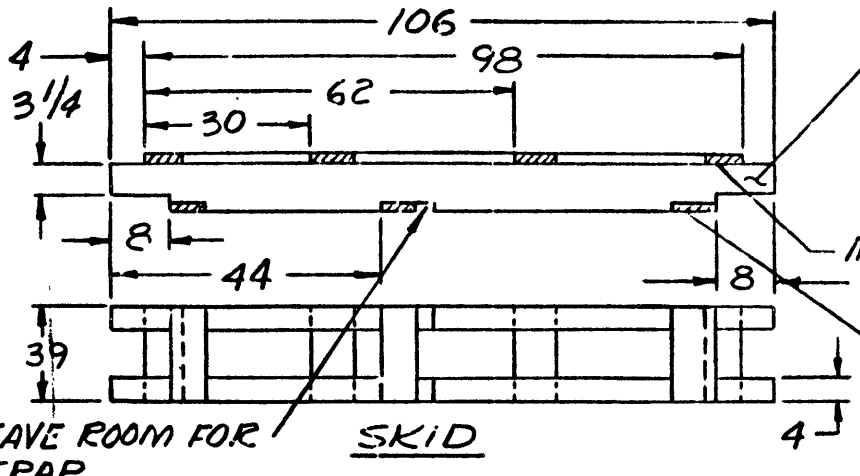
CONT ON SHEET SH NO.

TITLE

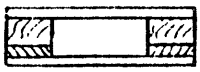
LIFTING & SKID REQUIREMENT

CONT ON SHEET 3 SH NO. 2

FIRST MADE FOR SYS STD



MATL: WOOD (CONST GR. D.F.)
4 X 6 - QTY 2

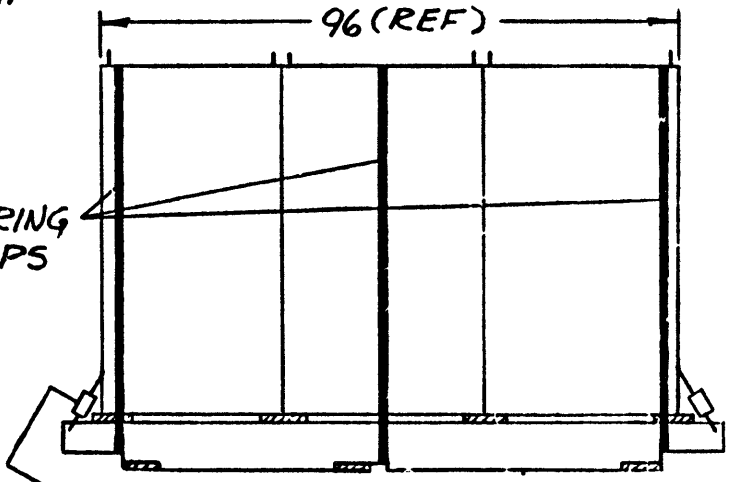


MATL: WOOD #1 1/2 OR BH SPRUCE
1 X 6 X S.S. QTY 4

MATL: WOOD #2 OR
BH SPRUCE
1 X 4 X S.S. QTY 3

LEAVE ROOM FOR STRAP

SKID



SECURING STRAPS

SECURING STRAPS

(2) TURN BUCKLES REQUIRED (BOTH SIDES)
(USE FOR TRUCK STYLE CABINET)

NOTE:
EACH DOOR TYPE CABINET IS TO BE SECURED TO THE SKID WITH A MIN OF (2) 3/8 X 2 LAG SCREW. THESE SCREWS WILL MOUNT THRU THE CABINETS MOUNTING HOLES IN THE BASE - USE OPP CORNERS.

ALL DIM ARE IN INCHES

UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
	K495199/	✓	±	±	±

REVISIONS

PRINTS TO

MADE BY	APPROVALS			
Philip Lowy June 21, 1965	12/8/65	PROC COMPUTER DIV OR DEPT.	I.C.	68A987265
ISSUED Dec. 9, 1965		PHOENIX LOCATION	CONT ON SHEET 3	SH NO. 2

REV NO.

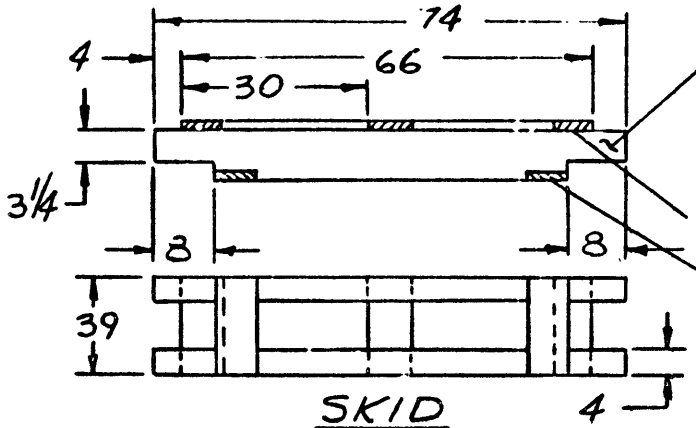
CONT ON SHEET SH NO.

TITLE

LIFTING & SKID REQUIREMENT

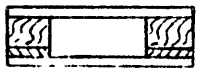
CONT ON SHEET 4 SH NO. 3

FIRST MADE FOR SYS STD



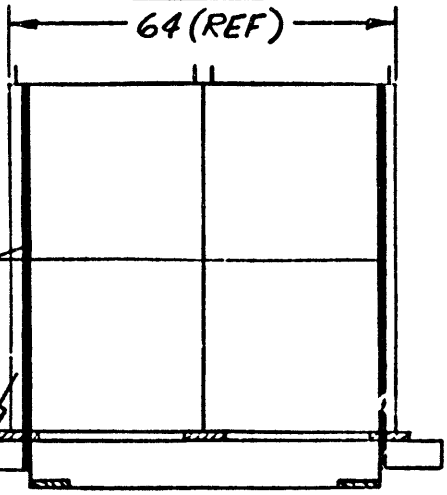
SKID

MATL: WOOD (CONST GR. D.F.)
4 X 6 QTY 2



MATL: WOOD #1 1/2 OR BH SPRUCE
1 X 6 X S.S. QTY 3

MATL: WOOD #2 OR BH SPRUCE
1 X 4 X S.S. QTY 2



(2) TURN BUCKLES REQUIRED
(USE FOR TRUCK STYLE CABINET)

NOTE:
EACH DOOR TYPE CABINET IS TO BE SECURED TO THE SKID WITH A MIN OF (2) 3/8 X 2 LAG SCREW. THESE SCREWS WILL MOUNT THRU THE CABINETS MOUNTING HOLES IN THE BASE - USE OPP CORNERS.

ALL DIM ARE IN INCHES

UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
	K495/1991	✓	+ −	+ −	+ −

REVISIONS

PRINTS TO

MADE BY Philip Levy June 21, 1965
ISSUED Dec. 9, 1965

APPROVALS 12/5/65

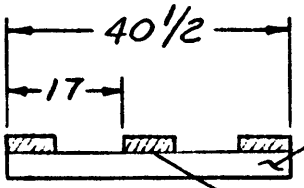
PROC COMPUTER I.C. DIV. OR DEPT.
PHOENIX LOCATION

68A987265

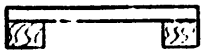
CONT ON SHEET 4 SH NO. 3

REV NO.	TITLE	CONT ON SHEET 5	SH NO. 4
CONT ON SHEET	SH NO.	FIRST MADE FOR SYS STD	

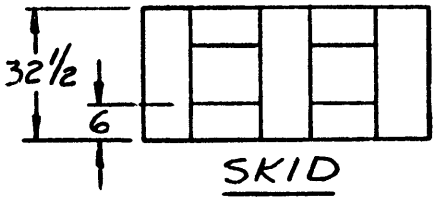
LIFTING & SKID REQUIREMENT



MATL: WOOD (CONST GR D.F.)
2 X 6 QTY 2



MATL: WOOD #1 1/2 OR BH SPRUCE
1 X 8 X S.S. QTY 3



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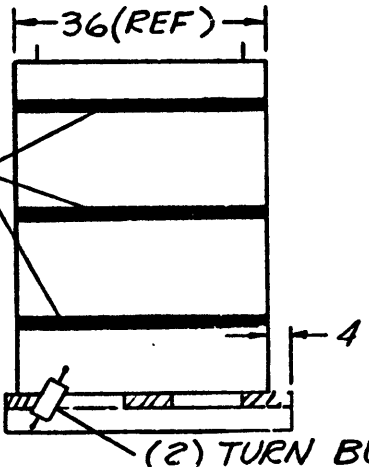
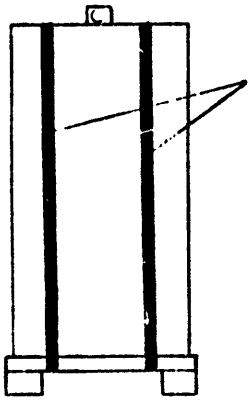




NOTE:
EACH DOOR TYPE CABINET IS TO BE SECURED TO THE SKID WITH A MIN OF (2) 3/8 x 2 LAG SCREW. THESE SCREWS WILL MOUNT THRU THE CABINETS MOUNTING HOLES IN THE BASE - USE OPP CORNERS.

ALL DIM ARE IN INCHES

UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
	K4951991	√	+ −	+ −	+ −

REVISIONS

PRINTS TO

MADE BY	APPROVALS			
Philip Lewis June 24, 1965	12/5/65	PROC COMPUTER	I.C. DIV. OR DEPT.	68A987265
ISSUED Dec. 9, 1965		PHOENIX	LOCATION	CONT ON SHEET 5 SH NO. 4

REV NO.

NT ON SHEET SH NO.

