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CONTRACTOR REPORT ARLCD-CR-82051

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**MAGNETIC POWER SUPPLY ASSEMBLY
OF
M509A2E1 FUZE (PHASE I)**

**MEL MOSKOWITZ
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**ROY NOBLE
PROJECT ENGINEER
ARRADCOM**

NOVEMBER 1982



**US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
LARGE CALIBER
WEAPON SYSTEMS LABORATORY
DOVER, NEW JERSEY**

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Contractor Report ARLCD-CR-82051	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MAGNETIC POWER SUPPLY ASSEMBLY OF M509A2E1 FUZE (PHASE I)		5. TYPE OF REPORT & PERIOD COVERED Interim Report 1 Aug 1980 thru 31 May 1982
7. AUTHOR(s) Mel Moskowitz, Bulova Systems and Instruments Corp. Roy Noble, Project Engr., ARRADCOM		6. PERFORMING ORG. REPORT NUMBER Project 274
9. PERFORMING ORGANIZATION NAME AND ADDRESS Bulova Systems and Instruments Corp. P.O. Box 189 Valley Stream, NY 11582		8. CONTRACT OR GRANT NUMBER(s) DAAK10-8-C-0183
11. CONTROLLING OFFICE NAME AND ADDRESS ARRADCOM, TSD STINFO Div (DRDAR-TSS) Dover, NJ 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS MMT-5804266
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) ARRADCOM, LCL Nuclear and Fuze Div (DRDAR-LCN-T) Dover, NJ 07801		12. REPORT DATE November 1982
		13. NUMBER OF PAGES 47
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES This project was accomplished as part of the US Army's Manufacturing Methods and Technology Program. The primary objective of this program is to develop, on a timely basis, manufacturing processes, techniques and equipment for use in production of Army materiel.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Magnetic power supply MMT-process improvement Fuze VIPER fuze Setback generator Sonic welding Centrifical timing Wave flow soldering Printed circuit Test console Electrical test console M509A2E1 fuze Release mechanism Lead-forming system		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The objective of this study was to develop the technology of manufacturing the M509A2E1 fuze used in the 105-mm heat round. The detailed design of the assembly stations was completed and a functional layout of the line was established. Fabrication and procurement of the hardware necessary to set up the critical stations were initiated. The planned phase II of the contract will provide for fabrication, installation, and debugging of the equipment.		

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INTRODUCTION

During Phase I, Bulova designed and fabricated equipment for assembly, inspection, and testing of the magnetic power supply assembly and associated electronics of the point initiating, base detonating (PIBD) fuze M509A2E1.

DISCUSSION

At the beginning of this project, it was anticipated that the existing fuze design would be available for high-volume producibility. However, as a result of tests, design modification was required. Rather than use a series of temporary modifications on an ongoing basis, Bulova proposed that basic design improvements be made which would take advantage of more sophisticated levels of technology and ensure higher reliability as well as better producibility.

Analysis and evaluation showed that certain assembly processes used in the development program were not fully suitable for high-volume production. The following examples show advances that have been made:

1. The original design for the setback generator, although functionally adequate, had some producibility shortcomings. An average time of 23 minutes was needed to wind the coil assembly. Seventeen of those 23 minutes were required to attach external leads to the coil's leads via a soldering process. To overcome this problem, and to strengthen the bobbin, the coil assembly was redesigned. External leads were replaced by resistance-welding the coil leads to pins installed in the bobbin.

2. The resistance-welding process also eliminated the need to clean up the flux residue left by the hand soldering process and further reduced the time to establish and test the coil connections to under 1 minute.

A Bulova-owned coil winding machine was modified to wind eight coils at a time, rather than one at a time, which a much less sophisticated machine had been doing during the development program.

The new improved design of the setback generator assembly included replacing the existing magnet and two core pieces with a longer single magnet of the same diameter. Test indicated two benefits:

1. Higher generator output voltage than previously available.
2. Abatement of a possible hang-up of the magnet/two core pieces on the inside of the generator coil assembly.

A new type magnetic charger and a special Gaussmeter were purchased and modified by Bulova. By using these in conjunction with additional special fixtures, Bulova could magnetize and validate 24 setback generator assemblies in a single charging cycle.

The printed circuit board assembly was redesigned and repackaged for high volume production. (A wave flow soldering process will replace the hand solder process in Phase II.) Component locations were changed so that four axial and one radial lead components could be formed by component lead-forming systems. These forming systems can yield preformed components for direct installation into the printed circuit board assembly in production quantities compared to very small quantities using hand tools. The specific quantity per hour is dependent on the packaging of the components "reeled," "on cards," or bulk packed and the type component.

A flow chart; bench layout schematic; bench layout assembly, stations 1 through 21; and proposed schedule for completion of Phase I tooling are shown in figures 1 through 4.

Details of the setback generator assembly are shown in table 1; details of the magnetic power supply assembly are in table 2.

PROPOSED PHASE II

In Phase II the initial tooling and inspection equipment designs will be carried beyond the interim concepts initiated in Phase I. Several new pieces of equipment have been proposed to ensure the quality and reliability goals:

1. The centrifuge timing test console will have a print-out and computer evaluation of the fuze to be tested. In addition, it will have the capability of testing, selecting, and segregating on a multiple limit selection option.

2. The Phase II version of the electrical acceptance test console for testing the magnetic power supply will have a computer evaluation of test data and a print-out of data as additional features. Information can be stored on a printed tape and identified by lot identification number.

3. The release mechanism assembly tester is an in-process functional tester used on the VIPER fuze program to confirm proper function of the three-leaf mechanism. This equipment is capable of testing 18 units simultaneously with a potential capability of approximately 200 units per hour. Projected VIPER fuze requirements are only 65 per hour, the same as the M509A2E1 fuze.

Therefore, the release mechanism assembly tester should easily be capable of supporting both the VIPER and the M509A2E1 fuze programs. Approval for use of this equipment will be requested of the VIPER prime contractor, General Dynamics. However, if required, a full set of existing drawings are available for replicating this unit.

As the need arises, Bulova will recommend improvements for all tooling and equipment designed in Phase I. Analysis will be made to determine whether replication or new designs are required to maintain or increase rates as required. Additional tooling, not previously considered, will be suggested if such is essential to the manufacture of a high reliability product.

A flow chart for Phase II is shown in figure 5.

Table 1. Setback generator assembly

TOOL NO.	TOOL DESCRIPTION	USED WITH PART/ASSY NO.	REMARKS
273-19002	Modified Production Type Coil Winding Machine	KC90211 Coil Assy	Wind Coil Assy of Setback Generator (Bulova Capital Equipment) 
273-19003	(2) Tension Devices	KC90211 Coil Assy	Wire Tension Control Device 
273-19006	Air Press & Sliding Anvil Fixture	KC90207 Bobbin Assy	Install (2) Terminal Posts
273-19007	Holding Fixture	KC90211 Coil Assy	Support and rotate Coil Assembly during application of insulating tape over winding.
273-19008	Trays Peg Board	KC90211 Coil Assy	Storage Tray for Coil Assy
BW-158862	Resistance Welding Machine-Unitek Weldmatic	KC90211 Coil Assy	Welding Machine - Power Pack, Welding Head and Remote Control Unit (Bulova Capital Equipment)
273-19010	Modified Electrodes & Table (Pressure Meas.) for Welding Machine	KC90211 Coil Assy	Special Welding Electrodes & Table
273-19011	Welding Fixture - Indexing Two Position	KC90211 Coil Assy	Fixture to Position Assy for Welding
273-60007	Welding Test Fixture (Fixture & Gage)	KC90211	To Measure Weld Strength
273-19013	Air Cylinder & Press-in Fixture	P/O KD90200 Setback Generator Assy	Press fit Armature Plt. into Armature Body

 Tooling to be completed during Phase II of program

Table 1. (cont)

TOOL NO.	TOOL DESCRIPTION	USED WITH PART / ASSY NO.	REMARKS
273-19014	Trays, - Storage	P/O KD90200 Setback Gen. Assy.	For Armature Subassy
273-19015	Air Cylinder & Press-in Fixture	P/O KD90200 Setback Gen. Assy.	Press fit Shearing Plt. into Generator Cover
273-19016	Air Cylinder & Press-in Fixture	P/O KD90200 Setback Gen. Assy.	Press fit Cover Subassy into Arm. Subassy.
273-19017	Air Press & Tooling	KD90200 Setback Gen. Assy.	Swage Body of Armature 360° Around Cover Sub Assy
273-60004	Continuity Tester Assy	KC90211	V. O. M. and Interface Fixture (Measure Continuity of Coil Assy)
273-60006	Setback Gen. Assy Tester	KD90200 Setback Gen. Assy.	Measures Generator R, L, and Insulation Resistance. Consists of 273, -60002, 273-60003, 273-60008 and Interface Fixture.
273-19001	Magnetic Charger, Charging Fixture, & Charging Tray	KD90200 Setback Gen Assy	Charge Magnet of Setback Generator Assy Gen. Assy.
273-60001	Gaussmeter and Holding Fixture W/Probe Built In	KD90200 Setback Gen. Assy.	Measures Gen. Flux Leakage after Magnetic Charge
273-60009	Pin Pull Out Tester	KD90207 Bobbin Assy.	Pull Test of (2) Pins Pressed into Flange of Bobbin

Test equipment to be completed during Phase II of program

Table 1. (cont)			
TOOL NO.	TOOL DESCRIPTION	USED WITH PART/ASSY NO.	REMARKS
273-60010	Polarization Tester	KD90211 Coil Assy	Test Electrically Direction of Winding of Coil and Validate Start Lead.
To be Assigned	Vacuum Test Device	KD90200	Validate Seals of Setback Generator Assembly After Completion.
273-90001	<u>Molds</u> Bobbin	KD90001	N.H.A. Bobbin Assy KC90207
273-90002	Cover Generator	KD90198	N.H.A. Setback Generator Assembly KD90200
273-50003	<u>Dies</u> Armature Body	KC90203	N.H.A. Setback Generator Assembly KD90200
273-50004	Bumping Die	KC90203	" " " "
273-70001	Projection Chart	KC90205	Used for inspection of Shear Disc.

Table 2. Magnetic power supply assembly

TOOL NO.	TOOL DESCRIPTION	USED WITH PART/ASSY NO.	REMARKS
273-19009	Crimping Tool, "AUTOMATOR"	KB90184 S2 Contact Assy	Crimp Contact Wire in Switch Terminal
273-19012	Holding Fixture Soldering	KB90184 S2 Contact Assy	Solder Contact Wire to Switch Terminal
273-19018	Tray-Storage	KB90184 S2 Contact Assy	Storage Tray
273-19019	Press-In Fixture w/Horizontal Slide Lever	KB90190 S2 Switch Housing Assy	Press-In (2) S2 Switch Contacts in S2 Housing
273-19020	Staking Tool, Air Press	KF 90194 Magnetic Power Supply Assy	Stake Switch S2 Contact Assy to P. C. Board
273-19021	Tray-Storage	KF 90194 Magnetic Power Supply Assy	Storage Tray
273-19004	Axial Lead Component Forming System	KF 90194 Magnetic Power Supply Assy	Heller Leadmaster H-116A and Custom Dies
273-19005	Radial Lead Component Forming System	KF 90194 Magnetic Power Supply Assy	Heller Radial Capacitor Lead Former Model RD-70C and Custom Die Set
273-19022	Press-In Fixture "Potence"	KF 90194 Magnetic Power Supply Assy	Press-In Connector Jack to P. C. Board

Table 2. (cont)

TOOL NO.	TOOL DESCRIPTION	USED WITH PART/ASSY NO.	REMARKS
273-19023	Holding Fixture, for P. C. B. Assy	KF90194 Magnetic Power Supply Assy	Holding Fixture for P. C. B. Assy during Installation of Components 
273-19024	Component Lead Bending/Clinching Hand Tool	KF90194 Magnetic Power Supply Assy	Hand Tool for Clinching Component Leads on P. C. Board 
273-19025	Holding Fixture Soldering & Switch S4 Perpendicularity Requirements	KF90194 Magnetic Power Supply Assy	Hand Soldering - P. C. Board Assy (Less Sw. S2 & Setback Generator Assy's) 
273-19026	Assembly Holding and Soldering Fixture	KF90194 Magnetic Power Supply Assy	Assemble and Solder S2 Switch Housing Assy & Setback Gen. Assy to P. C. B.
273-19027	Staking Tool, "Automator"	KD90156 H's'g., Pin & Contact Assy	Stake - Ground Wire in Rotor Housing Assy
273-19028	Staking Tool Air Press	KD90217 Molded Housing Assy	Stake P. C. Board (M. P. S.) in Housing Assy.
273-19029	Holding Fixture (Special Vise) Soldering	KD90217 Molded Housing Assy	Solder (2) Wires from Housing Assy to P. C. Board Assy
273-19030	Press-In Fixture, Probe Grommets	KD90217 Molded Housing Assy	Install (5) Probe Grommets in Power Supply Cover

