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TECHNICAL EVALUATION OF THE 8-INCH MAJOR CALIBER LIGHTWEIGHT GUN MOUNT, MARK 71 MOD 0

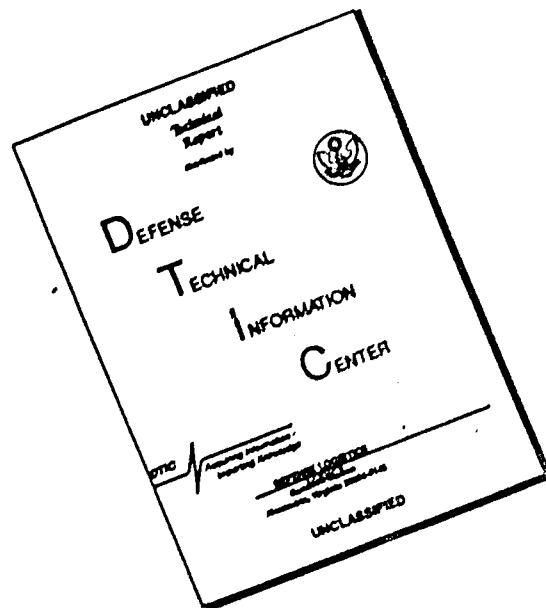
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1. NWL Technical Report TR-2854 of February 1973 "Technical Evaluation of the 8-Inch Major Caliber Lightweight Gun Mount, MARK 71 MOD 0" contains two errors. The following pen-and-ink corrections should be made by addressees:

a. Interchange the page number and legends on pages A-19 and A-20.

b. The figure on page A-17 should be labelled "Figure 18", "Pressure Transducer Locations - MARK 71 MOD 0 8"/55 MCLGM".

F. W. Kasdorf
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NWL Technical Report TR-2854
February 1973

**TECHNICAL EVALUATION
OF THE 8-INCH MAJOR CALIBER
LIGHTWEIGHT GUN MOUNT, MARK 71 MOD 0**

by

D. L. Bowen
Test and Evaluation Department

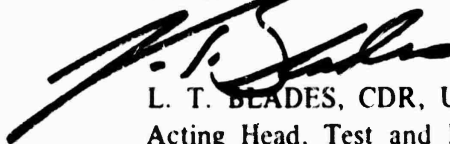
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Naval Weapons Laboratory, Dahlgren, Virginia 22448.

FOREWORD

This is the final report on the technical evaluation of the prototype 8"/55 Caliber Gun Mount, MARK 71 MOD 0. This work was conducted under NAVORD ORDTASK 553 111 090 1.

This report was given technical review by P. J. Olenick, Jr. and H. P. Caster of the Project Engineering Division of the Test and Evaluation Department.

Released by:



L. T. BLADES, CDR, USN
Acting Head, Test and Evaluation
Department

ABSTRACT

A technical evaluation was conducted on the 8-Inch Major Caliber Lightweight Gun Mount MARK 71 MOD 0 at the Naval Weapons Laboratory between 24 September and 12 November 1971. The evaluation included determining performance parameters of the laying and loading systems, electrical power consumption levels for the mount, checking misfire and regunning provisions, a safety analysis, and firing tests. During the firing tests:

- a. The mount was proofed satisfactorily.
- b. Rate of fire of the mount was determined to be 11.7 to 12.6 rounds per minute.
- c. Accuracy data were gathered indicating that round-to-round accuracy was satisfactory; although, a new 8-inch range table is recommended.
- d. Barrel life and velocity loss data were examined (including that from the operational evaluation) and, although too limited to be conclusive, the data do not indicate barrel wear and velocity loss to be excessive.
- e. A gun blast profile for the gun was established, blast being slightly less severe than that of an 8-inch bag gun.
- f. Smoke and carbon monoxide measurements were taken indicating it would be unsafe to circulate air within the mount to a ship's manned space during firing or for maintenance personnel to enter the mount after firing until the mount is purged.

During the testing, several problems were encountered which required minor design changes by the contractor, and several changes are recommended for incorporation in the production version. After completion of the technical evaluation, performance of the mount was judged acceptable and certification for release to operational evaluation was recommended.

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I. INTRODUCTION

The Major Caliber Lightweight Gun Mount (MCLGM) is a result of Navy and Marine Corps efforts beginning in 1960 to provide the fleet with the first major caliber gun mount to be designed since the end of World War II. This mount would provide firepower necessary to support troops ashore at ranges well beyond that of 5"0 guns and would provide greatly increased firepower for the fleet, particularly for smaller ships. A 175mm/60 caliber mount was specified by Reference 1 because of the potential advantages of achieving commonality in ammunition with the Army 175mm gun. Northern Ordnance Division of FMC Corporation at Minneapolis (NOD/fmc) was awarded the contract to design and develop the mount. A prototype was fabricated and subjected to testing at NOD/fmc, including a 50,000 cycle life and reliability test on the loading system. The mount was disassembled and delivered to the Naval Weapons Laboratory, Dahlgren, Virginia in August 1970 where it was reassembled, checked, proof-fired and evaluated to verify that contract requirements were met.

The Army, however, developed only one type of projectile for an anticipated family of ammunition; terminated plans for future ammunition development; planned the phaseout of the 175mm gun; and commenced development of an "up-gunned" 8-inch howitzer. Accordingly, the original SOR, Reference 1, was revised and superseded by Reference 2 in October 1969. The MCLGM was directed to be an 8-inch gun in production using the basic design established in the development of the 175mm prototype. To meet these new requirements, a program was authorized in February 1971 to convert the prototype MCLGM from its 175mm/60 configuration to an 8"/55. Thus, the Naval Weapons Laboratory, by Reference 3, was assigned the responsibility to effect this conversion and to evaluate the 8"/55 MCLGM MARK 71 MOD 0.

The oscillating assembly was returned to NOD/fmc in March 1971 for modification of the recoil and counterrecoil system to handle the increased loads when firing 8"0 MARK 25 projectiles. Since the cartridge case remained the same for both the 175mm and 8"0 applications, only minor modifications were required to the ammunition handling system to accommodate the heavier projectile. These were accomplished on the mount without removing it from its permanent emplacement. Two 175mm liners were converted to an 8"0 by Watervliet Arsenal. A four caliber extension was added to one liner so that it might be used in the mount, the second liner was converted to an 8"/51 caliber test gun for interior ballistic development programs. Two new 8"/55 caliber liners were also machined from new forgings. The converted oscillating assembly was returned to NWL in August 1971 and the mount was reassembled. The 8"0 MCLGM prototype mount was proofed with the EX 28 MOD 0 liner (with the extension) on 3 September 1971.

Reference 4 requested a concurrent evaluation of the 8"0 MCLGM MARK 71 MOD 0 at NWL Dahlgren, however, a separation of the Technical and Operational Evaluations were subsequently authorized and they were performed by NWL and OPTEVFOR, respectively. Both evaluations have now been completed. A preliminary report of results of the technical evaluation was submitted by Reference 5, and this document serves as the final report. Results of the Limited Scope Operational Evaluation (Project O/S 173) were reported by Reference 6.

The general objectives of the Technical Evaluation were to demonstrate mount performance parameters and to assure that the system was in suitable condition to undergo a Limited Scope Operational Evaluation (OPEVAL). The use of the term "OPEVAL" elsewhere in this report refers to this Limited Scope Operational Evaluation which was conducted at NWL without a complete system evaluation of fire control and ship installation interfaces. An at-sea OPEVAL of the MARK 71 MOD 0 mount was subsequently recommended in Reference 6. The technical evaluation was begun on 24 September 1971 and concluded, except for several tests of secondary importance, on 12 November 1971. The OPEVAL was begun on 15 November 1971 and concluded on 7 January 1972. During January and February 1972, the Technical Evaluation was completed. Although the results of the OPEVAL are reported elsewhere, (Reference 6) firing data accumulated are included here since they apply to such items as ballistic performance of the mount which is of interest from the technical viewpoint.

II. DESCRIPTION OF THE MOUNT

A. General

The 8"/55 Major Caliber Lightweight Gun Mount MARK 71 MOD 0 consists functionally of three systems. A gun laying system positions the gun while the gun loading system automatically loads single rounds of ammunition into the breech, completes the firing circuit, and disposes of empty cases. A control system regulates and monitors mount operations. Characteristics of the mount are listed in Table 1.

B. Major Units

The major units of the 8"/55 MCLGM are: (See Figure 1 of Appendix A and Table 2.)

Upper Structure. The primary components of the upper structure are the stand, carriage, slide and shield. They are all above-deck components.

Stand. The stand is a circular weldment on the open deck that forms a bearing and rollerpath foundation for the mount's rotating structure. A ring gear on the stand mates with a drive pinion to move the rotating structure in train.

Carriage. The carriage consists of a base ring and two trunnion supports (see Figure 2 of Appendix A). All components of the upper structure are mounted on the carriage. A water shield and a water seal are mounted to the stand and carriage to protect the thrust and radial roller bearings from water in a shipboard installation. The train stowing pin is used during mount transport or major repair to lock the gun mount carriage. The pin is installed through a hole in the base ring into the stand. The hole, which is located near the rear of the mount, is covered unless the pin is in place. The upper accumulator is located on the carriage. It supplies hydraulic fluid to the gun loading system components on the rotating structure.

Slide. The slide (see Figure 3 of Appendix A), which is a rectangular weldment with an integral trunnion on each side, is supported by the carriage trunnion supports. The slide contains components of the gun loading system for firing and for disposing of empty cases. The gun barrel which fits into the gun housing, combines with the slide to make up the oscillating assembly. The elevation system moves the oscillating assembly through a gear segment on the bottom of the slide to elevate or depress the gun.

TABLE 1**Mount Characteristics**

Ammunition	8"/55 MARK 25 projectiles with new design cartridge assembly.
Rate of fire	12 rounds per minute
Train limits	300 degrees (150° right or left)
Elevation limits	-5 degrees to +65 degrees
Train velocity	30 degrees per second
Train acceleration	60 degrees per second per second
Elevation velocity	20 degrees per second
Elevation acceleration	40 degrees per second per second
Retardation force	216,000 pounds
Length of recoil	36 inches
Mount height (above mounting surface)	168 inches
Trunnion height (above mounting surface)	105 inches
Base ring diameter	246.375 inches
Working circle (including barrel)	394.5 inches
Clearance circle (center of mount to 18 inches beyond shield)	175.3 inches
Mount weight	170,000 pounds
Loader capacity	75 rounds
Power (peak running load)	679 Kw

TABLE 2

Major Components of the Mount

Component	MARK	MOD
Stand	28	0
Carriage	41	0
Elevation Power Drive	72	0
Elevation Receiver-Regulator	56	0
Train Power Drive	73	0
Train Receiver-Regulator	55	0
Slide	34	0
Gun Housing	21	0
Loader	15	0
Shield	67	0
Gun Mount Control	116	0
EP 1 Panel	294	0
EP 2 Panel	295	0
EP 3 Panel	293	0
Upper Accumulator Power Drive	74	0
Lower Accumulator Power Drive	75	0
Gun Barrel	EX 28	0
	EX 28	1
	EX 30	0

Shield. The shield is a streamlined aluminum cover that mounts on the carriage base ring to protect the above-deck components. The shield has a gun port on the front, left and right access doors, and a circular access cover on the rear. A gun port shield, through which the gun barrel protrudes, moves with the oscillating assembly, keeping the gun port covered.

Gun Laying System. The gun laying system consists of the train and elevation system. The train system moves the rotating structure in the deck plane; the elevation system moves the oscillating assembly perpendicular to the deck plane. Both systems mount on the carriage.

Train and Elevation Systems. The train and elevation systems are similar. They are electrically powered hydraulic drives, each consisting of an electric drive motor, CAB (combination A and B end) units, and a gear-reduction and drive pinion. The train drive pinion revolves around the train circle gear in the stand; the elevation drive pinion moves the gear segment on the slide. The train and elevation systems are controlled by an electronic servo control unit in the EP-2 panel and a receiver-regulator mounted on each CAB unit. Air motors form an auxiliary and emergency power source to drive the train and elevation system.

Automatic Two-Speed Control. A two-speed synchro system controls the gun laying system. The one-speed synchro positions the mount within two degrees of the gun order. When the error signal is reduced to 2 degrees of arc, the 36-speed (fine control) synchro assumes position control of the mount.

Remote and Local Control. A control switch on the EP-2 Control Panel is positioned to select the mode of control for the gun laying systems. Weapons Control (Dummy Directors at NWL) control the train and elevation systems in remote control. The train and elevation systems are controlled locally from the EP-3 Test Panel for test or maintenance.

Automatic Limit-Stops. Both train and elevation systems have a pointing cutout system and a limit-stop system to prevent the gun from moving into specific zones where damage would result. In addition, if a failure of the pointing cutout and limit-stop systems allows the gun to travel beyond its maximum safe limits, emergency limit-stop valves are actuated which set the power-off brake and open safety relief valves to halt the gun mount.

Power-Off Brakes. The power-off brakes hold the train and elevation drives whenever the systems are shut down, or stop, and hold them in the event of a power failure. When the train and elevation systems are activated, the hydraulic system releases the power-off brakes.

Gun Loading System. The gun loading system loads ammunition into the breech, fires the round, extracts the empty case from the breech, and ejects the case from the mount. Components of the gun loading system are: loader drum, hoist, cradle, rammer, case extractors, breechblock, empty case tray and empty case ejector, which are all powered by the lower and upper accumulator systems.

Lower and Upper Accumulator Systems. The accumulator systems are sources of hydraulic power for gun loading system components. The lower accumulator supplies power to the lower structure, and the upper accumulator supplies power to upper structure components. The upper and lower systems each employ both main and auxiliary motor/pump assemblies to produce hydraulic power. The main pumps provide full power for the automatic loading system, while the auxiliary pumps provide only limited power for emergency or check-out operations in step mode.

Loader Drum. The loader drum, located below the stand and on the mount's vertical centerline, supports 25 ammunition clips. Each clip stores three rounds of ammunition and is positioned in a clip track on the drum. These clip tracks mate with transfer drive tracks and strikedown station tracks to guide the clips from the transfer station to the upper hoist or to the strikedown hoist. The upper hoist is on the vertical centerline of the mount. The strikedown hoist is outboard of the drum.

Hoist. The hoist receives individual rounds of ammunition from the transfer station and raises them into the cradle on the rotating structure.

Cradle. A cradle moves single rounds of ammunition from the hoist to the slide in alignment with the barrel. When aligned with the hoist, the cradle, being on the centerline of mount rotation, can receive rounds while it rotates with the upper structure. After the cradle raises and is latched to the slide, the rammer, which is mounted on the slide, rams the round into the breech.

Oscillating Assembly. The oscillating assembly is supported on, and pivots about, the trunnion supports and is made up of:

Breechblock. The breechblock is a vertical slide type containing the firing mechanism. The breechblock operating mechanism is mounted on top of the gun barrel housing. When the breechblock is closed, the firing circuit may be closed. The counter recoil action of the gun after firing activates the breechblock operating mechanism to open the breech.

Extractor. The empty case extractor mechanism, mounted on top of the gun barrel housing, has two extractor arms extending into extractor pockets in the breech face. When the breechblock rises (opening the breech), it actuates the extractor mechanism which kicks the empty case out of the breech and into the empty case tray.

Gas Ejector. After each firing, compressed air is discharged into the gun barrel to expel residual propellant gas remaining in the bore. The gas ejection system is activated by the breechblock at the end of the opening cycle.

Empty Case Tray. The empty case tray is a cylindrical tube pivoted at one side by an attachment to the slide. In the down position, it locks to the gun housing and recoils on a splined shaft driven by the empty case tray drive. The tray receives the empty case extracted from the breech and raises to align the empty case tray with the empty case ejector.

Empty Case Ejector. The empty case ejector is a tube mounted on top of the slide, along with an associated chain track assembly, which expels empty cases from the mount. The chain and attached pawl operate when an expended case in the empty case in the empty case tray is in alignment with the tube.

Recoil. Firing the gun causes recoil action in which the gun barrel housing slides backward in the slide on the keys supporting the housing. Recoil cylinders, machined in the gun barrel housing, control the deceleration of the recoiling components.

Counterrecoil. Two counterrecoil cylinders are mounted on the inboard sides of the slide walls in back of the gun barrel housing. They are nitrogen charged cylinders that help decelerate recoil. They also return and hold the gun in battery until the next firing.

Gun Barrel. The gun barrel fits into the gun barrel housing, and is secured by four segments of interrupted threads and a barrel locking key. The barrel is a two piece unit - a tube and a liner.

Gun Mount Control. The appropriate control mode of the gun mount is selected through switching at the control panel. Gun mount control is the combined control of the gun loading system and the gun laying (train and elevation) system to position the gun, and to load the breech with ammunition. The gun loading system may be controlled in automatic or step; the train and elevation systems in remote or local.

Automatic Control. Automatic control is the normal mode for the gun loading system. In this mode, the components of the gun loading system operate automatically in a synchronized sequence, and load orders initiate the operation of the gun's loading system.

Step Control. Step control is used during maintenance or testing, or if automatic control is inoperative. In step control, individual components of the gun loading system are operated by switches on the EP-2 control panel.

Remote Control. The train and elevation systems can be operated in remote control. In this mode, the mount is automatically positioned by gun orders generated by the fire control system or at NWL by dummy directors.

Local Control. In this mode the operation of the train and elevation systems are controlled from the EP-3 test panel for testing, checking and emergency purposes.

Control Panels. The control panels in the system are:

The Power Panel (EP-1), Figure 4 of Appendix A, contains circuit breakers and rotary switches used by the gun captain to distribute power to the gun mount motors, control circuits, and indicator light circuits.

The Control Panel (EP-2), Figure 5 of Appendix A, is the control panel for the gun mount. This panel has the electrical equipment for selecting, controlling and monitoring all phases of gun mount activity. Firing can be initiated at EP-2 by closing a firing key on the panel.

The Test Panel (EP-3), Figure 6 of Appendix A, is used to test and check the train and elevation systems. Test equipment can be plugged into the panel for checking the gun laying system and an operator can train and elevate the gun using the local control station at EP-3 panel.

Electrical Power. 440 volt, 60 Hertz, three-phase power is the main supply powering the train and elevation systems, the main and auxiliary loading system motors, the anti-icing and the ventilation systems. Also, the 440 volt power is transformed in the EP-1 panel to 115 volt, 60 Hertz, single phase power for the lighting, alarms, direct current conversion, power contactors, firing circuit relays, and the train and elevation test circuits synchros. A 115 volt, 400 Hertz, single-phase power line supplies the train and elevation synchros and the electronic servo control units. A separate 115 volt, 60 Hertz, single phase source is used for the firing circuit transformer, but a DC source is used instead of the transformer at NWL.

Auxiliary Equipment. The auxiliary equipment of the mount includes:

Ventilation System. The ventilation system expels hot air from the gun house through the base ring into the loader room. A heat exchanger is built into the ventilation system to cool hydraulic fluid of the upper system.

Cable Reel. The cable reel assembly is composed of two grooved reels – one at the stationary center section of the loader drum and one suspended from the carriage – that feed power supply lines from the ship into the rotating structure. The power supply lines (electric and pneumatic) are anchored at the carriage to provide sufficient slack and to prevent tangling.

Anti-Icing System. An anti-icing system to ensure normal operating of the mount under freezing weather conditions is provided. The base ring water shield, the gun port shield and the empty case ejector door are anti-iced. The system consists of a fluid heating and supply tank, fluid circulating motor pump, and a piping system. The system is charged with an ethyleneglycol-water mixture.

Ammunition Strikedown System. A strikedown hoist is installed in the NWL mount outboard of the loader drum. Carts for placing cartridges and projectiles on the hoist pawl were provided. (See Figures 7 and 8 of Appendix A.) This system is not representative of planned shipboard installations.

C. Installation

The general arrangement of the mount as installed at NWL can be seen in Figure 9 of Appendix A. The mount is operated from the control shelter located directly aft of the mount. A 5"/54 Caliber MARK 42 MOD 4 Mount is installed at the left of the 8"/55 mount, and a 5"/54 Caliber MARK 45 MOD 0 Mount is at the extreme left. The van trailers in the lower left house radar instrumentation and blast measuring equipment. Figure 10 of Appendix A shows the mount during installation of the oscillating assembly after conversion to 8-inch. The view is from the port side and the elevation power drive can be seen in the lower part of the picture. Figure 11 of Appendix A shows the mount installation from the front after decking and a water tank used to collect cases during firing have been installed. An X-band doppler radar can be seen at the left of the mount. An overall view showing the loading of charges and projectiles is given by Figure 12 of Appendix A, and Figure 13 of Appendix A is a view of the mount firing.

III. DESCRIPTION OF TEST EQUIPMENT

A. Train and Elevation Power Drive Tests

Power drive tests were conducted using the following equipment supplied with the mount:

Limiter and demodulator model G 2120897
Order signal generator 2626237
Recorder MARK 220 2860047

B. Loading System Tests

Event cycle times were obtained using the following equipment supplied with the mount:

Limiter and demodulator model G 2120897
Recorder MARK 220 2860047
Tachometer and synchro assembly LM 2626222
Connecting test cable T14159
Oscillograph hookup cable 2626238
Timer M6X3 on the inside of the back door of the EP-2 panel

Times were recorded on the recorder by positioning the timer to the function being performed by the mount (such as cradle raise) and measuring time between pips (indications of switch actuations) on the record. A back-up time was obtained from the timer reading. Position vs time, velocity vs time and acceleration vs time data were obtained from the recorder traces, with the tachometer and synchro assembly providing the input. Brackets and gearing are included on the mount at several locations for mounting the assembly. Procedures are given in the Maintenance Requirement Cards (MR cards) and calibrations were provided by NOD/fmc.

C. Electrical Power Consumption Tests

Power consumption was measured using the following equipment:

Halltron power computer model PC-2K4-3 including two model CT 2000L current transformers for measuring the 440-volt, 3 phase power.

Halltron power computer model PC-51 (400 Hz, 115 VAC) for measuring the 110-volt, 400 Hz, single phase power.

Newport model 60 differential amplifier with low pass filter

Sangamo Electric Co. Model 3600 14 channel tape recorder with wide band group II electronics.

Incor galvanometer driving amplifier.

Honeywell model 1508 24 channel oscillograph with model N-3300 galvanometer.

Portable cassette audio recorder.

The power computers were supplied by Ohio Semitronics, Inc. of Columbus, Ohio. They are precalibrated devices utilizing the "Hall Effect" in a multiplier circuit to obtain the true product of voltage and current in an AC circuit. The output is VDC proportional to the true power consumed by the load ($EI \cos \theta$). The power computer transformers were placed on the power lines supplying the EP-1 panel. The tape recorder provided a record of real power consumed, and an oscillograph was used for reproduction.

D. Firing Tests

All chamber pressures taken during firing were obtained using 1/30 in² area copper crusher disks in NWL Type D gauges. The disk lots were calibrated against measurements taken with piezoelectric gauges in 5"/54 gun firings.

Velocities were obtained using a chronograph with coils suspended in front of the gun with the projectiles magnetized, an X-band doppler radar system and/or a C-band doppler radar system. X-band doppler data were considered the primary system.

Equipment used with the coil velocity system was:

Coils (fabricated at NWL)

AUL Instrument Co. Model 1000 shaping adapter

Naniloa Model 282 time interval counter

Sangamo Electric Co. Model 4700 14 channel tape recorder

The counter was used for immediate read-out while the tape recorder gave a permanent record of flight time between coils.

Equipment used with doppler systems was:

- X-Band Radar of special manufacture
- C-Band Radar of special manufacture
- Wave Tech model 112 frequency oscillator
- Sangamo Electric Co. Model 3500 tape recorder
- General Radio variable filter
- Electrac model 215T filter
- Hewlett Packard model 5248 frequency meter
- Shaping amplifier (NWL fabricated)
- 3 Darcey model 361 A-R doppler counters
- 50 ms shaper (NWL fabricated)
- Tektronics model 184 timer mark generator
- Storage register (NWL fabricated)
- Franklin model 3200 digital printer
- Honeywell model 1508 direct print oscillograph
- Newport model 60 data amplifier
- Endevco model 4401 conditioning unit

Figure 14 of Appendix A is a schematic giving the arrangement of this equipment. All of this doppler equipment was located in a van in the foreground of Figure 9 of Appendix A except for the radars which were positioned to the right of the mount (X-band) and to the left-rear of the mount (C-band). Figure 15 of Appendix A shows the C-band radar in position.

Intensity of muzzle flash was measured using:

- EG&G photodiode model SGD-444
- Wide band-pass optical filter 1L/WB-510
- Newport model 60 data amplifier
- CEC oscillograph model 5-133 with a 7-362 galvanometer

The output of the detector is amplified and matched to the galvanometer in the oscillograph recorder through the amplifier.

Ranges of falls of shot were obtained by observers manning four range stations along the Virginia river shore, each provided with a theodolite to obtain the sight angle of the splash. The gun and the station are at known locations and the theodolites were referenced on known landmarks. A computer program was designed to select the median of the intersections of lines of sight from each station as the fall of shot and, given the gun train, to compute the range and drift from the line of fire. Meteorological data was obtained on the surface using local equipment and

at altitude from the Naval Air Station, Patuxent River. A Beukers system at NWL provided back-up data. Knowing gun trunnion height, tide level, and meteorological conditions, range table ranges could be computed using NAVORD OP 1041 and OP 1333. These ranging methods and computations were in accordance with current general NWL procedures.

Mount data was obtained using the following transducers:

Recoil pressure - Dynisco PT-81A, 5000 psi strain gauge - bridge type pressure transducer

Counterrecoil pressure - Dynisco PT-81A, 3000 psi

Strain measurements - Miro-Measurements type EA-06-250BF-350W single arm strain gauges.

Recoil displacements - NWL fabricated rack and pinion assembly driving a 10-turn potentiometer (Spectral model 510).

Small displacements of liner and breechblock with respect to the housing - Bourne Linipot model 2001416014-.44 (2000 ohms at .44 inches full displacement)

Timing - Tektronix time mark generator Model 184.

Transducer signals were applied to Endeveco model 4470 signal conditioning units with appropriate plug-in mode cards and Newport Model 60 data amplifiers. All data were recorded on magnetic tape (Sangamo model 4700 or 3600 recorder) and reproduced on a Honeywell model 1508 oscillogram using M-3300 galvanometers.

E. Gun Jump Test

An attempt was made to study gun jump using three Mitchell 35mm cameras and an horizontal and vertical scale attached to a velocity coil.

F. Cook-Off Test

An empty projectile was instrumented with iron constantan thermocouples with the leads fed through a pipe fitted to the base plug. An empty case with a brass plug with a hole for the pipe was used for loading and ramming the projectile. Thermocouple outputs were recorded on a Honeywell model 153X62P16-X-SONG recorder.

G. Gun Blast Test

Gun blast pressure measurements were made using the following equipment:

- Crystal Research Inc. piezoelectric pressure transducers
- Endevco charge amplifiers
- Honeywell model 1612 direct print oscillograph
- Sangamo model 3500 tape recorder
- Tektronix model 184 time mark generator

The transducer output was amplified and recorded with the timing pulser on both the oscillograph, for direct readout, and the tape recorder for the final record.

H. Smoke and Fumes Test

Equipment used in detecting toxic gases in the mount was:

- American Instrument Co. 100cc/min peristaltic pumps
- Mine Safety Appliances Co. (MSA) hand operated grab samplers
- MSA carbon monoxide colorimeter indicator tubes (0-1000 ppm range)
- Kitagawa Co. carbon monoxide length of stain indicator tubes (0-3000 ppm range)
- MSA Monitaire portable sampler (for lead detection)
- MSA Lira model 300 dual beam infrared carbon monoxide analyzer
- Newport model 60 data amplifiers
- Sangamo Electric Co. Model 4700 or 3600 tape recorder
- Honeywell model 1508 oscillograph using galvanometer M-3300

Sampling via the indicator tubes was governed by a sequence timer and solenoid valve arrangement. The continuous infrared analyzer output was amplified and recorded on the tape recorder. Recorded data was then reproduced on an oscillograph.

IV. TEST PROCEDURE

A. Train and Elevation Power Drive Tests

Train and elevation power drive tests were conducted using the order signal generator as the remote order source and the test panel (EP-3) as the local order source (shown in Figure 16 of Appendix A). Most testing was done in remote control. The limiter-demodulator and the double channel recorder were used to record error (difference between the B-end drive position and the ordered position) vs time, velocity vs time, or position vs time. The order signal generator provided the order signals to the stators of the 1X and 36X control transformer synchros in the (train or elevation) receiver-regulator.

Error Trace. B-end response error trace voltage was obtained from the 36X test control transformer synchro in the receiver-regulator. The rotor of this synchro is geared to the B-end response. The stators were electrically connected to the 36X control transmitter synchro stator in the EP-3 panel for local control, or to the order signal generator which electronically simulates the control transmitter synchro stator output in remote control. Rotor output voltage of this test synchro was applied through the test circuitry to the limiter-demodulator unit and then to the recorder.

Position Trace. B-end position trace voltage was obtained like the error trace voltage except that the test synchro stator was connected to a reference synchro which was kept in a fixed position. The order signal generator provided the order signal to the control transformer synchro stators, the 36X control transmitter synchro stator, and the test synchro rotor, mechanically linked to the B-end, provided the B-end position voltage to the limiter-demodulator and recorder.

Velocity Trace. B-end velocity trace voltage was obtained from the DC tachometer generator located in each receiver regulator. The tachometer generator is directly geared to the regulator B-end response gearing and furnishes a voltage proportional to B-end velocity. This voltage was applied through test circuitry to the limiter-demodulator and recorder.

Input Signals. The Order Signal Generator provided the several types of orders for the various power drive tests: static orders, constant velocity orders or SHM orders. Instantaneous switching from a static order to another static order was accomplished to obtain maximum accelerations, velocities and synchronizing times. Automatic switching where the operator switched from a static order to a constant velocity order at certain points enabled the mount to synchronize to a variable order with a known initial error.

B. Loading System Tests

Loading system cycle times were taken following detailed procedures given in MR card C-1. The tachometer-synchro assembly was coupled to the component cycled by attaching it to permanent brackets and gearing on the mount. Rate and position vs time records were taken, with appropriate ratios relating component movement to synchro rpm supplied by NOD/fmc. Switch action which initiated and terminated each cycle was superimposed as pips along the time axis. Traces with an empty mount were taken on 24 and 25 September 1971, and traces of cycles with a loaded drum, clips, cradle, and rammer were taken later at convenient times during the evaluation. Empty case ejector cycle times could not be obtained because of a bent mounting bracket for the tachometer-synchro assembly.

C. Ammunition Selectability

The ammunition selectability test was conducted by loading only one cell per clip (25 full charge rounds) since each clip can contain only one type of round. All round assignment switches were positioned at PD fuze and standard charge. Clip assignment switches were positioned as follows:

Clip	Cell Loaded	Type Assigned
1	1	1
2	2	1
3	3	1
4	2	2
5	2	5
6	3	2
7	1	6
8	1	2
9	2	2
10	3	2
11	1	3
12	1	3
13	3	3
14	1	3
15	3	4
16	1	4
17	2	4
18	3	4
19	2	3
20	1	1
21	1	5
22	3	6
23	1	6
24	2	6
25	3	6

The gun was to be fired in continuous load with the operator selecting the following in sequence:

Type Selected	Number of Rounds Fired
2	5
5	2
1	4
3	5
6	5
4	<u>4</u>
	25 Rounds Total

The actual firing sequence was modified somewhat as explained in the Results and Discussion. (MARK 18 MOD 9 projectiles (obsolete) were used for this test to save on test costs.) The windshield of round ten broke, damaging the velocity coils and velocities were taken only for the first nine rounds. Other instrumentation for this test included recoil and counterrecoil pressures and durations, recoil displacement, ejection time and interval between rounds.

It should be noted that in order to accomplish this test, a minor wiring change had to be made in the EP-2 panel to eliminate the long round capability (since no long rounds were available during the evaluation). Normally types 1 and 3 are long rounds and the hoist would have to shift to the long flight to load.