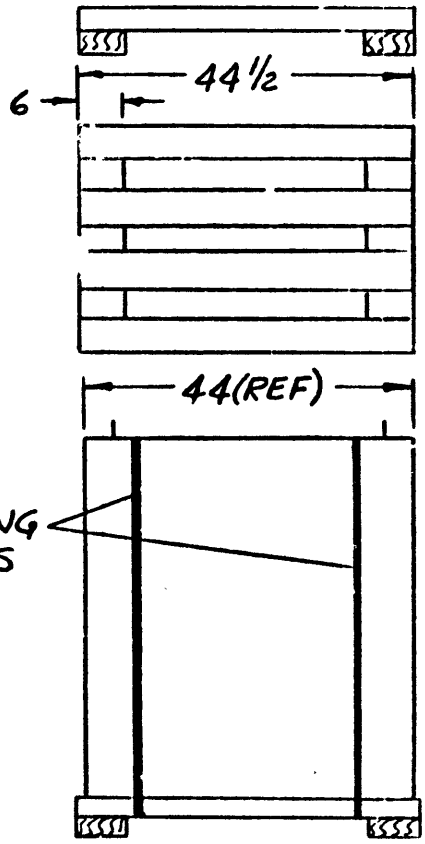
TITLE

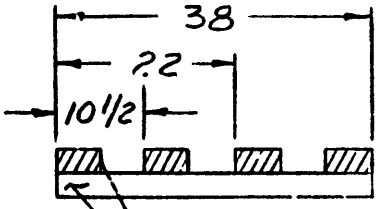
LIFTING & SKID REQUIREMENT

CONT ON SHEET 6 SH NO. 5

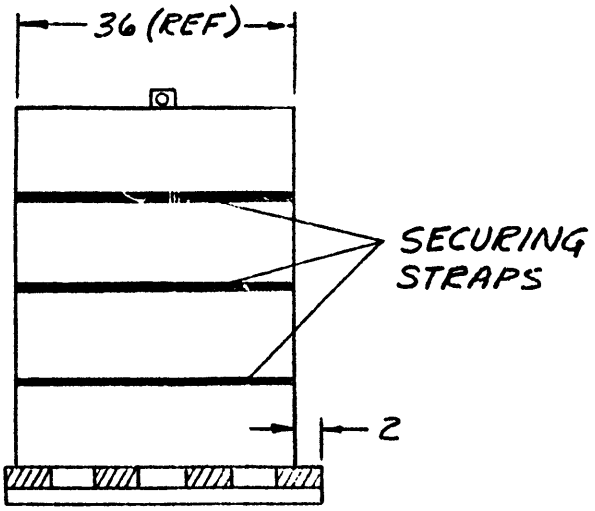
FIRST MADE FOR SYS STD

SKID





MATL: WOOD (CONST GR D.F.)
2 x 6 QTY 6



NOTE:
EACH DOOR TYPE CABINET IS TO BE SECURED TO THE SKID WITH A MIN OF (2) 3/8 X 2 LAG SCREW. THESE SCREWS WILL MOUNT THRU THE CABINETS MOUNTING HOLES IN THE BASE - USE OPP CORNERS.

ALL DIM ARE IN INCHES

UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
	K4951991	√	±	±	±

REVISIONS

PRINTS TO

MADE BY	APPROVALS			
Philip Lewy Aug 13, 1965	12/15/65	PROC COMPUTER I.C. DIV OR DEPT.	68A987265	
ISSUED Dec. 9, 1965		PHOENIX LOCATION	CONT ON SHEET 6	SH NO. 5

REV NO.

CONT ON SHEET SH NO.

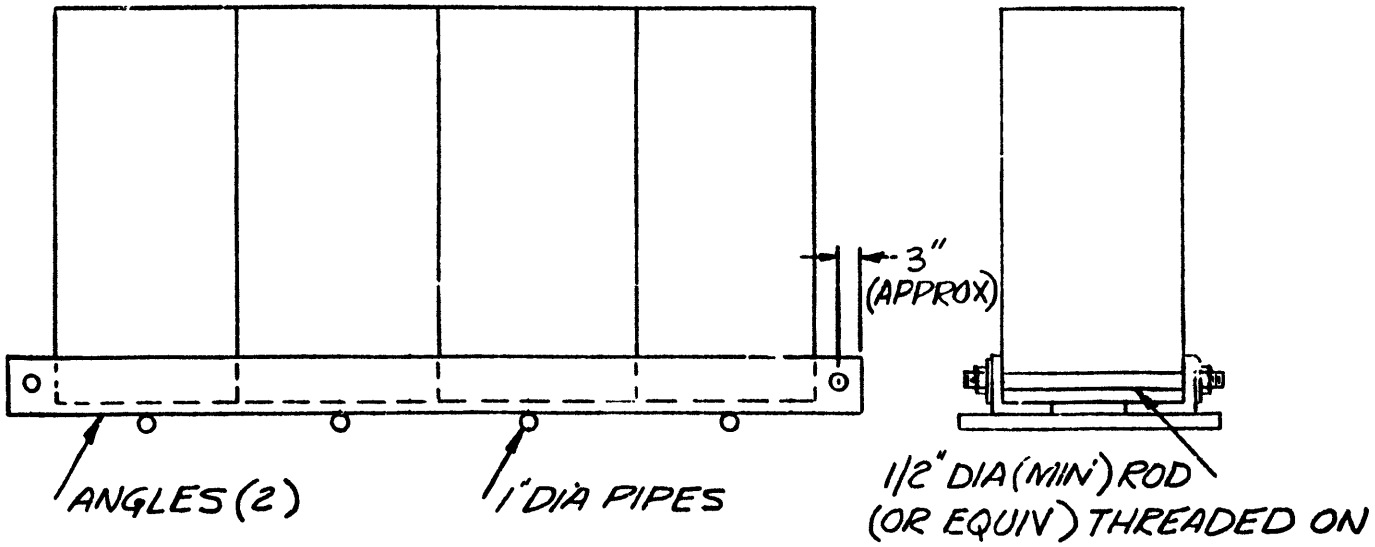
TITLE

LIFTING & SKID REQUIREMENT

CONT ON SHEET 7 SH NO. 6

FIRST MADE FOR SYS STD

ROLLER METHOD (CUSTOMER TO FURNISH PARTS)
(ALSO USED TO LIFT ON & OFF SKID)



# OF CABS	SIZE OF ANGLES OR EQUIV	# OF ROLLERS REQ'D
4	4"X4"X1/2"X140"	5
3	4"X4"X1/2"X118"	4
2	4"X4"X1/4"X86"	3
1	4"X4"X1/4"X44"	3

NOTE:
TIP CABS TO PLACE ANGLES UNDER EDGES.

UNLESS OTHERWISE SPECIFIED USF	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
	K4951991	✓	±	±	±

REVISIONS

PRINTS TO

MADE BY Philip Levy June 14, 1965
ISSUED Dec. 9, 1965

APPROVALS 12/15/65 LLF

PROC COMPUTER I.C. DEPT.
PHOENIX LOCATION

68A987265

CONT ON SHEET 7 SH NO. 6

REV NO.

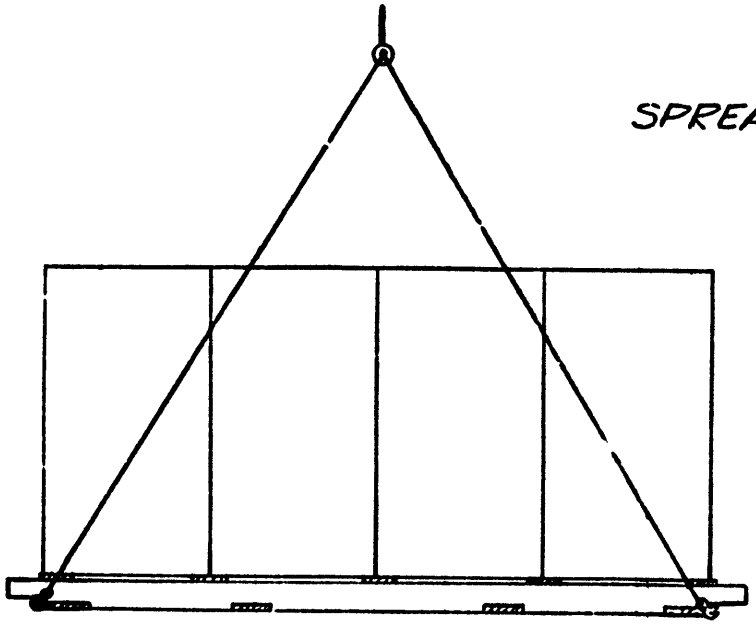
CONT ON SHEET — SH NO. 7

TITLE

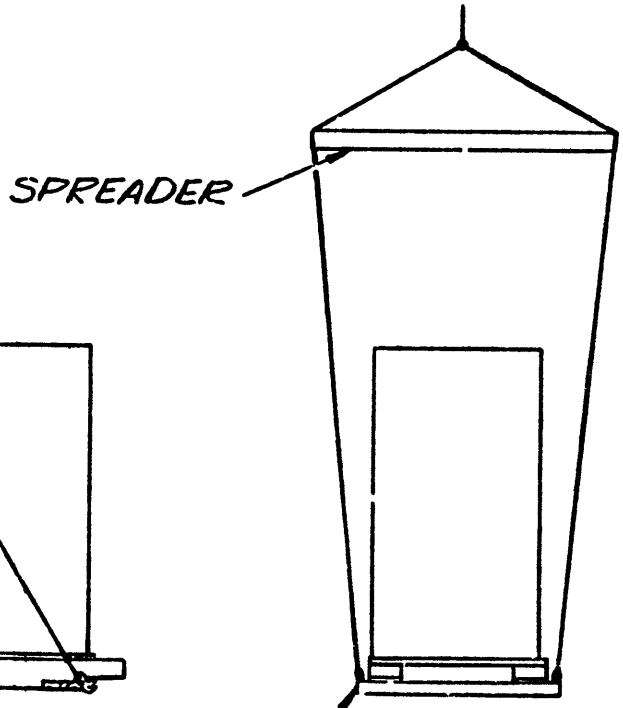
LIFTING & SKID REQUIREMENT

CONT ON SHEET — SH NO.