Table 2. (cont)

TOOL NO.	TOOL DESCRIPTION	USED WITH PART/ASSY NO.	REMARKS
273-19031	Press-In Fixture, Shell Receptacle	KD90217 Molded Housing Assy	Install (1) Shell Receptacle in Power Supply Cover
273-19032	Swaging Tool P.S. Cover to Rotor Housing	KD90217 Molded Housing Assy	Swage P.S. Cover to Rotor Housing
273-19033	Special Fittings for Encapsulating System	KD90217 Molded Housing Assy	Install Special Fittings on Encapsulating System 
273-19034	Tray-Storage	KD90217 Molded Housing Assy	Storage Tray
273-19035	Radial Riveting Machine	KF80049 Rear Bearing Plate & Spacer Assy	Install (2) Pin, Leafs in Rear Bearing Plate and Spacer Assy
273-19036	Fixture - Peening	KF80049 Rear Bearing Plate & Spacer Assy	Spacer Assy
273-60005	Acceptance Test Console - Magnetic Power Supply Assy	KD90217 Mold on Housing Assy	Electrical Check Out of Magnetic Power Supply Assy - Computer Evaluated - Including Print Out 
To be Assigned	Wave Flow Soldering System	KF90194 Magnetic Power Supply Assy	Wave Flow Soldering of M.P.S. Assy

 Tooling/Test equipment to be completed during Phase II of program

Table 2. (cont)

TOOL NO.	TOOL DESCRIPTION	USED WITH PART/ASSY NO.	REMARKS
To be Assigned	Carriers for W.F.S. System (Sheet 6)	KF90194 Magnetic Power Supply Assy	Wave Flow Soldering of M.P.S. Assy
To be Assigned	Fixtures for W.F.S. System (Sheet 6)	KF90194 Magnetic Power Supply Assy	Wave Flow Soldering of M.P.S. Assy
To be Assigned	Cleaning System for W.F.S. (Sheet 6)	KF90194 Magnetic Power Supply Assy	Wave Flow Soldering of M.P.S. Assy
331-60001	Acceptance Test Console & Centrifuge	KF90215 Housing & Mech. Assy	Arming Time Test Computer Evaluated Including Print Out (Centrifuge-Bulova Capital Equipment)
To be Assigned	Sonic Welding Machine to Weld S2 Switch Housing to P.C. Board Assy (M.P.S.A.)	KF50194 Magnetic Power Assy	To Heat Stake S2 Switch Housing to Magnetic Power Supply Assy
273-90003	Molds Mold section for Fork	KC90154 Fork	Mold for Fork - used in Cam Follower Assy. KC90153
273-90004	Injection Mold for S2 Switch Housing	KD90185	S2 Switch Housing used in all Magnetic Power Supply Assemblies

Test equipment/Tooling to be completed during Phase II of program

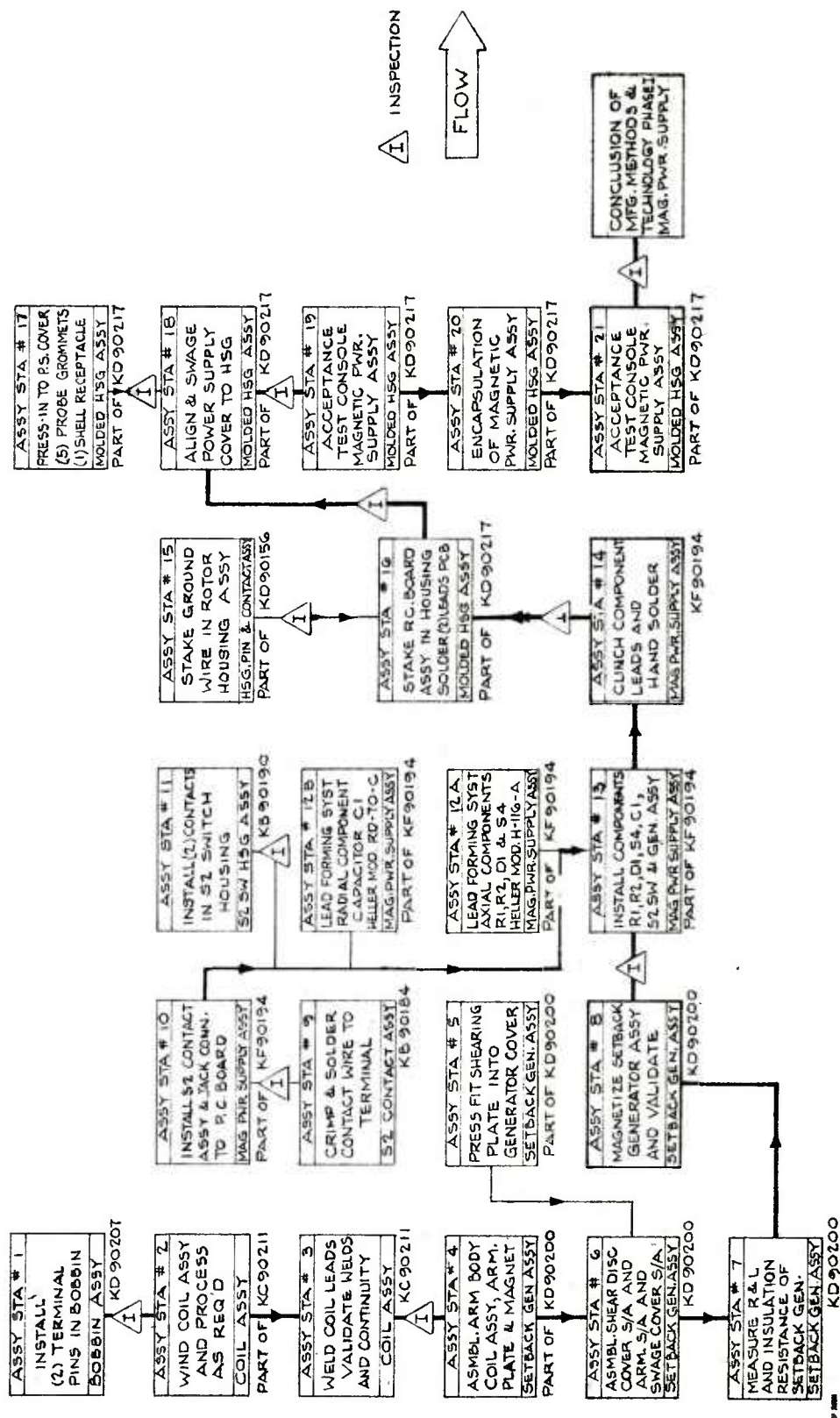


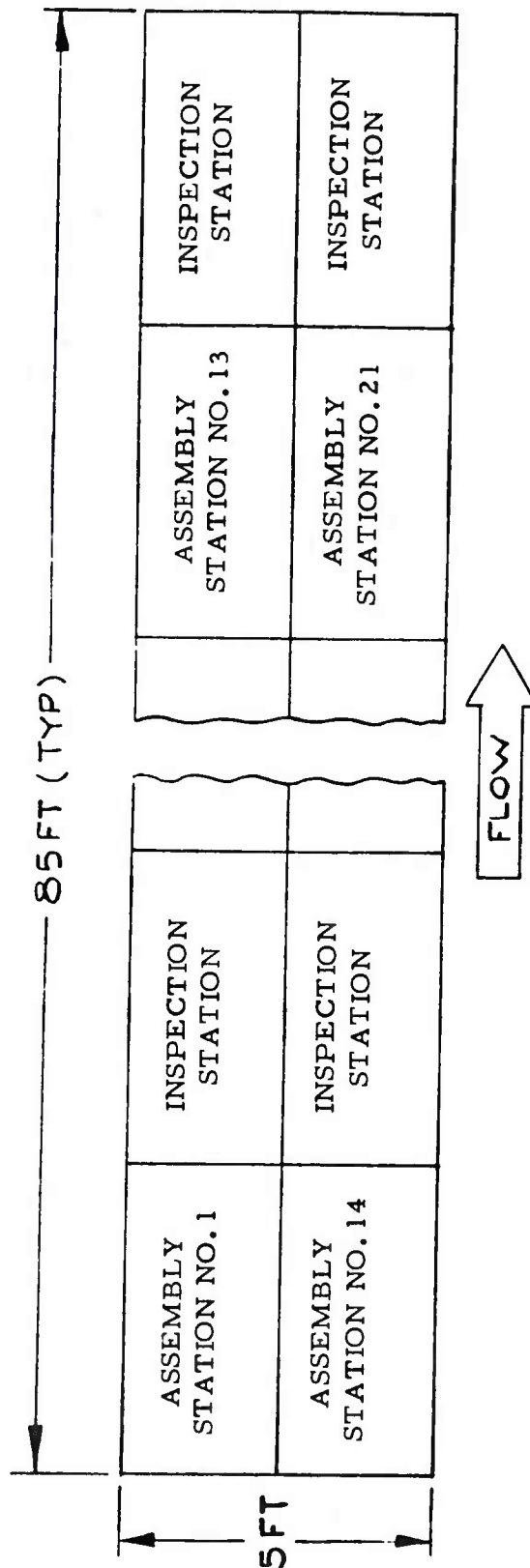
Figure 1. Phase I--Flow chart

BY ML DATE 6-23-91
APPRVD ML DATE 6-23-91

BULOVA
SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

PROJ 273/274
REV "NONE"

BENCH LAYOUT



STATIONS DIMENSIONS

5 FT x 2 1/2 FT (AS PER BENCH DETAIL SHEETS)

6 FT x 2 1/2 FT	"	"	"
6 FT x 2 1/2 FT	"	"	"
6 FT x 2 1/2 FT	"	"	"

LEGEND

22 ASSEMBLY STATIONS (BENCHES)

4 INSPECTION STATIONS (BENCHES)

Figure 2. Phase I--Bench layout schematic

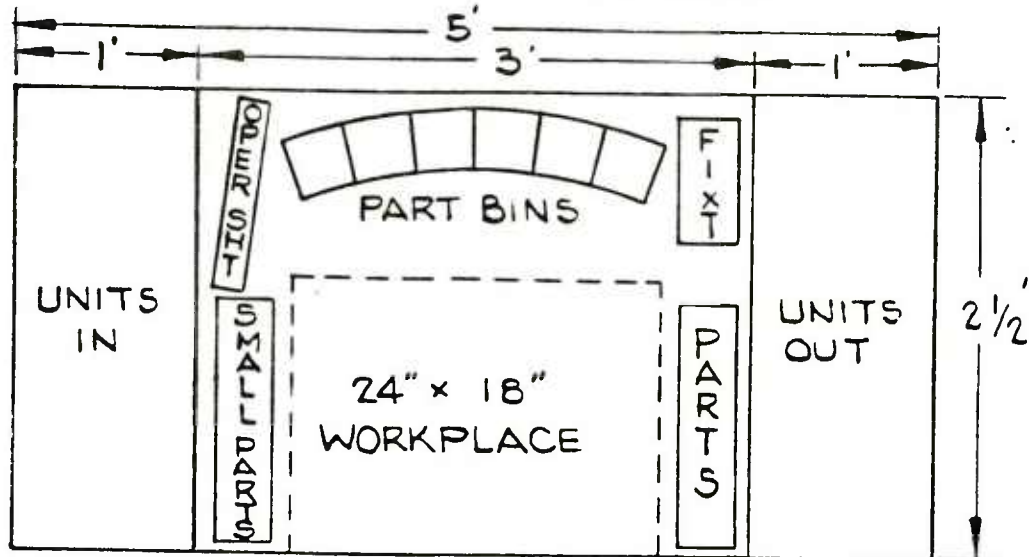
BULOVA

SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY MM DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

SETBACK GENERATOR ASSEMBLY

ASSY NO. KD90200

OPERATION SHEET NO. 273-1

ASSEMBLY STATION NO. 1

SHEETS to be determined (T.B.D.)

PARTS LIST (QTY PER ASSY)

- (1) KC90207 BOBBIN ASSY
- (2) KB90201 POST, TERMINAL

SPECIAL TOOLS/EQUIPMENT

- TOOL NO. 273-19006
- TOOLING TO INSTALL (2) TERMINAL POSTS
IN BOBBIN ASSY.
- TOOL NO. 273-60009
- PULL TEST OF (2) PINS PRESSED INTO
FLANGE OF BOBBIN.