D. Electrical Power Consumption

The 440 VAC-60Hz power and the 110 VAC-400Hz synchro power supplied to the EP-1 panel were monitored while various components of the mount were operated. Full mount operation with the anti-icing system heater and pump running was attempted but could not be accomplished because cold weather conditions were not severe enough.

E. Misfire Procedures

A check of misfire procedures, except for aspects covered by the safety analysis, consisted merely of checking the ability of the mount to unload a charge and to load a type 6 charge without a projectile. No attempt was made to use the misfire tray because of known deficiencies in the tray.

F. Regunning Procedures

Regunning was performed by removing the entire EX 28 MOD 0 liner and tube assembly, removing the liner from the tube on stationary supports on the ground, installing the EX 28 MOD 1 liner in the tube, and installing the assembly in the mount. This procedure was used in lieu of the standard procedure of replacing the liner with the tube still in the mount because of expected difficulty and potential damage in removing the liner, such as had occurred with 175mm assemblies of this design. On 20 April, after the Technical Evaluation, the EX 28 MOD 1 liner was removed from the tube in the mount, and then reinstalled. No serious problems or damage occurred.

G. Firing Tests

For most firing tests, the mount was instrumented for obtaining recoil pressure, counterrecoil pressure, and recoil displacement vs time data. Data were recorded on a common time base and referenced to the application of firing current for each round. Indications of projectile exit from the muzzle were provided by using strain gauges on the muzzle. For rapid fire programs, the recorders were run continuously so the time between applications of firing current could be obtained to get rate of fire.

All rounds fired with pressure gauges were fired in step load removing the empty powder cases by hand to prevent losing the gauges in the mount.

Powder case separation necessitated heat treatment of cases. All cases fired on and after 12 November 1971 were dipped in a sulphuric acid gun barrel decoppering solution for cleaning, and remaining dirt and corrosion were removed by hand prior to loading. All MARK 25 projectiles were loaded with cement to 260 lbs. Cartridges and projectiles fired on and after 12 November were wiped with a degreaser prior to loading in the mount.

H. Projectile Cook-Off

Attempts were made to check the possibility of a projectile cook-off in a hot gun by ramming an instrumented projectile as soon as possible after the last round was fired interfering as little as possible with other test requirements. After the last round of a test was fired the instrumented projectile and its cartridge case were loaded at the strikedown hoist into the drum, run through the loading system and rammed. The case was removed by hand and the thermocouple leads connected. The location of the thermocouples in the projectile were as follows:

1/2-inch aft of the nose plug on the projectile inner wall.
14 inches forward of the projectile base on the projectile inner wall.
1/2-inch forward of the front of the base plug on the projectile inner wall.
Imbedded in the rotating band at the maximum diameter.
Imbedded in the rotating band at the maximum diameter diametrically opposite the above thermocouple.
On the front of the base plug.

I. Reduced Charge

A reduced charge round of 67.00 lbs. of NACO propellant, SPCF 11073 was used early in the testing of the 8"/55 MCLGM. This charge was estimated based on testing conducted in an 8"/51 barrel in a test girder to give the desired reduced charge velocity of 2220 ft/sec. This charge was revised to 66.07 lbs. based on results of probing rounds fired from the EX 28 MOD 1 liner on 4 November and was used during the OPEVAL.

J. Gun Blast

Initial blast pressure measurements were made during three series of five single full charge rounds fired on 4, 6 and 7 October 1971. Twelve blast pressure transducers were arranged at various positions in the horizontal plane of the gun muzzle as shown in Figure 17 of Appendix A. The transducers were placed edge-on to the shock front in a horizontal attitude. Figures 18 and 19 of Appendix A show the gauges arranged in front of the mount.

Additional testing was done during the rapid fire test of 12 November using one piezoelectric transducer positioned in the horizontal plane, 17 feet from the gun muzzle along a radial line 60° from the bore axis. The transducer was in a plane with the gun if it would have been at $0^\circ 30'$ elevation. The test was fired at 10° elevation. During the firing of 13 December 1971 (actually during the OPEVAL test), two piezoelectric transducers were used. One was located 30 feet from the muzzle along a radial line 150° from the bore axis and the other was at 20 feet on a 90° radial. Both again were in a horizontal, gun bore-axis plane with the gun at $0^\circ 30'$ elevation. The firings were conducted at 20° elevation. The first transducer was about 11 feet below the horizontal, bore-axis plane and the second was about 8 feet below.

K. Smoke and Fumes

Smoke and fumes were monitored during testing on 12, 22, 23 and 30 November and 3 and 13 December 1971. Visual observations were used as a basis for qualitative observations on smoke buildup, and the infrared analyzer allowed continuous monitoring for carbon monoxide. The colorimetric indicator tubes were also used in conjunction with pumps and solenoid valves operated periodically by timers during firings to measure carbon monoxide concentrations at locations other than those monitored by the infrared analyzer. For the tests of 12, 22 and 23 November, the analyzer sampling tube was located above the deck on top of the loader drum at the rear of the mount under the left trunnion support. For the tests on and after 30 November, the tube was located at the top of the shield over the breech. Extensive amounts of air from above the loader drum were also drawn through two MSA "Monitaire" units to detect the presence of lead. Additionally, NOS, Indian Head personnel circulated large quantities of gas from the breech area through a Dewar apparatus cooled by liquid nitrogen to observe directly for the presence of any oxides of nitrogen. NOS, Indian Head personnel also obtained gas samples from the same area for subsequent detailed laboratory analysis of all possible toxic constituents.

During all firings, the ventilation system was operating and all doors were closed. Doors were opened when stoppages occurred due to mount casualties and after completion of the firings.

L. Anti-Icing System

The anti-icing system test was conducted on 8 February 1972 between 0500 and 0900 hours EST when the ambient temperature ranged between 16° and 18°F. The mount was sprayed periodically with water around the gun port shield and water seal. The mount was checked for operability in train and elevation and anti-icing fluid temperature was recorded every half-hour.

V. RESULTS AND DISCUSSION

A. Train and Elevation Power Drive Tests

Train and elevation drive tests were accomplished 20-22 October 1971. No problems were encountered except that with the dither pot, described in Appendix B, which was temporarily repaired on 21 October and permanently repaired on 23 October. Results of these tests are presented in Appendices D and E. All data in Tables D-1 of Appendix D and E-1 of Appendix E indicate performance meets or exceeds the requirements of Reference 7 and is satisfactory. The recorder trace of each test is included in Appendices D and E for reference and record purposes.

B. Ammunition Loading System

Loading system tests were conducted on 24-25 September 1971, except that empty case ejector traces could not be taken because a bracket for mounting the tachometer-synchro assembly was bent in shipment or during installation of the slide after conversion. Results are presented in Table F-1 of Appendix F. The recorder traces are also included in Figures 1 through 24.

C. Ammunition Selectability

Rounds were loaded for the selectability test in the morning of 27 September 1971, and fired that afternoon. Test results are tabulated in Appendix G (ballistic results) and Table 3 (actual firing order used). A problem with the cradle loaded indications caused by photocell sensitivity caused a stoppage after round 11 (a problem listed in Appendix B). Bulbs were replaced and voltages were adjusted, rendering the mount operable again. The test was resumed, skipping the first Type 3 round which was in clip 11 (round 12 of the firing order specified in the procedure). This round was picked up, then, as the last Type 3 round (round 16).

It can be determined from Table 3 that for each clip the drum indexes, approximately 2.3 seconds are added to the interval between rounds. The longest interval between rounds was 43.0 seconds between rounds 15 and 16 when the drum had to index from clip 19 to clip 11.

Because the mount fired only those rounds selected by the operator and functioned as designed and described in OP 4116, results of this test are deemed to be satisfactory.

TABLE 3

FIRING ORDER FOR SELECTABILITY TEST OF 9-27-71

Round No.	Round Type	Clip No.	Cell No.	Required Indexing (No. of Clips)	Required Cell Transfers	Time Between Rounds (sec)
1	2	4	2	0	Rd in Breech at T-0	T-0
2	2	6	3	0	Rd in hoist at T-0	4.8
3	2	8	1	2	HT, TH	6.1
4	2	9	2	1	2H, 3H, HT, TH, 2H	7.4
5	2	10	3	1	3H, HT, TH, 2H, 3H	7.4
6	5	21	1	11	HT, TH	28.2
7	5	5	2	9	2H, 3H, HT, TH, 2H	26.1
8	1	20	1	15	3H, HT, TH	38.1
9	1	1	1	6	2H, 3H, HT, TH	18.3
10	1	2	1	1	2H, 3H, HT, TH	7.5
11	1	3	3	1	2H, 3H, HT, TH, 2H, 3H	7.3
Stoppage due to casualty -----						
12	3	12	1	0	Rd in breech at T-0	T-0
13	3	13	3	0	Rd in hoist at T-0	4.8
14	3	14	1	1	HT, TH	5.2
15	3	19	2	5	2H, 3H, HT, TH, 2H	16.6
16	3	11	1	17	3H, HT, TH	43.0
17	6	22	3	11	2H, 3H, HT, TH, 2H, 3H	31.4
18	6	23	1	1	HT, TH	5.1
19	6	24	2	1	2H, 3H, TH, HT, 2H	7.3
20	6	25	3	1	3H, TH, HT, 2H, 3H	7.2
21	6	7	1	7	HT, TH	18.8
22	4	15	3	8	2H, 3H, HT, TH, 2H, 3H	24.5
23	4	16	1	1	HT, TH	5.1
24	4	17	2	1	2H, 3H, HT, TH, 2H	7.4
25	4	18	3	1	3H, HT, TH, 2H, 3H	7.2

H Hoist position.
T Transfer position
HT Clip transferred from Cell 3 at Hoist position to Transfer position.
TH Clip transferred from the Transfer position to the Cell 1 at the Hoist position.
2H Clip transferred from the Cell 1 at Hoist to Cell 2 at Hoist.
3H Clip transferred from Cell 2 at Hoist to Cell 3 at Hoist.

D. Electrical Power Consumption

Electrical power tests were conducted on 14 and 17 January 1972 after completion of the OPEVAL. The test could not be conducted prior to the OPEVAL because of transducer procurement lead time. Results of the tests are in Appendix H, with measurements listed in Table H-1. Reproductions of the power vs time analog data for each test are included as Figures 1 through 12 of Appendix H. Probably the most significant result is the peak true power demand of the mount of 637 kw, 599 kw peak without the anti-icing system and 38 kw for the anti-icing system. Theoretical peak running load power was computed to be 679 kw.

E. Misfire Procedures

Misfires occurred during the TECHEVAL due to primer blowback and were purposely caused during the OPEVAL by loading empty charges. Procedure 1 of OP 4116 specifies remote unloading and ejecting the charge and loading of a Type 6 clearing charge. Procedure 2 specifies unloading the charge out the rear of the mount using a misfire tray. Procedure 1 was generally adequate. Procedure 2 could not be checked because of the non-availability of an adequate misfire tray. Reference 8, the safety analysis report and Reference 6, the OPEVAL report treat this subject in more detail.

F. Regunning Procedures

Regunning was performed once during the technical evaluation when the liner for the EX 28 MOD 0 gun barrel assembly was replaced with that of the EX 28 MOD 1 assembly on 9 October 1971. After the operational evaluation, during the weeks of 17 and 24 April 1972, the liner for the EX 28 MOD 1 was removed and reinstalled, the EX 28 MOD 1 barrel assembly was removed, the EX 30 MOD 0 assembly was installed, and the liner for this barrel assembly was removed and reinstalled. Also, during the week of 8 May 1972, the EX 30 MOD 0 barrel assembly was removed and the EX 28 MOD 1 was installed. On 31 May, the liner for the EX 28 MOD 1 was removed and the liner for the EX 28 MOD 0 (after modification for a larger chamber) was installed.

In all cases, the liner was removed from the tube without excessive force. Dow Corning Molycote Type G lubricant was used, and seizing and scoring such as occurred with the 175mm liner did not occur. A wooden platform was constructed to give working space for men working at the barrel, icebreaker and bushing.

Raising the breechblock for access to the upper key for liner removal involves using a chain hoist without much overhead clearance, and may involve some trial and error until personnel become experienced.

Upon the last regunning (liner replacement), a five-man weight handling crew and a two-man gun crew performed the entire operation (excluding gathering of tools, etc.) in two hours and thirty-seven minutes. Several errors were made in the operation, and, especially if another man was added to the gun crew, this time could be reduced to less than two hours. Regunning by replacement of the liner-tube assembly was accomplished by the same number of people in about six hours. Differences in the two regunning procedures require that the slide be backed out of battery and the bushing and icebreaker removed to replace the liner-tube assembly. These operations are not required to replace the liner only, but the breechblock must be hoisted up to gain access to the upper liner locking key. Actual crane time to remove the liner or liner-tube assembly is the same.

G. Proof Tests

Proof testing was conducted with the EX 28 MOD 0 liner on 3 September 1971 and with the EX 28 MOD 1 liner on 13 October 1971. Because of limitations on the recoil system of this prototype mount, proof rounds were not fired at elevations higher than 10° . No damage was incurred by the mount, and instrumentation measurements are included in the tables of Appendix G.

H. Cartridge Assembly

It was decided to test the mount using MARK 25 260 lb projectiles and full charges which would produce a nominal muzzle velocity of about 2700 f/s with an upper service pressure limit of 56 ksi (or 20.8 tsi(Cu)) using flashless NACO propellant. A reduced charge to give 2220 f/s was also decided upon. The charge determination work is reported in References 9 and 10. Cases used were the EX 1 MOD 1 cases for the 175mm. All charge assemblies were not optimized for this evaluation but used off the shelf components to save time and money.

Partial case separation occurred in early 8"0 firings with service and proof charges. Failures of a similar nature had also occurred in 175mm firings. It was found that after heat treating, the cases did not separate at service pressure, hence, only heat-treated cases were used for full charge firings in rapid fire. Since cases were softer after heat treating, they had a tendency to deform. In some instances at proof pressure, cases ruptured at the extractor pockets and expanded into the head space jamming the breech closed.

A problem was encountered during rapid fire in that an occasional round would fail to ram fully. In some cases, this was due to pieces of plug jamming between the case and the chamber. At first, plugs with a very small radius at the leading edge were used and these would clip when sliding over the liner breech face

upon ramming. Plugs of a later design increased this radius and another spring was added under the cradle restrainer to solve this problem. All plugs were gauged as well. On 9 December 1971 a fire-out was attempted but a gun stoppage occurred after round 19 because the case failed to extract. An accumulation of fine soot was noticed in the chamber which had built up from firing heat-treated cases which had a dirty scale on the exterior surface. All cases were then cleaned by dipping in acid, rubbing dirty spots with emory cloth, and degreasing. All projectiles were wiped off with rags dampened with degreaser. All ammunition thus treated extracted satisfactorily.

Several stoppages were caused by primer blowback around the ignition element with both the MARK 37 MOD 2 and the MARK 38 MOD 2 primer used for full and reduced charges, respectively. Primer blowback caused residue around the firing pin, keeping the pin from protruding from the breech block and contacting the primer of the next round.

The propellant used during the TECHEVAL and OPEVAL was an 8"0 bag gun granulation, NACO formulation and was not especially designed for this gun. It should be noticed on Table G-1 of Appendix G that trunnion velocity uniformity was frequently undesireably high, and muzzle flash was frequent.

I. Rate of Fire

The rate of fire of the mount is highest, of course, when the same type of ammunition is fired from successive clips in continuous load. The data on Table G-1 of Appendix G indicate that the rate of fire is 11.7 rounds per minute at 0° elevation, increasing to 12.6 rounds per minute at 35° elevation, then decreasing to 12.0 rounds per minute at 60°. Rate of fire for firing in step control was about 3.5 rounds per minute, and the rates of fire for the selectability tests conducted during the TECHEVAL and OPEVAL were between 4 and 5 rounds per minute.

J. Gun Jump

It was decided not to conduct a test series designed explicitly to determine gun jump since gun jump is related to the ammunition characteristics and range tables as well as the mount. A small experiment was conducted, however, on 2 November 1971, the details and results of which are included in Appendix I.

K. Accuracy and Range Tables

Table 4 is an array of data taken from Table G-1 of Appendix G which shows accuracy of each shoot arranged by gun elevation. Acceptable accuracy is a corrected D/R of 0.70%, and from Table 4 it can be seen that on only one occasion out of fifteen for full charges was this exceeded. It was exceeded on two out of five for reduced charges, but one of these was at 60° elevation (the corrected D/R criteria of 0.70% can not be expected to apply at elevations above 45°). In four out of the twenty occasions (including the three where the corrected D/R was greater than 0.70%), the uncorrected D/R was less than the corrected D/R.

Agreement with the range table predictions was not good. Mean residuals, differences between corrected range and range table range, varied from -11 yds to 713 yds, showing considerable bias toward overshoot. Only one negative value out of 20 resulted.

L. Barrel Life

During the initial checkout, the Technical Evaluation, and the Operational Evaluation of the 8"0 MCLGM, 120 rounds were fired in the EX 28 MOD 0 liner and 473 rounds were fired in the EX 28 MOD 1 liner. Bore enlargement at the origin of bore was only 0.024 inch on the EX 28 MOD 0 barrel and 0.084 inch on the EX 28 MOD 1 barrel. The erosion gauge reading on the EX 28 MOD 1 was 2.75 inches

M. Velocity Loss

Mean velocities for the service charge with the EX 28 MOD 0 barrel ranged from 2784 f/s to 2708 f/s. Data from the six occasions for which mean velocities are available does not indicate a significant velocity loss slope.

Mean velocities for the service charge with the EX 28 MOD 1 liner are available from fifteen occasions when four or more rounds were fired, and range from 2711 f/s to 2674 f/s. Linear regression equations were fitted to the mean velocity vs bore enlargement at the origin data and to the mean velocity vs erosion gauge reading data. The equations are:

$$V = 2707 - 410.4 (\Delta Do) \text{ with a standard deviation of } \pm 7.5 \text{ f/s}$$

$$V = 2673 - 5.489 (BEGR) \text{ with a standard deviation of } \pm 9.2 \text{ f/s}$$

TABLE 4

**8"/55 MAJOR CALIBER LIGHTWEIGHT GUN MOUNT MARK 71 MOD 0
RANGE ACCURACY DATA**

Gun Elevation (degrees)	Range ¹ Residual (yards)	Corrected Range Standard Deviation (yards)	Corrected D/R (%)	Date Fired (1971)
FULL CHARGE				
8	153	59	.32	22 Nov
	92	107	.55	22 Nov
	-11	79	.48	30 Nov
10	79	166	.83	2 Nov
	97	83	.41	9 Nov
	8	83	.44	12 Nov
20	614	143	.51	4 Nov
	392	101	.36	13 Nov
	332	170	.59	13 Nov ²
	312	148	.53	13 Nov ²
27	543	116	.35	16 Nov
	580	106	.30	23 Nov
	563	135	.34	1 Dec
	713	131	.43	1 Dec
	541	169	.49	3 Dec
REDUCED CHARGE				
35	100	105	.40	16 Dec
	114	71	.25	16 Dec
45	503	185	.56	3 Dec
	533	281	.93	3 Dec
60	610	224	.74	22 Dec

¹ Range Residual - The difference between the mean range corrected to range table conditions and the range table range. A negative value indicates an undershoot.

² These two groups were fired at 19° 30' elevation, but are included under 20° for purposes of this table.

where

V = velocity in f/s

ΔD_o = bore enlargement at the origin in inches

BEGR = bore erosion gauge reading in inches

Mean velocities for the reduced charge with the EX 28 MOD 1 liner are available from five occasions and range from 2168 f/s to 2140 f/s. These data are insufficient to establish an approximate velocity loss slope.

N. Projectile Cook-Off Tests

A projectile instrumented with thermocouples was rammed and seated on three occasions:

1. After a 15-round rapid fire burst on 2 November. The projectile was rammed and the thermocouples were connected to the recorder seven minutes after firing the last round.
2. After 75 rounds rapid fire (4 bursts) on 12 November. The projectile was rammed and the thermocouples were connected nine minutes after firing the last round.
3. After 75 rounds on 13 December (during the OPEVAL) when the projectile was rammed and connected 20 minutes after firing.

Temperatures on the rotating band and on the inside of the projectile were highest on 12 November 1971. Temperatures at the base plug were higher than those at other locations in the projectile, reaching 178°F at 70 minutes after the last round was fired. Temperatures on the rotating band, at the base plug and near the nose plug vs time are plotted in Figure 20 of Appendix A for the round rammed on 12 November 1971.

It was noted that after firing the 75 rounds on 12 November, the barrel chamber was warm, but the hand could be placed against it indefinitely without real discomfort. The temperature on the outside of the barrel about three feet from the muzzle reached 504°F 30 seconds after the last round was fired, however.

O. Reduced Charge

The reduced charge was defined as a charge which would give a velocity of 2220 f/s using the MARK 25 projectile. Reduced charges were fired in rapid fire

on 13 and 14 September during the Technical Evaluation and firing data are tabulated in Appendix G. The mount operated satisfactorily on both occasions.

P. Safety Analysis

A safety analysis was conducted on the 8"0 MCLGM and is reported by Reference 8. No disqualifying safety problems were uncovered, although a number of improvements from a safety viewpoint are recommended.

Q. Blast Tests

Blast test data from the firings of 4, 6 and 7 October 1971 are tabulated in Table J-1 of Appendix J.

It was noticed by operating personnel and observers during various firings, however, that certain rounds had a seemingly greater shock and louder report than others; hence, the measurements of 12 November and 13 December. Since muzzle flash often accentuates blast effects, the purposes of these extra experiments were to examine differences between blast characteristics of flashing rounds and non-flashing rounds (none of the slow fire rounds fired on 4, 6 and 7 October flashed). Examination of the data taken on 12 November (only the data from the first 26 rounds were examined) indicated:

1. The average free-air peak pressure of the primary blast was 9.3 psi for the 8 rounds which flashed and 10.3 psi for the 18 non-flashing rounds.
2. All but one of the flashing rounds had a double peak, the time between peaks being about 0.4 milliseconds, and the average value of the second peak being 9.0 psi.

For the test of 13 December, the data from a sample of flashing and one non-flashing rounds from the 150°-30 feet transducer was played back over a longer time interval and examined:

1. There was no discernible difference in the free-air blast wave between flashing and non-flashing rounds (the average for the flashing rounds was 0.68 psi and that for the non-flashing was 0.65 psi).
2. A secondary shock was detected at between 65 and 85 milliseconds after the initial shock for the flashing rounds only, the secondary peak pressure being less than the primary peak and varying between 0.46 and 0.59 psi in value.

The double peak pressures occurring in flashing rounds is not significant because the peaks are too close together in time and there is no effective increase in peak pressure. The accentuated blast effects of flashing rounds could be explained by the delayed secondary blast noted in the test of 13 December.

R. Smoke and Fumes

The most significant carbon monoxide measurements were taken on 12 November and 13 December 1971 during 75-round firings. Carbon monoxide concentration versus time for these tests are shown in Figure 21 of Appendix A. Significant amounts of lead or oxides of nitrogen were not detected during any of the firings, but smoke would build up in the mount until the shield doors were opened. A waiting period of about 15 minutes, depending on ambient wind conditions, was required to clear the mount.

In summary, the only toxic hazard detected in the mount is from carbon monoxide. Peak transient concentrations of 3000 parts per million (PPM) were detected in the gun house, cradle and loader drum areas. After firing, residual concentrations of above 1000 PPM were observed.

S. Anti-Icing System Test

Water was sprayed on the mount at intervals during 0500 to 0900 hours on 8 February 1972 when ambient temperatures ranged from 15° to 18°F. The mount operated satisfactorily in train and elevation when checked at half hour intervals. No ice formed on the gun port shield, the empty case ejector door or the base ring, whereas it did form on other parts of the shield as can be seen in Figures 22 and 23 of Appendix A. Anti-icing fluid temperature started at 42°F and rose to 62°F at 0530, 72°F at 0600, and stayed between 60°F and 76°F until 0900.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

It can be concluded from the test results that:

1. the train and elevation power drives respond satisfactorily to local or remote orders from dummy directors.
2. the loading system can sustain rates of fire between 11.7 and 12.6 rounds per minute in auto-load, can be cycled in step-load, and can select and load any of six types of ammunition which have been predesignated.
3. misfires can be extracted and ejected through the empty case door, and a clearing charge can be loaded and fired without a man entering the mount.
4. the mount can be regunned in less than two hours provided the crew is experienced and the facilities and effort are well coordinated.
5. mechanical performance of the cartridge case and the primer, and the ballistics and flash of the propellant are not generally satisfactory. Excessive headspace (static clearance between the base of the case and the breechblock), and linear motion and axial expansion between the barrel and housing under dynamic loads are contributors to the marginal performance of the cartridge case.
6. ballistic accuracy of the MARK 25 projectile fired from the mount is satisfactory, although the range tables for both the full and reduced charge are deficient and generally biased so that the projectile will fall longer than predicted (up to 3% longer). This bias is not unique with the 8"0 MCLGM, being related to the projectile and therefore noted in all 8"0 mounts.
7. barrel life and velocity loss results are not conclusive due to the limited barrel erosion, however, barrel life to about twenty percent expended is roughly comparable to that of the 8"0 barrel MARK 16 and acceptable when using NACO propellant.
8. some minor deficiencies from a safety viewpoint were uncovered, however none are inherent or disqualifying.

9. the gun blast profile for this gun is slightly less in magnitude than that for an 8"/55 caliber bag gun under the conditions tested.
10. smoke and carbon monoxide concentrations during firing make it unsafe to circulate the air in the mount to other spaces in a ship or to enter the mount for repairs until after the mount has been properly ventilated.

B. Problem Areas

There are several circumstances avoidable only at high cost or by schedule slippage which detracted from both the Technical and Operational Evaluations:

1. the prototype MCLGM was originally designed, built and evaluated as a 175mm mount and later converted to 8"0. Certain structural members in the loader drum area will require strengthening in production mounts and the oscillating assembly and carriage modified to accommodate increased projectile weights and firing loads.
2. the mount had been subjected to considerable testing as a 175mm prior to conversion to 8"0 (e.g., the loading system was subjected to a 50,000 cycle life test at NOD/fmc) and hence some parts were worn and fatigue failures were more likely to occur than in a new mount.
3. an extremely severe and arbitrary schedule prevented the contractor from completing all necessary work prior to commencement of the evaluation. No correspondence from the contractor was received indicating that the installation, conversion and his checkout were completed prior to the Technical Evaluation.
4. contractor personnel were required to operate the mount during some of the Technical Evaluation because local personnel had still not completed schooling on the mount.
5. problems were encountered throughout the Technical Evaluation with the cartridge assembly.

C. Modifications to Mount

It was concluded that the design of certain components of the mount which affected performance adversely during testing should be modified during the evaluation. Design modifications included were:

1. the photoelectric detectors were changed by installing light sources opposite the photocells and removing the reflectors.
2. the counter-recoil cylinder seals were redesigned.
3. a new, stronger cradle restrainer spring arrangement was installed.

D. Release to OPEVAL

Based on results of the Technical Evaluation, the performance of the 8"/55 Major Caliber Lightweight Gun Mount MARK 71 MOD 0 was judged to be acceptable and certification for release to OPEVAL was recommended on 12 November 1971 by Reference 11. The Operational Evaluation was begun under the auspices of COMOPTEVFOR on 15 November 1971.

E. Recommendations

The following recommendations are offered for the production mount design:

1. a fold-away platform is needed on the carriage for maintenance operations on the chamber, breechblock, and firing pin assembly and for access to barrel keys during regunning.
2. ladder rungs on the shield are needed and provision should be made for attachment of scaffolding for access to the bushing and icebreaker during regunning.
3. breechblock headspace and any clearances allowing aft movement of the breechblock with respect to the housing should be minimized.
4. a cartridge development program is needed to eliminate primer blow back, and muzzle flash; increase round-to-round velocity uniformity; and, to develop a reliable case, plug and crimp.
5. a time between rounds fired function should be included on the timer in the EP-2 panel, or provided in addition to it, to provide an overall check on the "health" of the loading system.
6. a new 8"0 range table is needed for both full and reduced charges for the MARK 25 projectile.

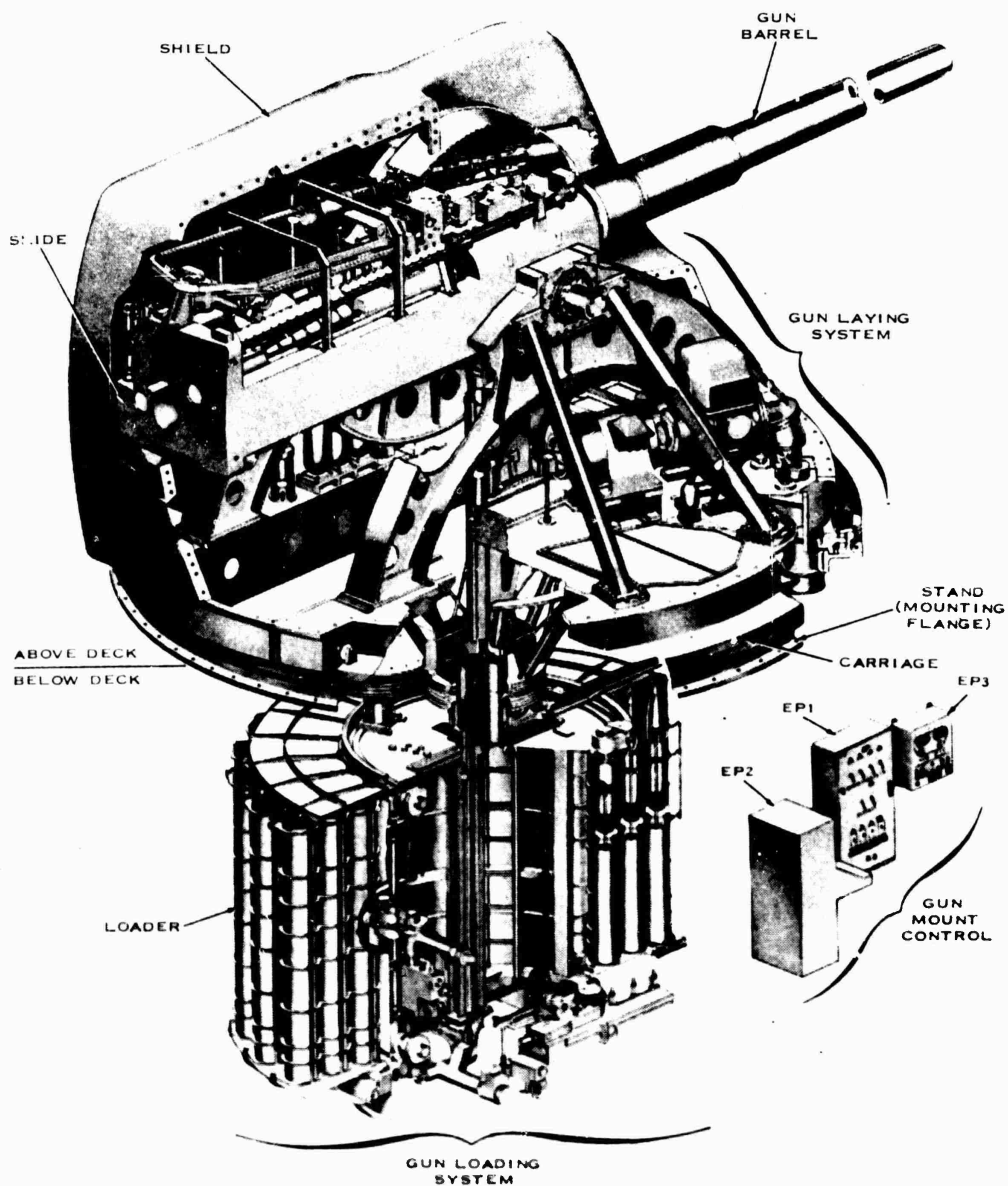
Additional recommendations from a safety viewpoint are provided in Reference 8.