FIRST MADE FOR SYS STD



CUSTOMER TO LIFT AS SHOWN
(CUSTOMER TO FURNISH ALL LIFTING EQUIPMENT)



UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
			FRACTIONS	DECIMALS	ANGLES
	K4951991	✓	+ −	+ −	+ −

REVISIONS

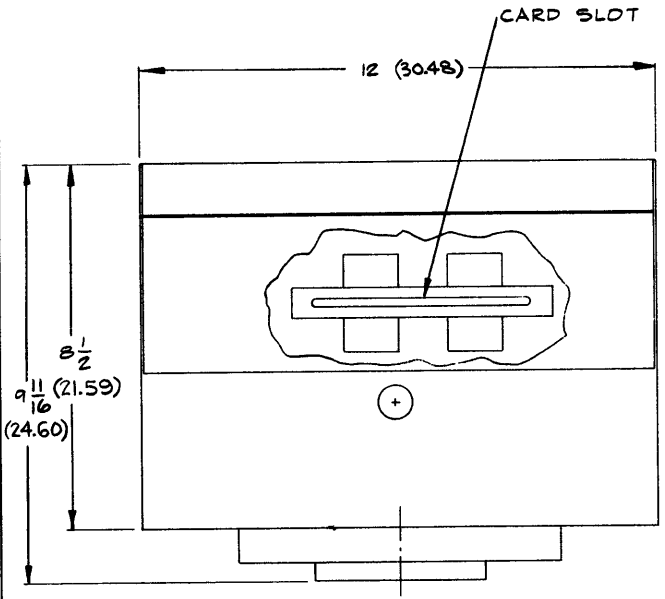
PRINTS TO

MADE BY	APPROVALS			
Philip Levy June 11, 1965	12/8/69	PROC COMPUTER I.C. DEPT.	68A987265	
ISSUED Dec. 9, 1965		PHOENIX LOCATION	CONT ON SHEET —	SH NO. 7

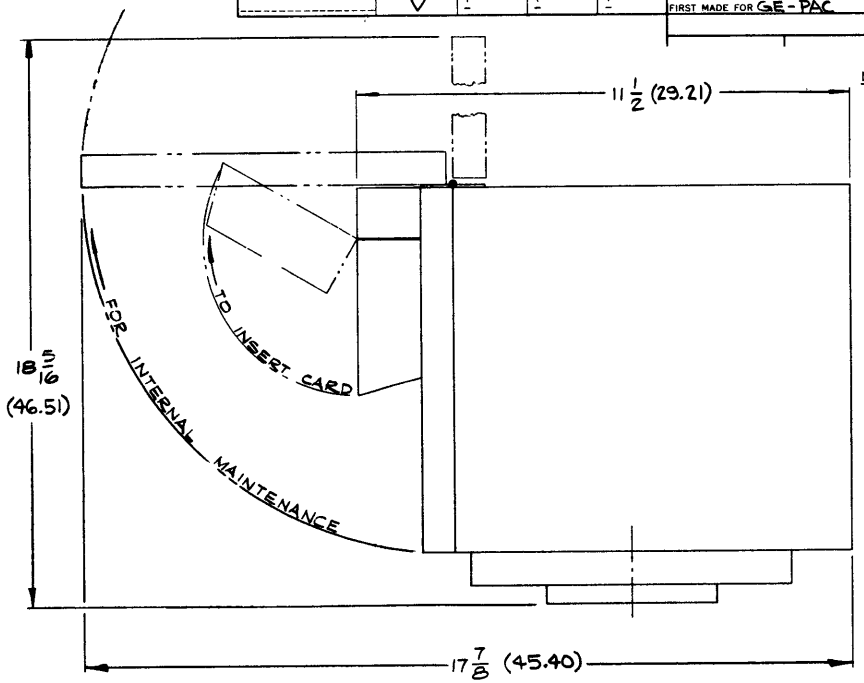
GENERAL ELECTRIC STD 68C998416

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —
APPLIED PRACTICES | SURFACES ✓ | TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± | DECIMALS ± | ANGLES ±

TITLE INSTALLATION OUTLINE
PLASTIC CARD READER
FIRST MADE FOR GE-PAC

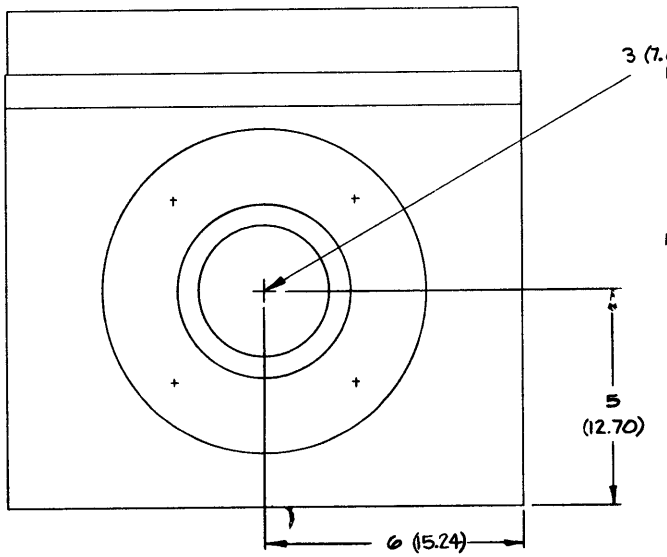


FRONT VIEW

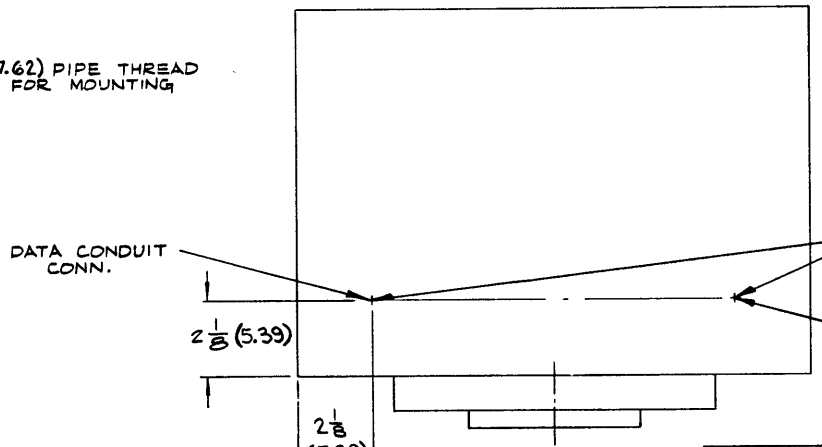


NOTES:

1. POWER REQUIREMENTS
   115 Vac ± 10%
   60/50 CPS ± 3%
2. TEMPERATURE: OPERATIONAL AMBIENT
   -30°F. TO 125°F (-34°C TO 52°C) OPERATIONAL TRANSIENT ± 27°F (± 15°C) AT A LINEAR RATE OVER A ONE HOUR PERIOD (0.45°F OR 0.25°C PER MINUTE).
   STORAGE: 40°F TO 158°F)
   40°C TO 70°C)
3. AMBIENT RELATIVE HUMIDITY 0° TO 100° (FOR BOTH STORAGE AND INSTALLED CONDITIONS). FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION: (ANY DIRECTION)
   .070 IN (.2 CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS.
   1 G AT 5 TO 120 CPS
5. SHOCK: (ANY DIRECTION)
   15 G's FOR 2 MS
6. WEIGHT: 52 LBS (23.59 KG)
7. DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS.
8. HEAT DISSIPATION: 1374 BTU/HR



BOTTOM VIEW



REAR VIEW

REVISIONS		PRINTS TO
B	J.D. Snyder June 26, 1967 10-14 REV. PER ECP	
AC	AN6WAX-40-321	GE
B	[illegible]	
AC	AN6WAX-40-325	

DRAWN BY J. FRITZ JULY 25, '64 | APPROVALS L. BECKER 7/27/64 | PROC COMPUTER IC DEPT PHOENIX LOCATION | 68C998416 CONT ON SHEET — SH NO 1

ISSUE June 26, 1967

STD

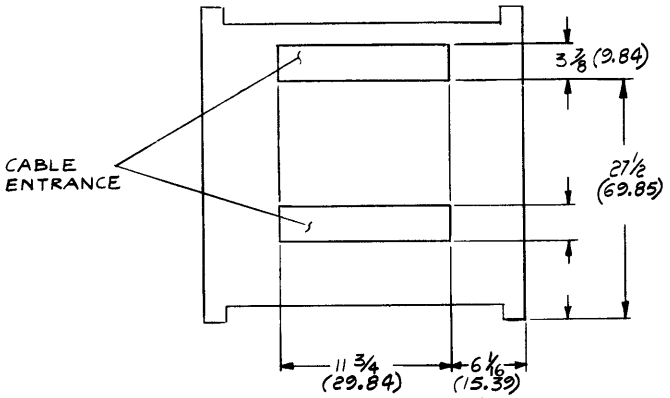
STD

GENERAL ELECTRIC 68C984982

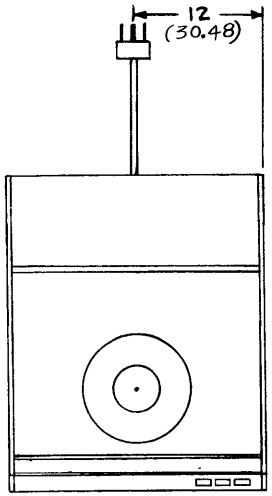
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

TITLE INSTALLATION OUTLINE,
4548A DISC MEMORY STORAGE DRIVE
FIRST MADE FOR GE-PAC



SECTION A-A



1. POWER REQUIREMENTS 60/50 CPS
LINE VOLTAGE - 208VAC 3 PHASE
LINE FREQUENCY TOLERANCE + 1% -2%
LINE CURRENT = 3.0 AMPERES PER PHASE
STARTING CURRENT = 12.0 AMPERES PER PHASE
POWER = .86 KW.