Figure 3a. Phase I--Bench layout, assembly station no. 1

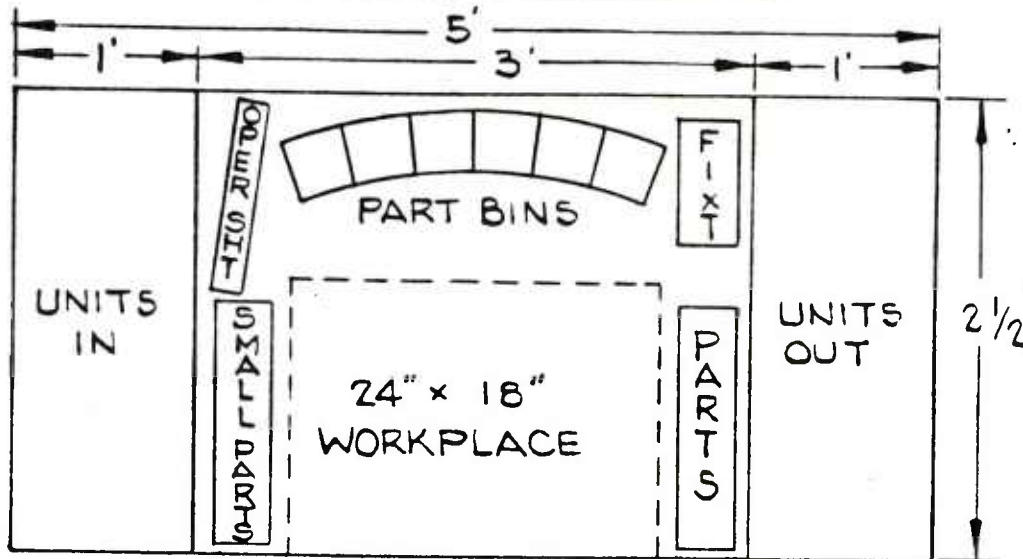
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SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY mm DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

COIL ASSEMBLY

ASSY NO. P/O KC90211

OPERATION SHEET NO. 273-2

ASSEMBLY STATION NO. 2

SHEET 1 OF 2

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

- (1) KD90207 BOBBIN ASSY
- (1) KB90438-1 TAPE, INSULATION
- (1) SET KB90326 WIRE

SPECIAL TOOLS/EQUIPMENT

- TOOL NO. 273-19002
- MODIFIED PRODUCTION TYPE COWECO
- COIL WINDING MACHINE
- BULOVA CAPITOL EQUIPMENT
- TOOL NO. 273-19003
- (2) WIRE TENSION DEVICES

Figure 3b. Phase I--Bench layout, assembly station no. 2

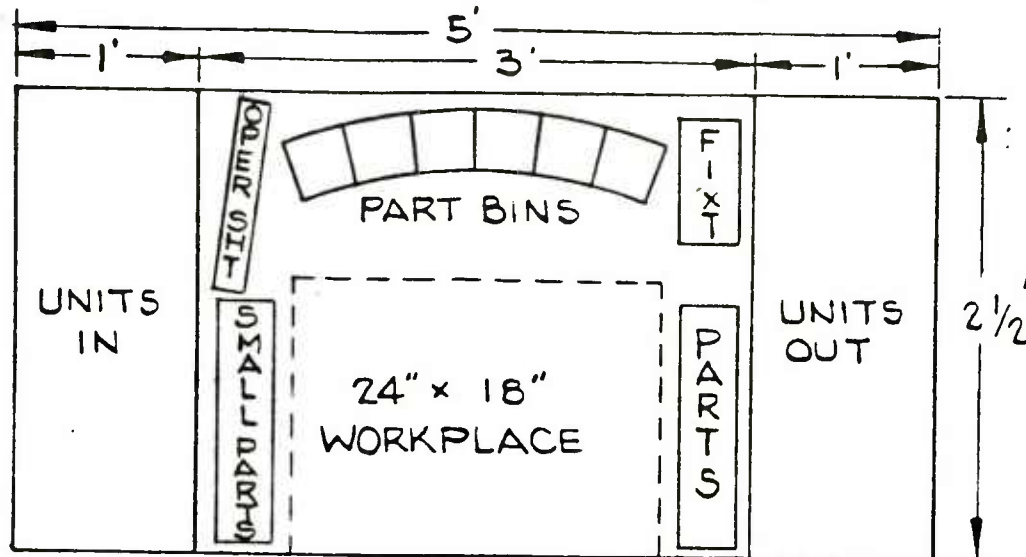
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VALLEY STREAM, NEW YORK**

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APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

COIL ASSEMBLY
ASSY NO. P/O KC90211
CONTINUED

ASSEMBLY STATION NO. 2
SHEET 2 OF 2

SPECIAL TOOLS/EQUIPMENT CONTINUED

TOOL NO. 273-19007

HOLDING FIXTURE FOR APPLYING TAPE TO
WINDING

TOOL NO. 273-19008

STORAGE TRAY FOR COIL ASSY.

Figure 3b. (cont)

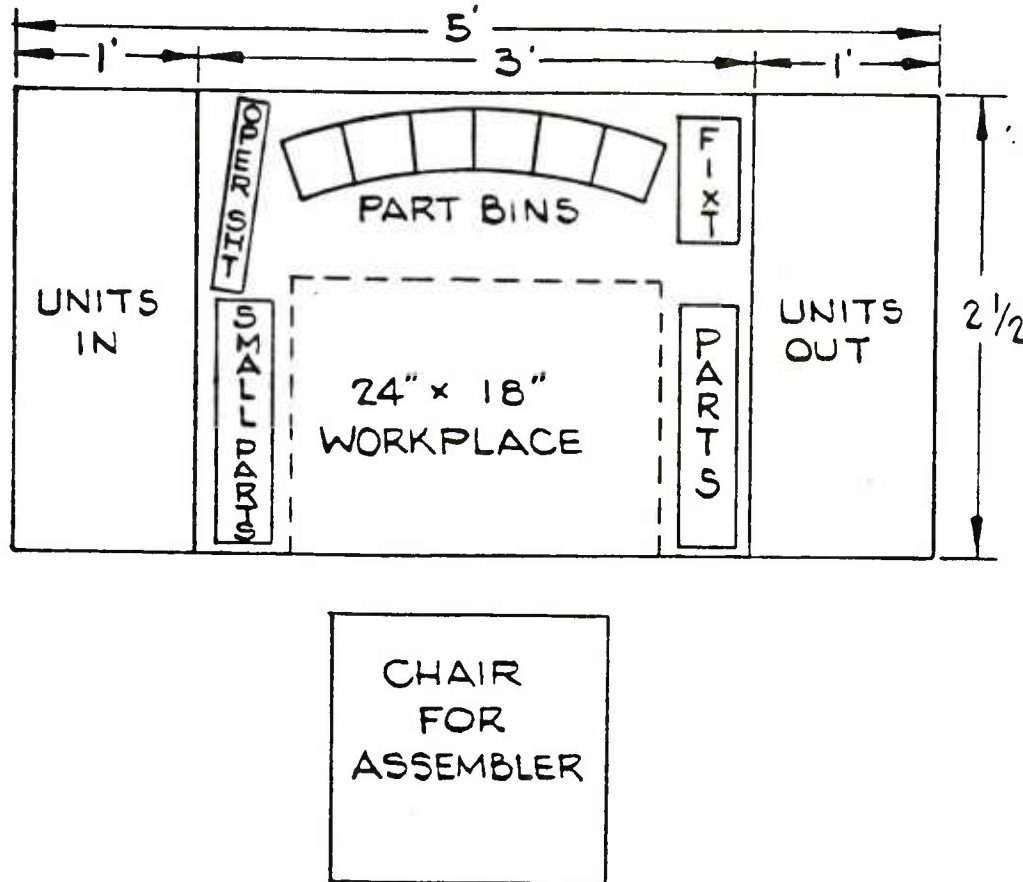
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REV NONE

TYPICAL BENCH LAYOUT



WELDING STATION

ASSY NO. KC90211

OPERATION SHEET NO. 273-3

ASSEMBLY STATION NO. 3

SHEET 1 OF 2

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

(1) P/O KC90211 COIL ASSY
(SUPPLIED BY ASSY STATION NO. 2)

SPECIAL TOOLS/EQUIPMENT

TOOL NO. BW-158862
BULOVA CAPITAL EQUIPMENT
RESISTANCE WELDING MACHINE
TOOL NO. 273-19010
MODIFIED ELECTRODES AND TABLE
TOOL NO. 273-19011
WELDING FIXTURE INDEXING
TWO POSITIONS

CONTINUED

Figure 3c. Phase I--Bench layout, assembly station no. 3

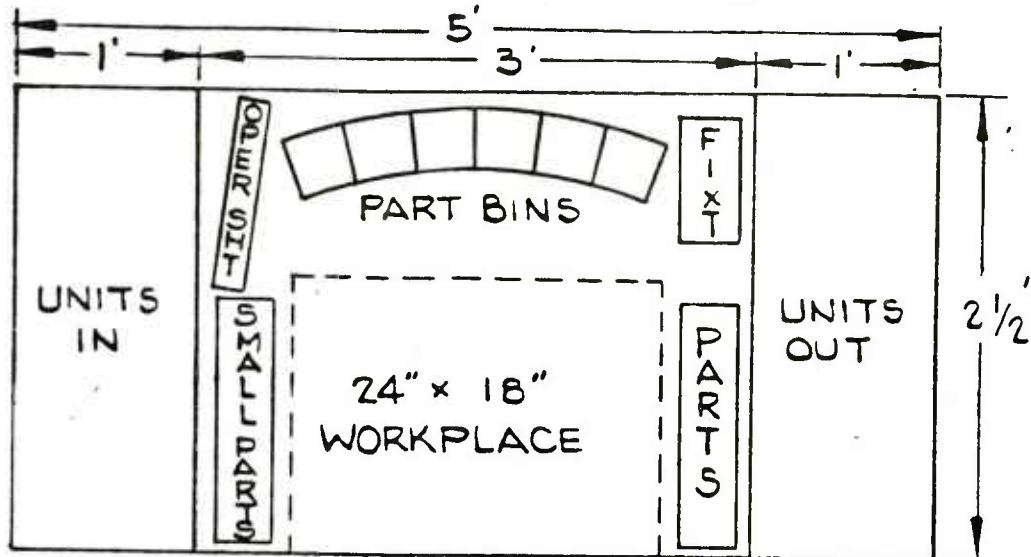
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PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

WELDING STATION

ASSY NO. KC90211

CONTINUED

ASSEMBLY STATION NO. 3

SHEET 2 OF 2

SPECIAL TOOLS /EQUIPMENT CONTINUED

TOOL NO. 273-60007

WELDING TEST FIXTURE TO MEASURE
STRENGTH OF WELD

TOOL NO. 273-60004

CONTINUITY TESTER

TOOL NO. 273-60010

POLARIZATION TESTER

Figure 3c. (cont)

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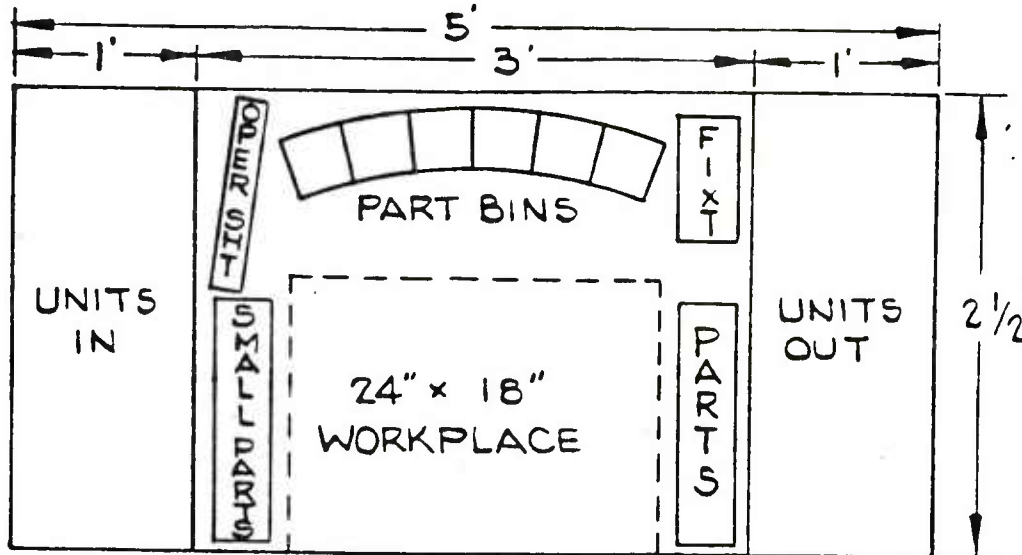
BY MM DATE 6-30-82

PROJ 273/274

APPRVD _____ DATE _____

REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

SETBACK GENERATOR ASSEMBLY

ASSEMBLY STATION NO. 4

ASSY NO. KD90200

OPERATION SHEET NO. 273-4

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

- (1) KC90211 COIL ASSY
(SUPPLIED BY ASSY STATION NO.3)
- (1) KC90203 BODY, ARMATURE
- (1) KD 90206 PLATE ARMATURE
- (2) KB90325 INSULATING SLEEVES