REFERENCES

1. CNO Conf ltr OP344G/701E/pnl Ser 0255P70 to CNM of 26 Feb 1965, Subj: SOR No. 12-10
2. CNO Conf ltr OP723C/701E/ec Ser 0601P70 to CNM of 1 Oct 1969, Subj: SOR No. 12-10R1
3. NAVORD ORDTASK 553-111-090-1-U-1210330 of 22 Mar 1971, Subj: MCLGM 8" Conversion
4. NAVORD Conf ltr ORD-5531/456:EJK Ser 03819 to CNO of 12 Aug 1971 Subj: Project Assignment Request for 8"/55 Caliber EX 71 MOD 0 Gun Mount
5. NWL Conf ltr TP:DLB/PJO:jca 8300 Ser 0720067 to NAVORD of 19 Jan 1972, Subj: 8"/55 MCLGM EX 71 MOD 0 Technical Evaluation; preliminary report of
6. COMOPTEVFOR Conf ltr 722:rg 3930 (0/S173) Ser 0122 to CNO and NAVORD of 20 Mar 1972, Subj: Final Report on Project 0/S 173. *"Conduct a Limited Scope Operational Evaluation of the 8"/55 MCLGM EX 71 MOD 0"*
7. NAVORD Specification XWS-4952
8. NWL ltr ESE:JSN:vdc 8000 to NAVORD (ORD-5531) of 5 May 1972, Subj: MARK 71 MOD 0 Eight-Inch Lightweight Gun System; safety evaluation of
9. NWL ltr TPB:JLM:pjc 8010/1-21 to NOSIH of 13 Jun 1972, Subj: 8-Inch Major Caliber Lightweight Gun (MCLG) Reduced Charge; establishment of
10. NWL ltr TPB:BZJ:scc 8010/1-21 to NOSIH of 22 Jun 1972, Subj: 8-Inch Major Caliber Lightweight Gun Propellant Evaluation; results of
11. NWL Conf msg 122230Z Nov 1971
12. NWL ltr FVE:MHP:ljb 10552 to NAVORD of 6 Jan 1972, Subj: Electromagnetic Susceptibility Test Plan for 8-Inch 55 Caliber Gun Mount MARK 71 MOD 0; report of

APPENDIX A

Figures 1 Through 23



PHD-2497-11-72

FIGURE 1

Cut-Away View of the
8"/55 Major Caliber Lightweight Gun Mount MARK 71 MOD 0

A-1

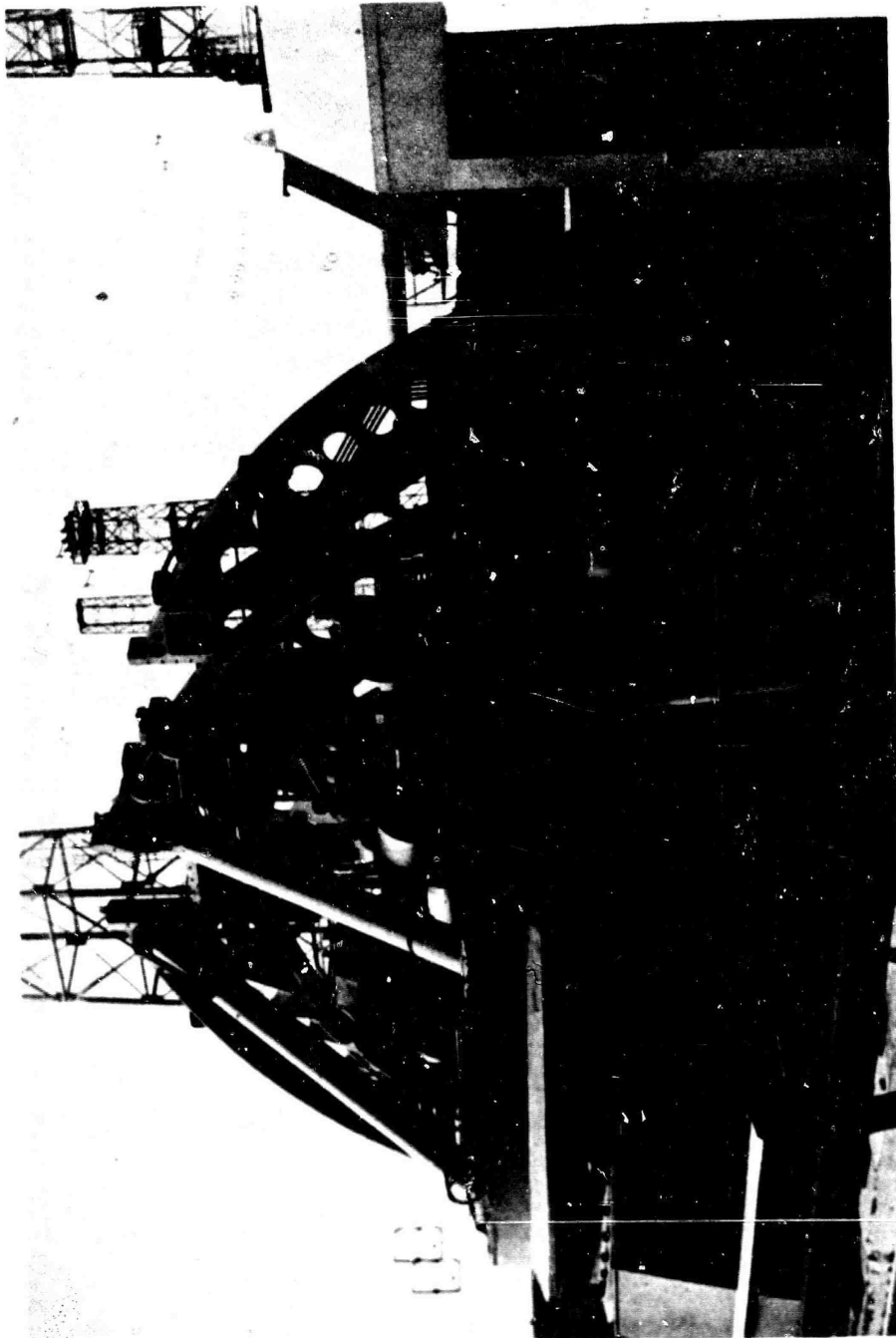


FIGURE 2

View of the Base Ring and Trunnion Supports of the
8"/55 MCLGM Installed at NWL

PHD.2498-11-72

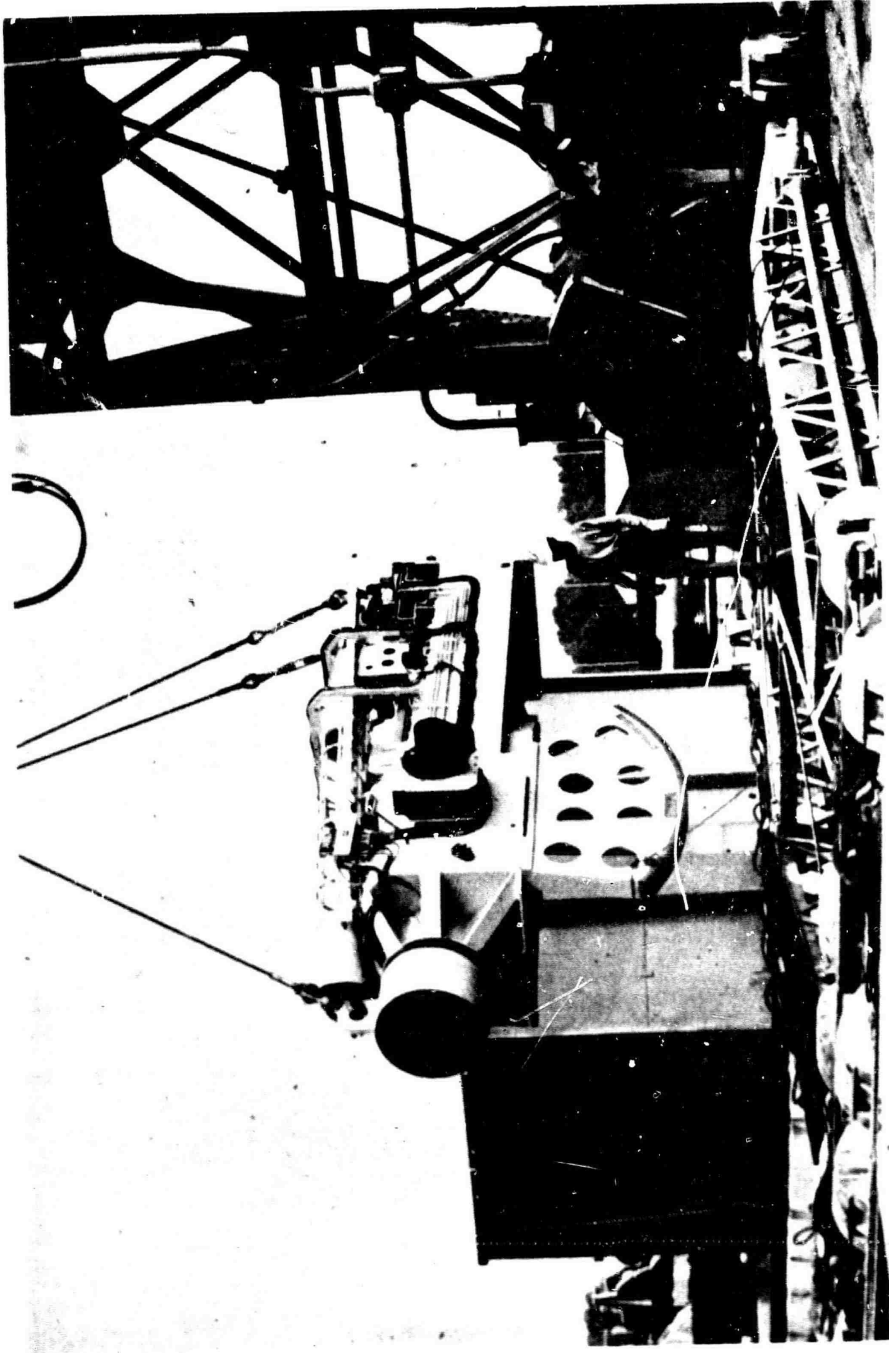
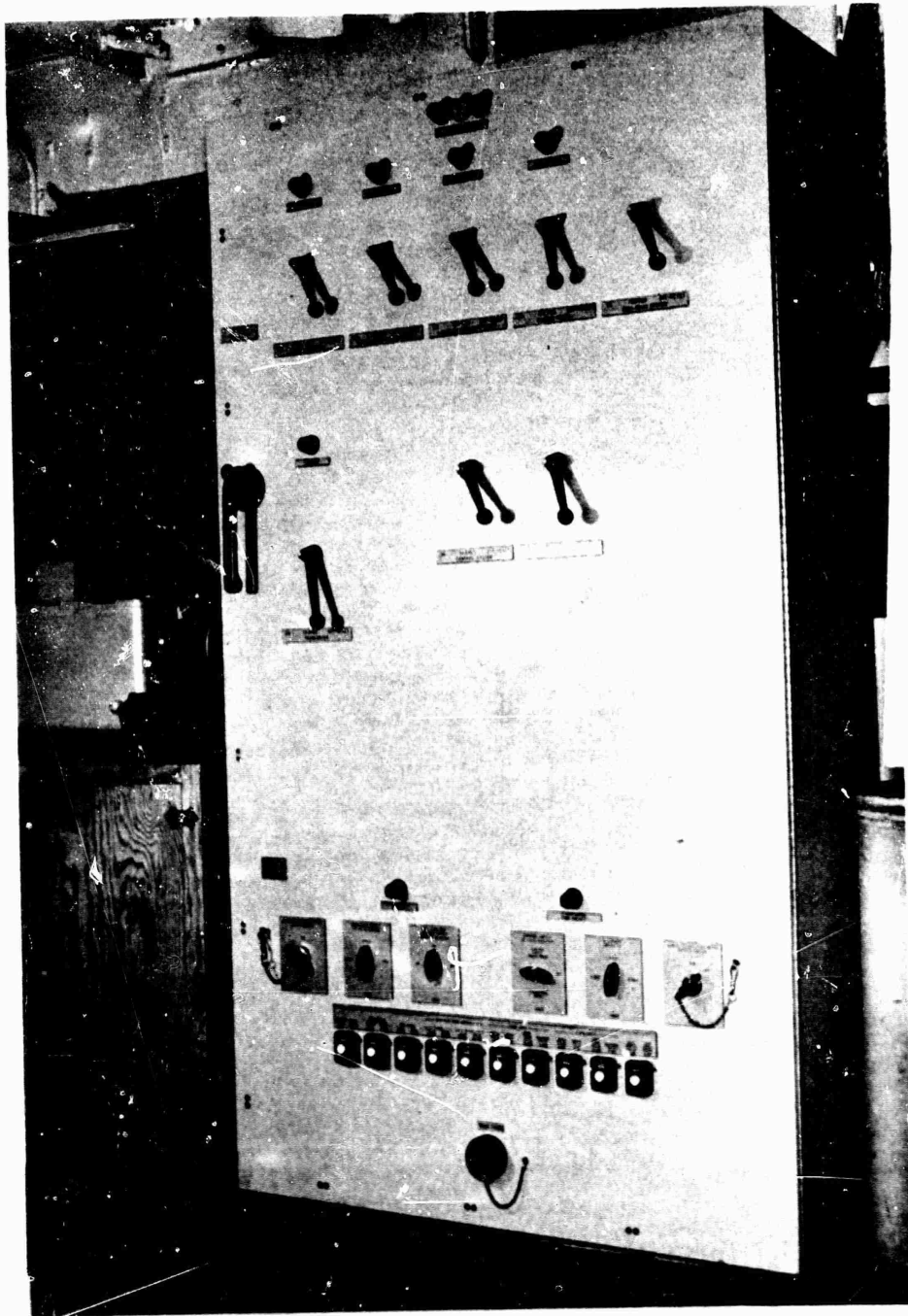


FIGURE 3

View of the Slide During Assembly of the MCLGM After
Conversion to the 8"/55 Caliber

PHD 2499.11.72



PHD 2500-11-72

FIGURE 4

View of the 8"/55 MCLGM EP-1 Panel

A 4

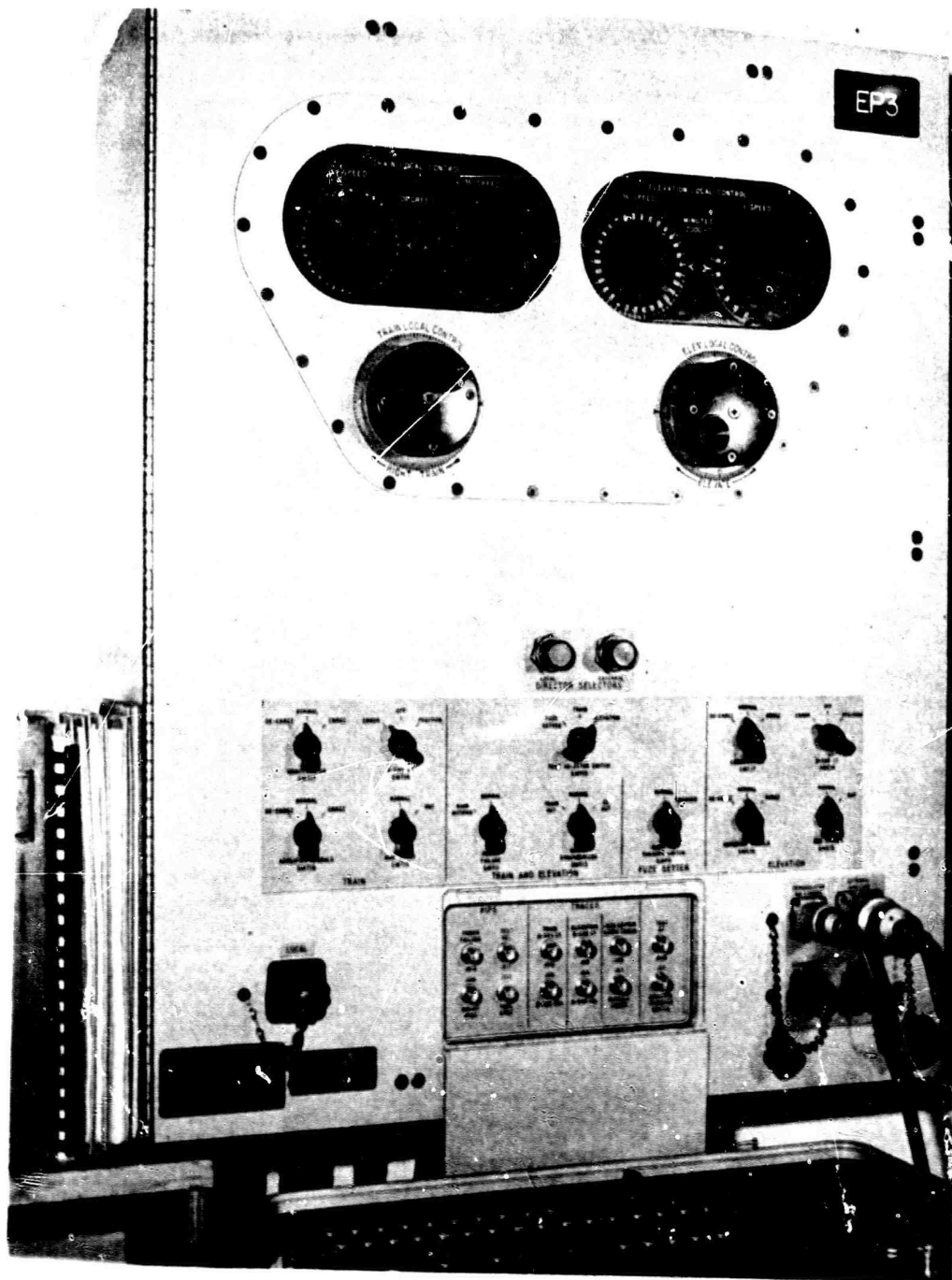


PHD-2501-11-72

FIGURE 5

View of the 8"/55 MCLGM EP-2 Panel

A-5

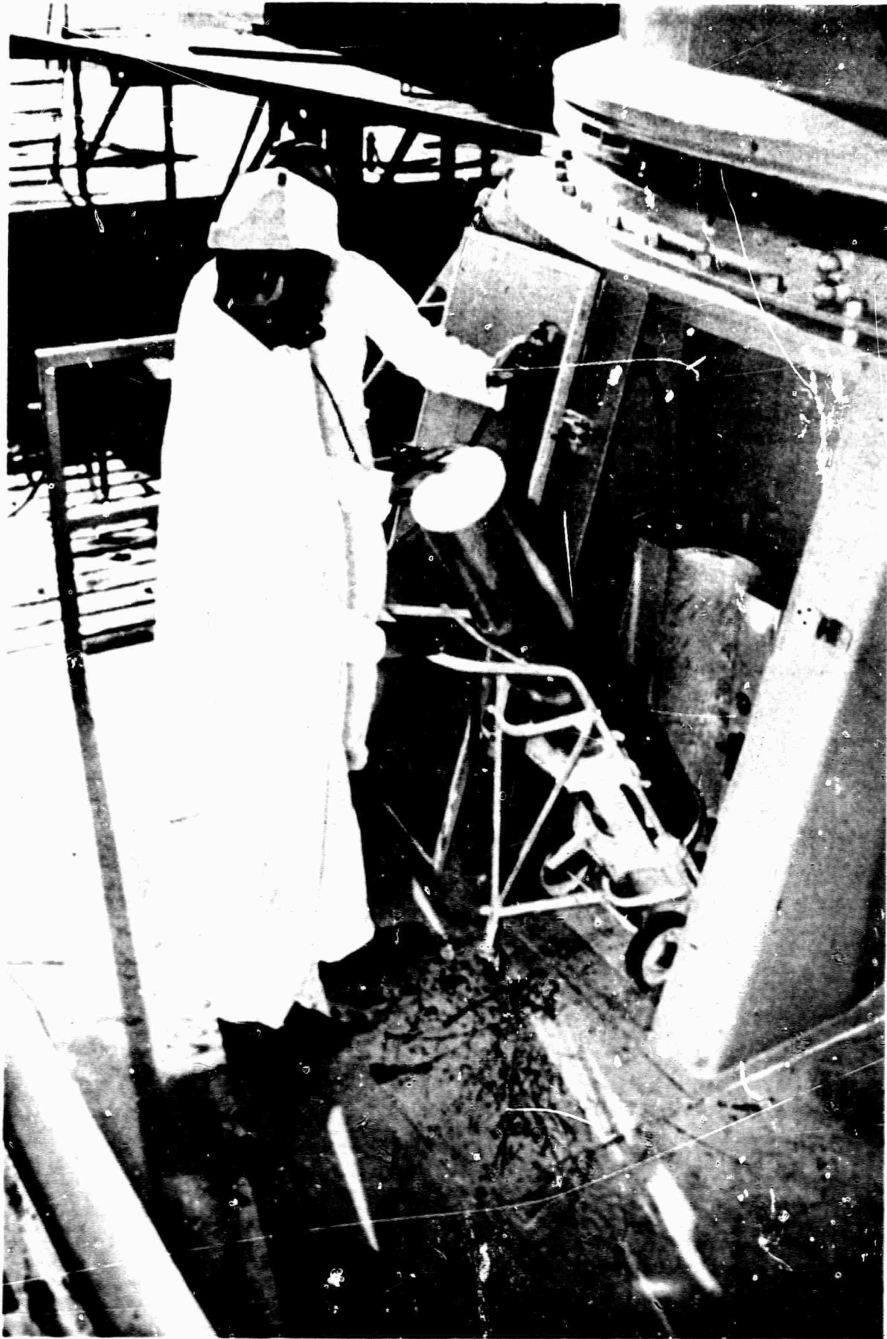


PHD-2502-11-72

FIGURE 6

View of the 8"/55 MCLGM EP-3 Panel

A-6

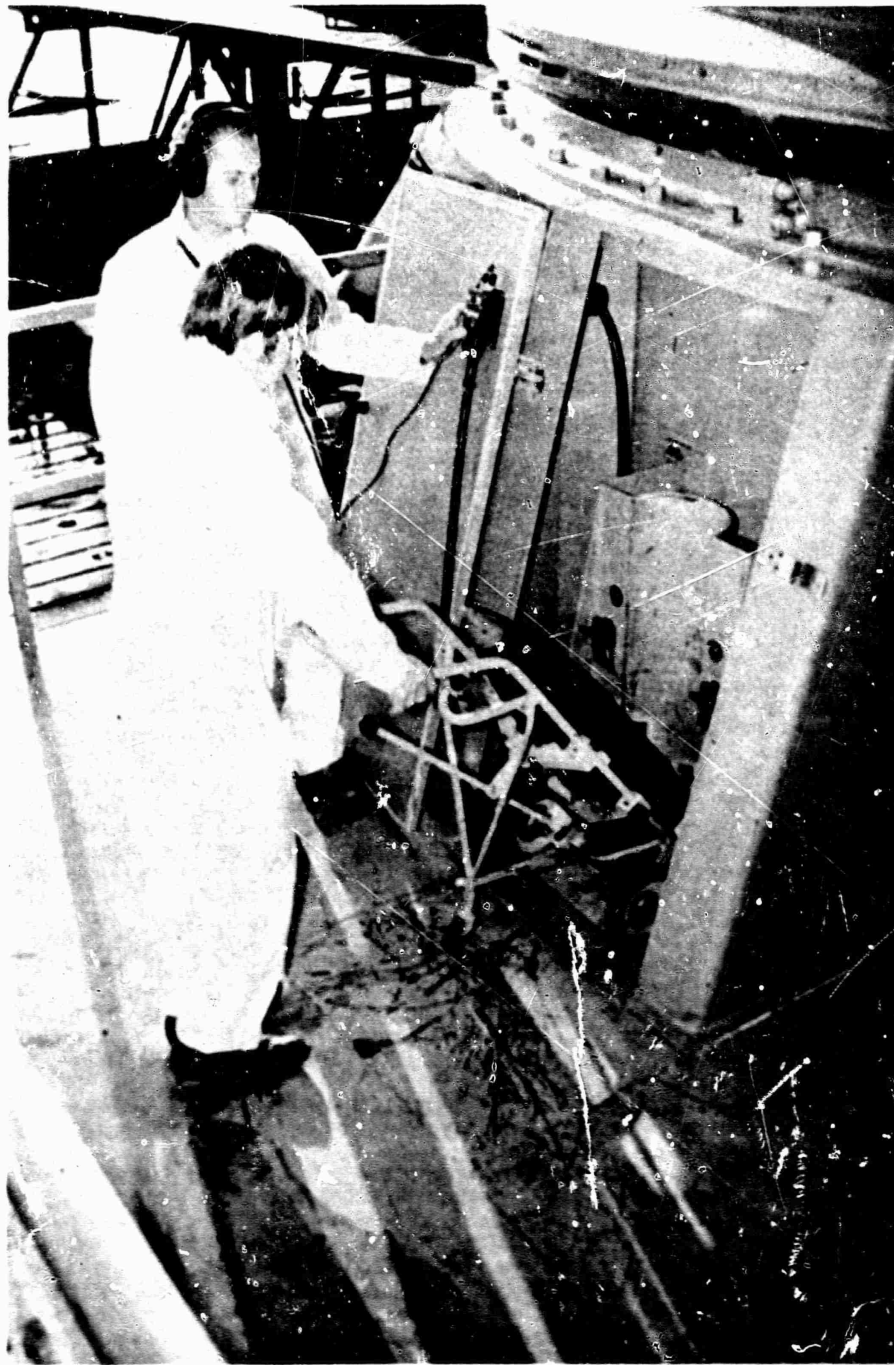


PHD-2503-11-72

FIGURE 7

Photograph of a Cartridge Being Placed in the
Strikedown Hoist of the 8"/55 MCLGM at NWL

A-7

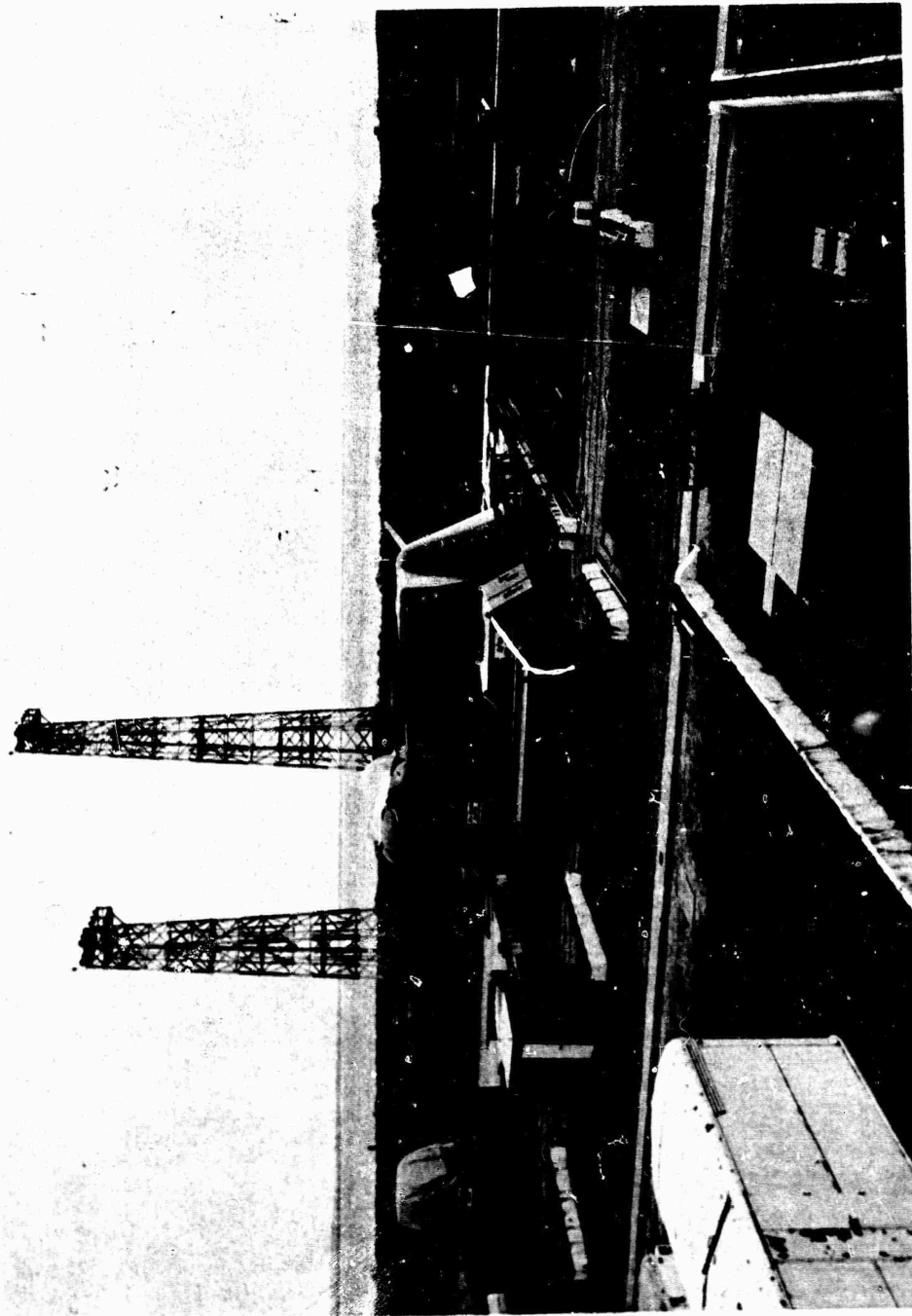


PHD-2504-11-72

FIGURE 8

Photograph of a MARK 25 Projectile Being Placed in the
Strikedown Hoist of the 8"/55 MCLGM at NWL