2. TEMPERATURE: OPERATIONAL AMBIENT
65°F TO 85°F (18°C TO 30°C)
OPERATIONAL TRANSIENT ±27°F (±15°C)
AT A LINEAR RATE OVER A ONE HOUR
PERIOD. (0.45°F OR 0.25°C PER MINUTE).

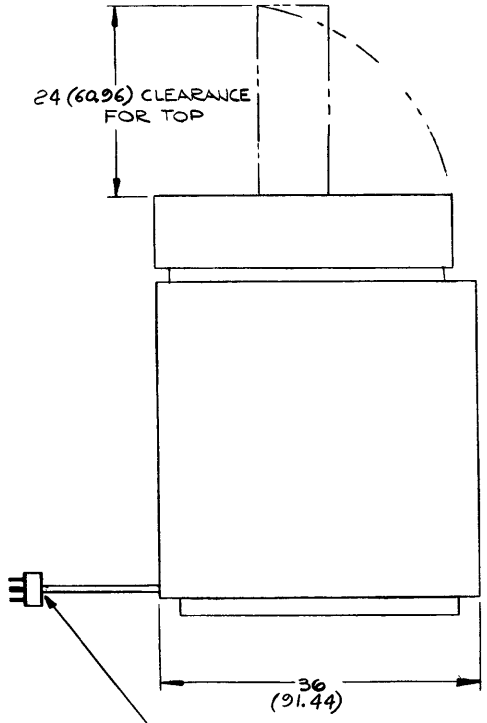
STORAGE: -40°F TO 158°F (-40°C TO 70°C).

3. AMBIENT RELATIVE HUMIDITY
20% TO 80% (FOR BOTH STORAGE AND
INSTALLED CONDITIONS). FOR ANY OF THE
ABOVE TEMPERATURE CONDITIONS.

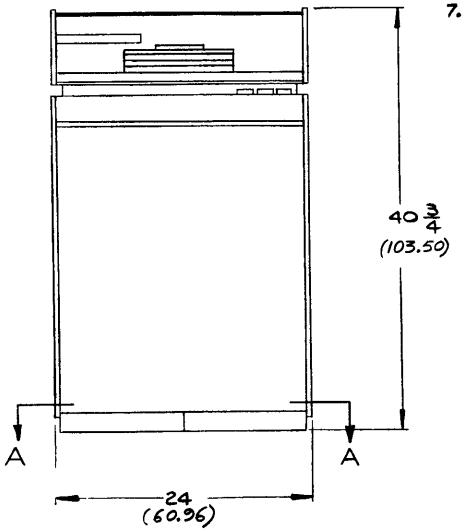
4. HEAT DISSIPATION: 3000 BTU/HR.

5. WEIGHT 480 LBS (217.73 KG.)

6. DIMENSIONS SHOWN IN
PARENTHESIS ARE
IN CENTIMETERS.



5 FT-0 (152.40) #12 5 TYPE 50 HUBBEL
#3521 TWISTLOCK 5 WIRE.



7. INSTALLATION REQUIREMENTS-
THE NECESSARY INSTALLATION REQUIREMENTS ARE SIMPLE POWER AND SIGNAL CABLE CONNECTIONS THROUGH THE BASE OF THE MACHINE. IN ADDITION, THE FOUR LEVELERS ARE SCREWED DOWN TO CONTACT THE FLOOR, RAISING THE MACHINE SLIGHTLY OFF THE CASTERS. THE DISTRIBUTED FLOOR LOAD OF THE 9483 IS 80 LB/SQ. FT., AND THE CONCENTRATED FLOOR LOAD AT EACH OF THE FOUR CASTERS IS 120 LB. THE MACHINE SHALL BE LEVELLED WITHIN ± 3 DEGREES. THREE FEET (91.44) OF ACCESS SPACE SHALL BE PROVIDED AT THE FRONT AND REAR OF THE MACHINE FOR SERVICING.
WEIGHT - 480 LB.

REVISIONS			PRINTS TO
C	B. Mitchell	June 26 1967	KG-14
AC	REV & ECT PER ANGWAX-40-321		L/CGE

MADE BY	APPROVALS	PROC COMPUTER	68C984982
H. DUNBAR MAY-11-1966	A. COTTRELL MAY-12-1966	PHOENIX	
RELEASED June 26/1967		LOCATION	CONT ON SHEET — SH NO

STD

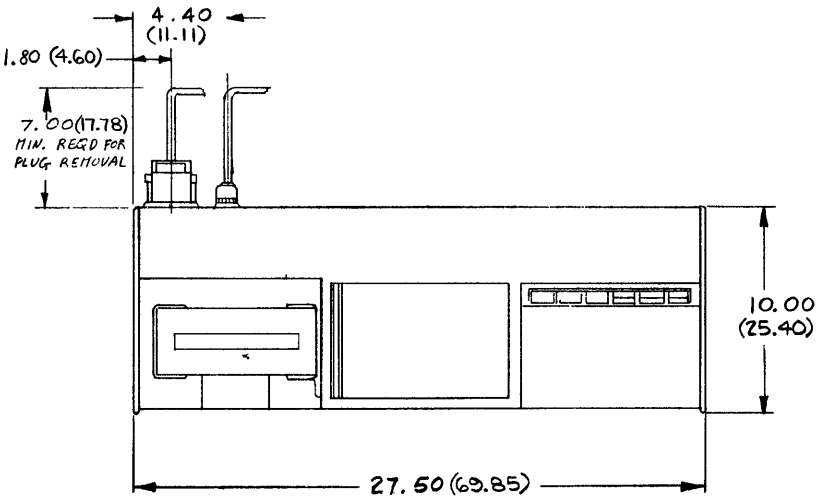
GENERAL ELECTRIC STD 68C972159

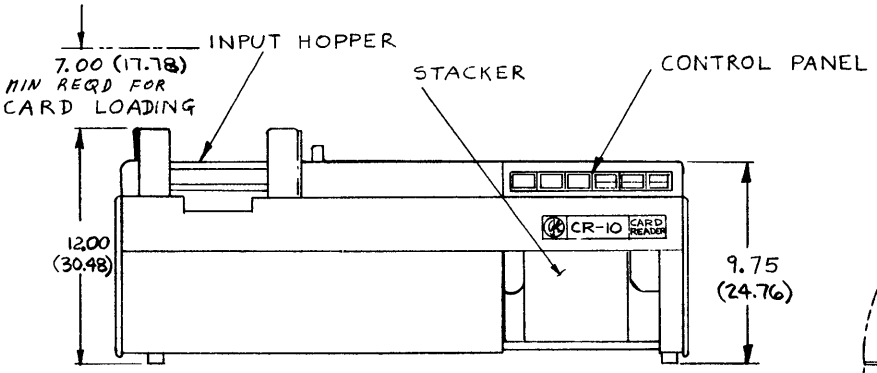
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —

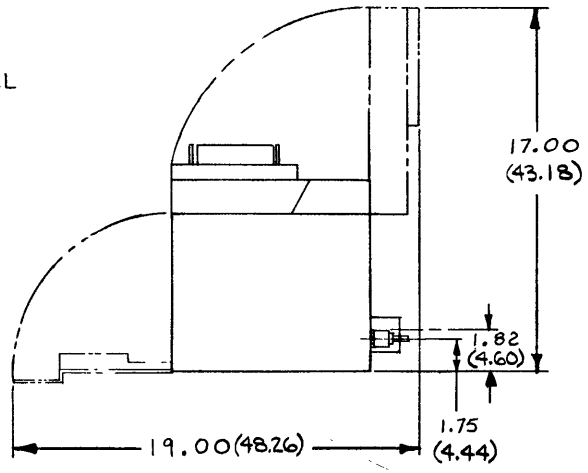
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

TITLE
INSTALLATION OUTLINE
CR-10 CARD READER

FIRST MADE FOR GE-PAC







NOTES:

1. POWER REQUIREMENTS:
   115VAC ± 10%, 60/50 CPS ± 3%
2. TEMPERATURE: OPERATIONAL AMBIENT 65°F TO 85°F (18°C TO 30°C) OPERATIONAL TRANSIENT ±27°F (±15°C) AT A LINEAR RATE OVER A ONE HOUR PERIOD. (0.45°F OR 0.25°C PER MINUTE.)

   STORAGE: -40°F TO 158°F (-40°C TO 70°C)
3. AMBIENT RELATIVE HUMIDITY: 20% TO 80% (FOR BOTH STORAGE AND INSTALLED CONDITIONS) FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION: (ANY DIRECTION) .070 IN. (.2 CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS. 1G AT 15 TO 120 CPS.
5. SHOCK: (ANY DIRECTION) 15 G's FOR 2 MS
6. WEIGHT: 40 LBS (18.14 KG)
7. DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS.
8. HEAT DISSIPATION: 491 BTU/HR
9. DEVICE TEMP & HUMIDITY SPECS. LIMITED BY CARD MEDIA.