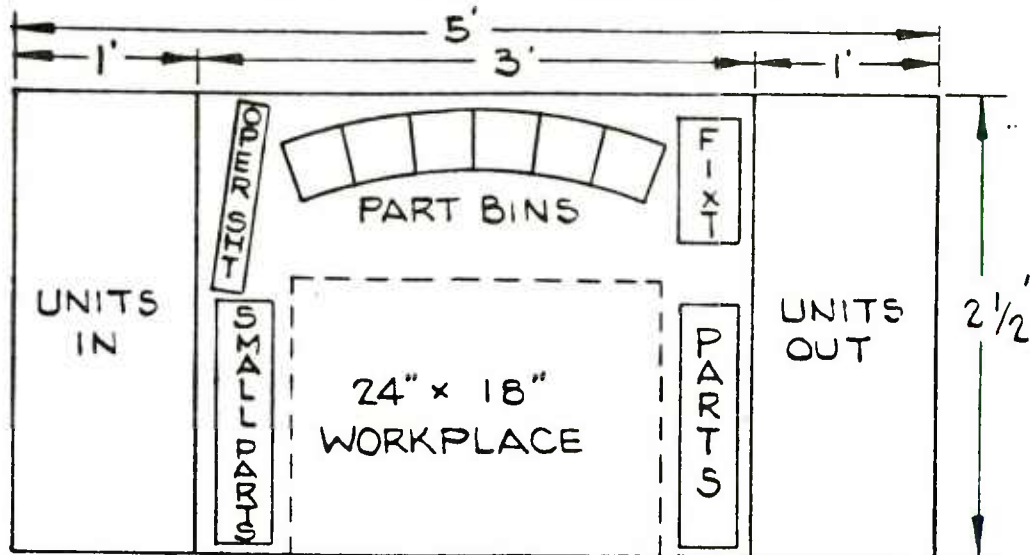
SPECIAL TOOL/EQUIPMENT

- TOOL NO. 273-19013
- PRESS-IN FIXTURE TO INSTALL COIL ASSY,
AND ARMATURE PLATE INTO ARMATURE BODY
- TOOL NO. 273-19014
- STORAGE TRAY FOR ARMATURE SUB ASSY.

Figure 3d. Phase I--Bench layout, assembly station no. 4

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VALLEY STREAM, NEW YORKBY 7/7/7 DATE 6-30-82PROJ 273/274

APPRVD _____ DATE _____

REV NONETYPICAL BENCH LAYOUTCHAIR
FOR
ASSEMBLERGENERATOR COVER SUB ASSYASSY NO. KD90200OPERATION SHEET NO. 273-5ASSEMBLY STATION NO.5SHEETS T.B.D.PARTS LIST (QTY PER ASSY)

(1) KD90198 COVER, GENERATOR

(1) KD90199 PLATE, SHEARING

SPECIAL TOOLS/EQUIPMENT

TOOL NO. 273-19015

PRESS FIT SHEARING PLATE INTO GENERATOR
COVER.

Figure 3e. Phase I--Bench layout, assembly station no. 5

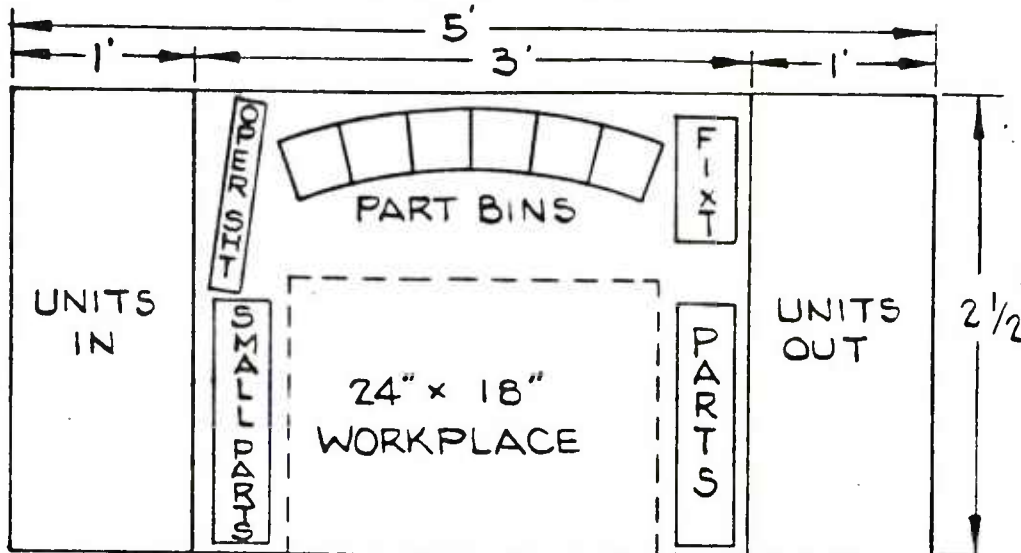
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TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

SETBACK GENERATOR ASSEMBLY

ASSY NO. KD90200

OPERATION SHEET NO. 273-6

ASSEMBLY STATION NO. 6

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

- (1) P/O KD90200 GENERATOR COVER
SUB ASSEMBLY
(SUPPLIED BY ASSY STATION NO. 5)
- (1) P/O KD90200 ARMATURE SUB ASSY
(SUPPLIED BY ASSY STATION NO. 4)
- (1) KB 90130 MAGNET
- (1) KC90205 DISC, SHEAR

SPECIAL TOOLS/EQUIPMENT

- TOOL NO. 273-19016
PRESS FIT COVER SUB ASSY INTO ARMATURE
SUB ASSY
- TOOL NO. 273-19017
SWAGE BODY OF ARMATURE 360° AROUND
COVER SUB ASSY.

Figure 3f. Phase I--Bench layout, assembly station no. 6

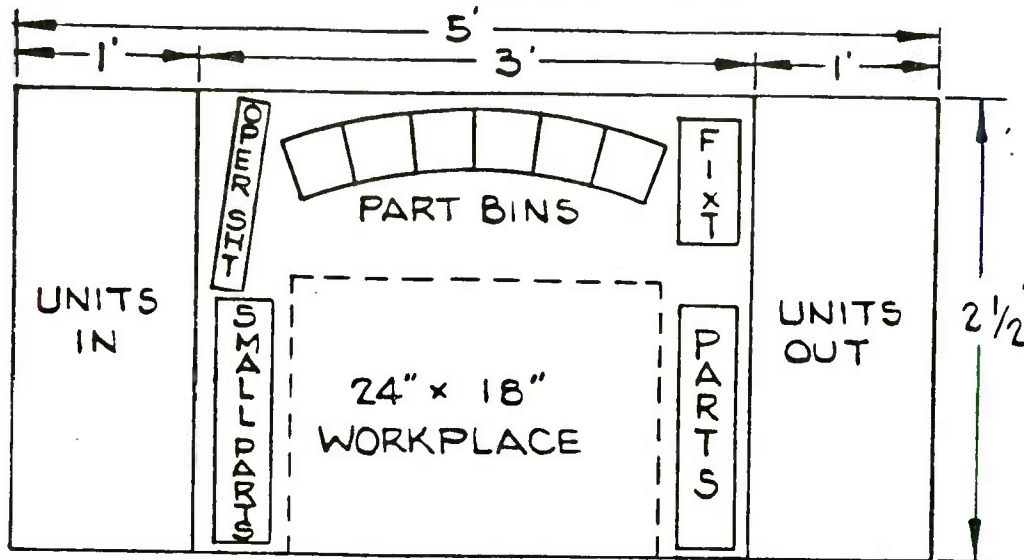
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SYSTEMS & INSTRUMENTS CORPORATION
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TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

SETBACK GENERATOR ASSEMBLY

ASSY NO. KD90200

OPERATION SHEET NO. 273-7

ASSEMBLY STATION NO. 7

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

(1) KD90200 SETBACK GENERATOR ASSY
(SUPPLIED BY ASSY STATION NO.6)

SPECIAL TOOLS/EQUIPMENT

TOOL NO. 273-60006

FINAL ASSEMBLY TESTER, MEASURES
GENERATOR-COIL D.C. RESISTANCE,
INDUCTANCE AND INSULATION
RESISTANCE TO ARMATURE CASE.

Figure 3g. Phase I--Bench layout, assembly station no. 7

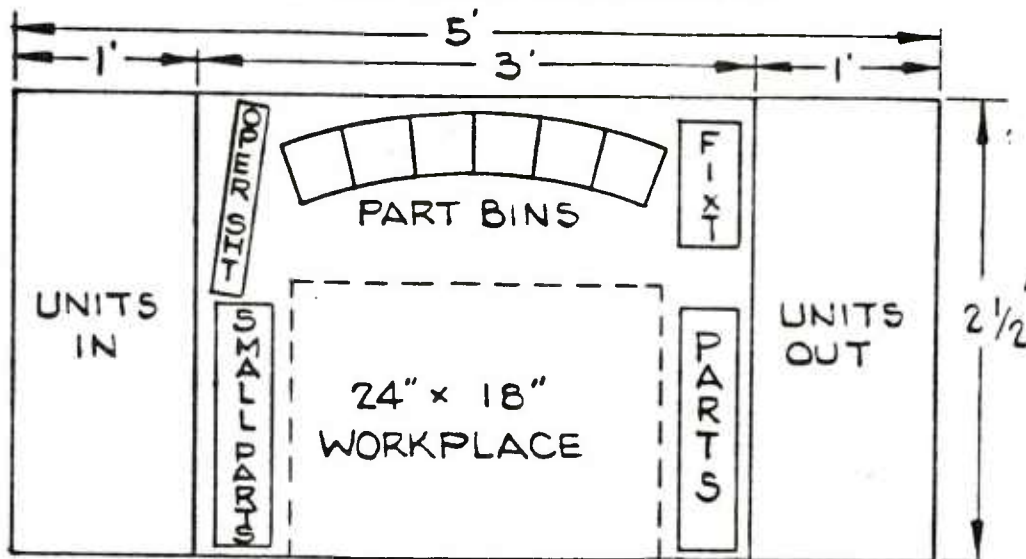
BULOVA

SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY MM DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

SETBACK GENERATOR ASSEMBLY

ASSY NO. KD90200

OPERATION SHEET NO. 273-8

ASSEMBLY STATION NO. 8

SHEET T.B.D.

PARTS LIST (QTY PER ASSY)

- (1) KD90200 SETBACK GENERATOR
ASSEMBLY
(SUPPLIED BY ASSY STATION NO. 7)
- (1) KB 88757 FOIL P.I.C.

SPECIAL TOOLS / EQUIPMENT

- TOOL NO. 273-19001
MAGNETIC CHARGER, CHARGING FIXTURE
AND CHARGING TRAYS TO CHARGE
MAGNET OF GENERATOR.
- TOOL NO. 273-60001
MEASURES GENERATOR FLUX LEAKAGE AFTER
MAGNETIC CHARGE.

Figure 3h. Phase I--Bench layout, assembly station no. 8

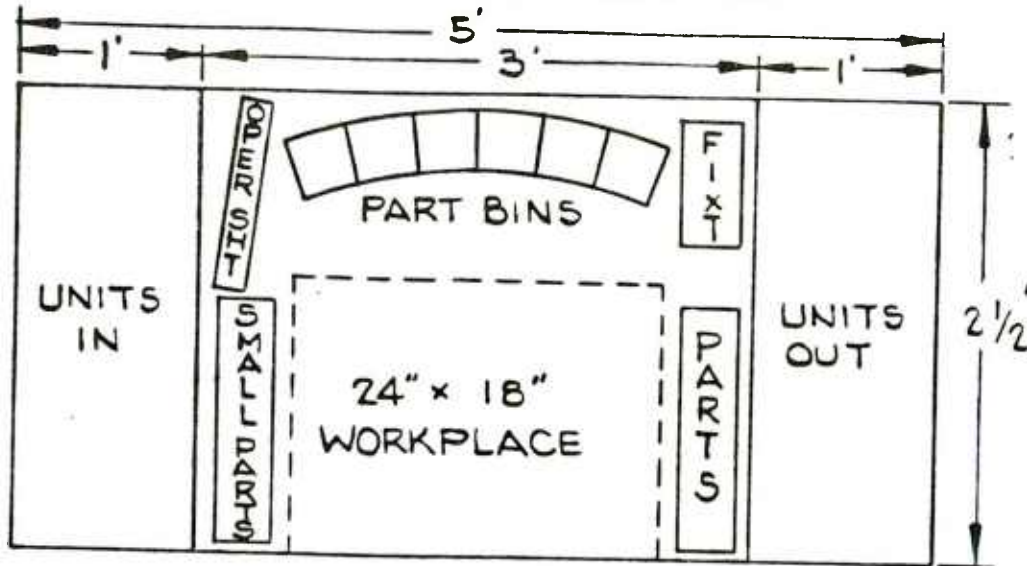
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BY 7/7/77 DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

S2 CONTACT ASSEMBLY

ASSY NO. KB90184

OPERATION SHEET NO. 273-9

ASSEMBLY STATION NO. 9

SHEET T.B.D.