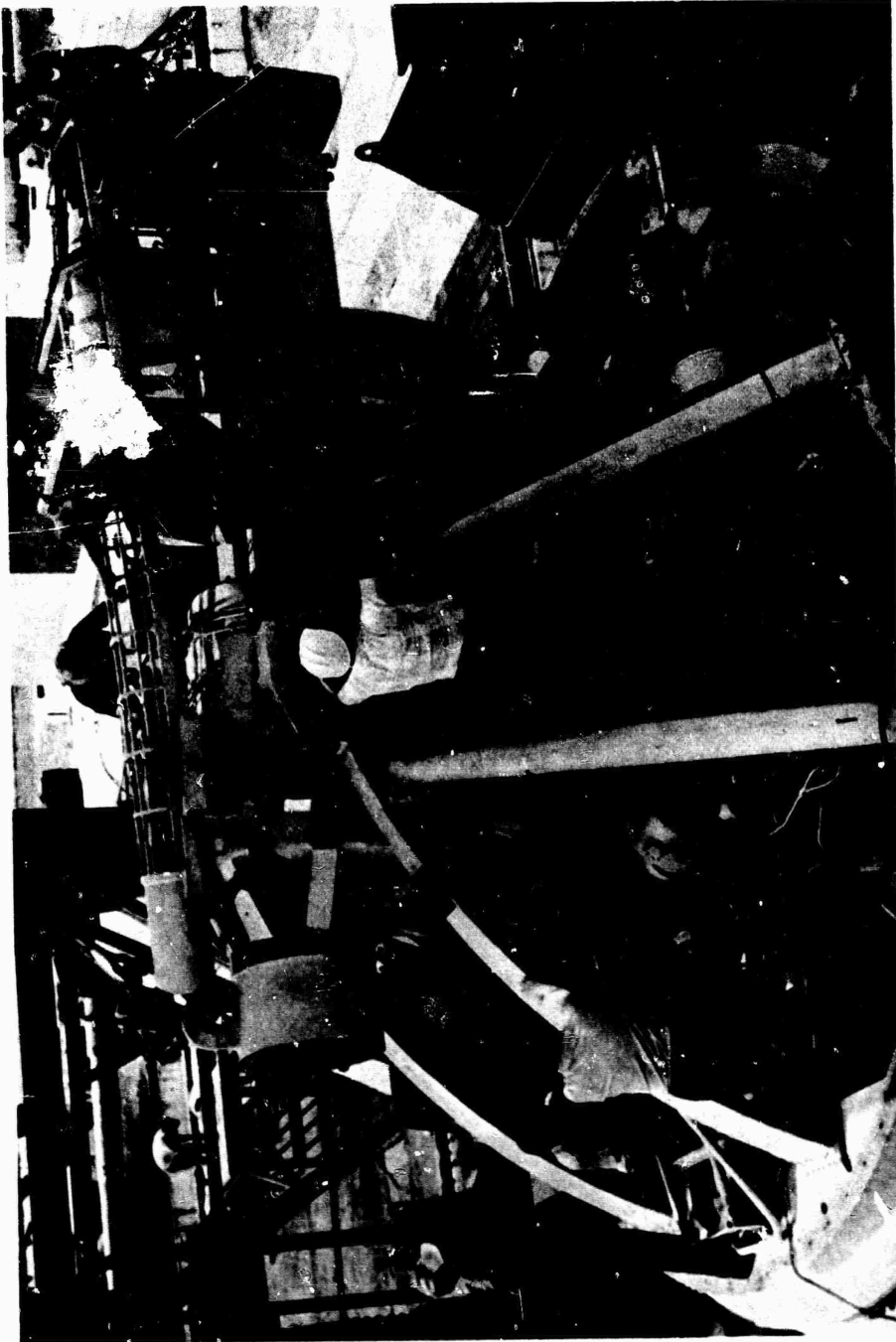
A-8



PHD-0180-2-72

FIGURE 9

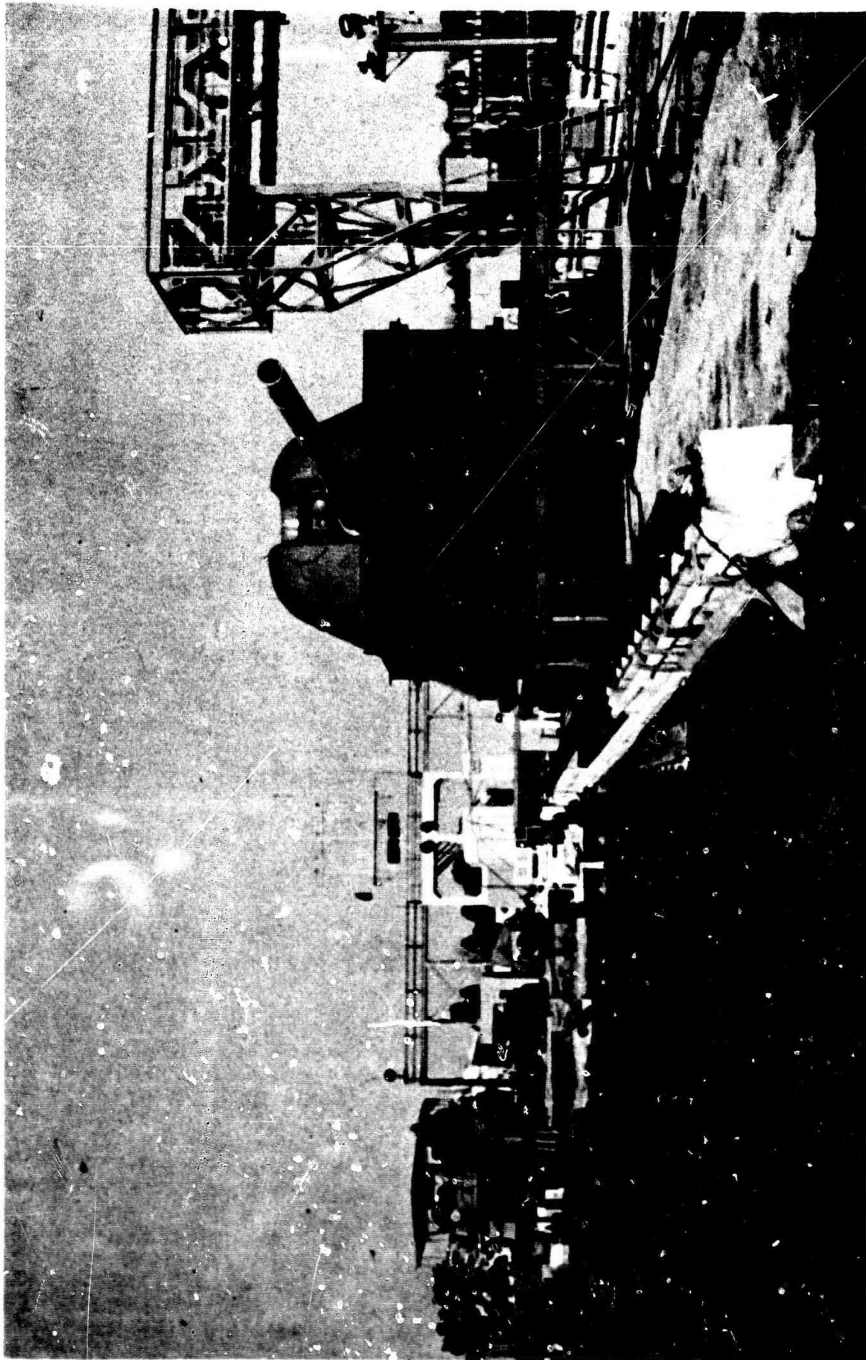
8"/55 MCLGM Installed at NWL as Viewed From Behind



PHD-2505-11-72

FIGURE 10

View of the MCLGM During Installation of the Slide After
Conversion to 8"/55 Caliber



PHD-2506-11-72

FIGURE 11

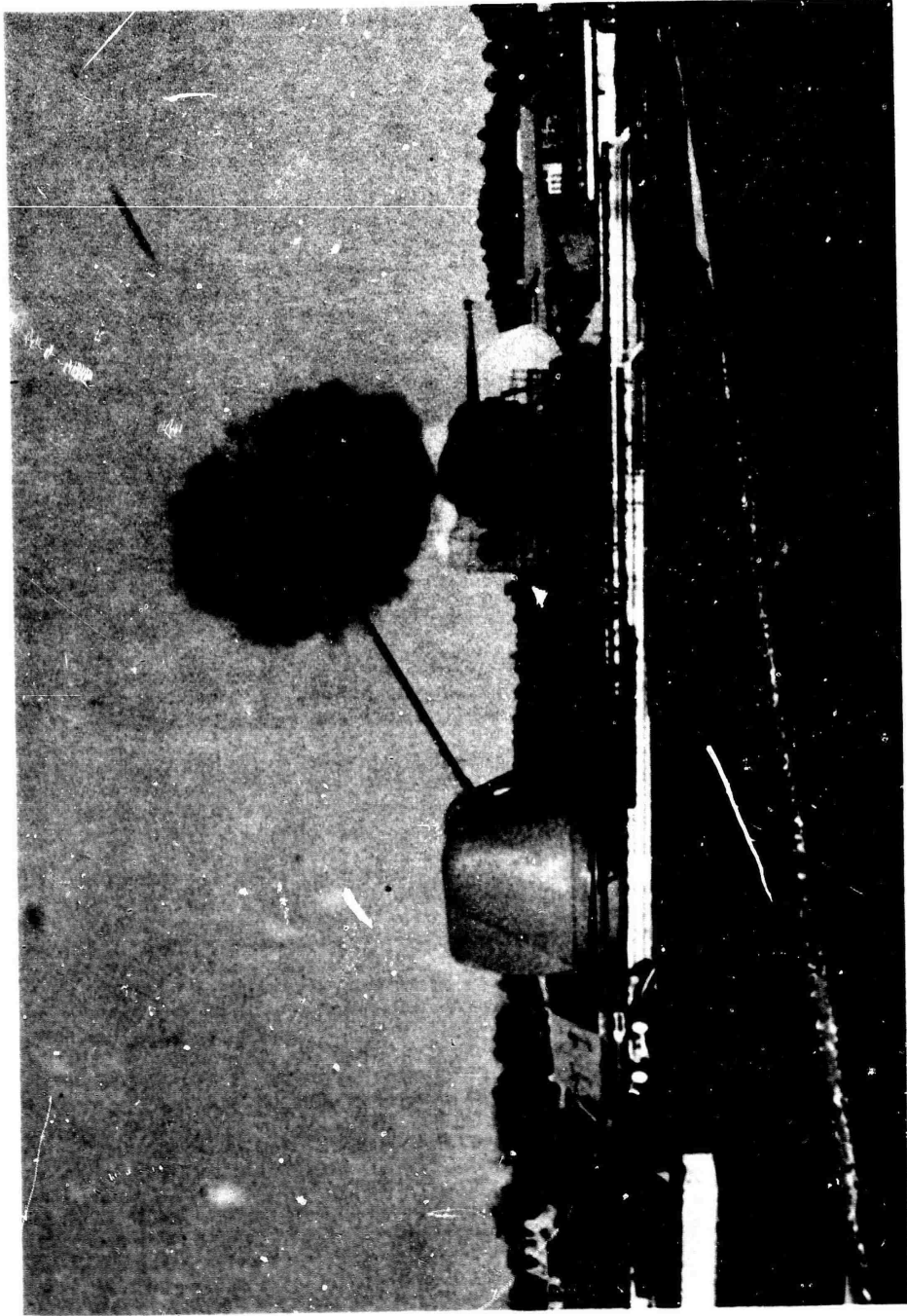
8"/55 MCLGM Installation at NWL as Viewed From in Front of the Mount



FIGURE 12

View of the Cartridges and Projectiles Being Loaded at the
Strikedown Hoist of the 8"/55 MCLGM at NWL

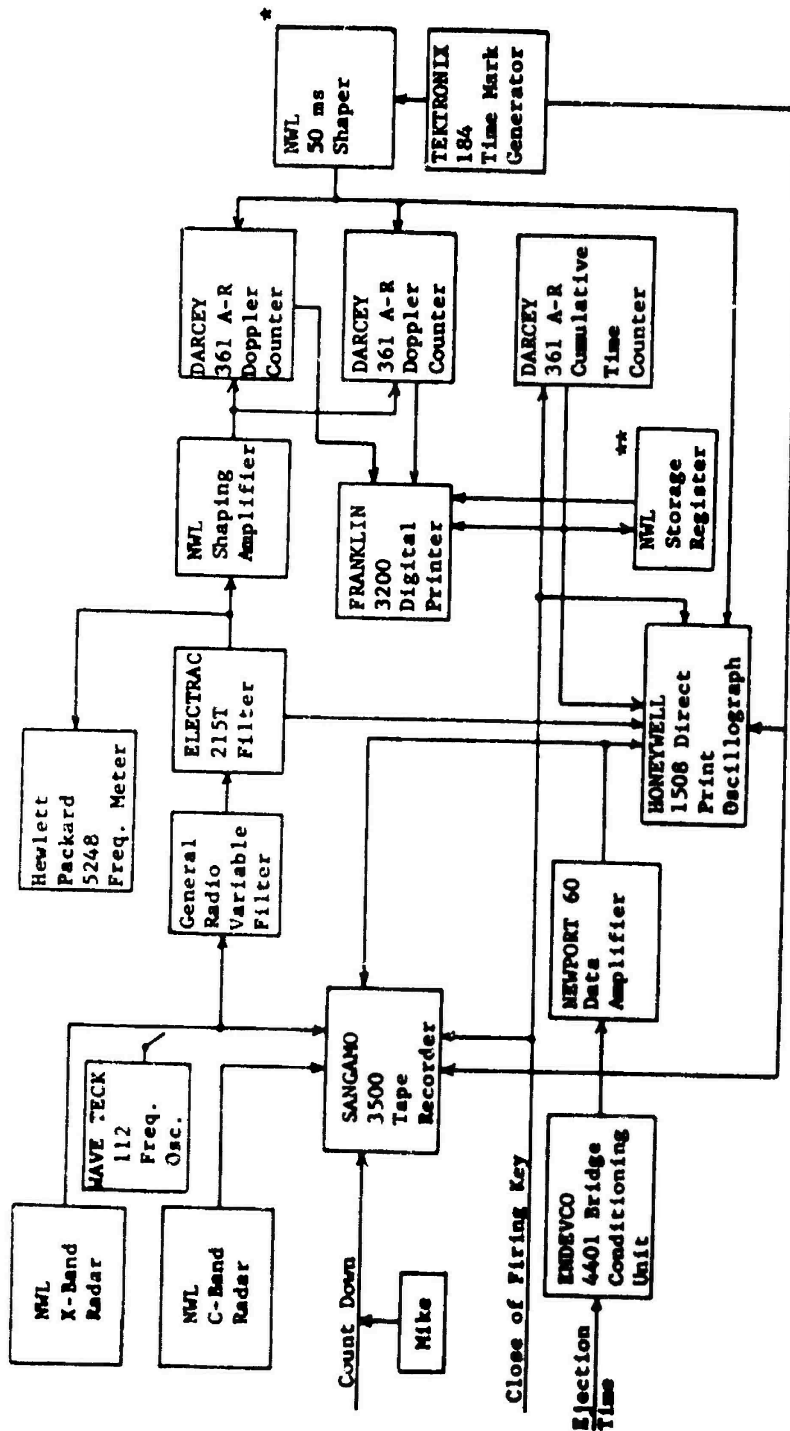
PHD-2507-11-72



PHD-0218-2-72

FIGURE 13

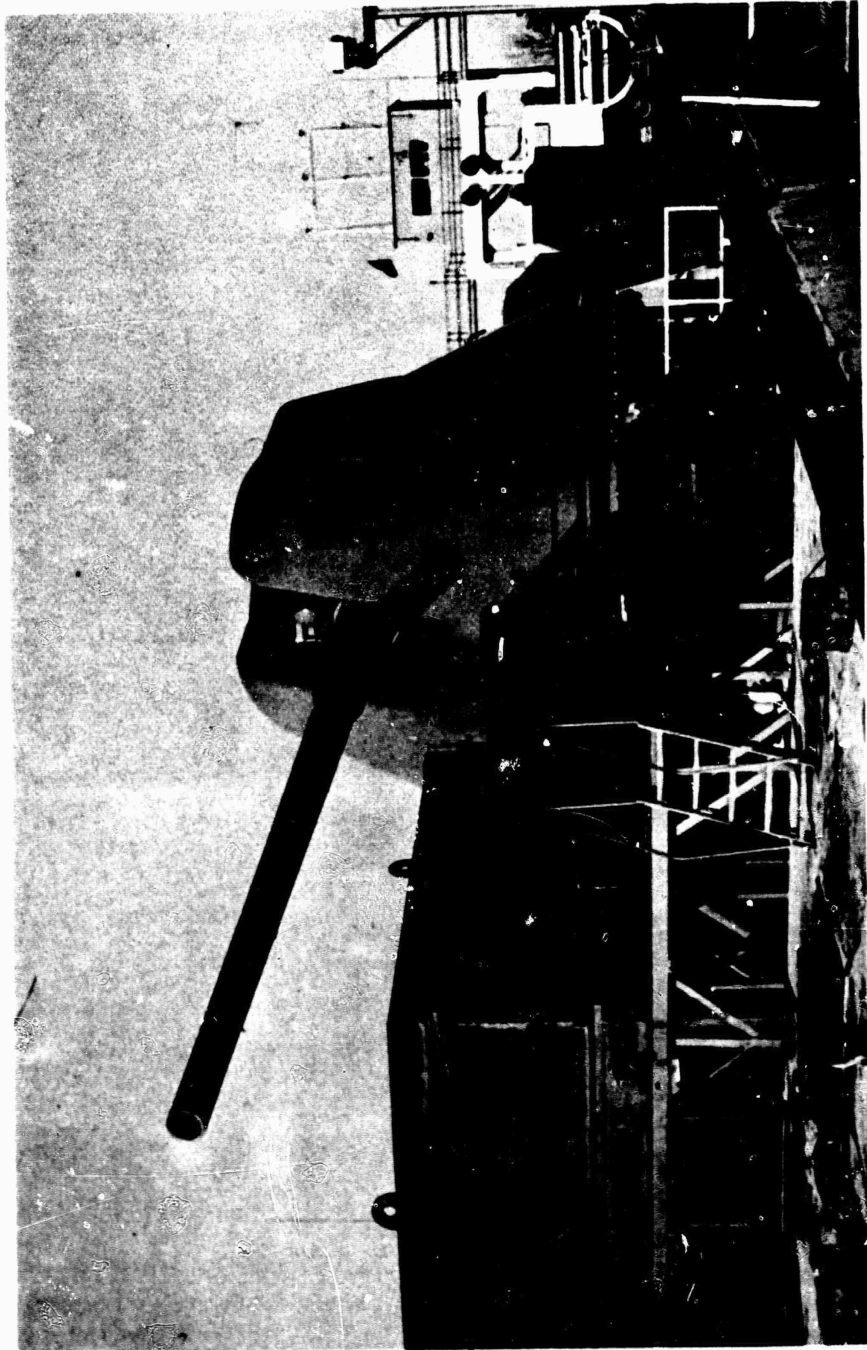
View of the 8" .0 MCLGM Firing at NWL



* Gates counters (on-off alternately) to permit counting of doppler cycles.
 ** Stores time counts until printer can accept them.

FIGURE 14

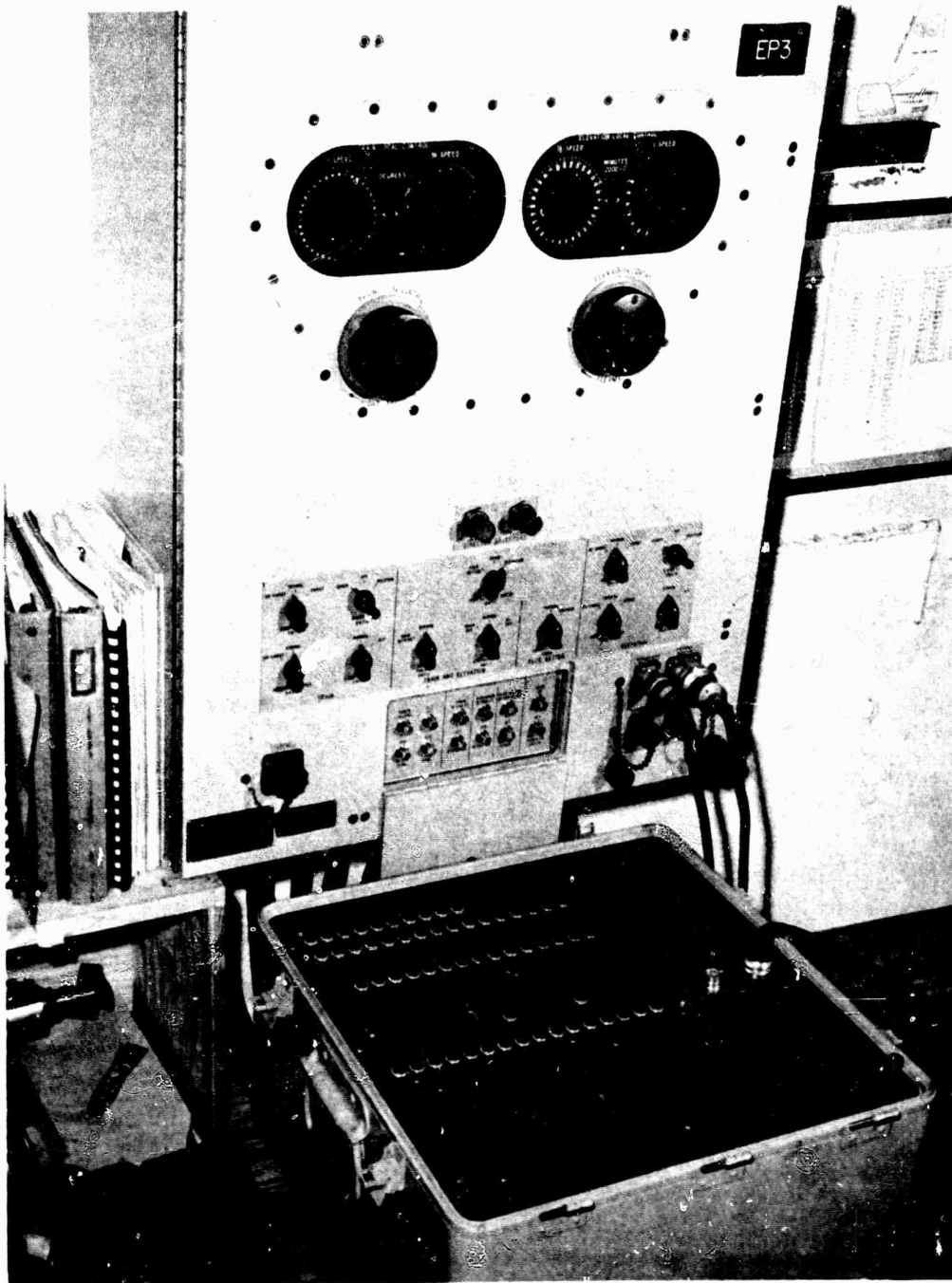
Initial Velocity Data Acquisition System for Doppler Radar



PHD-2508-11-72

FIGURE 15

View of the 8"0 MCLGM Showing the C-Band Doppler Radar (on Wheels at the Right)

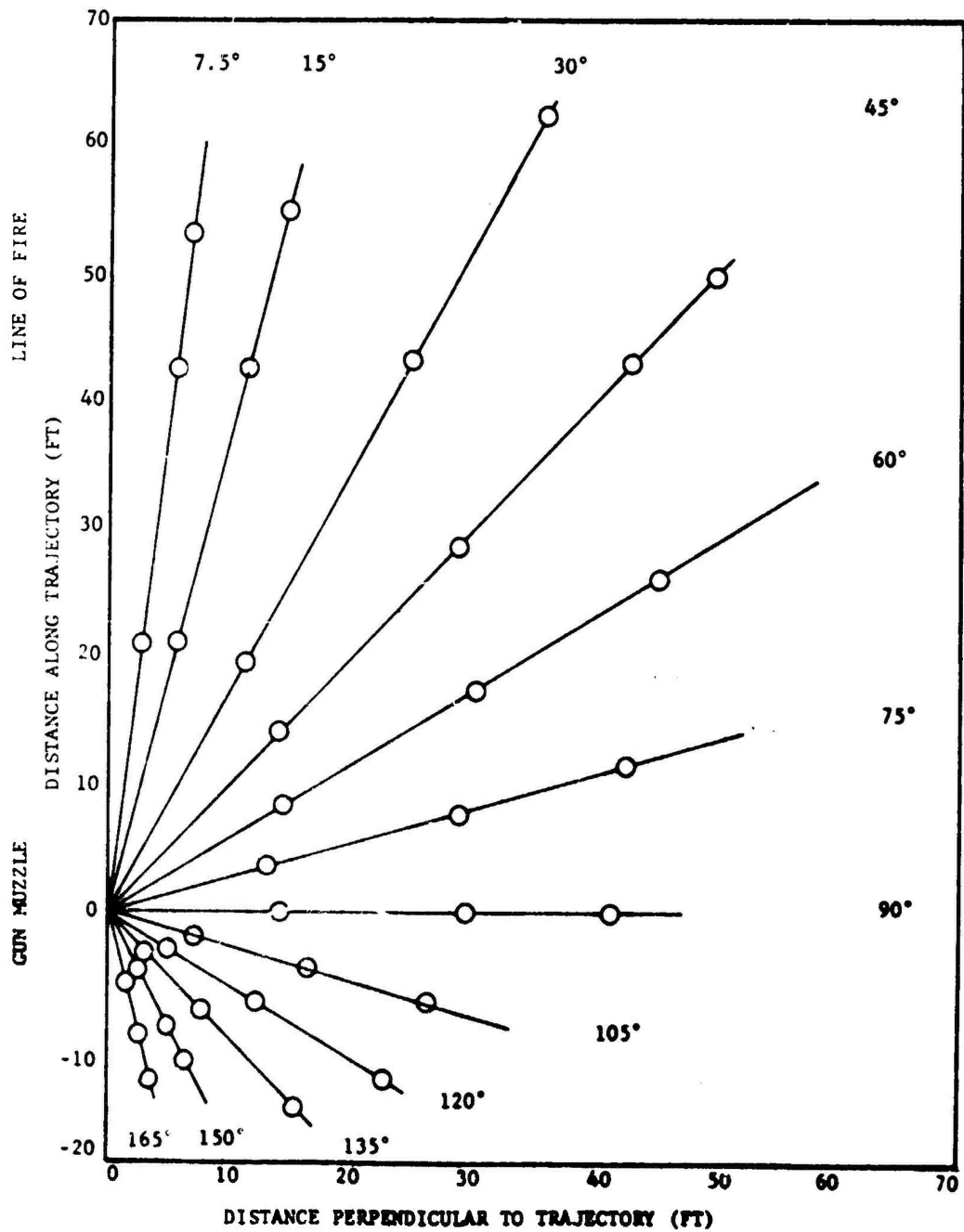


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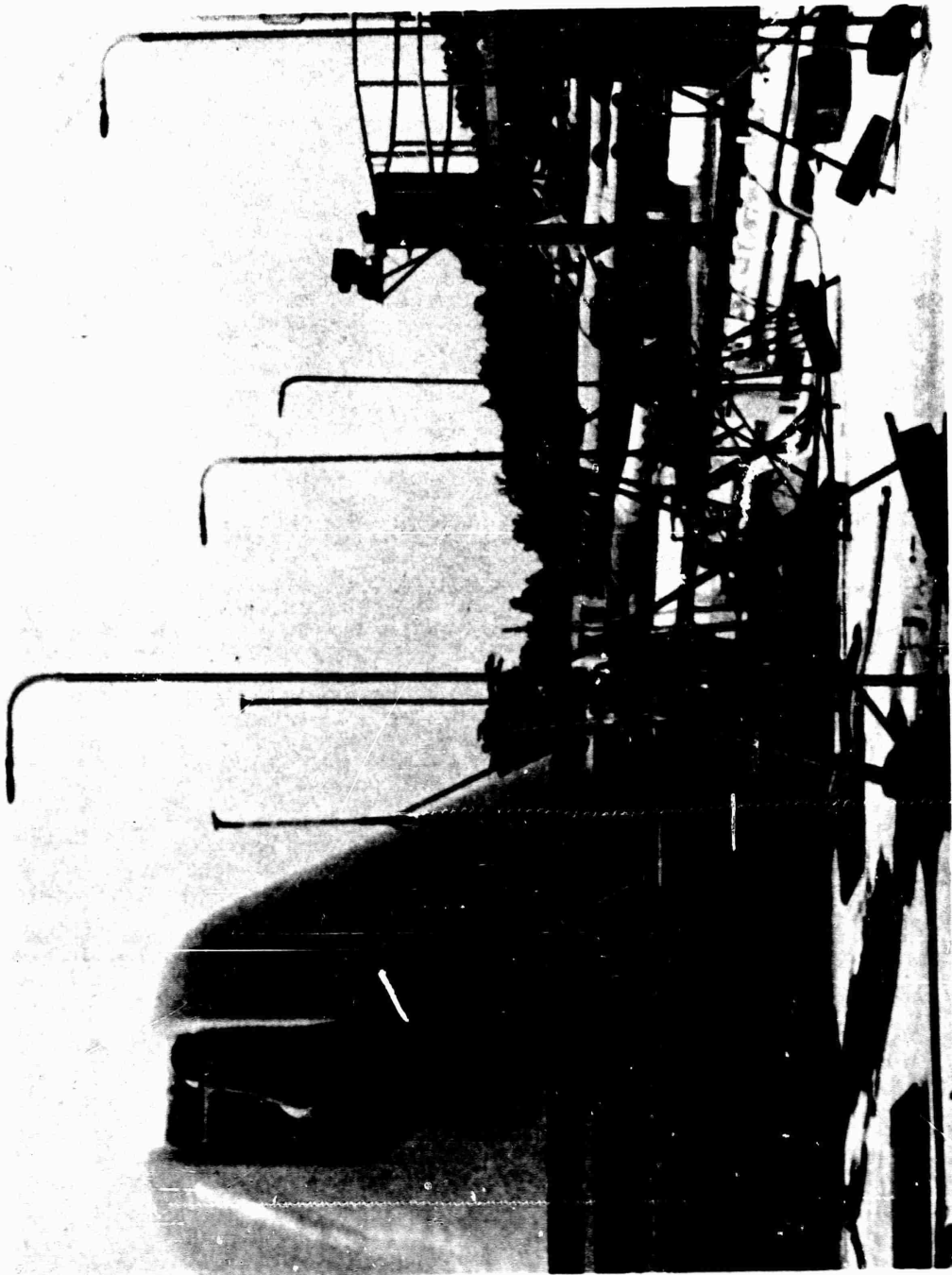
FIGURE 16

View of the 8" MCLGM Test Panel (EP-3)
and the Order Signal Generator

A-16



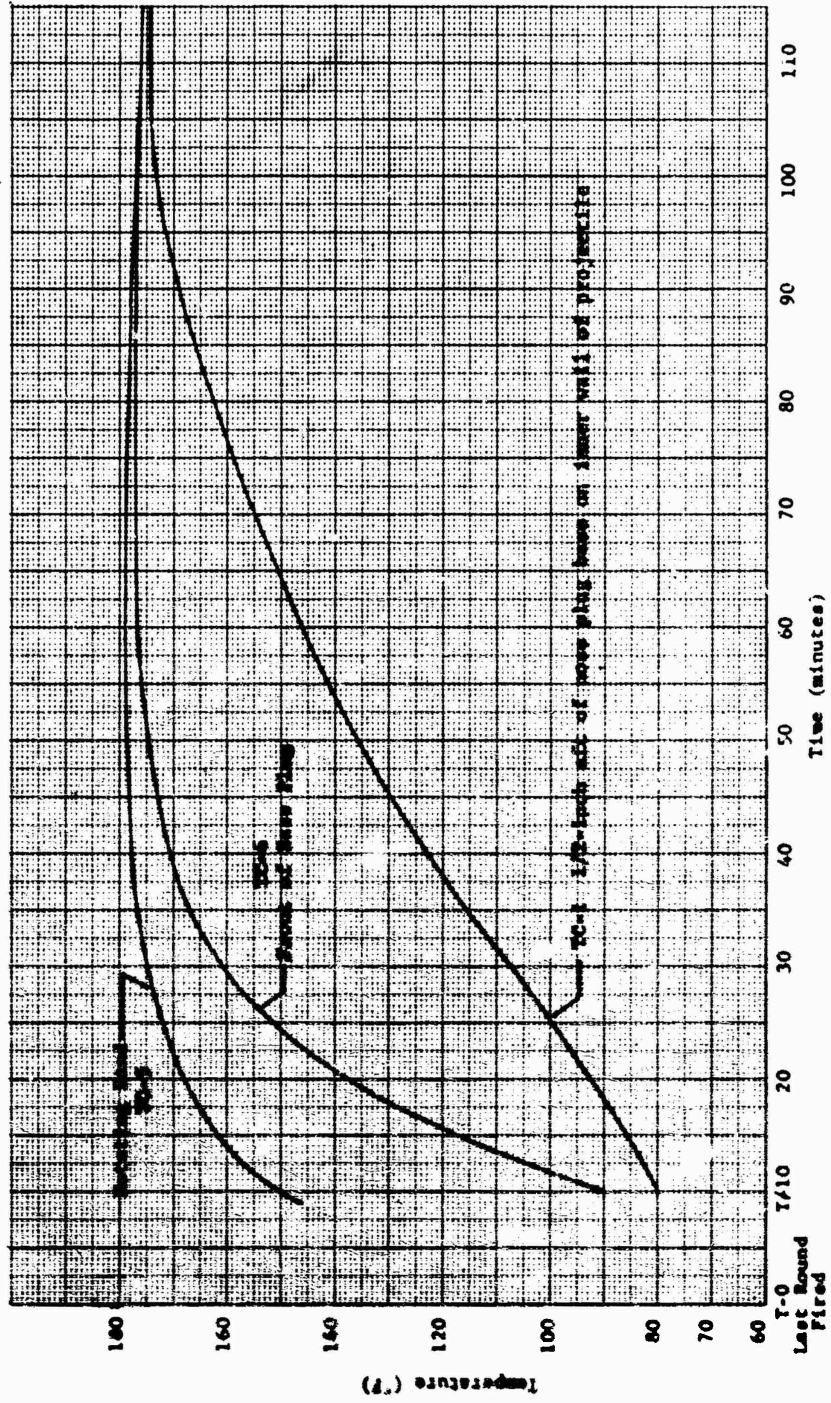
Distance Perpendicular to Trajectory (ft)