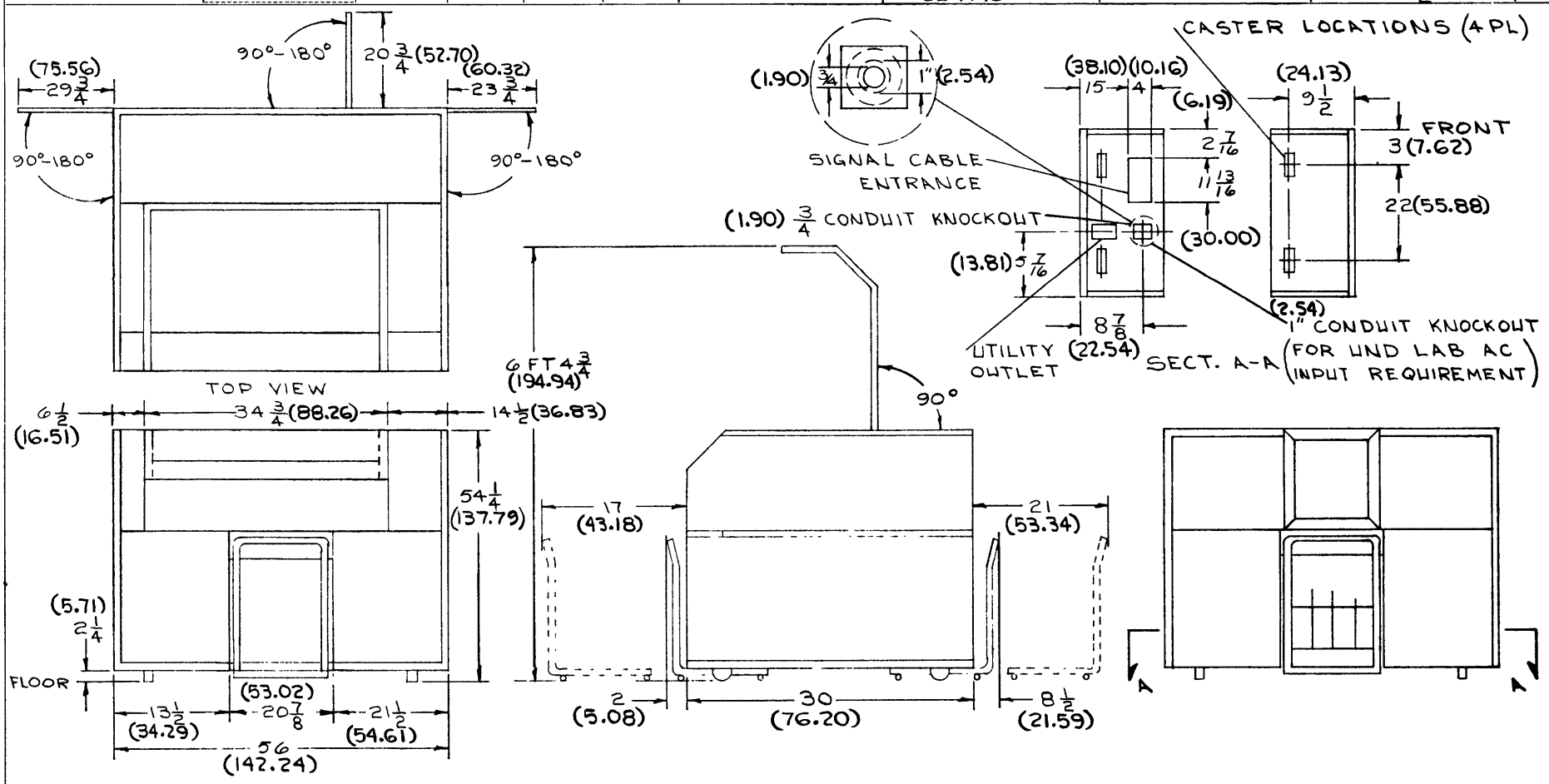
DRAWING NO
CONT ON SHEET
SH NO
REV NO

REVISIONS		PRINTS TO
B	J.J. Snyder June 26, 1967	K9-14
CC	REV. PER ANGWAX-40-321	L/CGE

	MADE BY	APPROVALS		
DES	B. MASTRODONATO JULY 13, 66	P. GOSHIA 7-21-66	PROG COMPUTER DEPT	68C972159
CHKR	June 26 1967		PHOENIX LOCATION	CONT ON SHEET F SH NO 1 STD

STD

DIST.	UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING — APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS	DECIMALS	ANGLES	GENERAL ELECTRIC PROCESS COMPUTER PHOENIX	TITLE INSTALLATION OUTLINE LINE PRINTER FMF GE-PAC FCF	DWG NO 68B994818 CONT ON SHEET 2 SH NO 1
K6-14		√	±	±	±			



MADE BY	APPROVAL		REV.		DWG. NO.
A.R. VARNEK MAY, 14, 65	C.D.G. JUNE, 18, '66	DES	E		68B994818
ISSUED June 26, 1967		CHKR			CONT ON SHEET 2 SH NO. 1

STD

2-65 PCE 2991

GENERAL ELECTRIC

68C995969

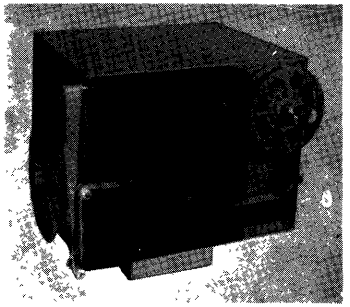
CONT ON SHEET — SH NO 1

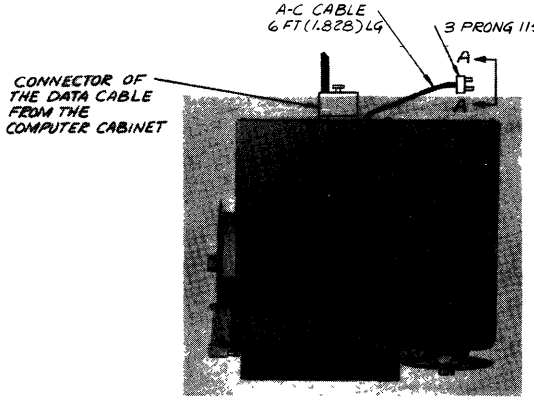
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING --

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS		
		FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

TITLE INSTALLATION OUTLINE,
HIGH SPEED PAPER TAPE PUNCH

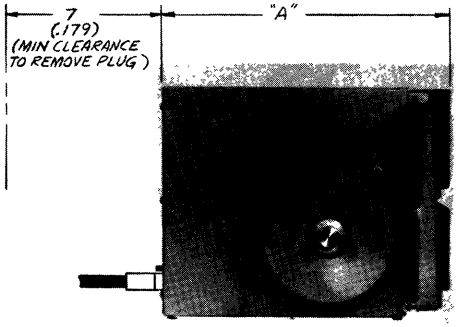
FIRST MADE FOR SYS STD

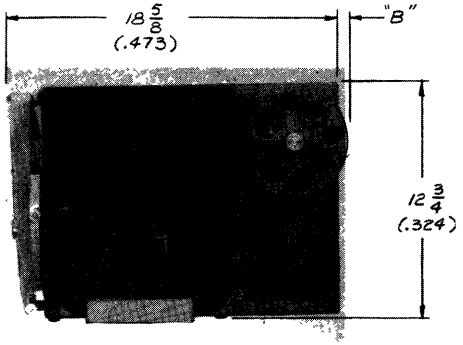




NOTES:

1. ENVIRONMENT LIMITS:
   (a) VIBRATION -.010 TOTAL DISPLACEMENT @ 5-55 CPS
   (b) SHOCK - 5G'S @ 10 MILISEC DURATION.
   (c) AMBIENT TEMPERATURE -32°F TO 131°F.
   (d) AMBIENT HUMIDITY - 5% TO 95%
2. WEIGHT:
   PUNCH - 58# (26.31 KG)
3. POWER REQUIREMENTS:
   115 VAC 50 OR 60 ~ = 2 AMPS
4. HEAT DISAPPATION:
   450 WATTS
5. ONLY PARTS 4DP4253AX0Z AND 4DP4253AX1Z MAY BE USED WITH A PERIPHERAL STATION TABLE TOP ENCLOSURE. PAPER TAPE READER (MODELS 4212 AND 4213) MAY BE SET ON TOP OF PARTS 4DP4253AX2Z AND 4DP4253AX3Z BUT NOT WHEN TABLE TOP ENCLOSURE IS USED.
6. ALL DIMENSIONS SHOWN IN PARENTHESIS ARE IN METERS.





SECT A-A

*SEE NOTE *5

PART NO.	* FIT ENCLOSURE	TAPE TAKE-UP	A	B
4DP4253AX0Z	YES	WITHOUT	10 3/4 (.273)	—
4DP4253AX1Z	YES	WITH	10 3/4 (.273)	1/4 (.006)
4DP4253AX2Z	NO	WITHOUT	15 3/4 (.400)	—
4DP4253AX3Z	NO	WITHOUT	15 3/4 (.400)	1/4 (.006)

CONT ON SHEET — DRAWING NO — SH NO — REV NO

REVISIONS

PRINTS TO K6-14

MADE BY Philip Chung Nov 17, 1965
ISSUED Nov. 18, 1965
APPROVALS C&G NOV. 17, 65
PROC COMPUTER DEPT PHOENIX LOCATION
68C995969
CONT ON SHEET — SH NO 1

PF-609-P (1-65) PRINTED IN U.S.A.