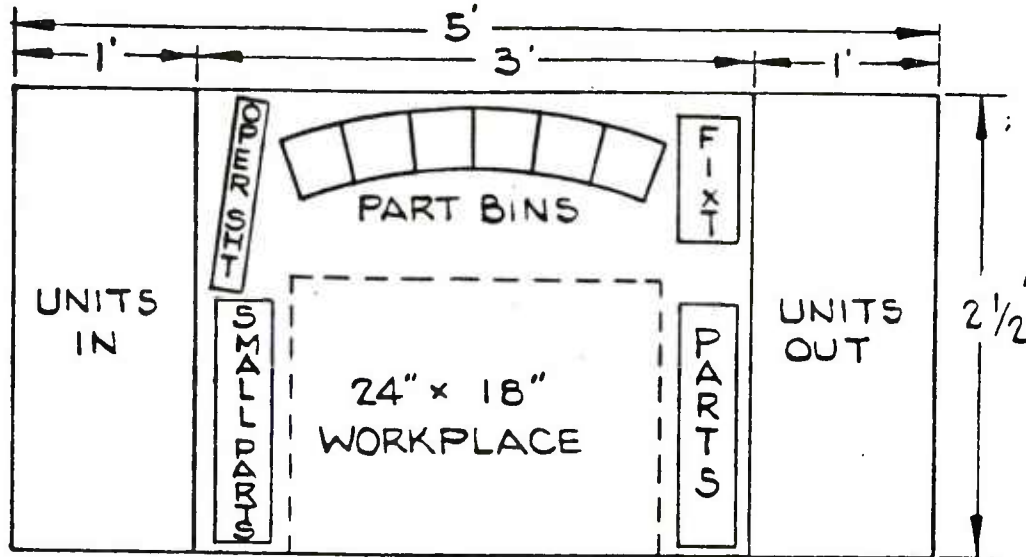
PARTS LIST (QTY PER ASSY)

- (1) KB90017 WIRE, CONTACT
- (1) KB90183 SWITCH, TERMINAL

SPECIAL TOOLS / EQUIPMENT

- TOOL NO. 273-19009
- CRIMP CONTACT WIRE IN SWITCH TERMINAL
- TOOL NO. 273-19012
- SOLDER CONTACT WIRE TO SWITCH TERMINAL
- TOOL NO. 273-19018
- STORAGE TRAY FOR S2 CONTACT ASSY.

Figure 3i. Phase I--Bench layout, assembly station no. 9

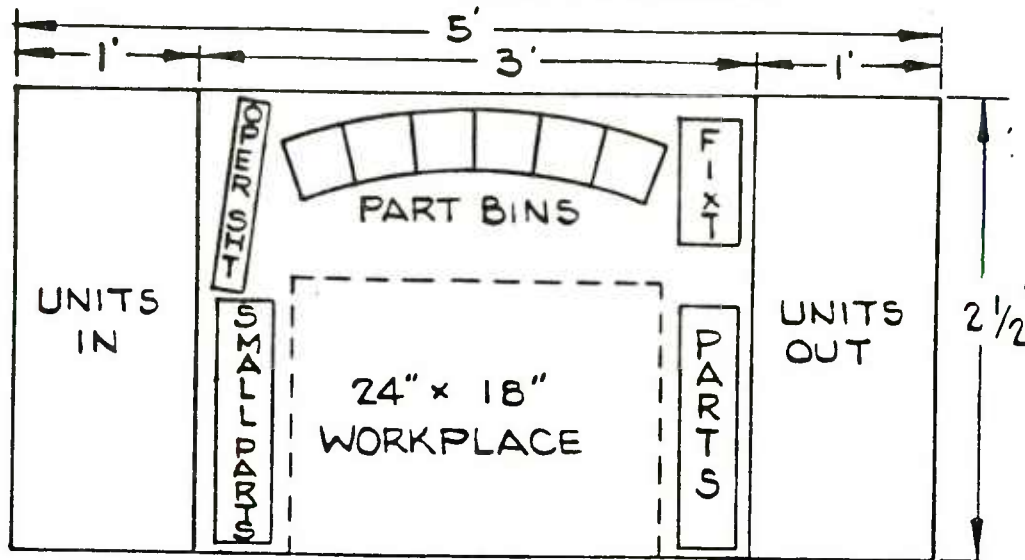
BULOVASYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORKBY MM DATE 6-30-82
APPRVD _____ DATE _____PROJ 273/274
REV NONETYPICAL BENCH LAYOUTCHAIR
FOR
ASSEMBLERMAGNETIC POWER SUPPLY ASSYASSY NO. KF 90194OPERATION SHEET NO. 273-10ASSEMBLY STATION NO. 10SHEETS T.B.D.PARTS LIST (QTY PER ASSY)

- (1) KB90184 S2 CONTACT ASSY
(SUPPLIED BY ASSY STATION 9)
- (1) KF 90193 PRINTED CIRCUIT BOARD
- (1) KB90210 JACK, CONNECTOR

SPECIAL TOOLS /EQUIPMENT

- TOOL NO. 273-19020
- STAKE S2 SWITCH CONTACT ASSY TO
P.C. BOARD
- TOOL NO. 273-19022
- PRESS IN CONNECTOR JACK TO P.C. BOARD
- TOOL NO. 273-19021
- STORAGE TRAY.

Figure 3j. Phase I--Bench layout, assembly station no. 10

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VALLEY STREAM, NEW YORKBY MM DATE 6-30-82
APPRVD _____ DATE _____PROJ 273/274
REV NONETYPICAL BENCH LAYOUTCHAIR
FOR
ASSEMBLERS2 SWITCH HOUSING ASSYASSY NO. KB90190OPERATION SHEET NO. 273-11ASSEMBLY STATION NO. 11SHEETS T.B.D.PARTS LIST (QTY PER ASSY)

- (1) KD90185 HOUSING, SWITHCH S2
- (2) KB90155 WIRE CONTACTS

SPECIAL TOOLS/EQUIPMENT

TOOL NO. 273-19019

PRESS-IN (2) S2 SWITCH CONTACTS IN
S2 HOUSING.

Figure 3k. Phase I--Bench layout, assembly station no. 11

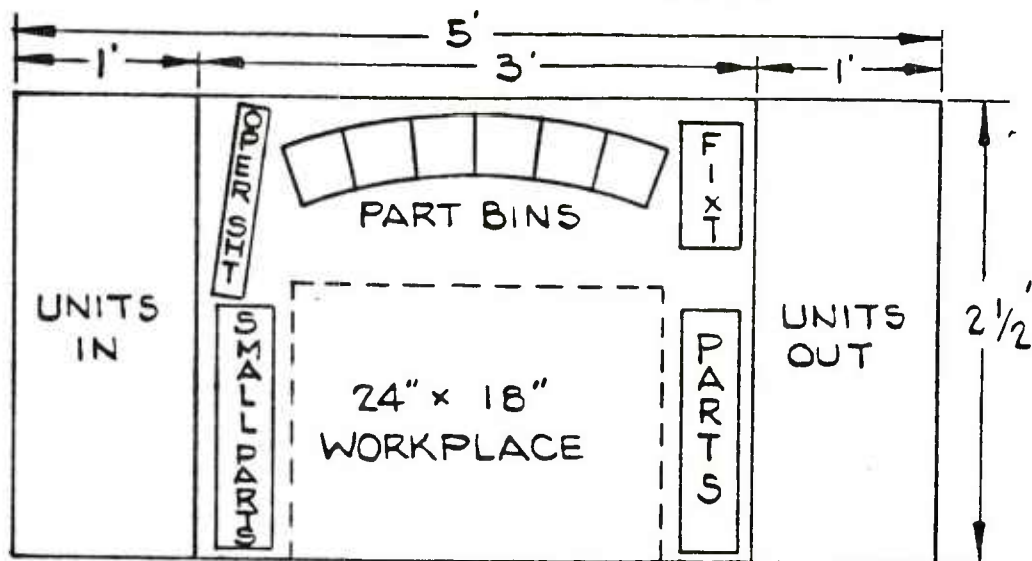
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SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY MJM DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MAGNETIC POWER SUPPLY ASSY.

ASSEMBLY STATION NO. 12A

ASSY NO. KF90194

AXIAL LEAD COMPONENT FORMING
STATION

OPERATION SHEET NO. 273-12A

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

SPECIAL TOOLS/EQUIPMENT

(1) KA90115 RESISTOR, COMPOSITION

TOOL NO. 273-19004

(1) MIL -S-19500 DIODE TX IN645-1
OR JX IN645-1

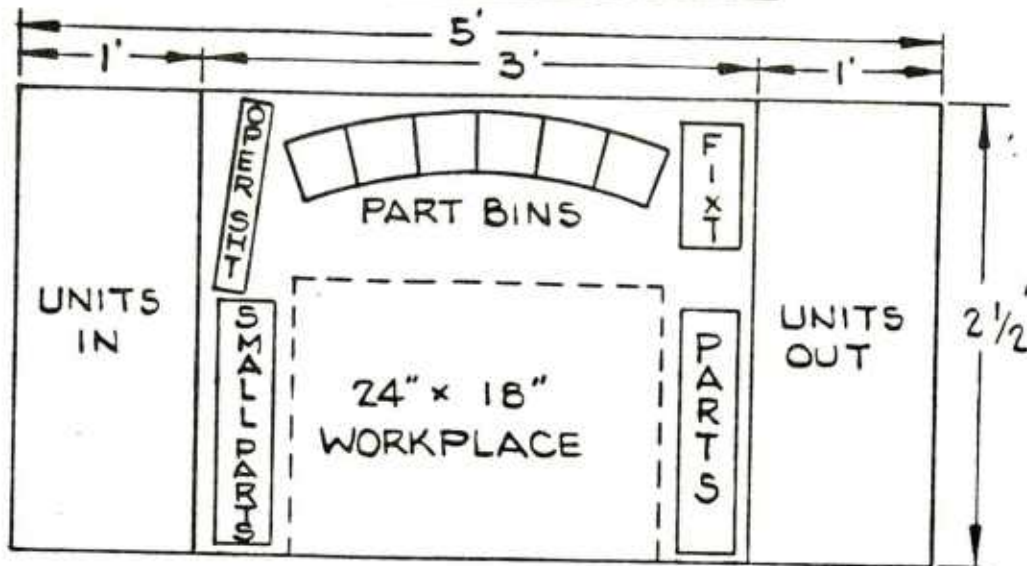
HELLER AXIAL COMPONENT LEAD FORMING
SYSTEM

(1) MIL -R-39008 RESISTOR RCR059104KS

(H-116-A AND CUSTOM DIES)

(1) KC90066 IMPACT SWITCH ASSY

Figure 31. Phase I--Bench layout, assembly station no. 12a

BY mm DATE 6-30-82
APPRVD _____ DATE _____PROJ 273/274
REV NONETYPICAL BENCH LAYOUTCHAIR
FOR
ASSEMBLERMAGNETIC POWER SUPPLY ASSY.ASSEMBLY STATION NO. 12BASSY NO. KF90194RADIAL LEAD COMPONENT FORMING
STATIONOPERATION SHEET NO. 273-12BSHEETS T.B.D.PARTS LIST (QTY PER ASSY)SPECIAL TOOLS/EQUIPMENT

(1) KB90212 CAPACITOR (RADIAL LEAD)

TOOL NO. 273-19005

HELLER RADIAL COMPONENT LEAD FORMING
SYSTEM
(RD-70-C AND CUSTOM DIE SET)

Figure 3m. Phase I--Bench layout, assembly station no. 12b

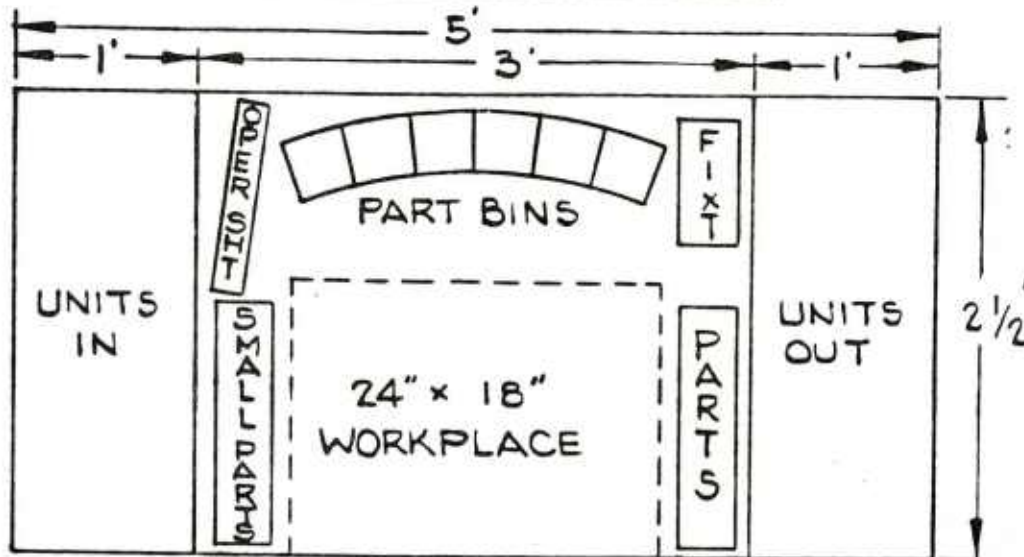
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VALLEY STREAM, NEW YORK