PHD-2509-11-72

FIGURE 18

View of Blast Pressure Transducer Arrangement in Front of the 8"/55 MCLGM



PHD-2510-11-72

FIGURE 19

View of Blast Pressure Transducer Arrangement in Front of the 8"/55 MCLGM

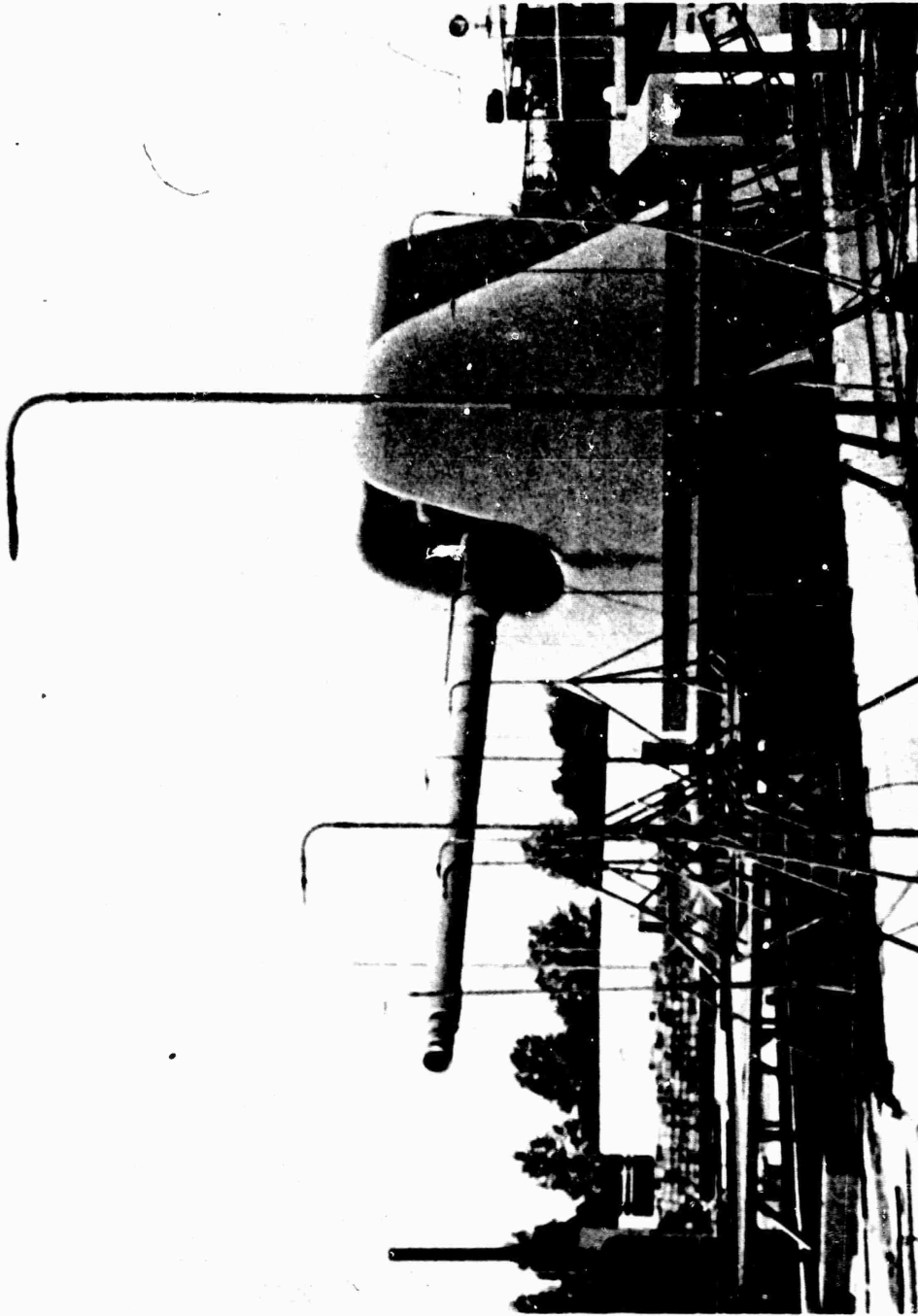
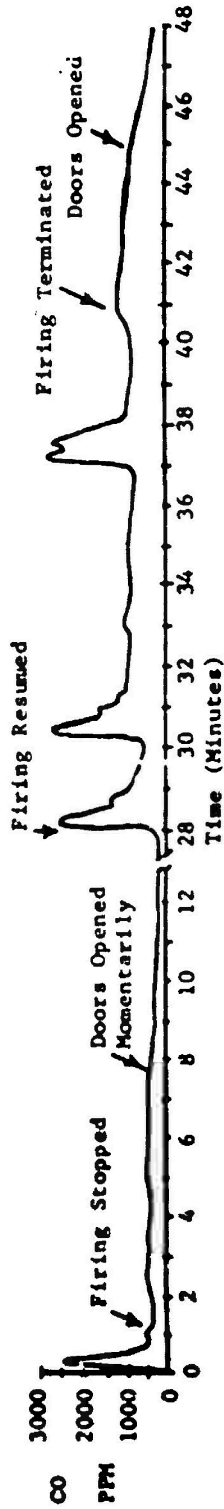


FIGURE 20

Temperature vs Time at Several Locations on an 8" Projectile

CARBON MONOXIDE DATA FOR LAST 37 ROUNDS SHOT ON 12/13/71

SAMPLE POINT: INSIDE CROWN OF GUN HOUSE, ABOVE BREECH



CARBON MONOXIDE DATA FOR 75 ROUNDS SHOT ON 11/12/71

SAMPLE POINT: FIVE FEET ABOVE DECK IN AFT AREA OF CRADLE ROOM

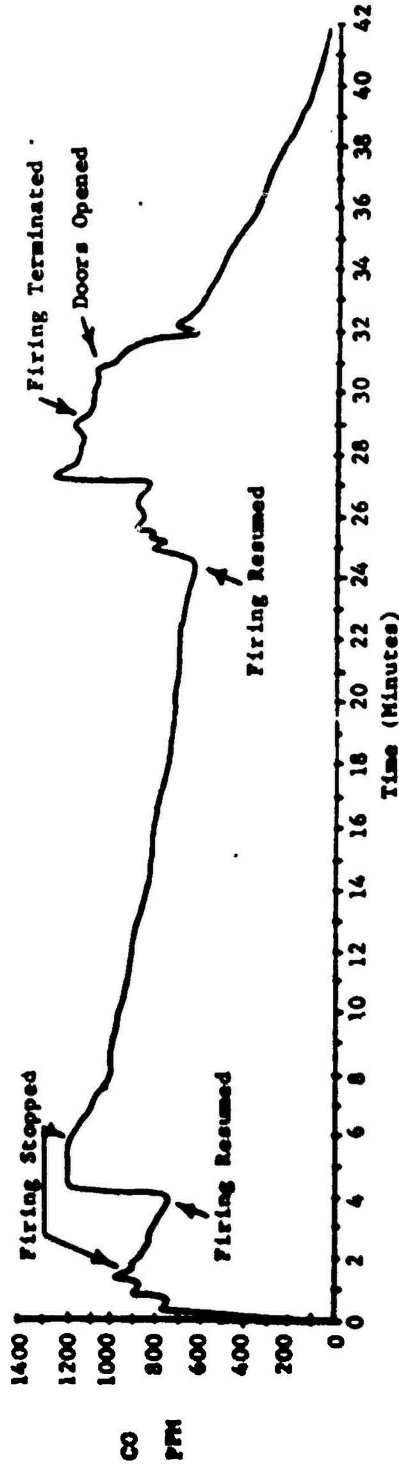
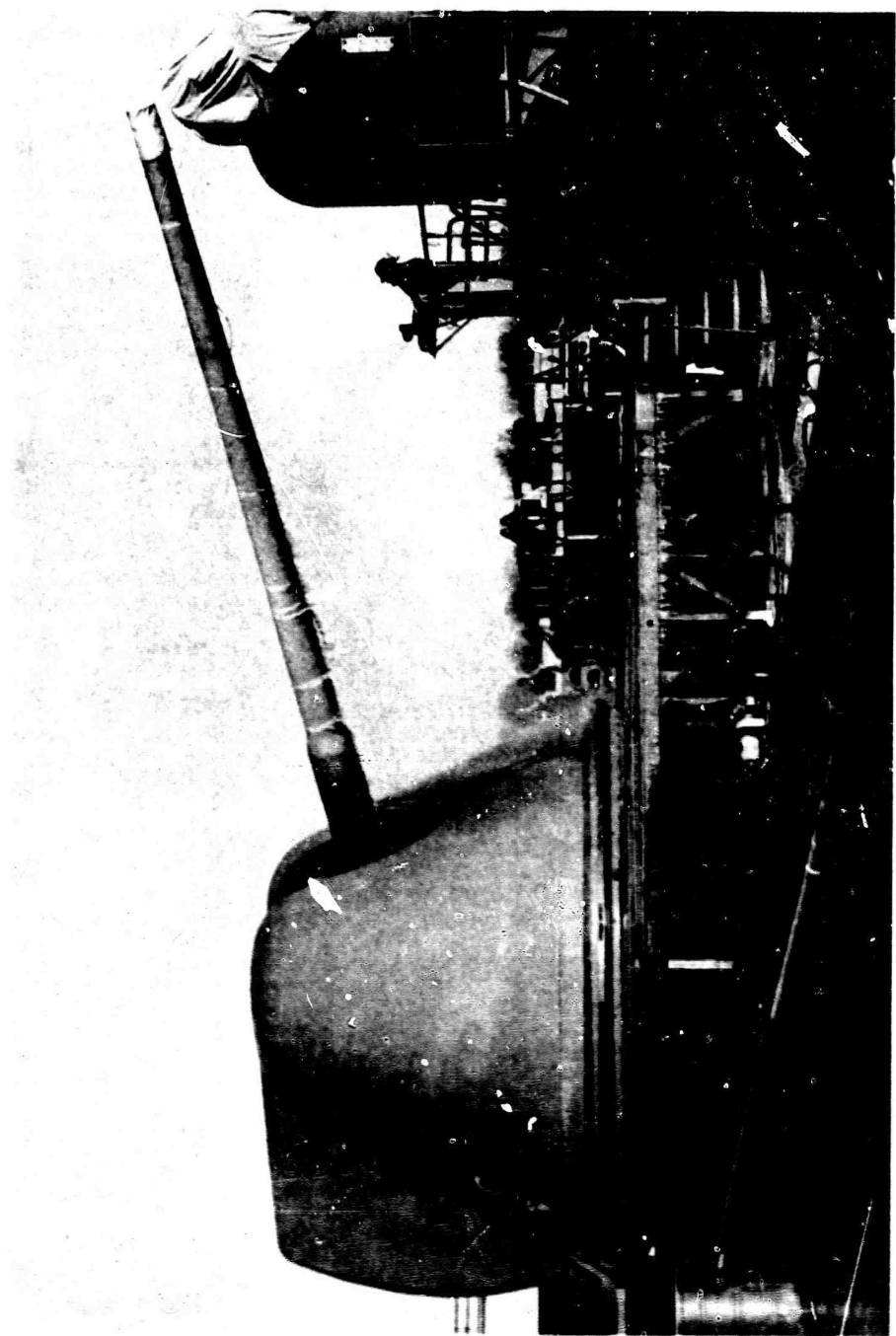


FIGURE 21

Carbon Monoxide Concentration vs Time for 8"0 MCLGM



A-22

PHD-2511-11-72

FIGURE 22

View of the 8" MCLGM During Anti-Icing Test



PHD-2512-11-72

FIGURE 23

View of the Gun Port Shield of the 8" 0 MCLGM During the Anti-Icing Test

APPENDIX B

**Problems Encountered During the TECHEVAL
Table B-1**

TABLE B-1
LIST OF PROBLEMS ENCOUNTERED DURING THE 8" MCLGM TECH EVAL

<u>Date (1971)</u>	<u>Description of Problem</u>	<u>Effect of Problem</u>	<u>Corrective Action</u>
9 September	Extractor cylinder operating piston cap was bowed.	Hydraulic leakage	A redesigned cap was installed.
25 September	Bracket for mounting the tachometer assembly to get empty case ejector traces was bent in shipment of the slide to NWL or in installation.	Cannot obtain velocity and position vs. time data for the empty case ejector (Part of MR card C-1 and Tech Eval. Test T-3).	An attempt was made to straighten the bracket, but could not be satisfactorily repaired and this test was omitted.
27-28 Sept	Photocell indicators overly sensitive giving wrong (loaded or unloaded) indications.	Gun stoppage	New type photocells (with the light source on the opposite side of the ammunition train) were installed. This was completed on 30 October.
28 Sept	Rammer failed to ram the round far enough for the round latch to extend.	Gun stoppage	Small pieces of plug were believed jamming between the case and the chamber. Use of the plug with a radius at the circumference and adding another spring on the cradle restrainer reduced plug chipping. Crimping the plugs carefully and removing chips around the crimp also reduced the probability of a chip jamming a case and causing a stoppage. The rammer extend indicating switch was adjusted since this was a possible cause.
Throughout the evaluation	Cartridge cases not extracting freely or partially separating.	Gun stoppage	Heat treating cases and dipping in a sulfuric acid solution, degreasing the ammunition and chamber, and thoroughly cleaning the ammunition corrected this problem at service charge pressures. For proof pressure charges, the heat treated cases were not satisfactory and no corrective action proved successful.
20 Oct	One pin of the Dither Pot in the train receiver regulator was in contact with a pin of a transformer.	Train acceleration too slow.	The Dither Pot was rotated 180° on the assembly and then the entire Dither assembly was rotated 180°.

TABLE B-1 (Continued)

<u>Date (1971)</u>	<u>Description of Problem</u>	<u>Effect of Problem</u>	<u>Corrective Action</u>
22 Oct	Primer blowback on reduced charge.	Misfire on next round because of fouled firing pin.	Problem is the design/quality control of the MARK 38 MOD 2 primer and not associated with the gun mount. No corrective action was taken which would allow the firing pin assembly to continue functioning after a blowback.
Prior to 29 Oct	Counter recoil piston picked up material from their bushings.	Problem was corrected before effects were severe.	New type bushings were installed with teflon seals. This work was completed on 29 Oct and no problems were encountered after that date.
Prior to 1 Nov	Cable not locked to empty case tray solenoid housing	Intermittent stoppage during simulate cycling.	Locked cable.
3 Nov	Fuze for anti-icing pump motor was too small.	Anti-icing pump wouldn't start.	Installed a 15-amp fuze.
11 Nov	Screw on switch actuator on the lower accumulator pump sheared.	Lower accumulator failed to start.	Replaced the screw.
12 Nov	Loose bolt at motor contactor in EP-1 panel.	Motors shut down during simulate cycling.	Tightened bolt.
12 Nov	Loose lead in EP-3 panel	Gun stoppage	Lead was pushed back in jack.

Note: Several instances of finding loose or shorted wires during checkout and maintenance are not listed because of their minor consequence.

APPENDIX C

**List of Technical Evaluation Tests
Table C-1**

TABLE C-1

**8"/55 MCLGM TECHNICAL EVALUATION
LIST OF TESTS CONDUCTED**

TRAIN POWER DRIVE TESTS

Accuracy Tests
Maximum Velocity and Acceleration Tests
Synchronizing Time Tests
Synchro Power Failure Tests
Limit Stop Tests
Emergency Limit Stop Tests
Frequency Response Tests

ELEVATION POWER DRIVE TESTS

Accuracy Tests
Maximum Velocity and Acceleration Tests
Synchronizing Time Tests
Synchro Power Failure Tests
Limit Stop Tests
Emergency Limit Stop Tests
Frequency Response Tests

AMMUNITION LOADING SYSTEM TESTS

Drum Indexing
Clip Transferring
Hoist Operation
Cradle Operation
Breechblock Operation
Empty Case Tray Operation
Rammer Operation
Hoist Pawl Positioner Operation
Round Centering Snubber and Latch Operation

AMMUNITION SELECTABILITY TEST

ELECTRICAL POWER CONSUMPTION TEST

TEST OF MISFIRE PROCEDURES

TEST OF REGUNNING PROCEDURES AND PROVISIONS

PROOF TESTS

CARTRIDGE ASSEMBLY TESTS

RATE OF FIRE TESTS

GUN JUMP TESTS

ACCURACY AND RANGE TABLE TESTS

BARREL LIFE AND VELOCITY LOSS STUDIES

PROJECTILE COOK-OFF TESTS

REDUCED CHARGE TESTS

SAFETY ANALYSIS

GUN BLAST TESTS

SMOKE AND FUMES TESTS

ANTI-ICING SYSTEM TEST

TABLE C 1 (Continued)

This differs from the list of tests in Reference 5 in the following ways:

AMMUNITION SELECTABILITY TEST. This test is listed separately rather than as a part of the loading system test.

HEAT RISE. This test was omitted because the schedule precluded doing it after installation of the air conditioning and before the OPEVAL was begun (the test was not regarded to be of primary importance). The heat exchanger was found to be leaking after the OPEVAL, and a new one is being procured. Plans are currently to perform this test after installation of a new heat exchanger and report results by separate correspondence.

RECOIL AND SHIPS LOADING. It is not planned to perform this test since there is doubt as to the importance of the results.

PROJECTILE/CARTRIDGE COOK-OFF. Projectile cook-off is listed but cartridge cook-off is not because it would not present the same degree of hazard if precautions are observed.

EMR INTERFERENCE. This test was conducted during the OPEVAL and is reported in Reference 5.

FIRE OUT. This test is combined with the other tests and not listed separately here.

SMOKE AND FUMES. Smoke and fumes data were accrued during both the TECHEVAL and OPEVAL, and are covered in this report as well as in Reference 6.

ANTI-ICING SYSTEM TEST. Weather conditions did permit some testing of the anti-icing system, hence it is included here.

APPENDIX D

Train Power Drive Test Data

Table D-1

Figures 1 Through 47

TABLE D-1

8"/55 MCLGM TECHNICAL EVALUATION
TRAIN POWER DRIVE TEST DATA

ACCURACY TESTS

Figure Number	Input Signal	Error (min)
1	Stationary	
1	60°	0.1
1	90°	0.1
1	120°	0.1
	Constant Velocity	
2	5°/sec	0.75
3	-5°/sec	0.5
4	15°/sec	1.3
4	-15°/sec	1.1
5	25°/sec	1.5
6	-25°/sec	1.75
	Simple Harmonic Motion (Amplitude-Period)	
7	30° - 9 sec	1.5
8	15° - 4.5 sec	10.0

MAXIMUM VELOCITY AND ACCELERATION TESTS

Figure Number	Maximum Velocity (deg/sec)	Max. Acceleration (deg/sec ²)
9	31	-62.2
10	-32	61.3

SYNCHRONIZING TIME TESTS

x Figure Number	Input Signal		Initial Error (deg)	Mount Motion Induced	Synchronizing Time (sec)
	Order ¹	Order ²			
11	Stationary	Stationary	-5	Right Train	0.63
12	Stationary	Stationary	+5	Left Train	0.68
13	Stationary	Stationary	-20	Right Train	1.31
14	Stationary	Stationary	+20	Left Train	1.32
15	Stationary	Stationary	-45	Right Train	2.10
16	Stationary	Stationary	+45	Left Train	2.09
17	Stationary	Stationary	-90	Right Train	3.50
18	Stationary	Stationary	+90	Left Train	3.48
19	Stationary	C.V. 5°/sec	0	Right Train	0.44
20	Stationary	C.V. 5°/sec	-60	Right Train	2.89
21	Stationary	C.V. 10°/sec	0	Right Train	0.39
22	Stationary	C.V. 5°/sec	+60	Left, Then Right	2.31
23	Stationary	C.V. 10°/sec	+60	Left, Then Right	2.12

TABLE D-1 (Continued)

SYNCHRO POWER FAILURE TESTS

Figure Number	Mount Motion	Maximum Deceleration (deg/sec ²)	Distance Traveled After Failure (From Dials)
24	Right Train 31.9 deg/sec	105.5	9° 9'
25	Left Train 32 deg/sec	104.2	10° 23'

LIMIT STOP TESTS

Figure Number	Mount Motion Into Stop Direction	Velocity	Maximum Deceleration (deg/sec ²)
26	Right Train	15 deg/sec	51.3
27	Left Train	-15 deg/sec	42.7
28	Right Train	Maximum	45.5
29	Left Train	Maximum	48.0

Figure Number	Mount Order	Mount Motion Out of Stop	Synchronizing Time (sec)
30	Constant Velocity of 15°/sec	Right Train	0.24
31	Constant Velocity of -15°/sec	Left Train	0.24

EMERGENCY LIMIT STOP TESTS

Figure Number	Mount Motion Into Stop Direction	Velocity	Maximum Deceleration (deg/sec ²)	Distance Traveled Past Stop Setting (From Dials)
32	Right Train	15 deg/sec	88	1° 46'
33	Left Train	-15 deg/sec	67	1° 49'
34	Right Train	Maximum	88	6° 59'
35	Left Train	Maximum	77	7° 10'

FREQUENCY RESPONSE TESTS

Figure Number	SHM Input Signal Frequency (Hz)	Amplitude Ratio Output/Input	Approximate Phase Angle (deg)
36	0.23	1.05	0
37	0.48	1.12	7.0
38	0.68	1.15	4.9
39	0.89	1.30	9.6
40	1.4	1.45	20.0
41	2.0	1.55	45.4
42	2.8	1.45	68.0
43	3.6	1.28	146
44	3.9	0.90	166
45	5.3	0.20	157
46	7.4	0.33	154
47	7.9	0.33	163

Figure 1 Accuracy Test, stationary input signal, mount trained at 60°, 90° and 120°.

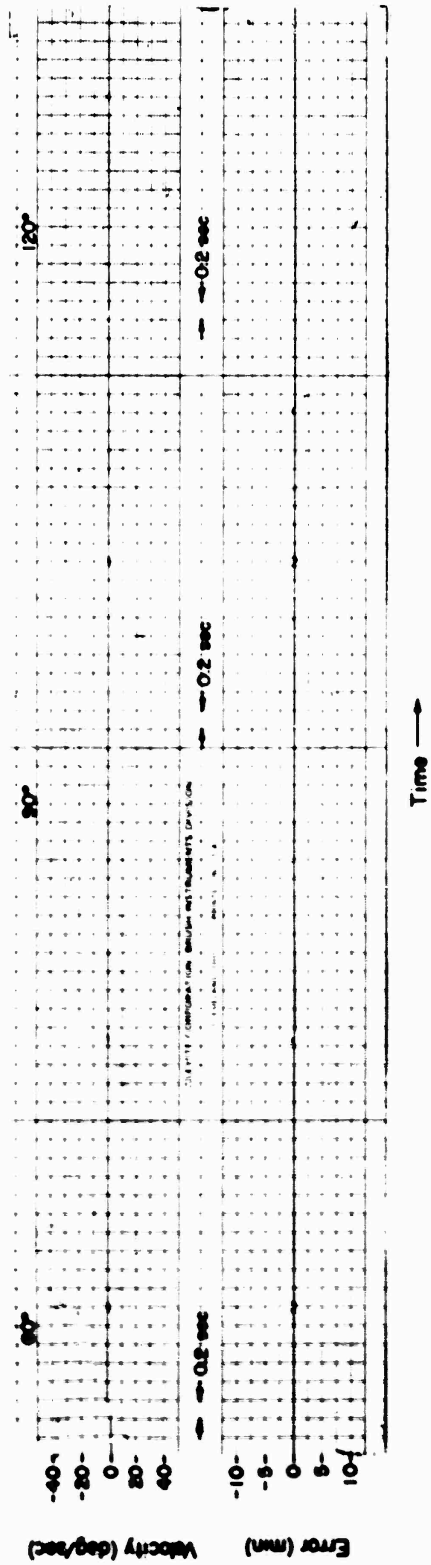


Figure 2 Accuracy Test, constant velocity input signal of 5°/sec (right train).

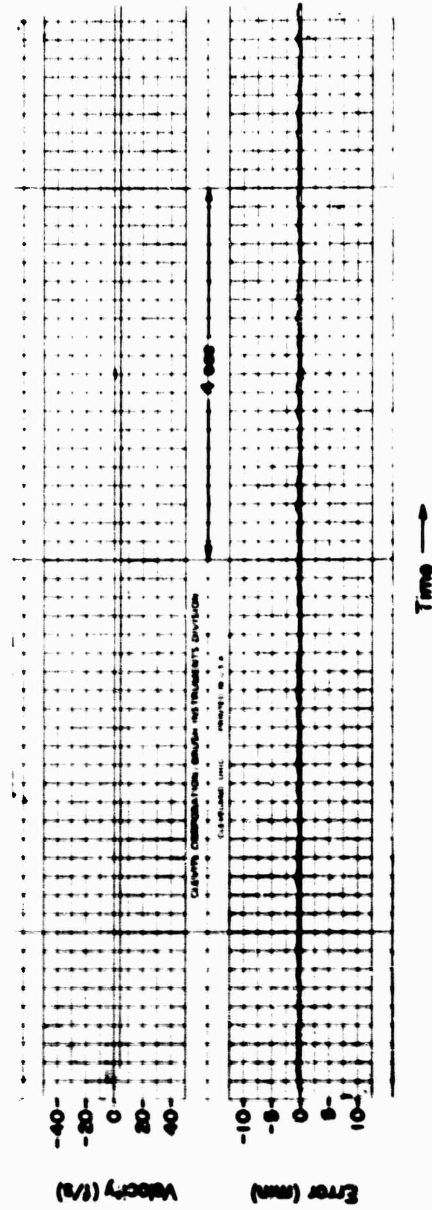


Figure 5. Accuracy Test, constant velocity input signal of 25°/sec.

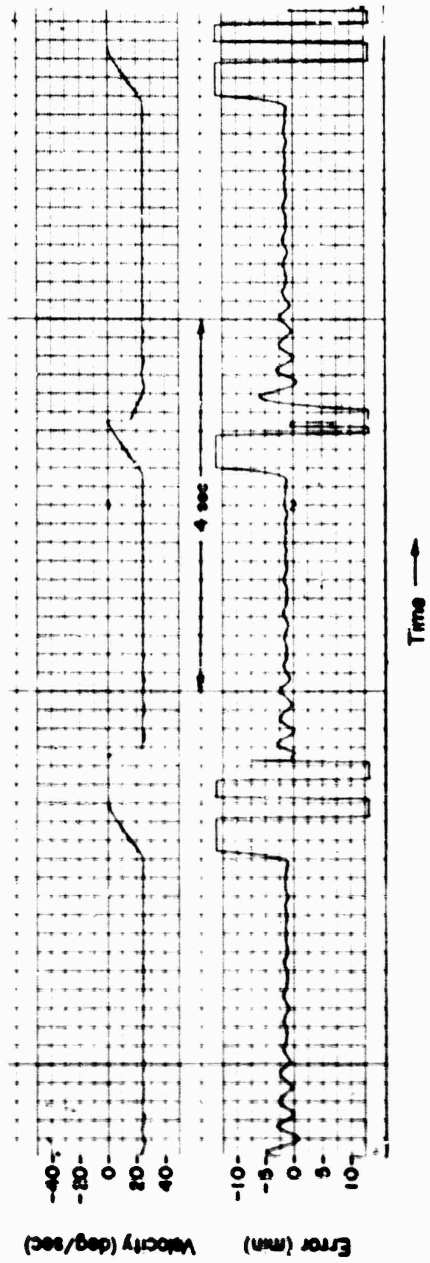


Figure 6. Accuracy Test, constant velocity input signal of -25°/sec.

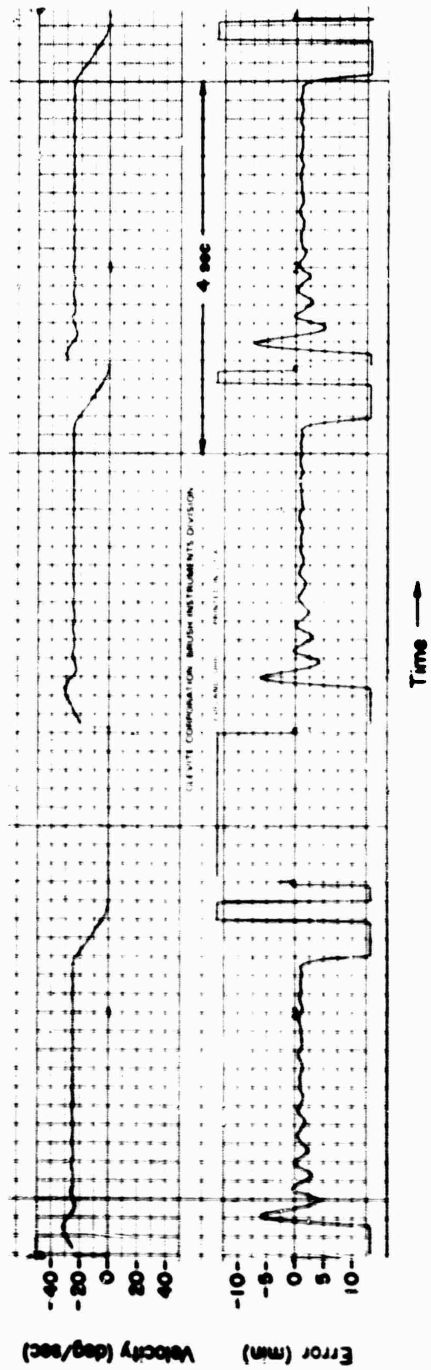
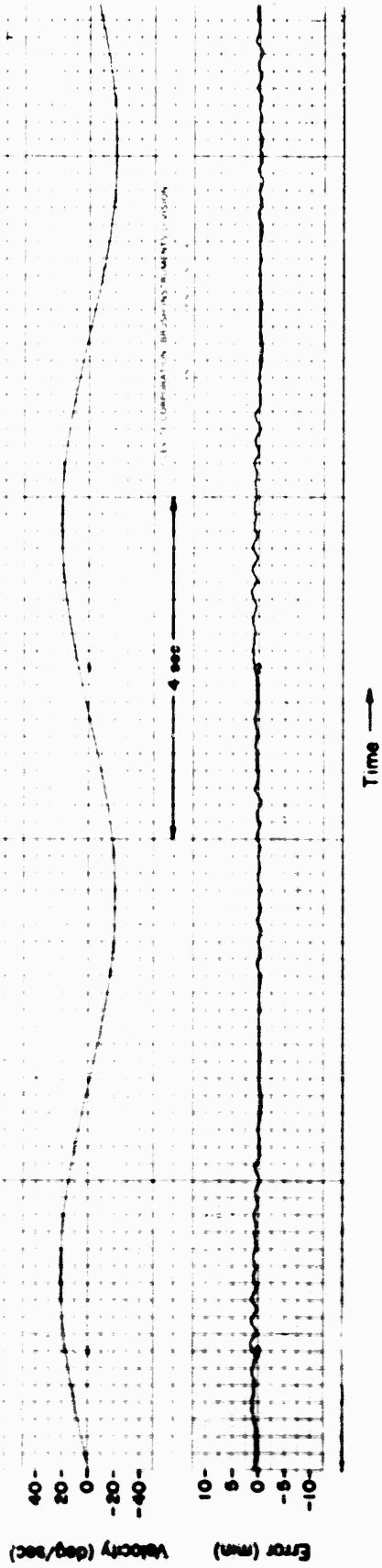


Figure 7 Accuracy Test, SHM input signal of 30° amplitude and 9 sec period.