GENERAL ELECTRIC 68C984630

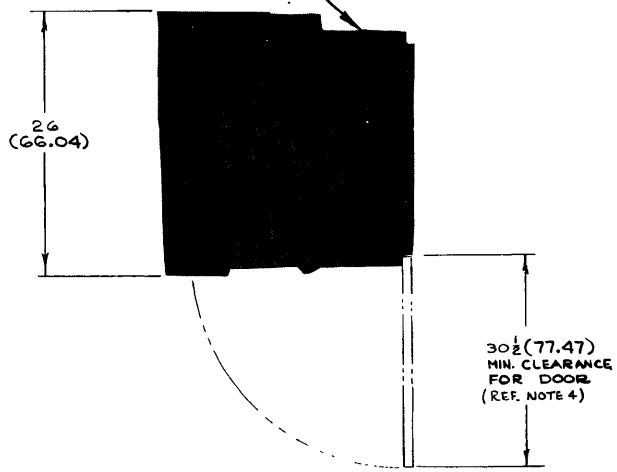
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING

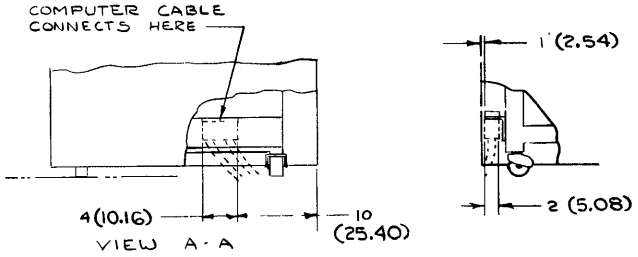
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

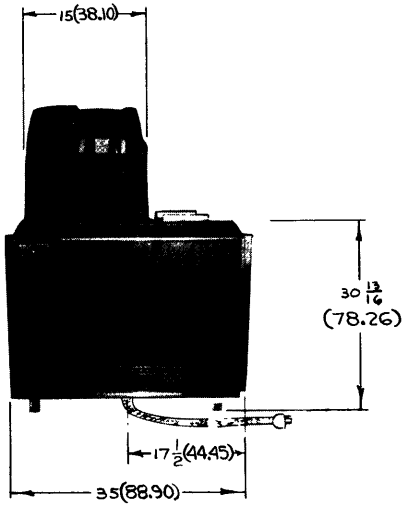
TITLE INSTALLATION OUTLINE
ICT CARD PUNCH
FIRST MADE FOR GE-PAC
STD

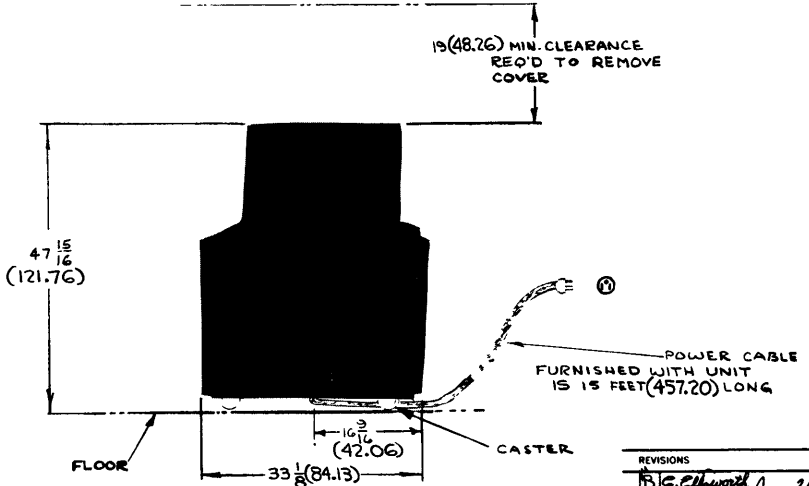
REAR PANEL REMOVEABLE FOR ACCESS. ALLOW 30(76.20) WORKING CLEARANCE OR CABLE ALLOWANCE TO MOVE CABINET AWAY FROM WALL.

NOTES:
1. POWER REQUIREMENTS:
   115 VAC ± 10%, 60/50 CPS ± 3%
   14 AMPS
2. TEMPERATURE: OPERATIONAL AMBIENT 65°F TO 85°F (18°C TO 30°C)
   OPERATIONAL TRANSIENT ± 27°F (± 15°C) AT A LINEAR RATE OVER A ONE HOUR PERIOD. (0.45°F OR 0.25°C PER MINUTE.)
   STORAGE: -40°F TO 158°F (-40°C TO 70°C)
3. AMBIENT RELATIVE HUMIDITY 20% TO 80% (FOR BOTH STORAGE AND INSTALLED CONDITIONS.) FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. DEVICE TEMP. & HUMIDITY SPECS. LIMITED BY CARD MEDIA.
5. VIBRATION: (ANY DIRECTION). .070 IN. (.2CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS. 1G AT 15 TO 120 CPS.
6. SHOCK: (ANY DIRECTION). 15 G'S FOR 2 MS
7. WEIGHT: 470 LBS (213.19 KG)
8. HEAT DISSIPATION: 5490 BTU/HR
9. DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS.









REVISIONS		PRINTS TO
B	C. Ellsworth June 26, 1967	K 6-16
C	REV. & RET ANGWAX-40-321	

DRAWN BY ISSUE	APPROVALS			68C984630
L. DONITHAN JAN. 26 '66	S.L.F. 1-27-66	PROC. COMPUTER	PHOENIX	68C984630
June 26, 1967				STD

GENERAL ELECTRIC

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —				
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

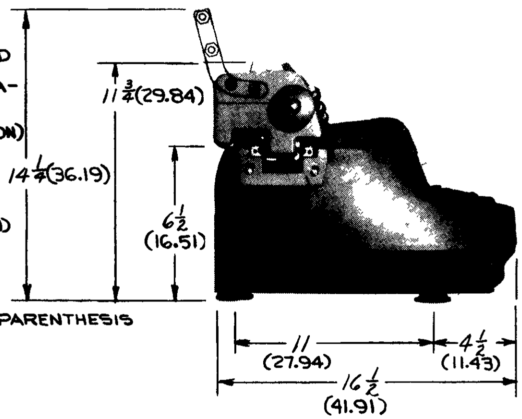
TITLE *INSTALLATION OUTLINE - TYPEWRITER*
FIRST MADE FOR GE-PAC

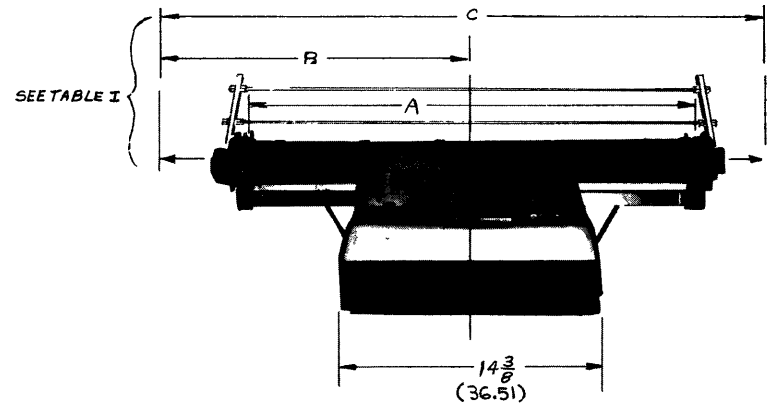
68C998357 CONT ON SHEET — SH NO 1

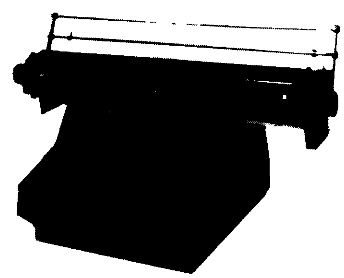
STD

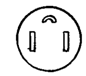
NOTES:
1. POWER REQUIREMENTS:
   115VAC±10%, 60/50 CPS±3%
   1 AMP
2. TEMPERATURE: OPERATIONAL AMBIENT
   32°F TO 131°F (0°C TO 55°C)
   OPERATIONAL TRANSIENT ±27°F (±15°C)
   AT A LINEAR RATE OVER A ONE HOUR PERIOD. (0.45°F OR 0.25°C PER MINUTE.)

   STORAGE: -40°F TO 158°F (-40°C TO 70°C)
3. AMBIENT RELATIVE HUMIDITY
   0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS). FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION: (ANY DIRECTION)
   .070 IN. (.2 CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS.
   1 G AT 15 TO 120 CPS
5. SHOCK: (ANY DIRECTION)
   15G'S FOR 2 MS
6. HEAT DISSIPATION:
   597 BTU/HR
7. DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS.









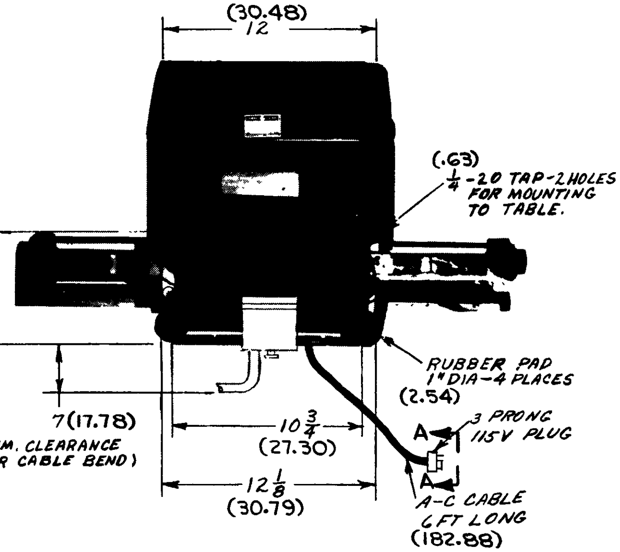


TABLE I

PLATEN LENGTH "A"	CARRIAGE TRAVEL LEFT OF CENTER "B"	CARRIAGE TRAVEL OVERALL "C"	PLATEN STYLE	FORM WIDTH	PIN TO PIN DIMENSIONS	WRITING LINE	CHAR/LINE* AT 14 CHAR 1 IN.	NUMBER OF LINES 1 IN	WEIGHT LBS	WEIGHT KG.
12 (30.48)	13 3/4 (34.92)	28 (71.12)	FRICTION	12 (30.48)	——	11 (27.94)	154	6	67	30.40
12 (30.48)	13 3/4 (34.92)	28 (71.12)	PIN FEED	9 7/8 (25.08)	9 3/8 (23.81)	8 7/8 (22.54)	124	6	67	30.40
16 (40.64)	17 3/4 (45.08)	36 (91.44)	PIN FEED	13 5/8 (34.60)	13 1/8 (33.33)	12 5/8 (32.06)	176	6	69	31.30
20 (50.80)	21 3/4 (55.24)	44 (111.76)	PIN FEED	17 25/32 (45.16)	17 9/32 (43.89)	16 25/32 (42.62)	234	6	71	32.20
24 (60.96)	25 3/4 (65.40)	52 (132.08)	PIN FEED	21 1/2 (54.61)	21 (53.34)	20 1/2 (52.07)	286	6	74	33.56
30 (76.20)	31 3/4 (80.64)	64 (162.56)	PIN FEED	27 1/2 (69.85)	27 (68.58)	26 1/2 (67.31)	371	6	84	38.10