BY MM DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MAGNETIC POWER SUPPLY ASSY

ASSY NO. KF90194

INSTALL COMPONENTS IN P.C.
BOARD

OPERATION SHEET NO. 273-13

ASSEMBLY STATION NO. 13

SHEET 1 OF 2

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

(1) RESISTOR R1 (FORMED)

(1) RESISTOR R2 (FORMED)

(1) DIODE D1 (FORMED)

(1) INPACT SWITCH (FORMED)

(1) CAPACITOR C1 (FORMED)

(ABOVE SUPPLIED ASSY STATIONS 12A & 12B)

SPECIAL TOOLS /EQUIPMENT

TOOL NO. 273-19023

HOLDING FIXTURE FOR P.C. BOARD
DURING INSTALLATION OF COMPONENTS

CONTINUED

Figure 3n. Phase I--Bench layout, assembly station no. 13

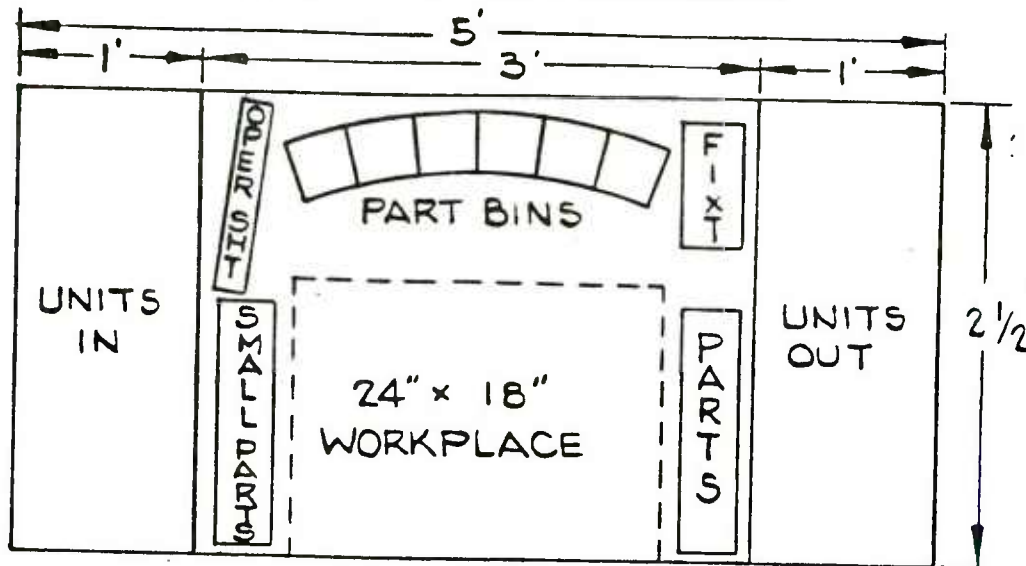
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VALLEY STREAM, NEW YORK**

BY 2/2/77 DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MAGNETIC POWER SUPPLY ASSY

ASSY NO. KF90194

CONTINUED

ASSEMBLY STATION NO. 13

SHEET 2 OF 2

PARTS LIST (QTY PER ASSY) CONTINUED

- (1) KB90190 SWITCH S2 ASSY
(SUPPLIED BY ASSY STATION 11)
- (1) KD90200 SETBACK GENERATOR ASSY
(SUPPLIED BY ASSY STATION 8)
- (1) P/O KF90194 P.C. BOARD SUB ASSY
(SUPPLIED BY STATION 10)

Figure 3n. (cont)

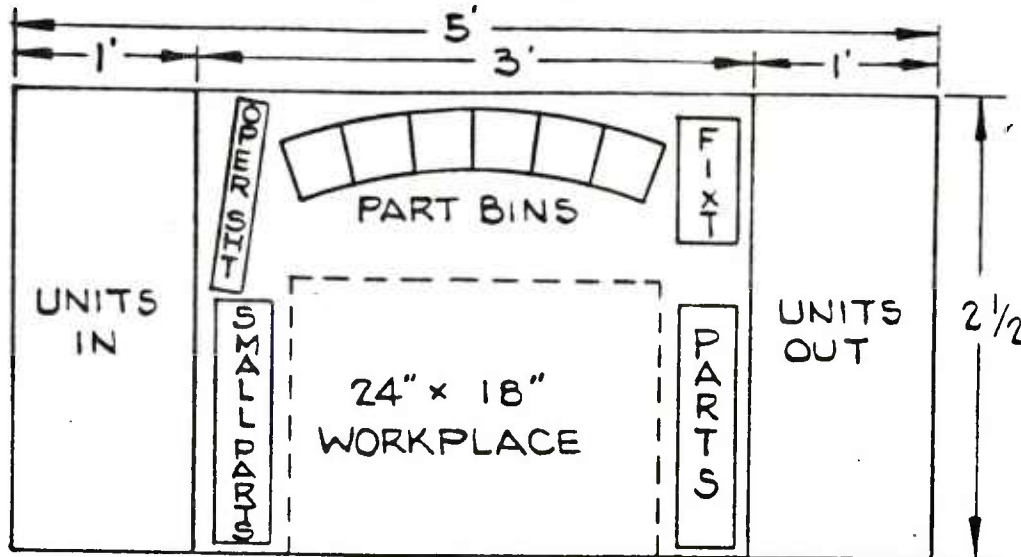
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VALLEY STREAM, NEW YORK

BY MM DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MAGNETIC POWER SUPPLY ASSY

ASSY NO. KF90194

COMPONENT LEAD CLINCHING
AND SOLDERING

OPERATION SHEET NO. 273-14

ASSEMBLY STATION NO. 14

SHEET 1 OF 2

SHEETS T.B.D.

PARTS LIST(QTY PER ASSY)

(1) P/O KF90194 P.C. BOARD SUB ASSY
(SUPPLIED BY STATION 13)

SPECIAL TOOLS/EQUIPMENT

TOOL NO. 273-19024

HAND TOOL FOR CLINCHING COMPONENT
LEADS

TOOL NO 273-19025

HOLDING FIXTURE FOR COMPONENTS
WHILE SOLDERING.

CONTINUED

Figure 30. Phase 1--Bench layout, assembly station no. 14

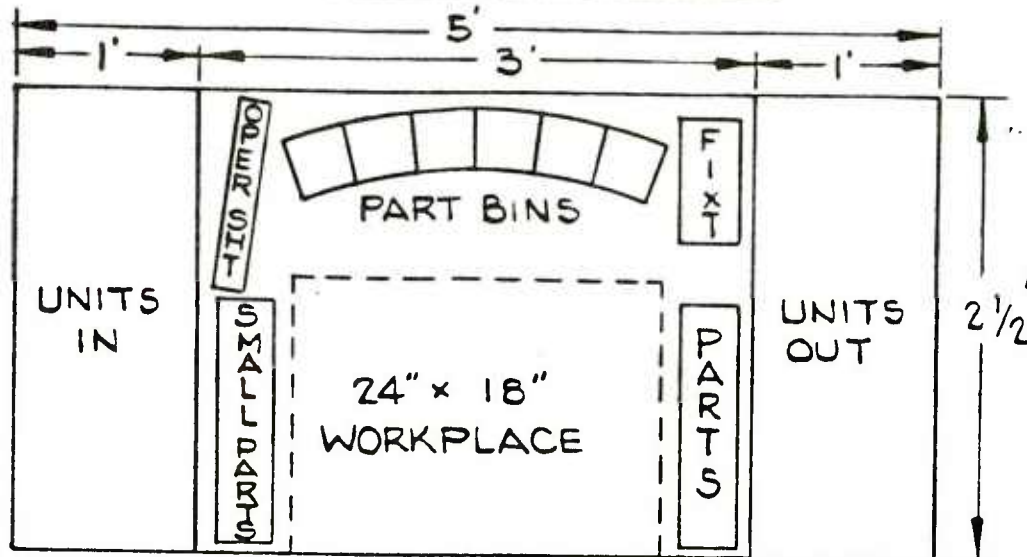
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SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY 22212 DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MAGNETIC POWER SUPPLY ASSY

ASSY NO. KF90194

CONTINUED

ASSEMBLY STATION NO. 14

SHEET 2 OF 2

SPECIAL TOOLS/EQUIPMENT CONTINUED

TOOL NO. 273-19026

HOLDING FIXTURE FOR S2 SWITCH
HOUSING AND SETBACK GENERATOR ASSY
WHILE SOLDERING TO P.C. BOARD
SUB ASSEMBLY.

Figure 3o. (cont)

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VALLEY STREAM, NEW YORK

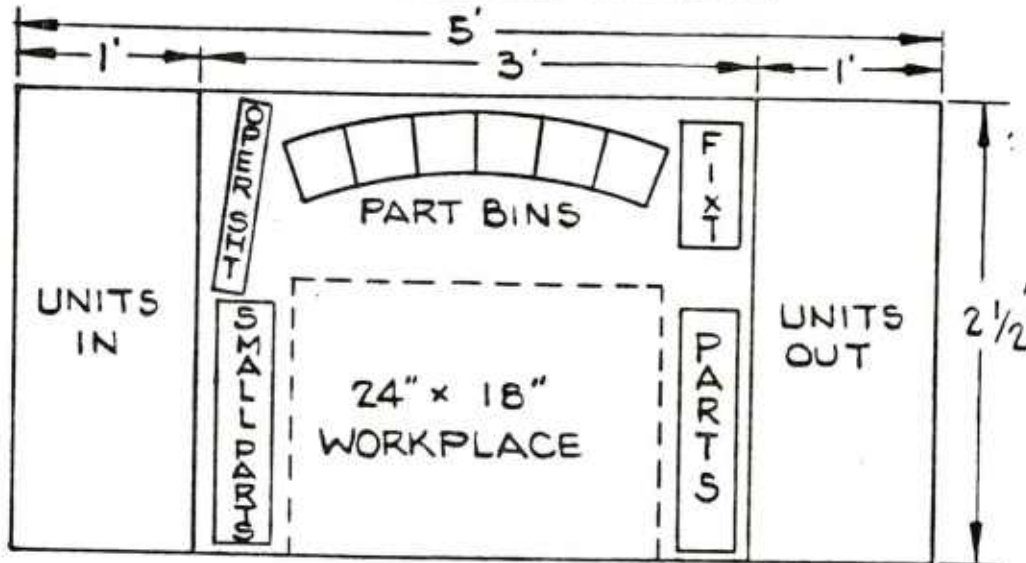
BY W. J. J. DATE 6-30-82

APPRVD _____ DATE _____

PROJ 273/274

REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

HOUSING, PIN AND CONTACT ASSY.

ASSY NO. KD90156

OPERATION SHEET NO. 273-15

ASSEMBLY STATION NO. 15

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

(1) KF90222 HOUSING , ROTOR

(1) KB90228 GROUND WIRE

SPECIAL TOOLS /EQUIPMENT

TOOL NO. 273-19027

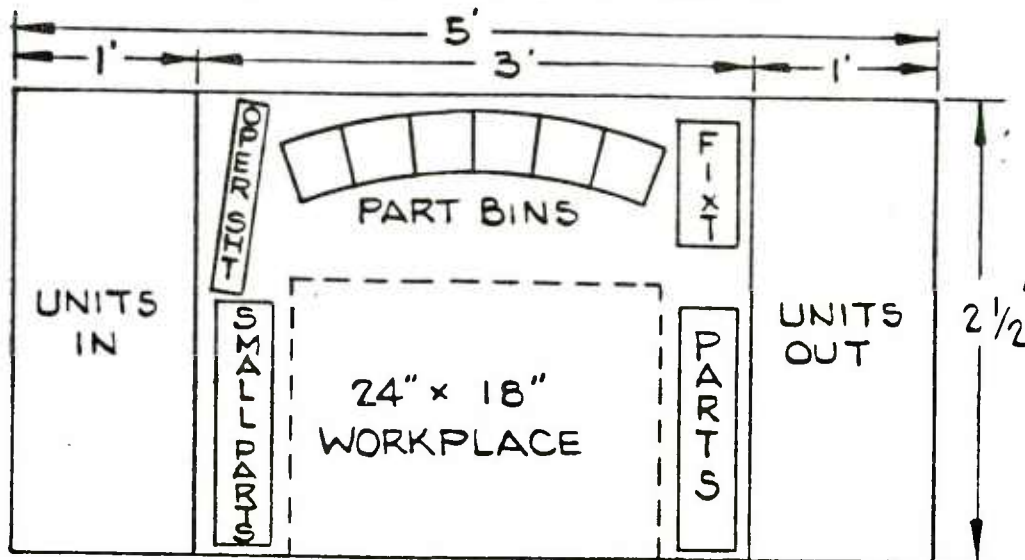
STAKE GROUND WIRE IN ROTOR HOUSING
ASSEMBLY.