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Figure 8 Accuracy Test, SHM input signal of 15° amplitude and 4.5 sec period.

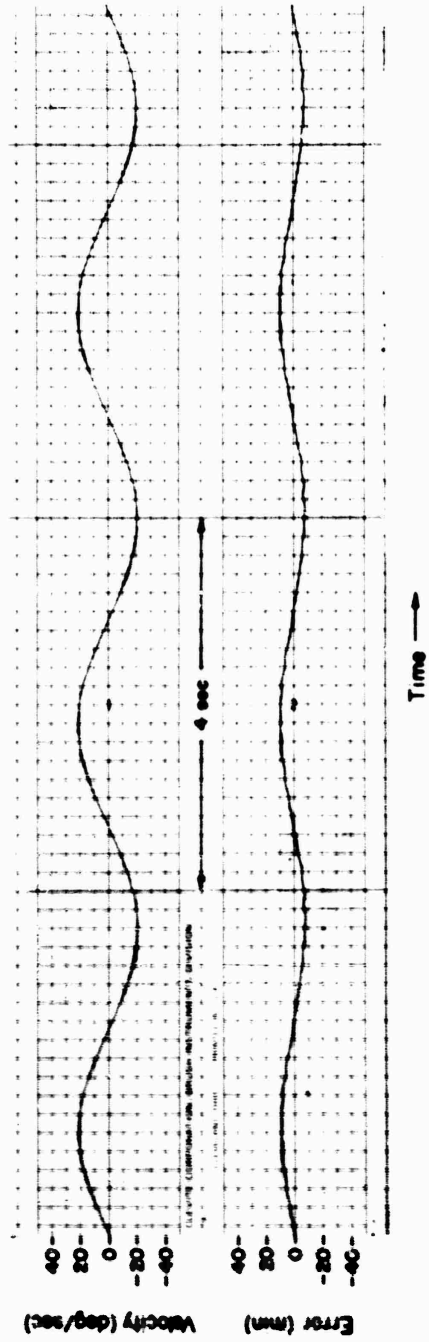


Figure 9. Maximum Velocity and Acceleration Test, stationary input signals: Fixed point to a point to the right and back (after maximum right train velocity is reached) to the original point.

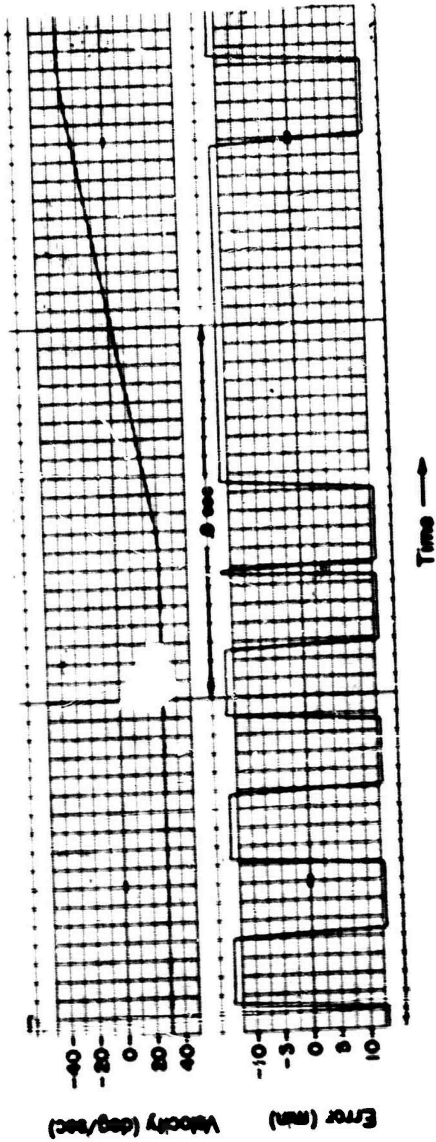


Figure 10. Minimum Velocity and Acceleration Test, stationary input signals: Fixed point to a point to the left and back (after maximum left train velocity is reached) to the original point.

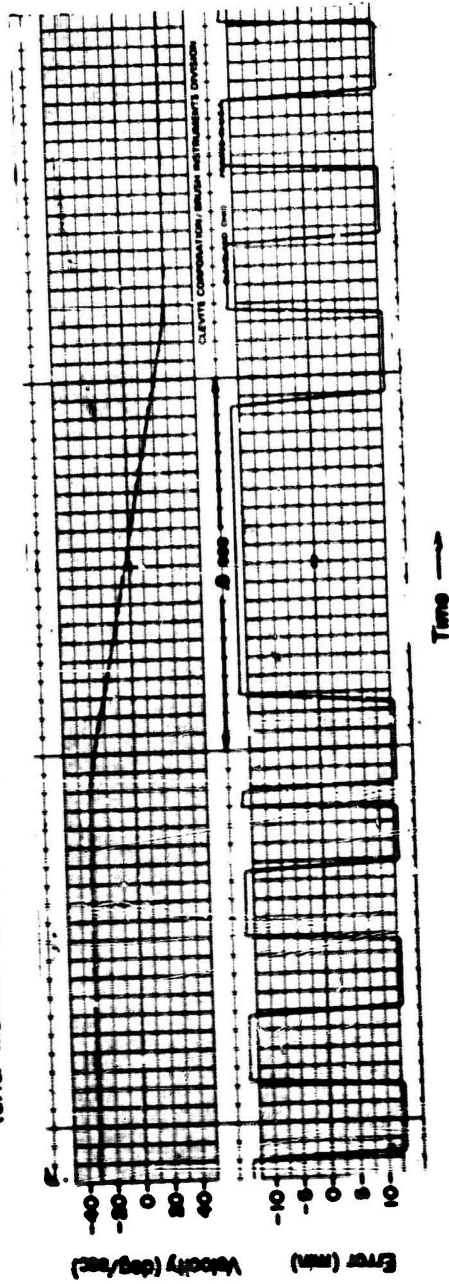


Figure 11. Synchronizing Time Test, stationary input signal 5° to the right.

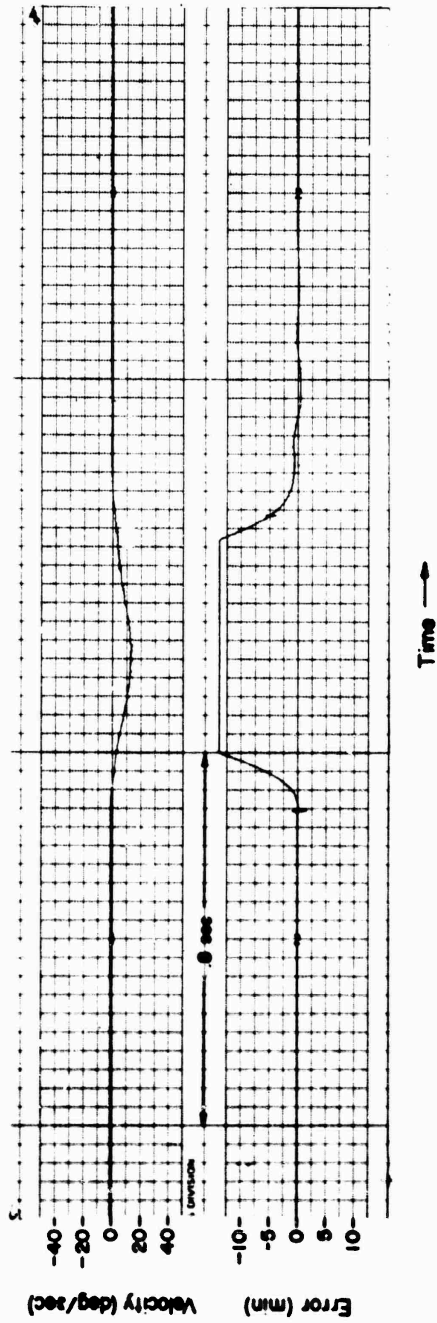


Figure 12. Synchronizing Time Test, stationary input signal 5° to the left.

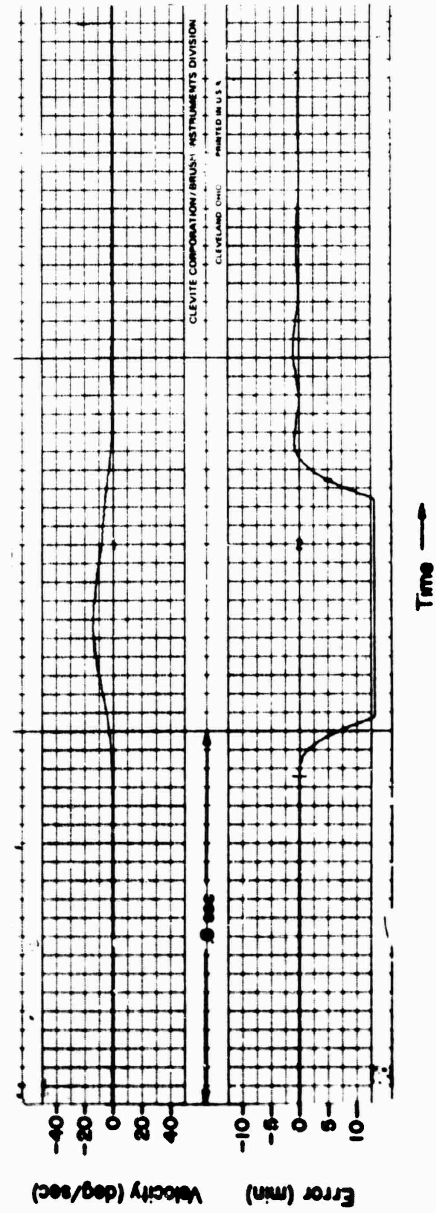


Figure 13. Synchronizing Time Test, stationary input signal 20° to the right.

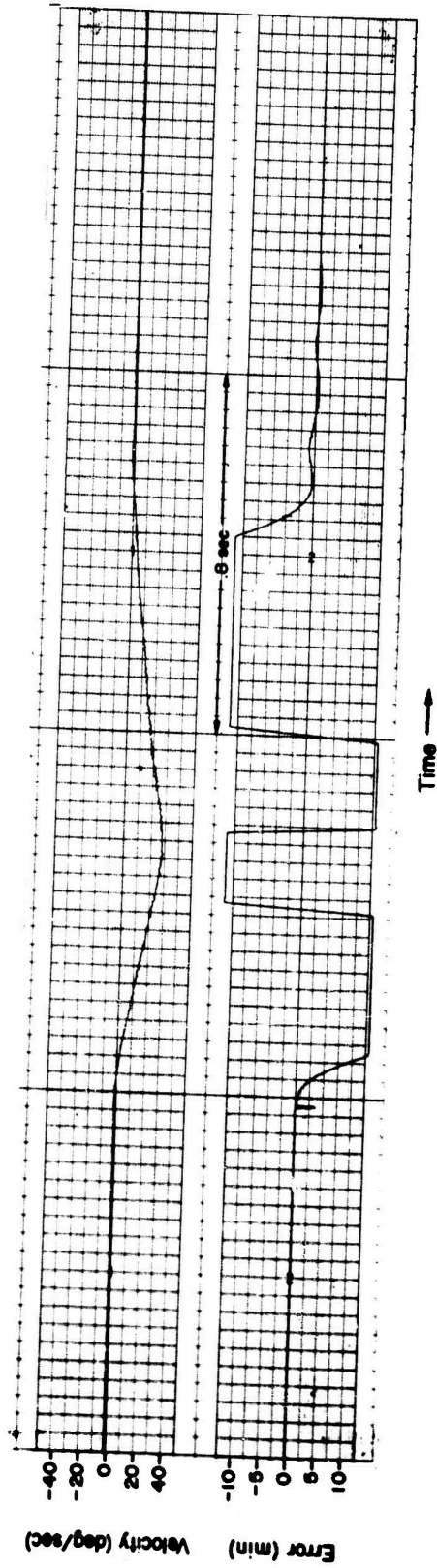


Figure 14. Synchronizing Time Test, stationary input signal 20° to the left.

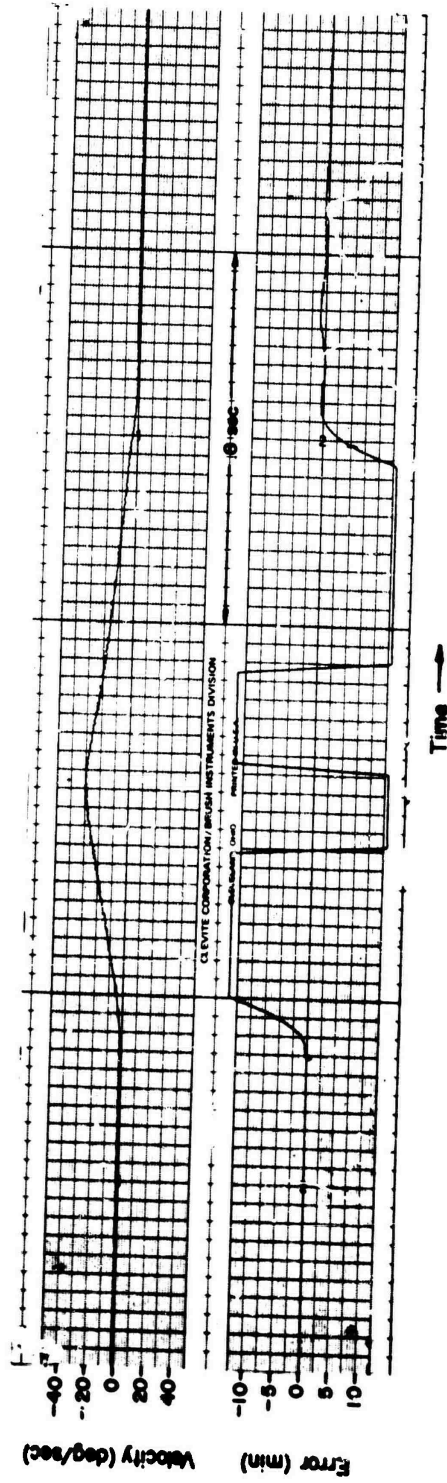


Figure 15. Synchronizing Time Test, stationary input signal 45° to the right.

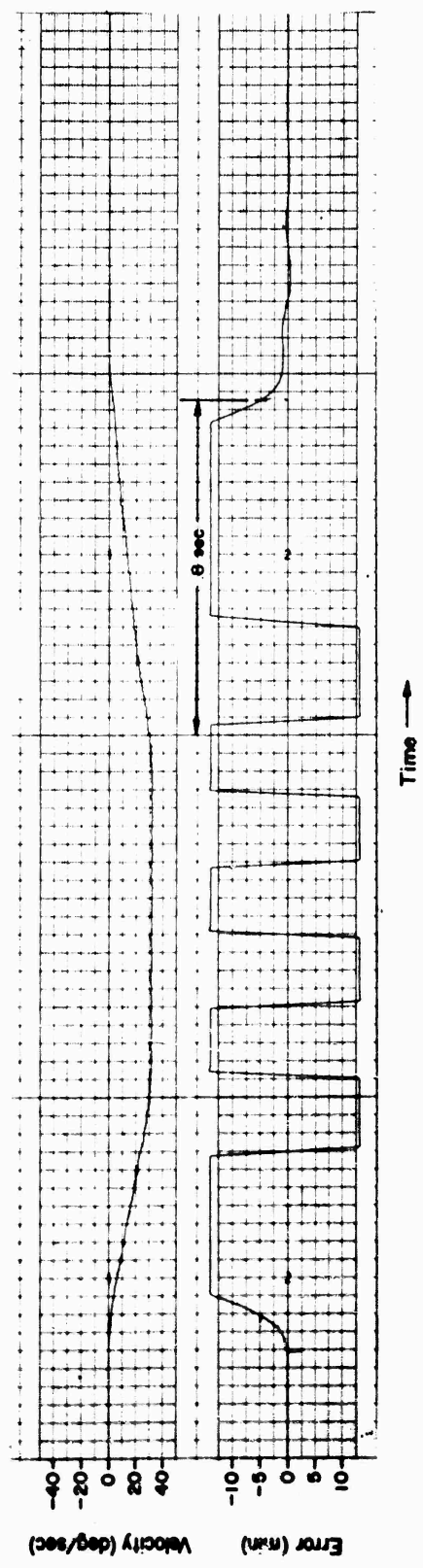


Figure 16. Synchronizing Time Test, stationary input signal 45° to the left.

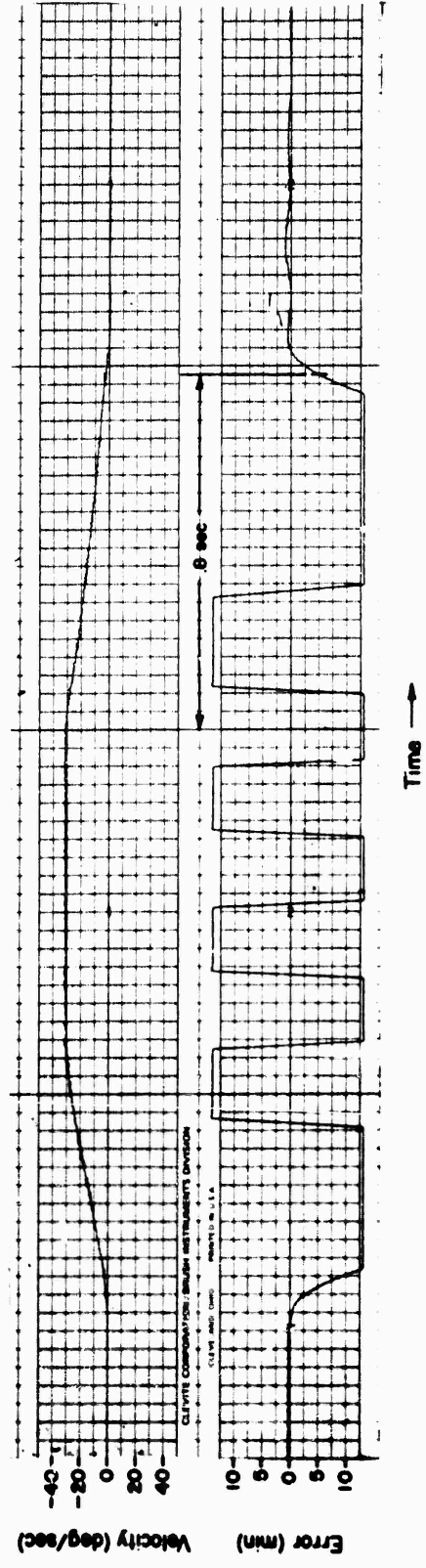


Figure 17 Synchronizing Time Test, stationary input signal 90° to the right

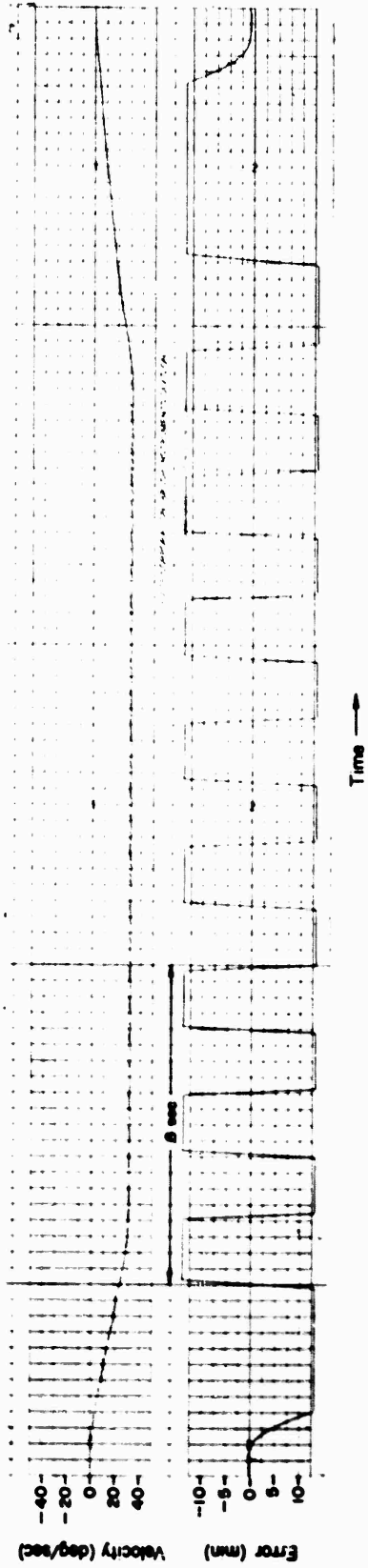


Figure 18 Synchronizing Time Test, stationary input signal 90° to the left

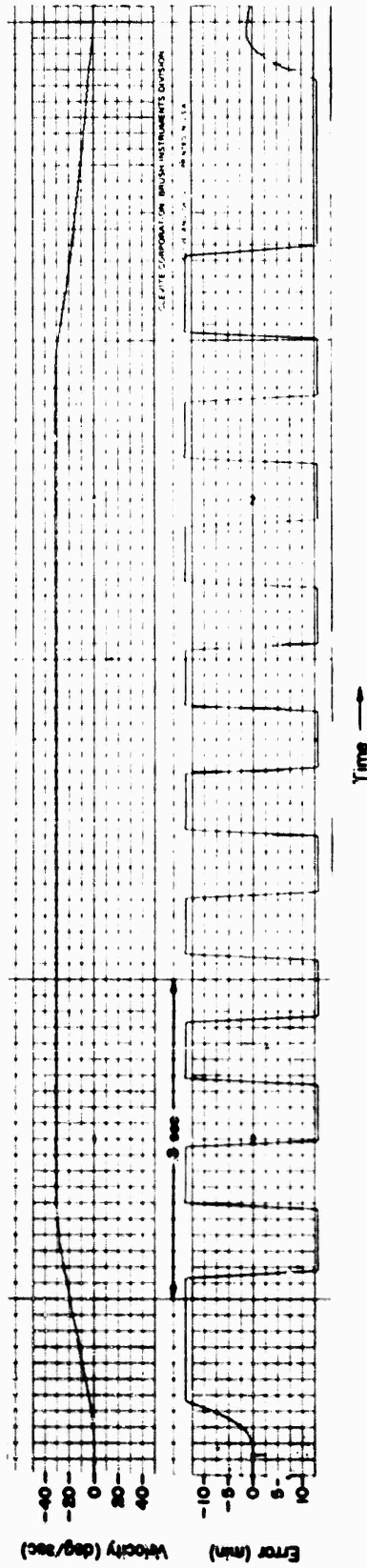


Figure 19. Synchronizing Time Test, constant velocity input signal of 5°/sec, initial error of 0°

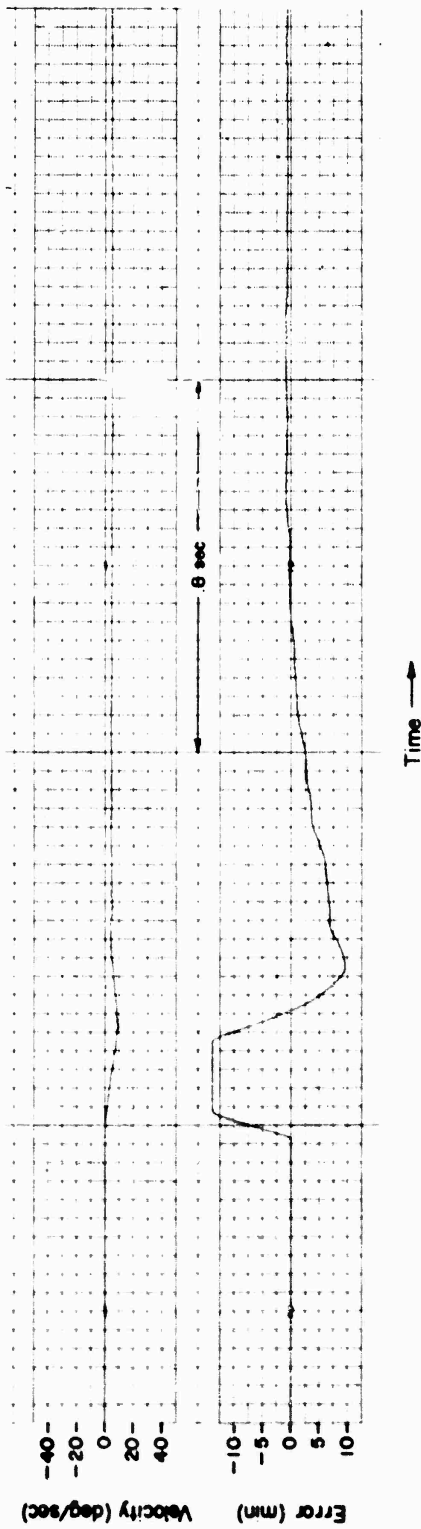


Figure 20. Synchronizing Time Test, constant velocity input signal departing gun position of -60° (mount trains to the right to synchronize, then trains to the right at constant velocity).

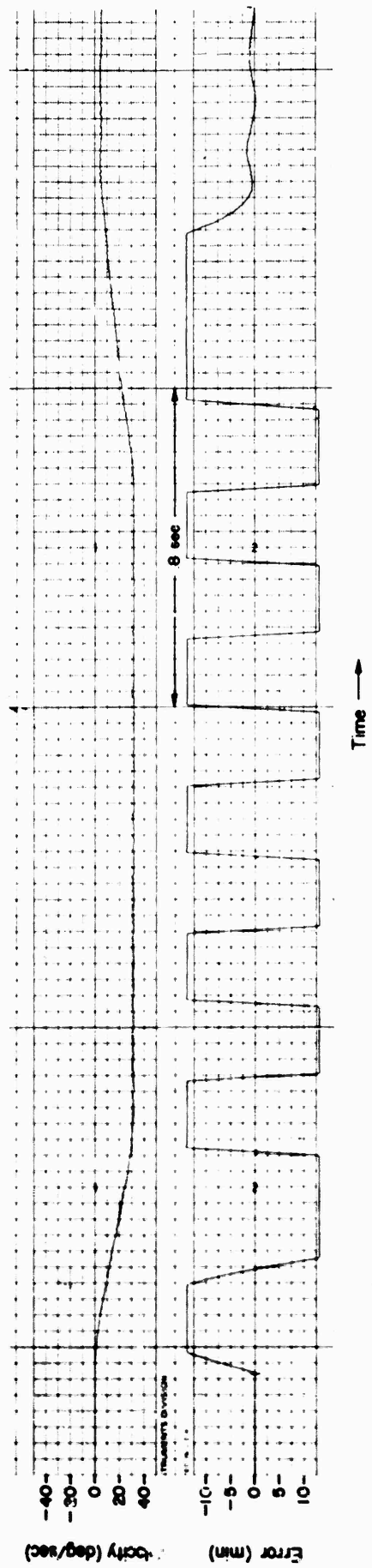


Figure 21. Synchronizing Time Test, constant velocity input signal of 10°/sec, initial error of 0°.

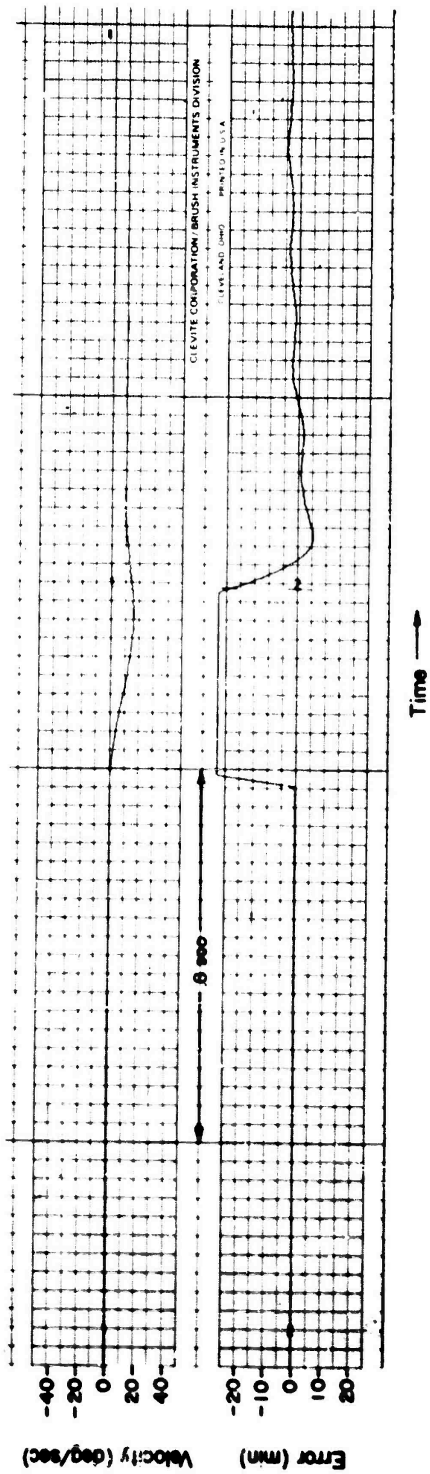


Figure 22. Synchronizing Time Test, constant velocity input signal approaching gun position of 60° (mount trains to the left to synchronize, then trains to the right).

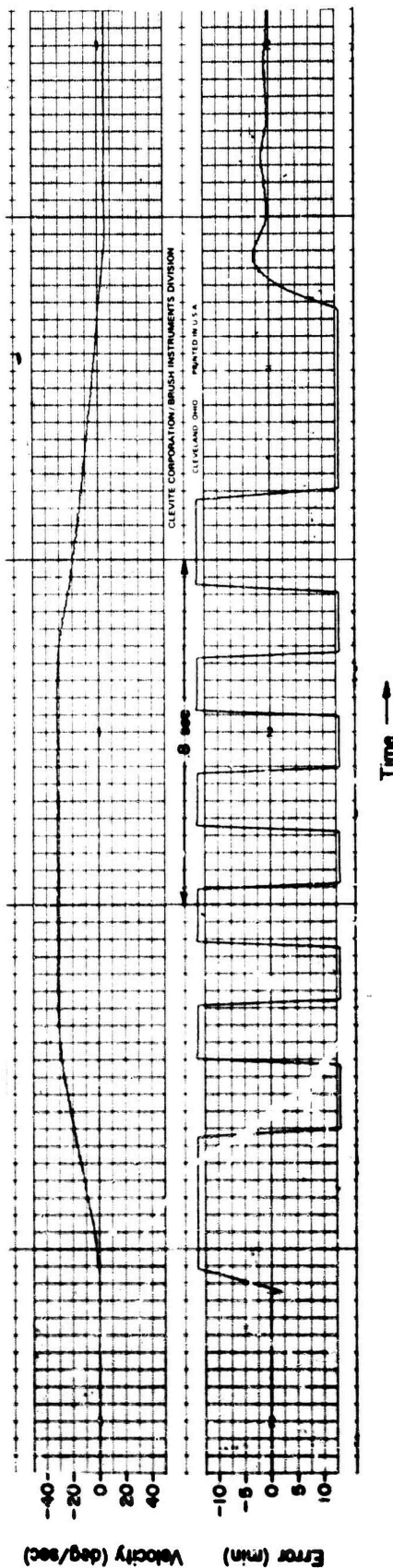


Figure 23. Synchronizing Time Test, constant velocity input signal approaching gun position of 60° (mount trains to the left to synchronize, then trains to the right).