*NOTE: TYPE STYLE 10 OR 14 CHAR / IN. SPACING IS AVAILABLE

REVISIONS	PRINTS TO
D G. Ellsworth June 24 1966-14 REV. & RET. ANGWAX-40-321	L/CGAE

MADE BY ARVARNER JUN. 23, 64 / ISSUED June 26, 1967	APPROVED C.D.G. JULY 14, 64	PROCESS COMPUTER DEPT / LOCATION PHOENIX	68C998357 CONT ON SHEET — SH NO. 1

STD

GENERAL ELECTRIC STD 68C998913 CONT ON SHEET F SH NO 1

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING —

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

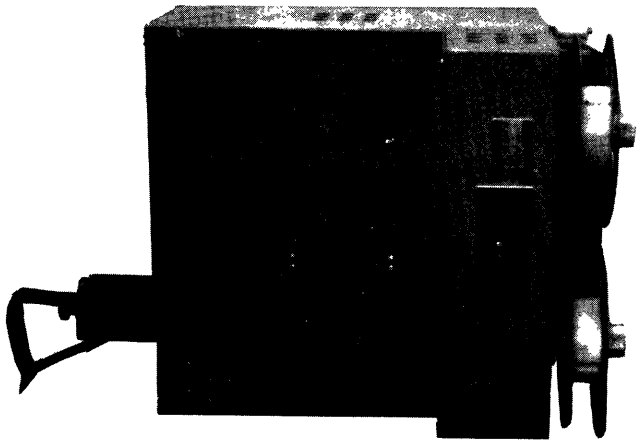
TITLE INSTALLATION OUTLINE

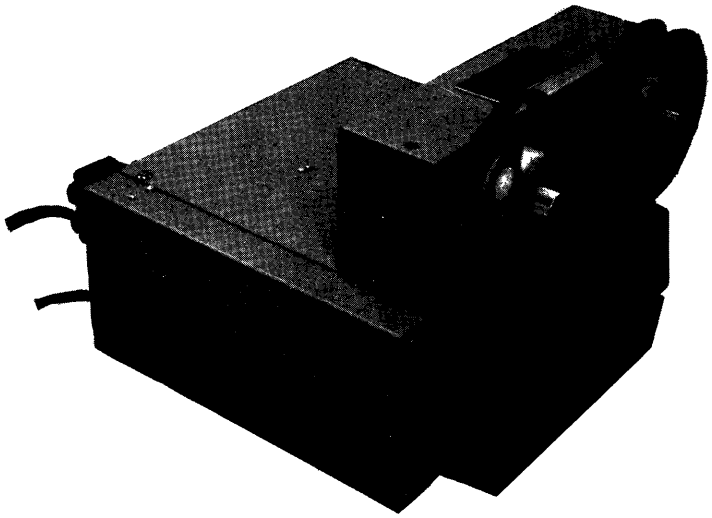
HIGH SPEED PAPER TAPE READER

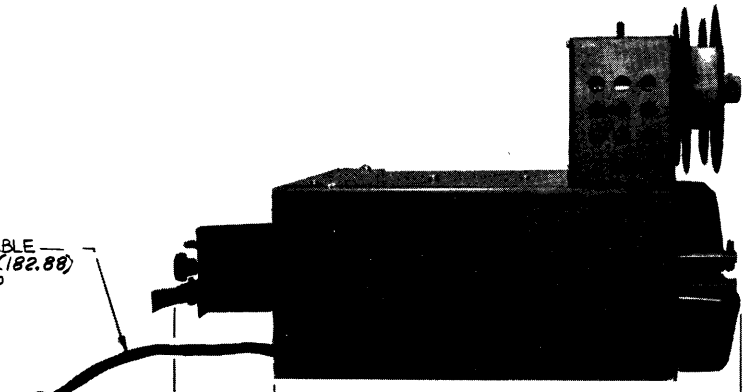
FIRST MADE FOR G E-PAC

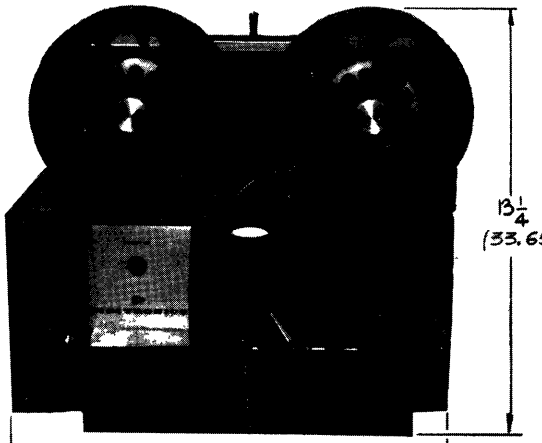
NOTES:

1. POWER REQUIREMENTS 115 VAC ± 10%, 60/50 CPS ± 3%
2. TEMPERATURE OPERATIONAL AMBIENT 32°F TO 131°F (0°C TO 55°C) OPERATIONAL TRANSIENT ±27°F (±15°C) AIR TEMP RATE OVER A ONE HOUR PERIOD. (0 45°F OR 0.25°C PER MINUTE.) STORAGE: 40°F TO 158°F (-40°C TO 70°C)
3. AMBIENT RELATIVE HUMIDITY 5% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS). FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION: (ANY DIRECTION) .070 IN (.20CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS. 1 G AT 15 TO 120 CPS.
5. SHOCK: (ANY DIRECTION) 15 G's FOR 2 MS.
6. WEIGHT: 43 LBS (19.50KG)
7. HEAT DISSIPATION: 545 BTU/HR
8. DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS









REVISIONS

B	B. M. Goodwin June 26, 1967	
AC	REV. & RELEASED PER ANGWAX-40-321	L/C G.E.

PRINTS TO

REL B	B. COMPARET JAN-26-65	APPROVALS C. D. G. JAN-27-65	PROCESS COMPUTER DEPT	68C998913	
RE	ISSUED June 26, 1967		PHOENIX LOCATION	CONT ON SHEET F	SH NO 1

STD

FF-496-F (10-63) PRINTED IN U.S.A.

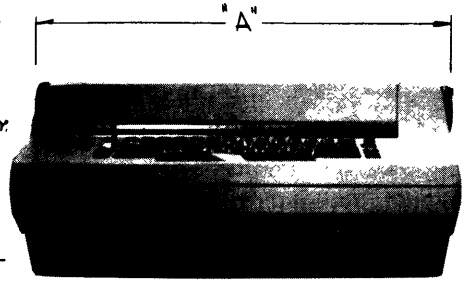
GENERAL ELECTRIC STD 68C998915

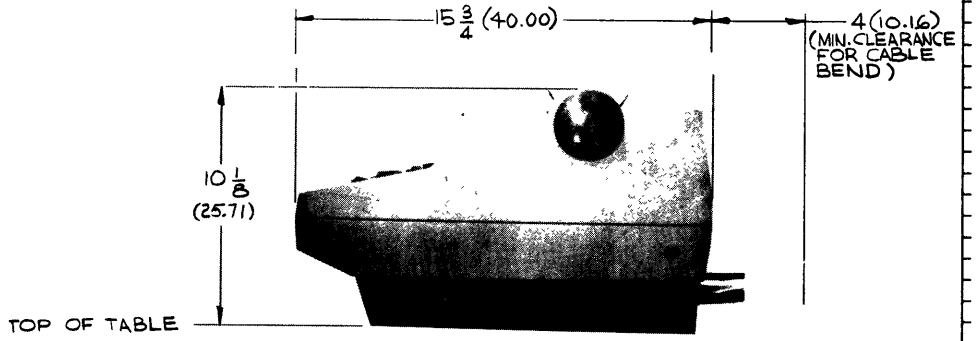
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING

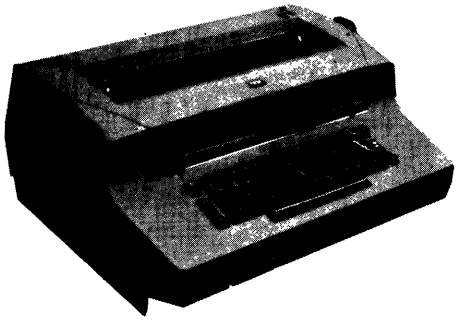
APPLIED PRACTICES	SURFACES	CLEARANCES ON MACHINED DIMENSIONS FRACTION ±	DECIMALS ±	ANGLES ±
	✓			

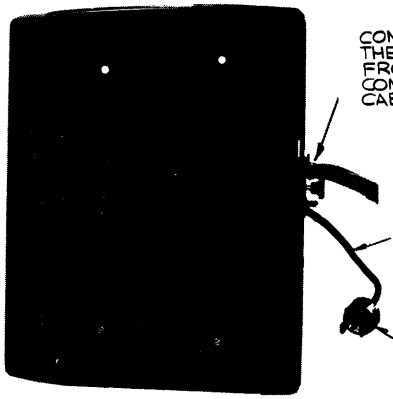
TITLE INSTALLATION OUTLINE
SELECTRIC TYPEWRITER
FIRST MADE FOR GE-PAC

NOTES:
1. POWER REQUIREMENTS
   115 VAC ± 10%, 60/50 CPS ± 3%
2. TEMPERATURE: OPERATIONAL AMBIENT
   32°F TO 131°F (0°C TO 55°C)
   OPERATIONAL TRANSIENT
   ±27°F (±15°C) AT A LINEAR RATE OVER A ONE HOUR PERIOD (0.45°F OR 0.25°C PER MINUTE)
   STORAGE: -40°F TO 158°F (-40°C TO 70°C)
3. AMBIENT RELATIVE HUMIDITY 0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS), FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS
4. VIBRATION: (ANY DIRECTION) .010 IN. (.2 CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS. 1G AT 15 TO 120 CPS
5. SHOCK: (ANY DIRECTION) 15G's FOR 2 MS
6. HEAT DISSIPATION: 580 BTU
7. 6 LINES PER INCH (2.54 cm)
8. MANIFOLD 10 TYPE STYLE
9. ALL DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS.