Figure 3p. Phase I--Bench layout, assembly station no. 15

BY W.M. DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MOLDED HOUSING ASSEMBLY

ASSY NO KD90217

OPERATION SHEET NO. 273-16

ASSEMBLY STATION NO. 16

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

- (1) P/O KD90156 HOUSING, PIN & CONTACT ASSEMBLY
(SUPPLIED BY ASSY STATION 15)
- (1) KF90194 MAGNETIC POWER SUPPLY ASSY
(SUPPLIED BY ASSY STATION 14)

SPECIAL TOOLS /EQUIPMENT

- TOOL NO. 273-19028
- STAKE MAGNETIC POWER SUPPLY ASSY (P.C. BOARD ASSY) IN HOUSING ASSY
- TOOL NO. 273-19029
- FIXTURE TO HOLD HOUSING ASSY WHILE SOLDERING GROUND WIRE TO P.C. BOARD ASSY (ABOVE)

Figure 3q. Phase I--Bench layout, assembly station no. 16

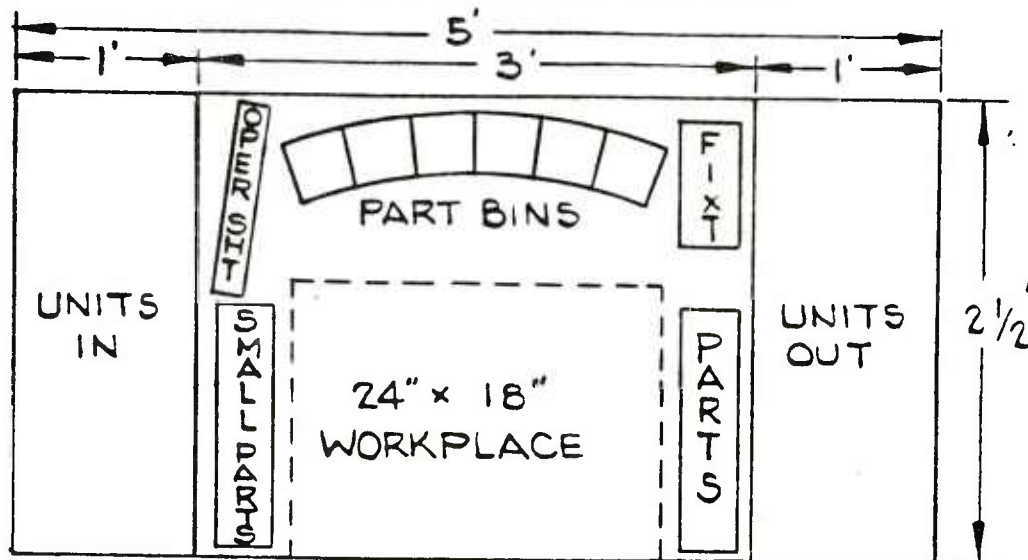
BULOVA

SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY H. M. DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MOLDED HOUSING ASSEMBLY

ASSY NO. KD 90217

OPERATION SHEET NO. 273-17

ASSEMBLY STATION NO. 17

SHEETS T.B.D.

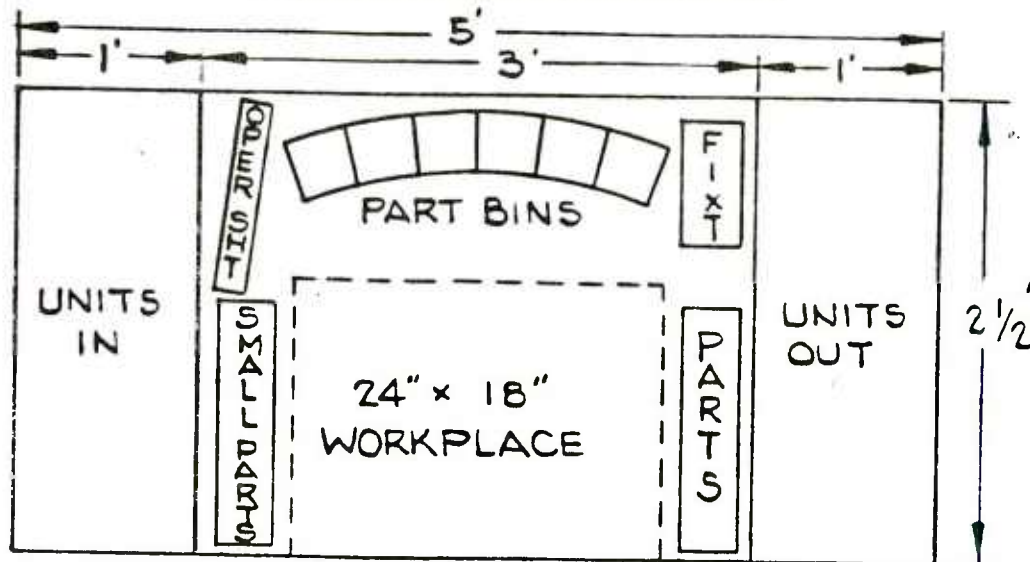
PARTS LIST (QTY PER ASSY)

- (1) KC90192 COVER, POWER SUPPLY
- (5) KB90513 GROMMET, PROBE
- (1) KC 90056 SHELL RECEPTACLE

SPECIAL TOOLS /EQUIPMENT

- TOOL NO. 273-19030
- INSTALL (5) GROMMET PROBES INTO
POWER SUPPLY COVER
- TOOL NO. 273-19031
- INSTALL (1) SHELL RECEPTACLE IN POWER
SUPPLY COVER

Figure 3r. Phase I--Bench layout, assembly station no. 17

BULOVASYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORKBY WJH DATE 6-30-88
APPRVD _____ DATE _____PROJ 273/274
REV NONETYPICAL BENCH LAYOUTCHAIR
FOR
ASSEMBLERMOLDED HOUSING ASSEMBLYASSEMBLY STATION NO. 18ASSY NO. KD90217OPERATION SHEET NO. 273-18SHEETS T.B.D.PARTS LIST (QTY PER ASSY)SPECIAL TOOLS / EQUIPMENT(1) P/O KD90217 MOLDED HOUSING ASSY
(SUPPLIED BY STATION 16)

TOOL NO. 273-19033

(1) P/O KD90217 MOLDED HOUSING ASSY
(POWER SUPPLY COVER SUB ASSY)
(SUPPLIED BY STATION 17)ALIGN AND SWAGE POWER SUPPLY COVER
SUB ASSY TO ROTOR HOUSING ASSY

Figure 3s. Phase I--Bench layout, assembly station no. 18

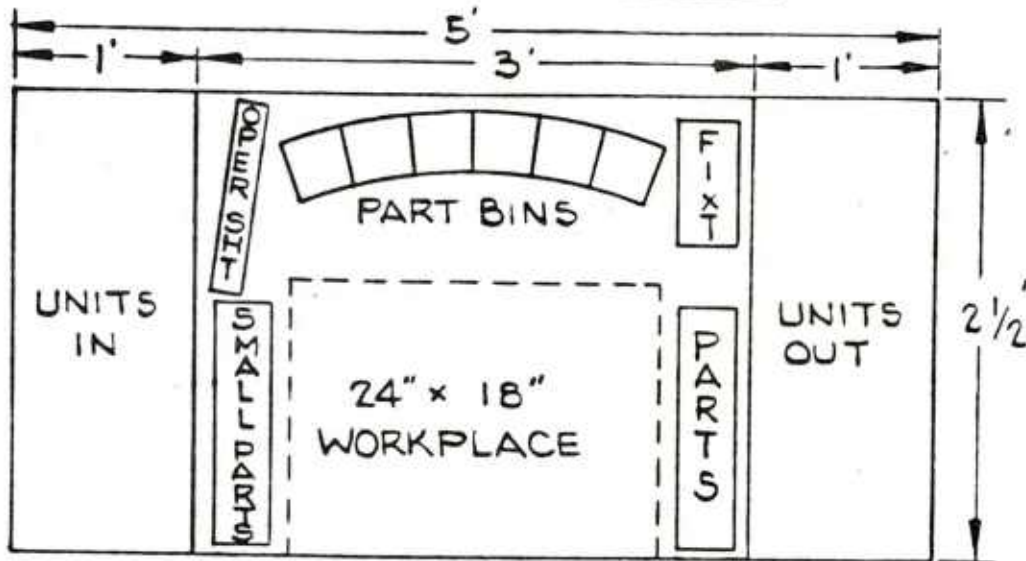
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VALLEY STREAM, NEW YORK

BY MW DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MOLDED HOUSING ASSEMBLY

ASSY NO. KD 90217

(MAGNETIC POWER SUPPLY ASSY
PRE-ENCAPSULATION TEST)

OPERATION SHEET NO. 273-19

ASSEMBLY STATION NO. 19

SHEET 1 OF 2

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

(1) P/O KD90217 MOLDED HOUSING
ASSY (MAGNETIC POWER SUPPLY
ASSY)
(SUPPLIED BY ASSY STATION 18)

SPECIAL TOOLS /EQUIPMENT

TOOL NO. 273-60005-001
ACCEPTANCE TEST CONSOLE
TOOL NO. 273-19033
SPECIAL FITTINGS FOR ENCAPSULATING
SYSTEM

Figure 3t. Phase I--Bench layout, assembly station no. 19

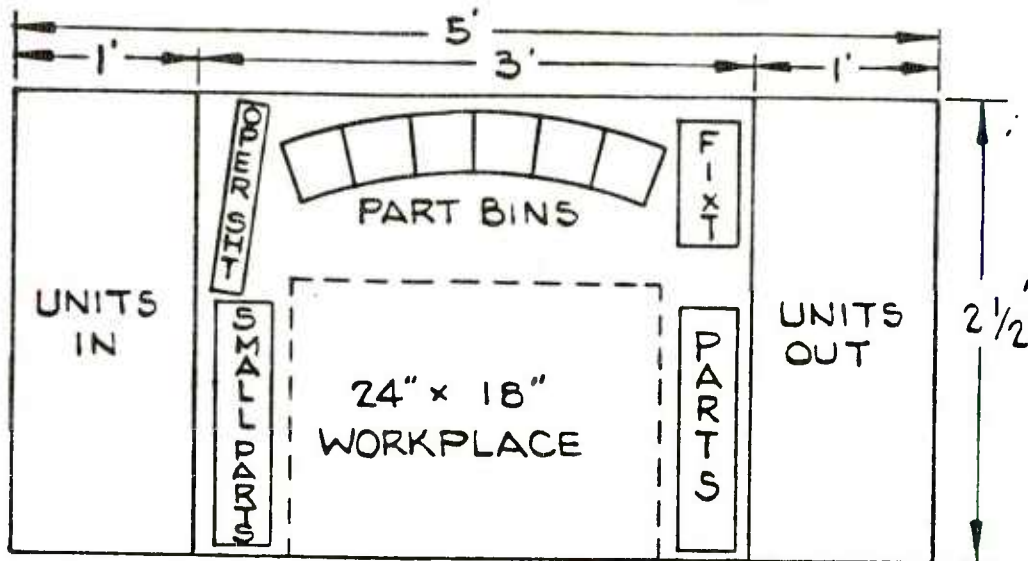
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SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY WJG DATE 6-30-92
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MOLDED HOUSING ASSEMBLY
ASSY NO. KD90217
CONTINUED

ASSEMBLY STATION NO. 19
SHEET 2 OF 2

PARTS LIST (QTY PER ASSY) CONTINUED
(1) SET KA90696 ENCAPSULATING
COMPOUND

SPECIAL TOOLS /EQUIPMENT CONTINUED
TOOL NO. 273-19034
STORAGE TRAYS

Figure 3t. (cont)

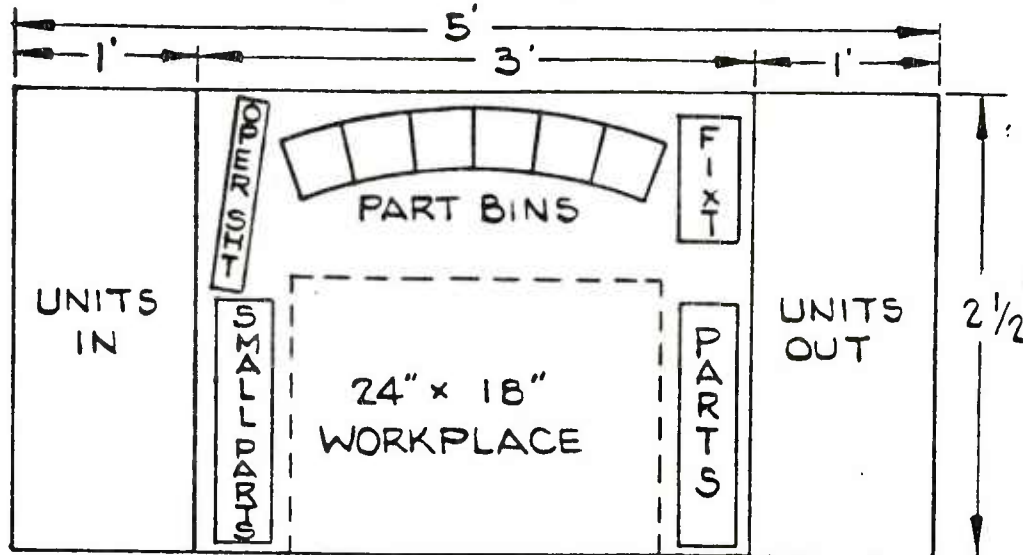
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SYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORK

BY MM/11/ DATE 6-30-82
APPRVD _____ DATE _____

PROJ 273/274
REV NONE

TYPICAL BENCH LAYOUT



CHAIR
FOR
ASSEMBLER

MOLDED HOUSING ASSEMBLY

ASSY NO. KD 90217

(ENCAPSULATION OF MAGNETIC
POWER SUPPLY ASSY)

OPERATION SHEET NO. 273-20

ASSEMBLY STATION NO. 20

SHEETS T.B.D.