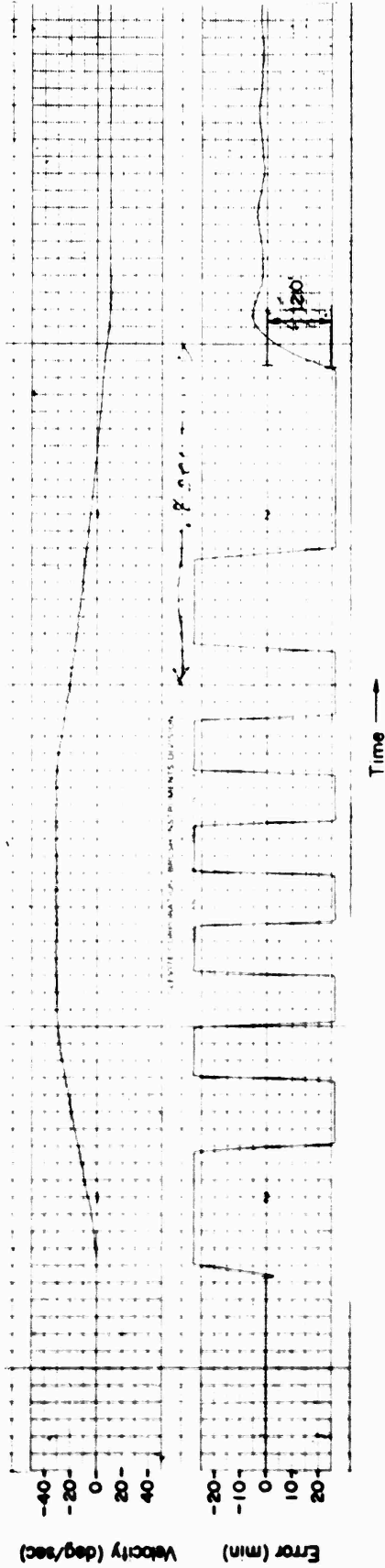


Figure 24. Synchro Power Failure Test, stationary input signals: Fixed point to the right. Pip on position trace indicates interruption of synchro power.

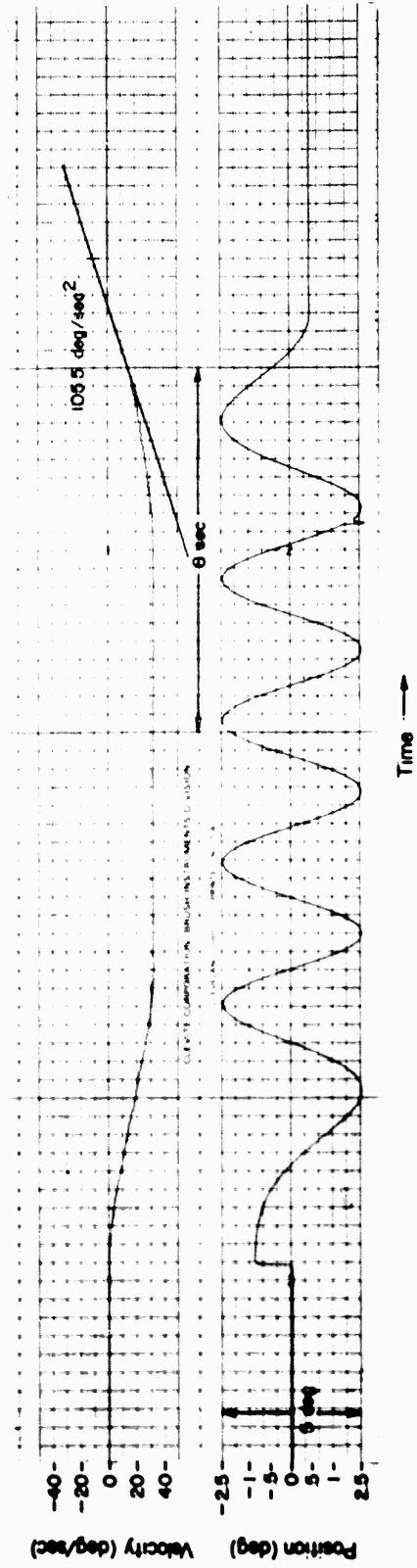


Figure 25. Synchro Power Failure Test, stationary input signals Fixed point to the left. Pip on position trace indicates interruption of synchro power.

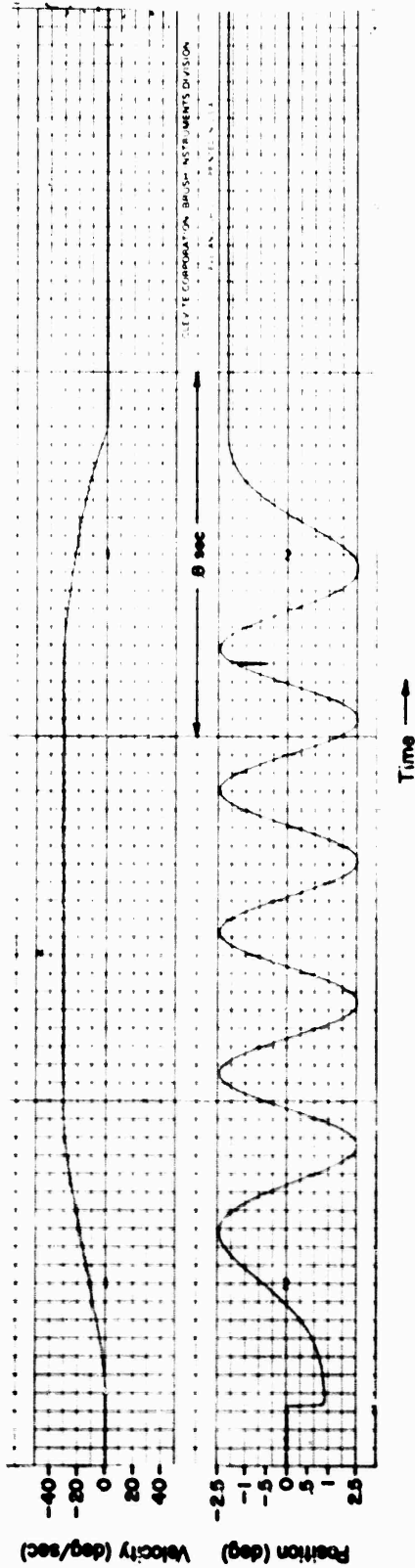


Figure 26. Limit Stop Test, constant velocity input signal of 157/sec (trained into right limit stop).

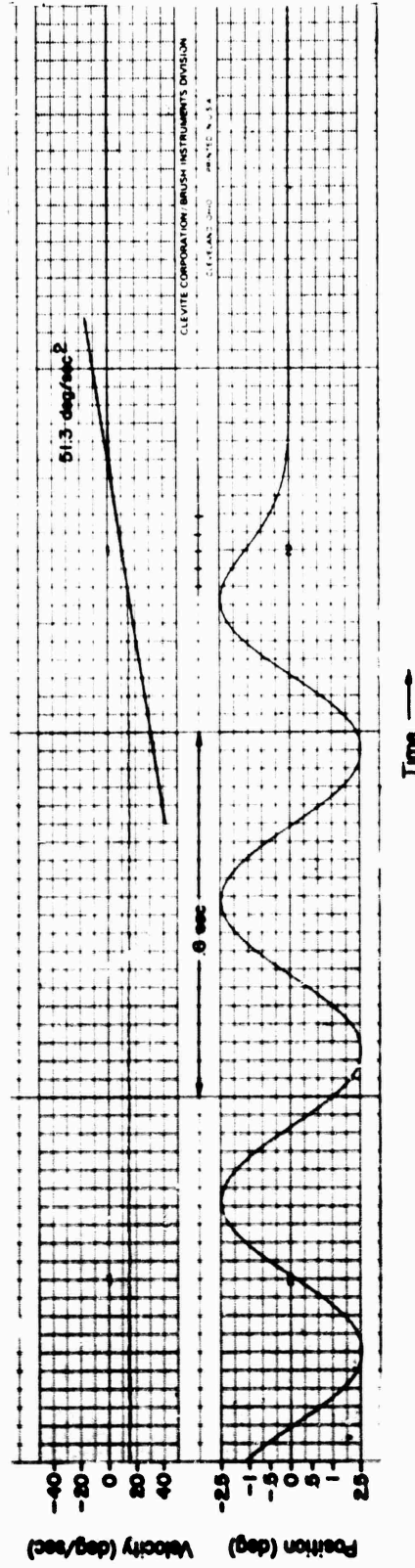


Figure 27. Limit Stop Test, constant velocity input signal of -157/sec (trained into left limit stop).

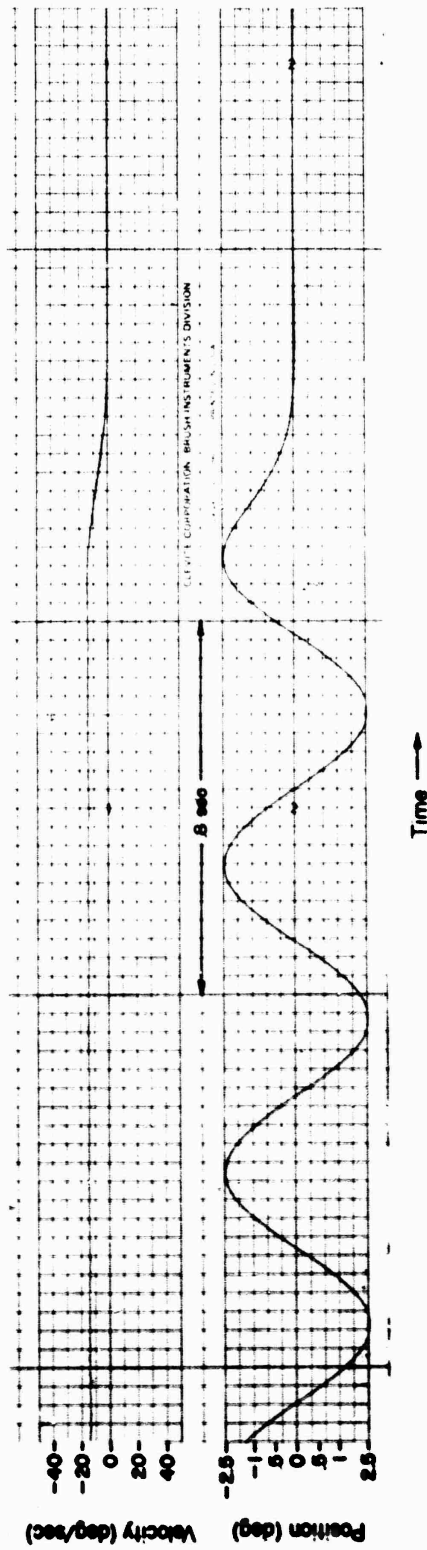


Figure 28. Limit Stop Test, stationary input signals: Fixed point to the right beyond the right limit stop (trained into right limit stop of maximum velocity).

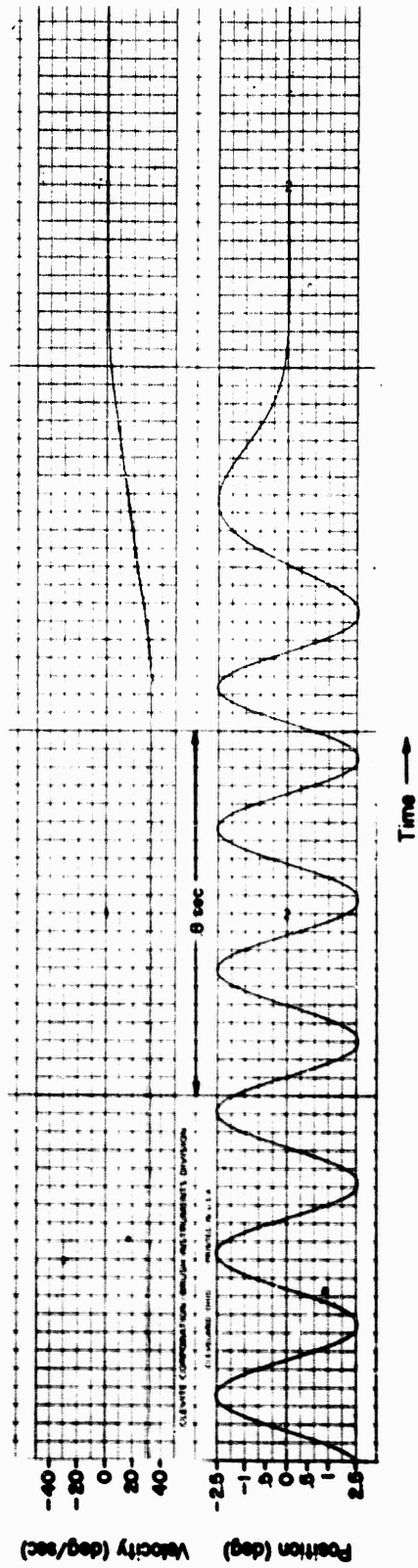


Figure 29. Limit Stop Test, stationary input signals: Fixed point to a point to the left beyond the left limit stop (trained into left limit stop of maximum velocity).

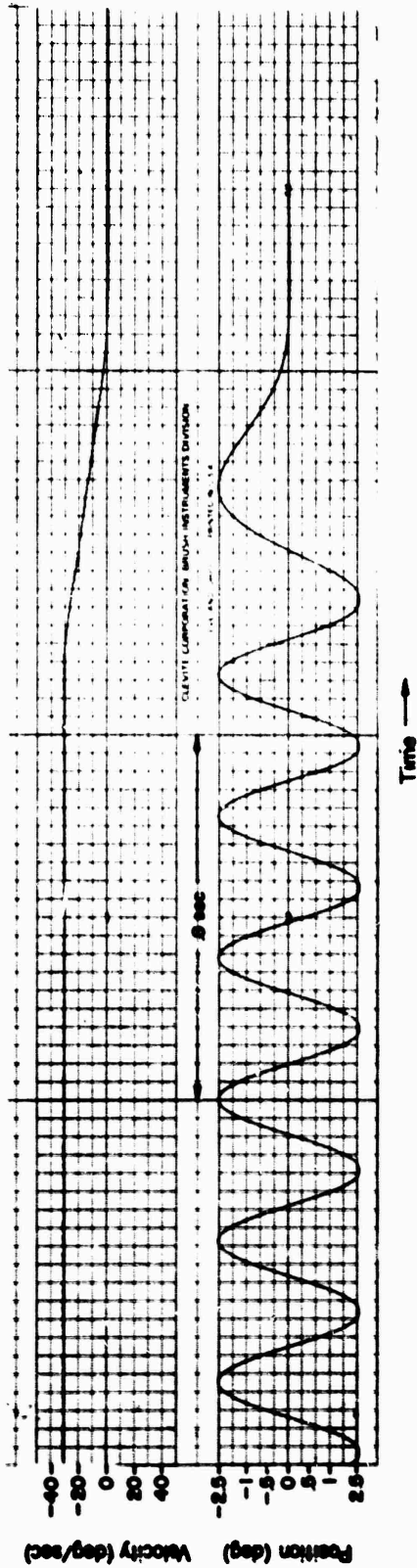


Figure 30. Limit Stop Test, constant velocity input signal of 157/sec (trained out of left limit stop).

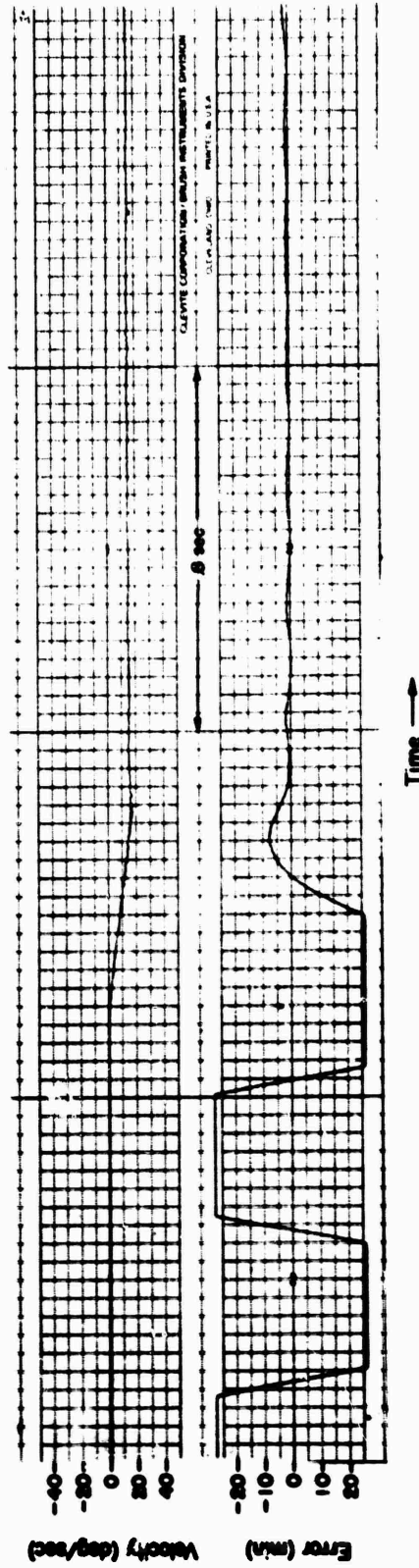


Figure 31. Limit Stop Test, constant velocity input signal of $-15^\circ/\text{sec}$ (trained out of right limit stop).

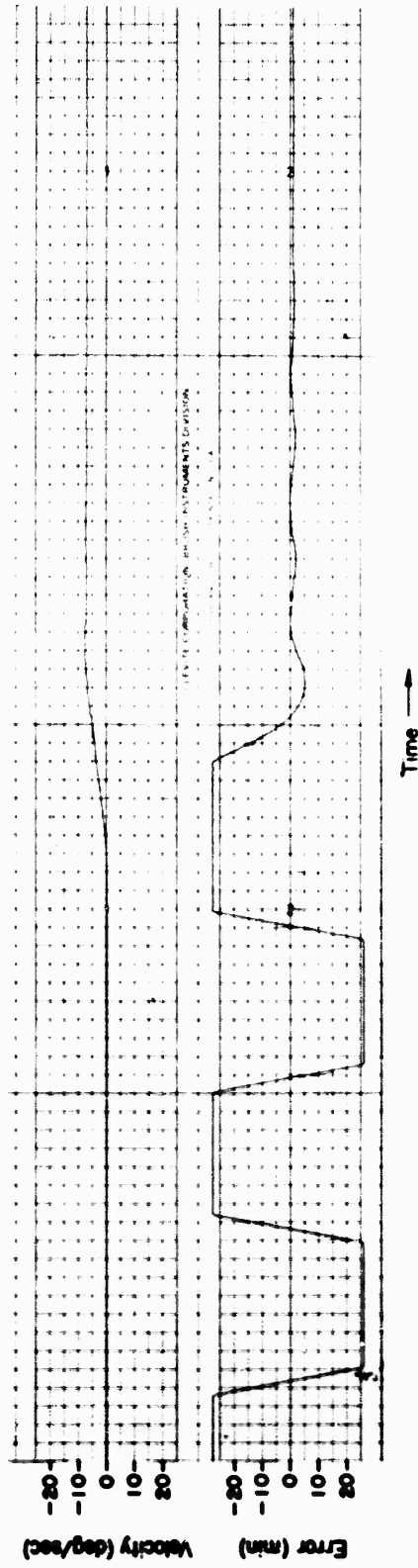


Figure 32. Emergency Limit Stop Test, constant velocity input $15^\circ/\text{sec}$ (trained into right emergency limit stop).

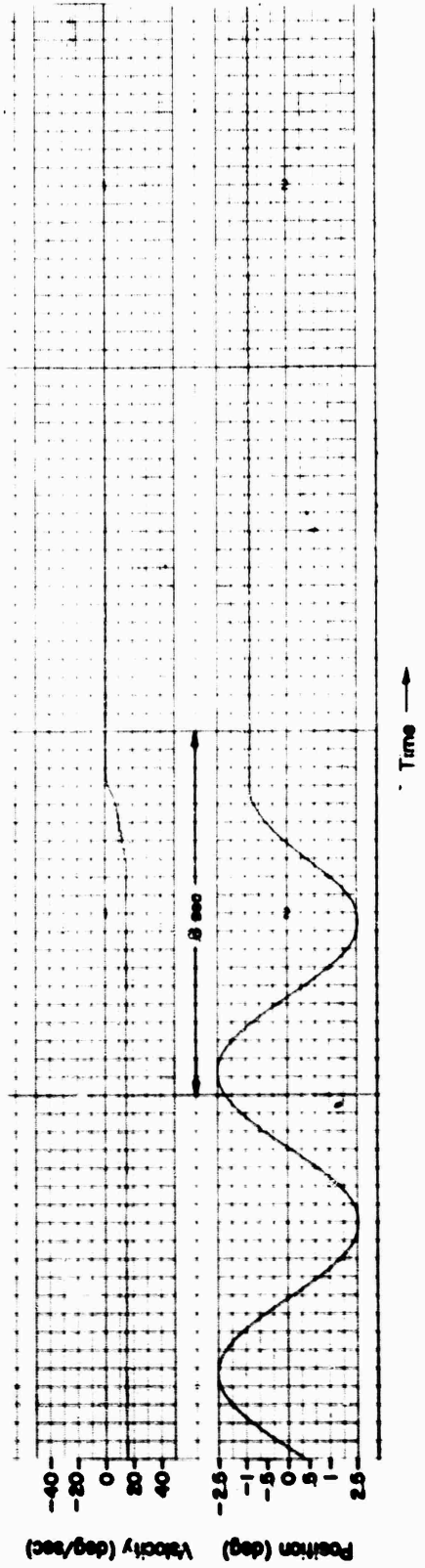
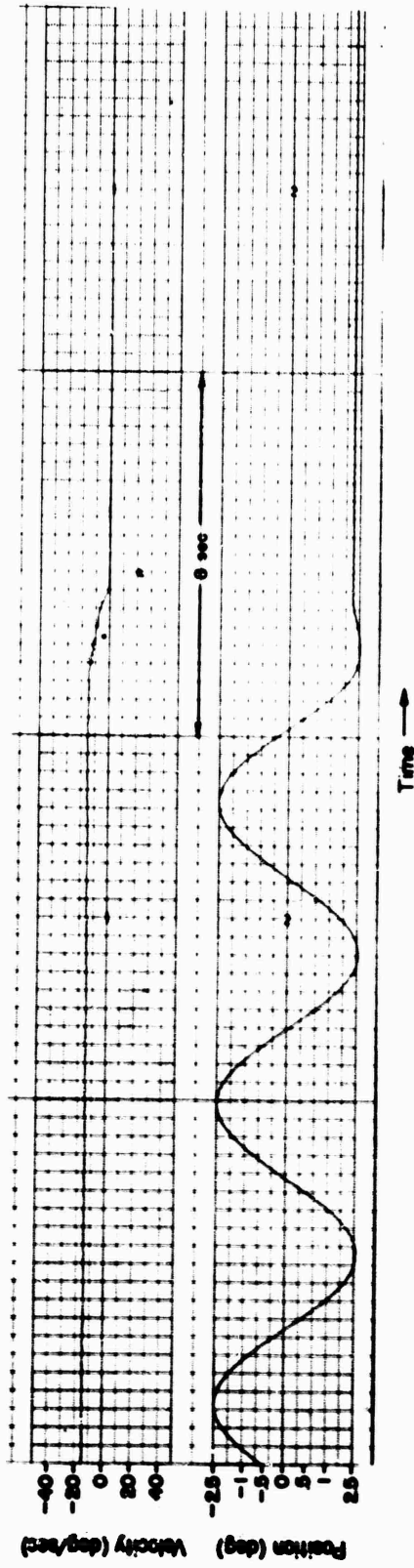


Figure 33. Emergency Limit Stop Test, constant velocity input signal of $-15^\circ/\text{sec}$ (traced into left emergency limit stop).



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Figure 34. Emergency Limit Stop Test, stationary input signal: Fized point to a point to the right beyond the right emergency limit stop (traced into right emergency limit stop at maximum velocity).

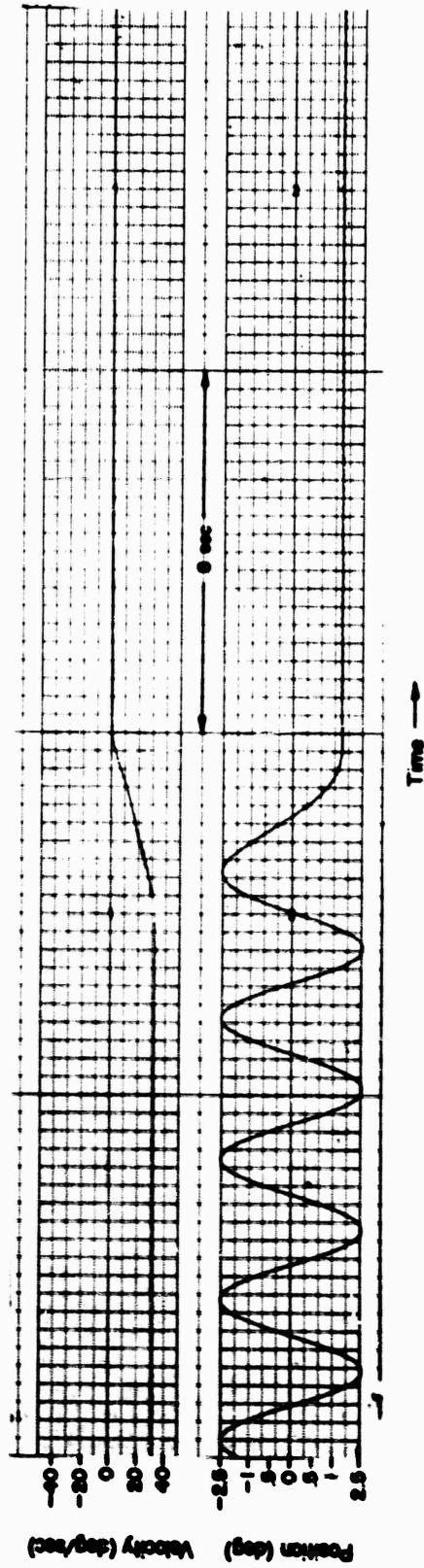


Figure 35 Emergency Limit Stop Test, stationary input signals Fixed point to a point to the left beyond the left emergency limit stop (traced into left emergency limit stop at maximum velocity)

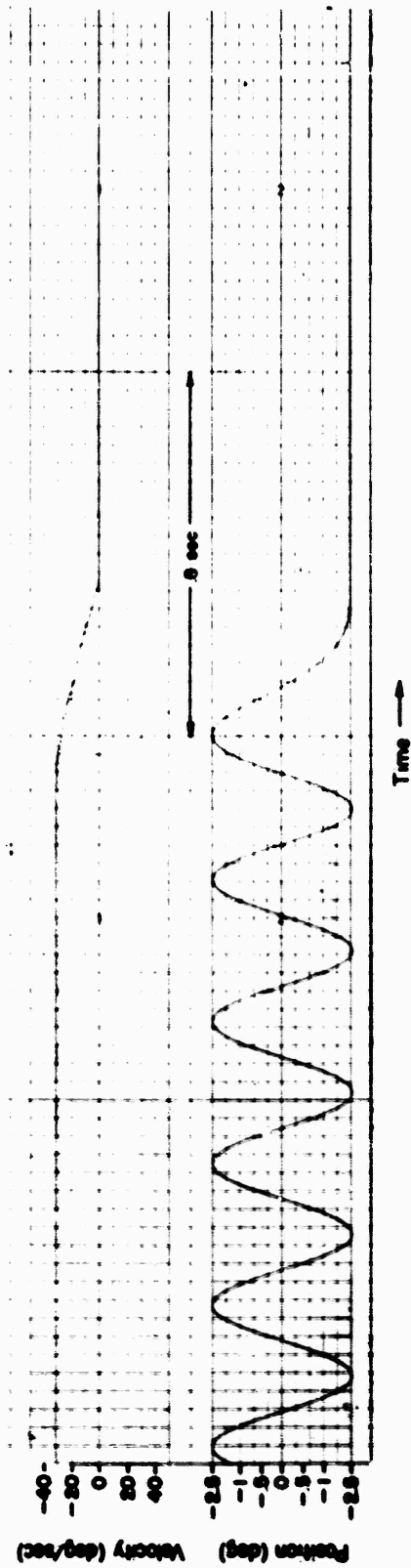


Figure 36 Frequency Response Test, SHM input of 3' amplitude, 0.23 Hz frequency

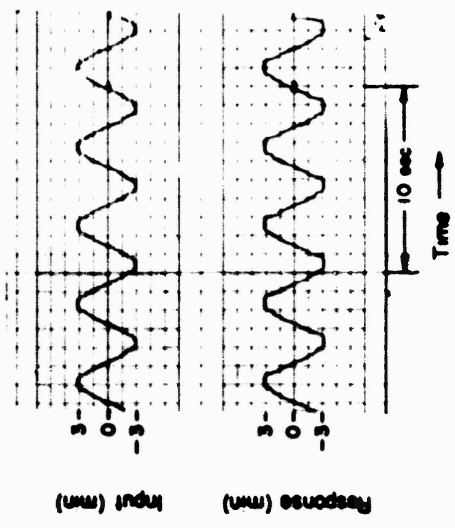


Figure 37. Frequency Response Test, SHM input of 3' amplitude, 0.48Hz frequency.

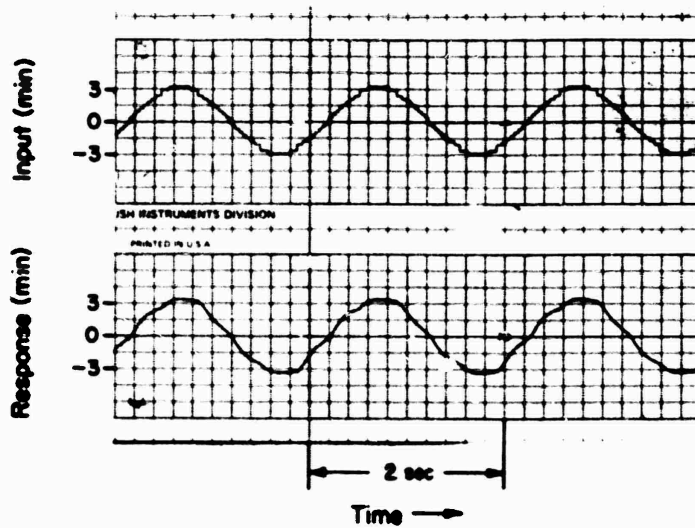


Figure 38. Frequency Response Test, SHM input of 3' amplitude, 0.68Hz frequency.

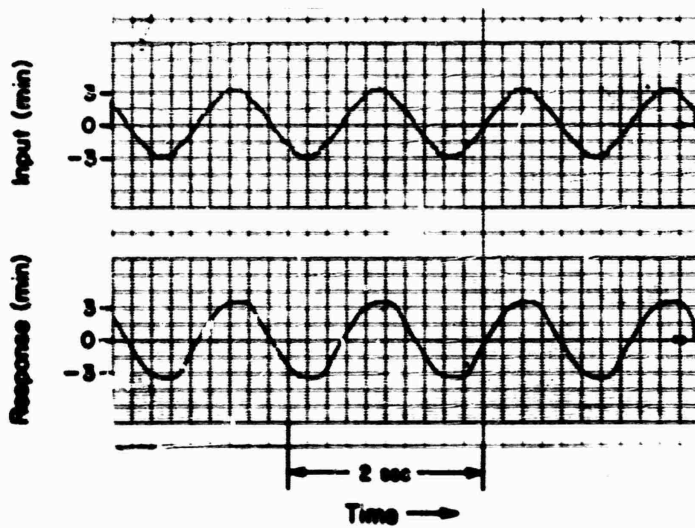


Figure 39. Frequency Response Test, SHM input of 3' amplitude, 0.69Hz frequency.