PART NO	PLATEN STYLE	FORM WIDTH (MAX)	PIN TO PIN DIMENSIONS	WRITING LINE (MAX)	A	WEIGHT
4DP4221AX1Z	FRICTION	11 (27.94)		8 1/2 (21.59)	17 1/4 (43.81)	52# (23.59KG)
4DP4221AX3Z	FRICTION	15 1/2 (39.37)		13 (33.02)	21 3/4 (55.24)	61# (27.67KG)
4DP4221AX0Z	PIN FEED	9 7/8 (25.08)	9 3/8 (23.81)	8 7/8 (22.54)	17 1/4 (43.81)	52# (23.59KG)
4DP4221AX2Z	PIN FEED	13 5/8 (34.60)	13 1/8 (33.33)	12 5/8 (32.06)	21 3/4 (55.24)	61# (27.67KG)
4DP4270BX01	PIN FEED	13 1/2 (34.29)		13 (33.02)	21 3/4 (55.24)	61# (27.67KG)
4DP4270BX02	FRICTION	13 5/8 (34.60)	13 1/8 (33.33)	12 5/8 (32.06)	21 3/4 (55.24)	61# (27.67KG)

REVISION

		PRINTS TO
B	D. Carson Jan. 26, 1967 REV & RETR PER AN 6 WAX-40-321	4C-14
AC		4CGS

RE B. COMPARET JAN 26 67 Jan. 26, 1967 APPROVALS C.D.G. JAN 27 '65 PROCESS COMPUTER DEPT PHOENIX LOCATION 68C998915 F STD

GENERAL ELECTRIC STD 68C984640

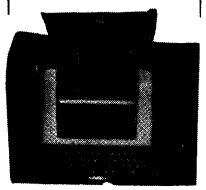
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRAC	DECIMALS	ANGLES
	✓	±	±	±

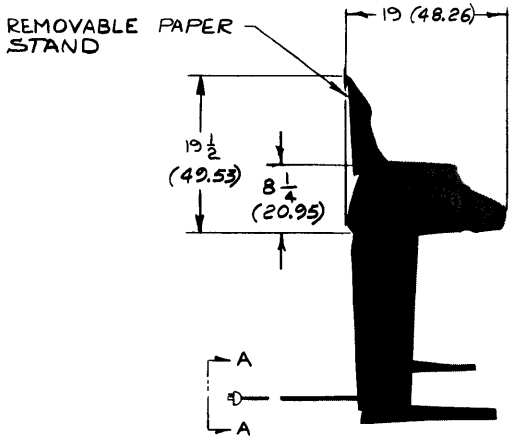
TITLE
INSTALLATION OUTLINE MODEL 33 TELETYPE

FIRST MADE FOR GE-PAC

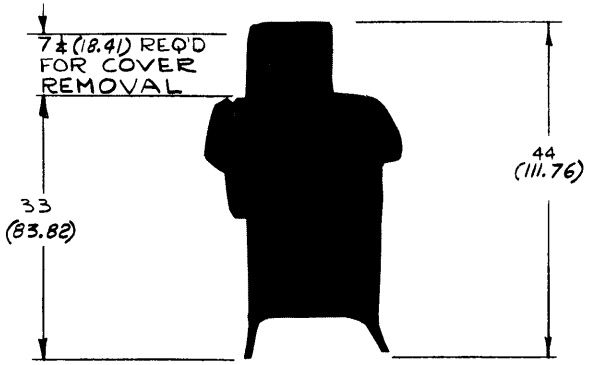
THIS DRAWING REPLACES 68C998118



19¼ (48.89) — WITHOUT PUNCH & READER (MODEL KSR) WITH KEY BOARD
(MODEL RO) WITHOUT KEY BOARD



VIEW A-A



NOTES:

1. POWER REQUIREMENTS: 115 VAC ± 10%, 60/50 CPS ± 3% 2.1 AMPS.
2. TEMPERATURE: OPERATIONAL AMBIENT 32°F TO 131°F (0°C TO 55°C) OPERATIONAL TRANSIENT ± 27°F (± 15°C) AT A LINEAR RATE OVER A ONE HOUR PERIOD. (0.45°F OR 0.25°C PER MINUTE).

   STORAGE: -40°F TO 158°F (-40°C TO 70°C).
3. AMBIENT RELATIVE HUMIDITY: 0% TO 95% (FOR BOTH STORAGE AND INSTALLED CONDITIONS) FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION: (ANY DIRECTION) .070 IN (.20 CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS. 1G AT 15 TO 120 CPS.
5. SHOCK: (ANY DIRECTION) 15 G's FOR 2 MS.
6. WEIGHT: ASR - 44 LBS (19.96 KG) KSR - 40 LBS (18.14 KG) RO - 39 LBS (17.69 KG)
7. DIMENSIONS SHOWN IN PARENTHESIS ARE IN CENTIMETERS.
8. HEAT DISSIPATION: 825 BTU/HR

MODEL ASR SHOWN

REVISIONS		PRINTS TO
B	B. Mahoney June 26, 1967 REV. & RE-ISSUED PER AN6WAX-40-321	XL-14
C		L/CGE

DRAWN BY	APPROVALS	PROC. COMPUTER	
L. DONITHAN JAN-28-66	2-23-66 A. D. C.	PHOENIX	68C984640
RE-ISSUED June 26, 1967			STD

GENERAL ELECTRIC STD 68C984641

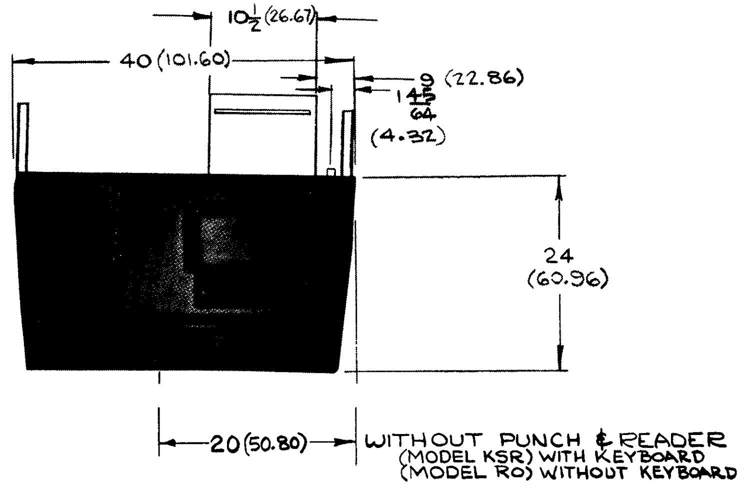
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING –

TITLE
INSTALLATION OUTLINE MODEL 35 TELETYPE

FIRST MADE FOR GE-PAC

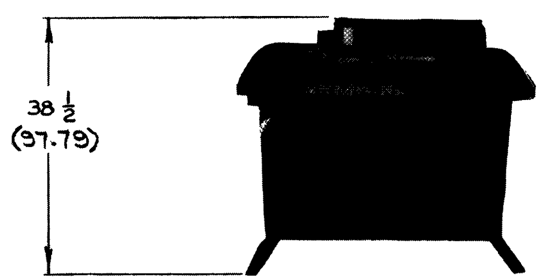
THIS DRAWING REPLACES 68C998118



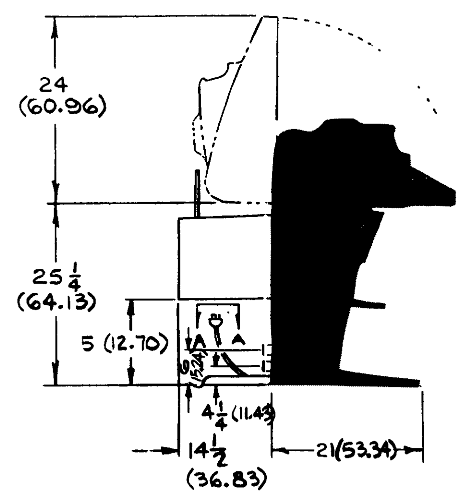
NOTES:

1. POWER REQUIREMENTS:
   115 VAC ± 10 %, 60/50 CPS ± 3%
   3.8 AMPS
2. TEMPERATURE: OPERATIONAL AMBIENT
   32°F TO 131°F (0°C TO 55°C)
   OPERATIONAL TRANSIENT ± 27°F (± 15°C)
   AT A LINEAR RATE OVER A ONE HOUR PERIOD. (0.45°F OR 0.25°C PER MINUTE).

   STORAGE: -40°F TO 158°F (-40°C TO 70°C)
3. AMBIENT RELATIVE HUMIDITY:
   0% TO 95 % (FOR BOTH STORAGE AND INSTALLED CONDITIONS) FOR ANY OF THE ABOVE TEMPERATURE CONDITIONS.
4. VIBRATION: (ANY DIRECTION)
   .070 IN. (.2 CM) PEAK TO PEAK DISPLACEMENT AT 5 TO 15 CPS.
   1G AT 15 TO 120 CPS.
5. SHOCK: (ANY DIRECTION)
   15 Gs FOR 2 MS.
6. WEIGHT:
   KSR - 225 LBS (102.06 KG)
   RO - 225 LBS (102.06 KG)
7. HEAT DISSIPATION:
   1490 BTU/HR.
8. DIMENSIONS IN PARENTHESIS ARE IN CENTIMETERS.



MODEL ASR SHOWN



VIEW A-A

REVISIONS		PRINTS TO	
B	J.A. Snyder June 26 1967	KG-14	PS-2
AC	REV & RET. PER ANGWAX-40-321	4/GE	

L. BONITHAN FEB 1, 1966 / June 26, 1967	A. H. C. 2-23-66	PROC COMPUTER PHOENIX	68C984641 STD

Progress Is Our Most Important Product

GENERAL ELECTRIC

PROCESS COMPUTER BUSINESS SECTION

PHOENIX, ARIZONA

2M (7-67)