PARTS LIST (QTY PER ASSY)

(1) P /O KD90217 PRE-TESTED
MOLDED HOUSING ASSY
(SUPPLIED BY ASSY STATION 19)

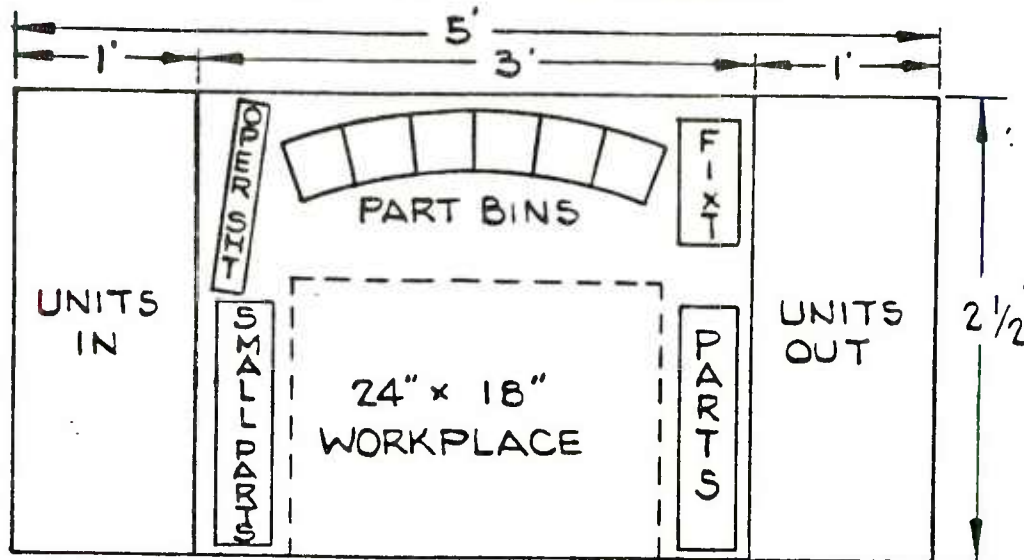
(1) SET KA90696 ENCAPSULATING
COMPOUND

SPECIAL TOOLS /EQUIPMENT

TOOL NO. 273-19033

SPECIAL FITTINGS FOR ENCAPSULATING
SYSTEM.

Figure 3u. Phase I--Bench layout, assembly station no. 20

BULOVASYSTEMS & INSTRUMENTS CORPORATION
VALLEY STREAM, NEW YORKBY W/W DATE 6-30-82
APPRVD _____ DATE _____PROJ 273/274
REV NONETYPICAL BENCH LAYOUTCHAIR
FOR
ASSEMBLERMOLDED HOUSING ASSEMBLYASSY KD90217(ENCAPSULATED MAGNETIC POWER
SUPPLY ASSY)OPERATION SHEET NO. 273-21ASSEMBLY STATION NO. 21SHEETS T.B.D.PARTS LIST (QTY PER ASSY)(1) P/O KD90217 MOLDED HOUSING
ASSY-ENCAPSULATED MAGNETIC
POWER SUPPLY ASSY
(SUPPLIED BY ASSY STATION 20)SPECIAL TOOLS /EQUIPMENT

TOOL NO. 273-60005

ACCEPTANCE TEST CONSOLE
(SAME UNIT AS AT ASSY STATION 19)

Figure 3v. Phase I--Bench layout, assembly station no. 21

JUNE 30, 1982

CONTRACT DAAK10-80-C-0183

1982

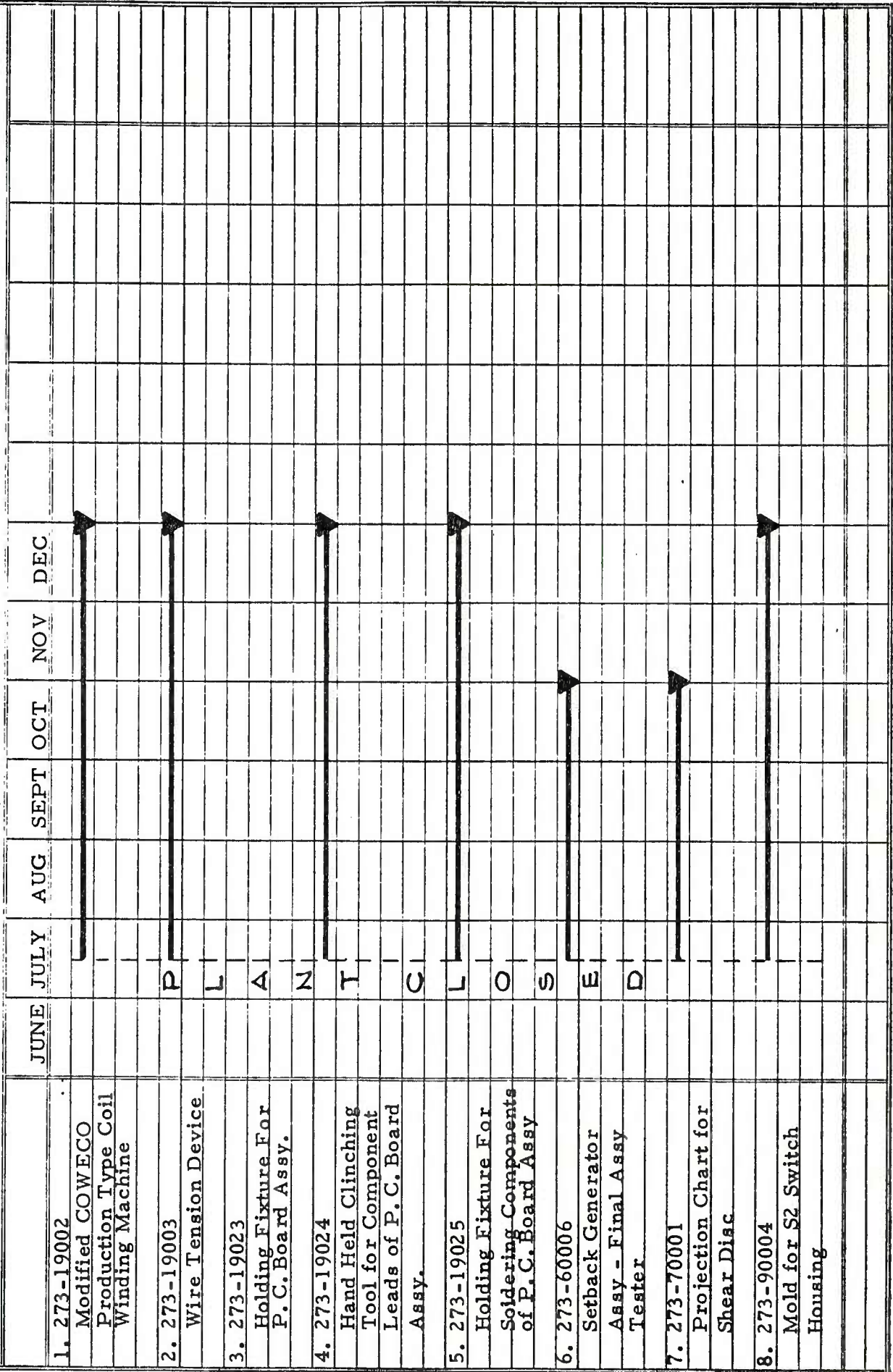


Figure 4. Phase I--Proposed schedule for completion/prove-out of uncompleted tooling and special equipment

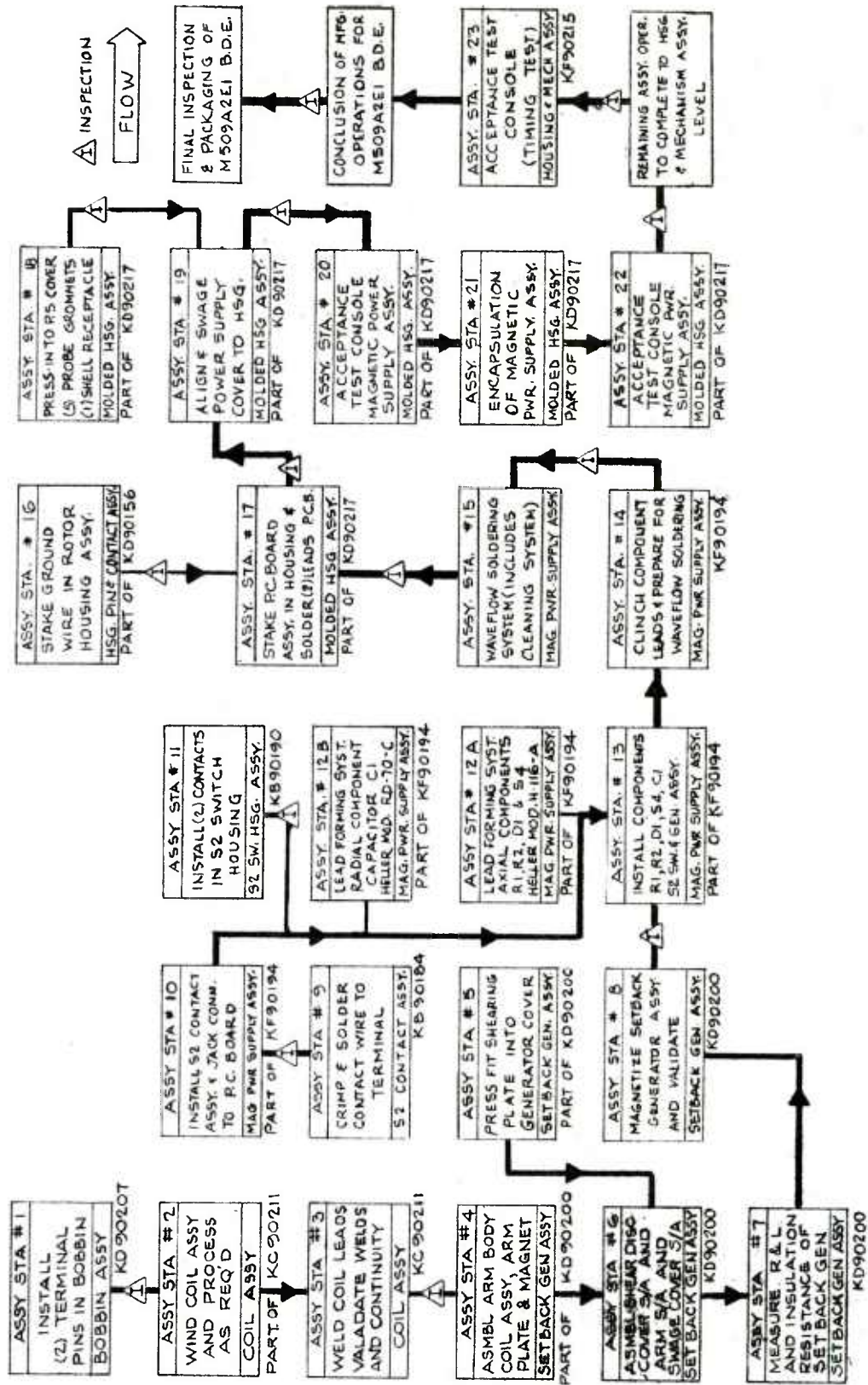


Figure 5. Phase II--Flow chart

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