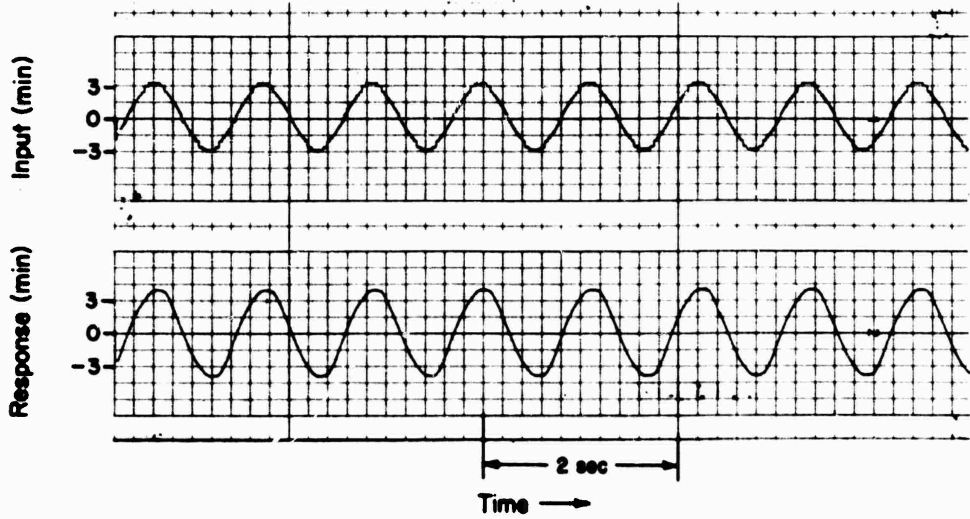


Figure 40. Frequency Response Test, SHM input of 3' amplitude, 1.4 Hz frequency.

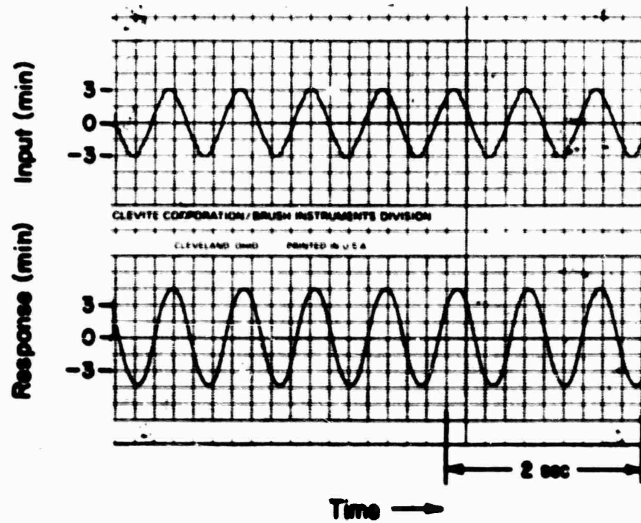


Figure 41. Frequency Response Test, SHM input of 3' amplitude, 2.0Hz frequency.

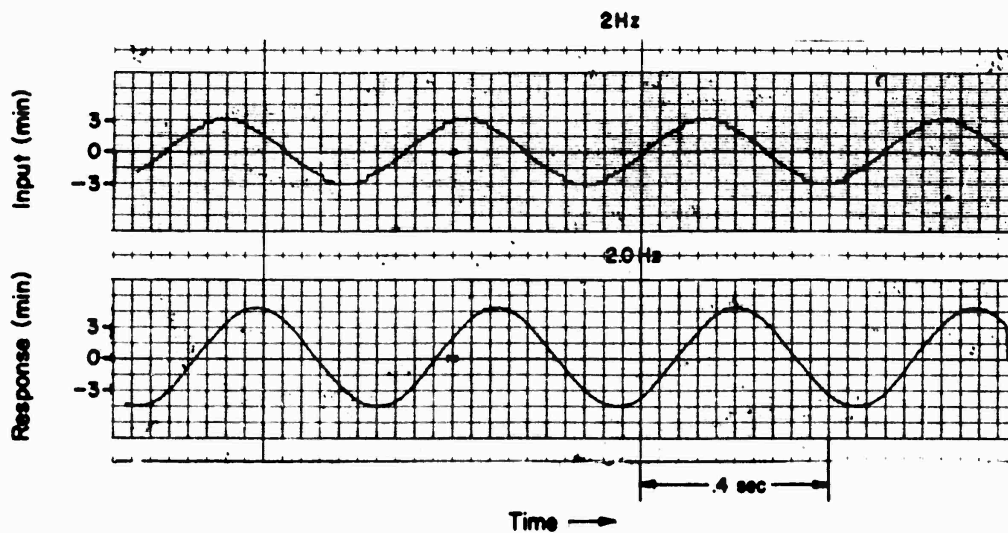


Figure 42. Frequency Response Test, SHM input of 3' amplitude, 2.8Hz frequency.

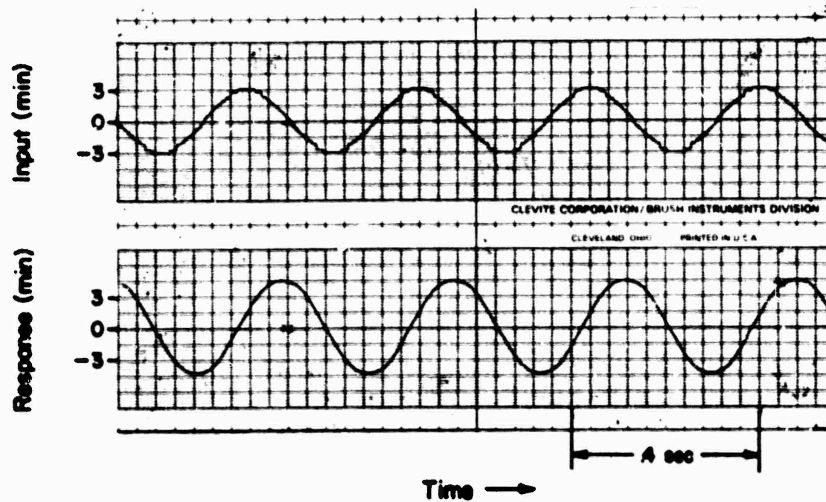


Figure 43. Frequency Response Test, SHM input of 3' amplitude, 3.6Hz frequency.

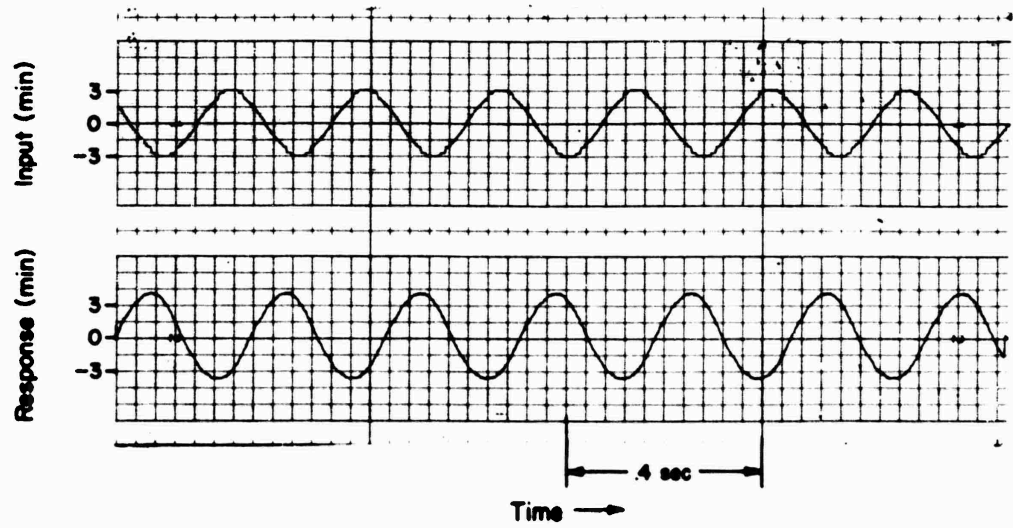


Figure 44. Frequency Response Test, SHM input of 3' amplitude, 3.9Hz frequency.

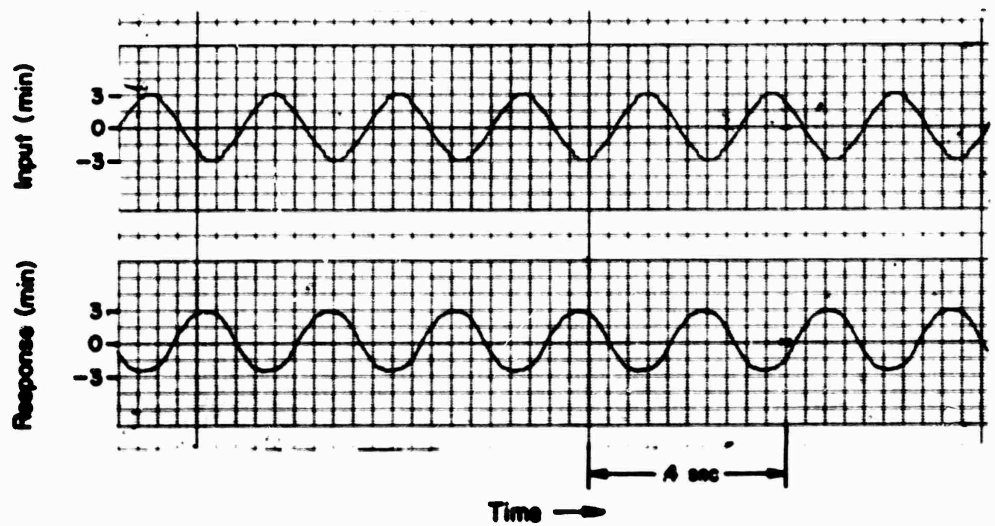


Figure 45. Frequency Response Test, SHM input of 3' amplitude, 5.3Hz frequency.

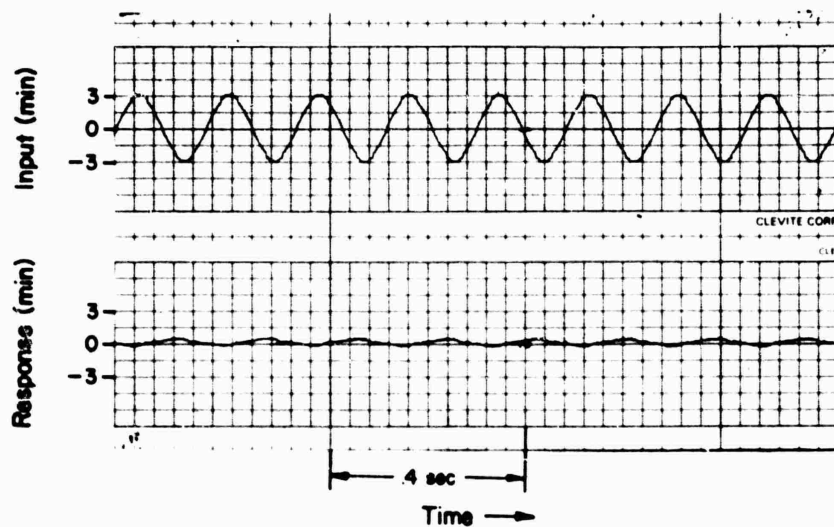


Figure 46. Frequency Response Test, SHM input of 3' amplitude, 7.4 Hz frequency.

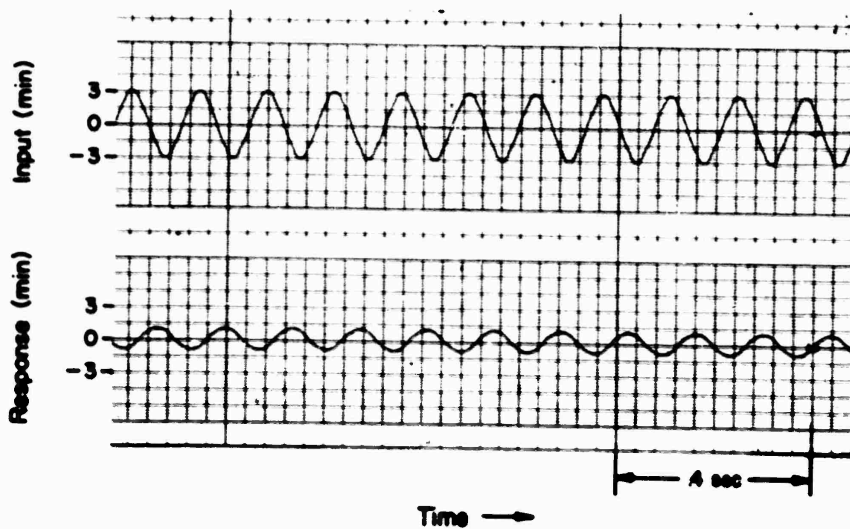
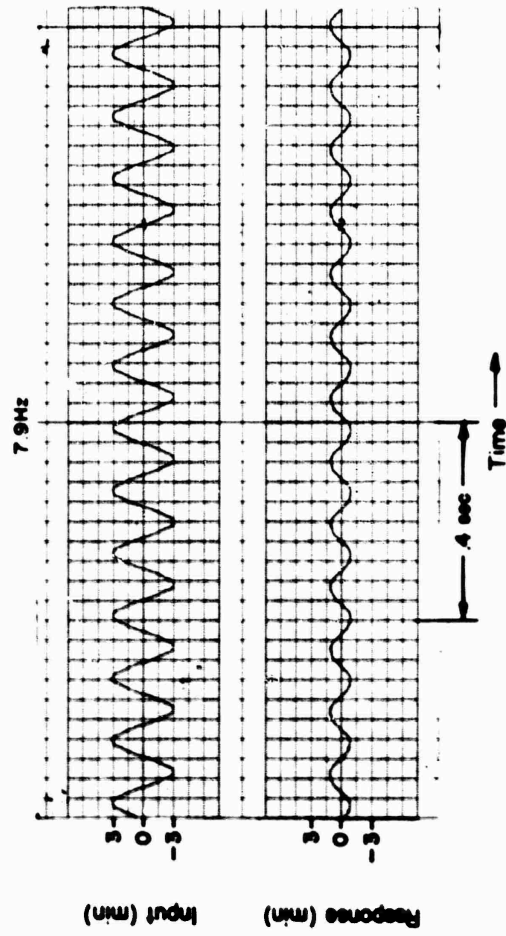


Figure 47. Frequency Response Test, S-HM input of 3' amplitude, 7.9Hz frequency.



APPENDIX E

Elevation Power Drive Test Data

Table E-1

Figures 1 Through 50

TABLE E-1

8"/55 MCLGM TECHNICAL EVALUATION
ELEVATION POWER DRIVE TEST DATA

ACCURACY TESTS

Figure Number	Input Signal	Error (min)
	Stationary	
1	2000' (0 deg)	0.1
1	3000' (16.67 deg)	0.5
2	4000' (33.33 deg)	0.3
2	5000' (50.00 deg)	0.1
	Constant Velocity	
3	5°/sec	0.6
3	-5°/sec	1.0
4	10°/sec	1.0
4	-10°/sec	1.2
5	15°/sec	1.0
5	-15°/sec	2.0
	Simple Harmonic Motion (Amplitude-Period)	
6	5°-4.5 sec	1.75
7	10°-4.5 sec	1.75
8	5°-9 sec	0.75
9	10°-9 sec	1.25
10	15°-9 sec	1.75
11	20°-9 sec	1.50

MAXIMUM VELOCITY AND ACCELERATION TESTS

Figure Number	Maximum Velocity (deg/sec)	Maximum Acceleration (deg/sec ²)
12	20.3	-41.4
13	-21.1	41.4

TABLE E-1 (Continued)

SYNCHRONIZING TIME TESTS

Figure Number	Order ¹	Input Signals Order ²	Initial Error (deg)	Gun Motion Induced	Synchronizing Time (sec)
14	Stationary	Stationary	-5	Elevate	0.78
15	Stationary	Stationary	+5	Depress	0.78
16	Stationary	Stationary	-20	Elevate	1.64
17	Stationary	Stationary	+20	Depress	1.63
18	Stationary	Stationary	-45	Elevate	2.78
19	Stationary	Stationary	+45	Depress	2.76
20	Stationary	C.V. 5°/sec	0	Elevate	0.68
21	Stationary	C.V. 5°/sec	+30	Depress then Elevate	1.88
22	Stationary	C.V. 5°/sec	-60	Elevate	2.45
23	Stationary	C.V. 5°/sec	+60	Depress then Elevate	2.78
24	Stationary	C.V. 10°/sec	+30	Depress then Elevate	1.79
25	Stationary	C.V. 10°/sec	0	Elevate	0.56
26	Stationary	C.V. 10°/sec	+60	Depress then Elevate	2.72
27	Stationary	C.V. 10°/sec	+90	Depress then Elevate	3.84

SYNCHRO POWER FAILURE TESTS

Figure Number	Mount Motion	Maximum Deceleration (deg/sec ²)	Distance Traveled After Failure (From Dials)
28	Elevate	108	6°6'
29	Depress	100	6°18'

LIMIT STOP TESTS

Figure Number	Gun Motion Into Stop Direction	Velocity	Maximum Deceleration (deg/sec ²)
30	Elevate	+10°/sec	25
31	Depress	-10°/sec	25
32	Elevate	Maximum	27.8
33	Depress	Maximum	31.6

TABLE E-1 (Continued)

Figure Number	Mount Order	Gun Motion Out of Stop	Synchronizing Time (sec)
34	Constant Velocity of $10^\circ/\text{sec}$	Elevate	0.23
35	Constant Velocity of $-10^\circ/\text{sec}$	Depress	0.28

EMERGENCY LIMIT STOP TESTS

Figure Number	Gun Motion Direction	Into Stop Velocity	Maximum Deceleration (deg/sec^2)	Distance Before Setting Gun Stopped (From Dials)
36	Elevate	$10^\circ/\text{sec}$	79	$3^\circ 26'$
37	Depress	$-10^\circ/\text{sec}$	75	$3^\circ 16'$
38	Elevate	Maximum	92	$4^\circ 0'$
39	Depress	Maximum	80	$3^\circ 59'$

Gun stopped position when driven into each actual emergency limit stop at a constant velocity of $1^\circ/\text{sec}$.

Depression

$-5^\circ 25'$

Elevation

$65^\circ 21'$

FREQUENCY RESPONSE TESTS

Figure Number	SHM Input Signal Frequency (Hz)	Amplitude Ratio Output/Input	Approximate Phase Angle (deg)
40	0.24	1.075	1.76
41	0.49	1.15	1.80
42	0.68	1.25	1.5
43	1.8	1.48	46.5
44	2.0	1.45	53.0
45	2.5	1.30	54.7
46	2.8	1.28	80.5
47	4.0	0.95	145
48	5.6	0.30	124
49	7.8	0.10	137

Figure 1. Accuracy Test, stationary input signal, gun elevated at 2000 min (0° 0' elevation from horizontal and 3000 min.

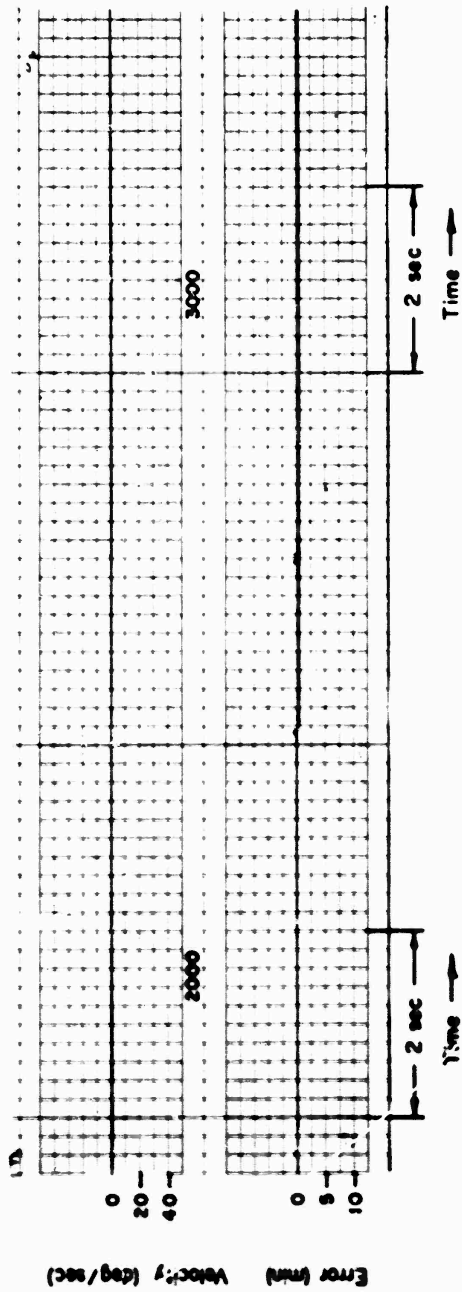


Figure 2. Accuracy Test, stationary input signal, gun elevated at 4000 min and 5000 min.

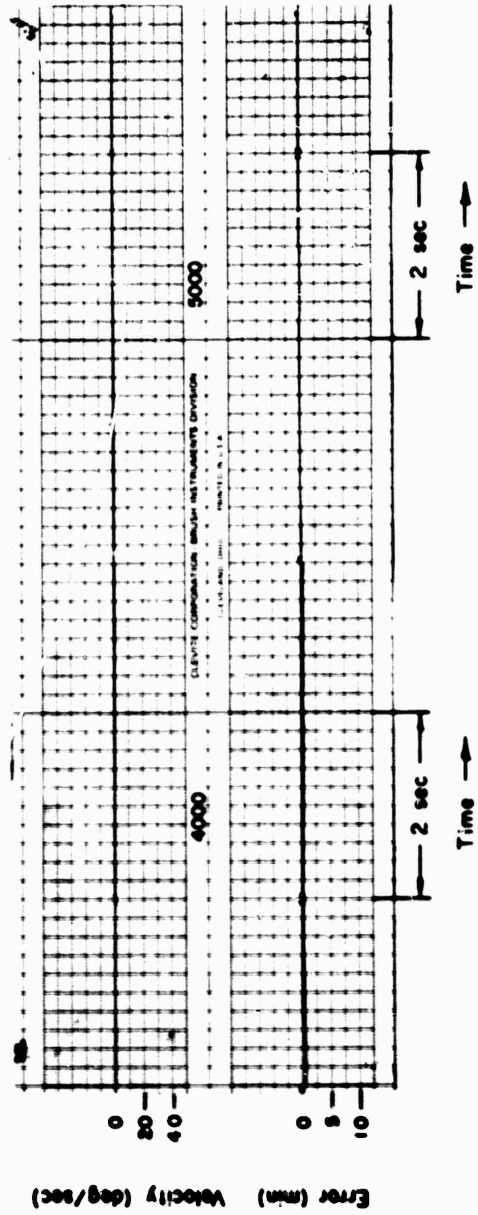
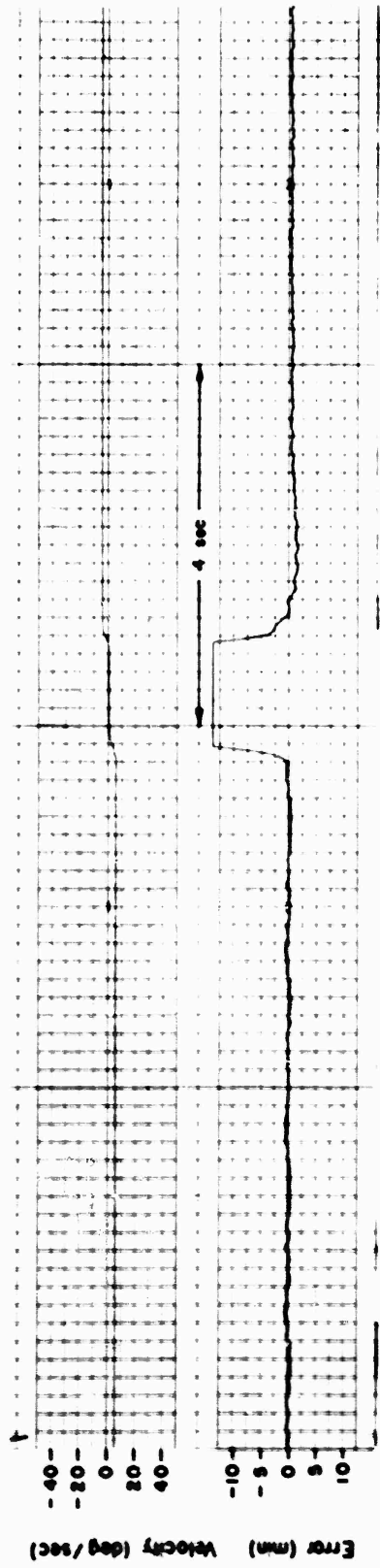
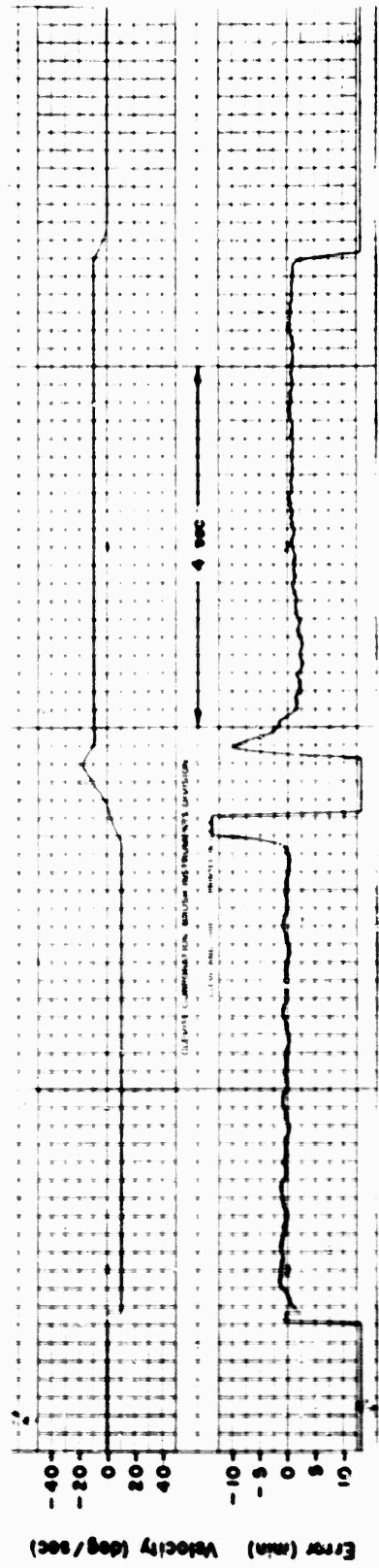


Figure 3 Accuracy Test, constant velocity input signals of 5°/sec (elevating) and -5°/sec (depressing).



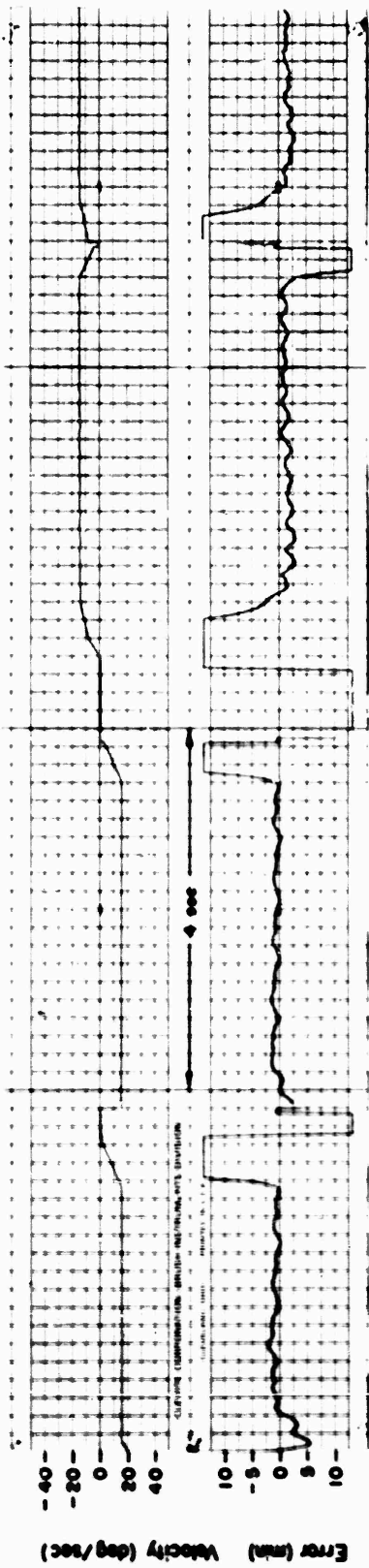
Time →

Figure 4 Accuracy Test, constant velocity input signals of 10°/sec and -10°/sec.



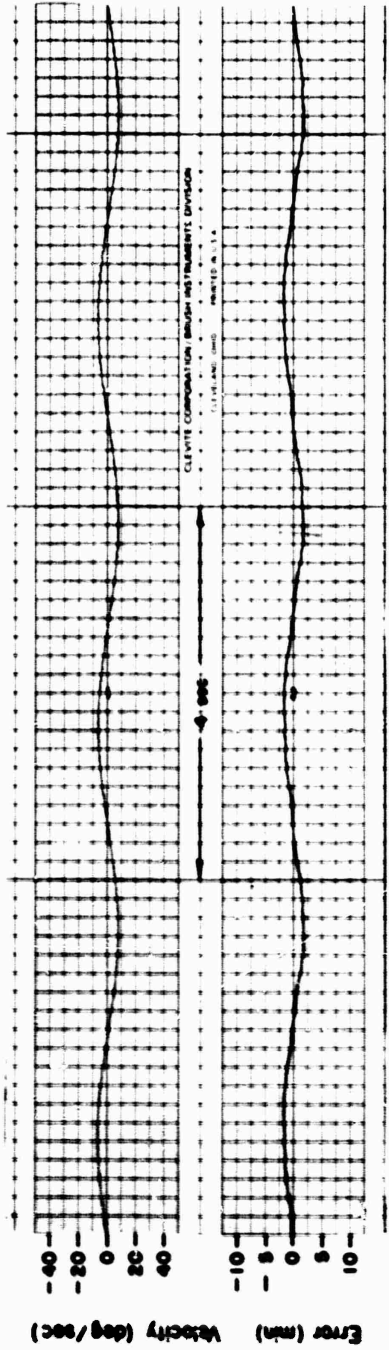
Time →

Figure 5 Accuracy Test, constant velocity input signals of 15°/sec and -15°/sec.



Time →

Figure 6 Accuracy Test, STHM input signal of 5° amplitude and 4.5 sec period.



Time →

Figure 7 Accuracy Test, SHM input signal of 10° amplitude and 4.5 sec period.

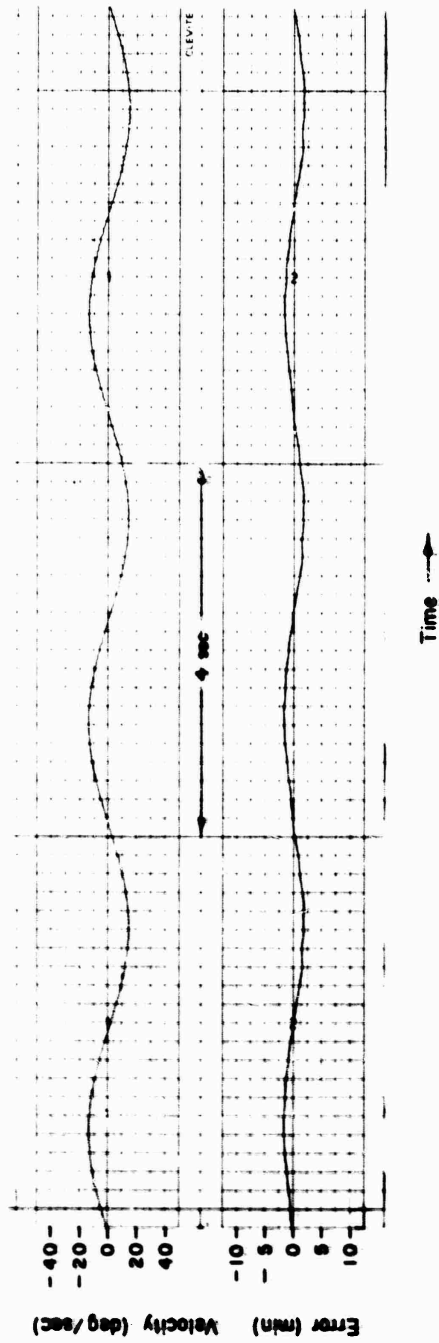


Figure 8 Accuracy Test, SHM input signal of 5° amplitude and 9 sec period.

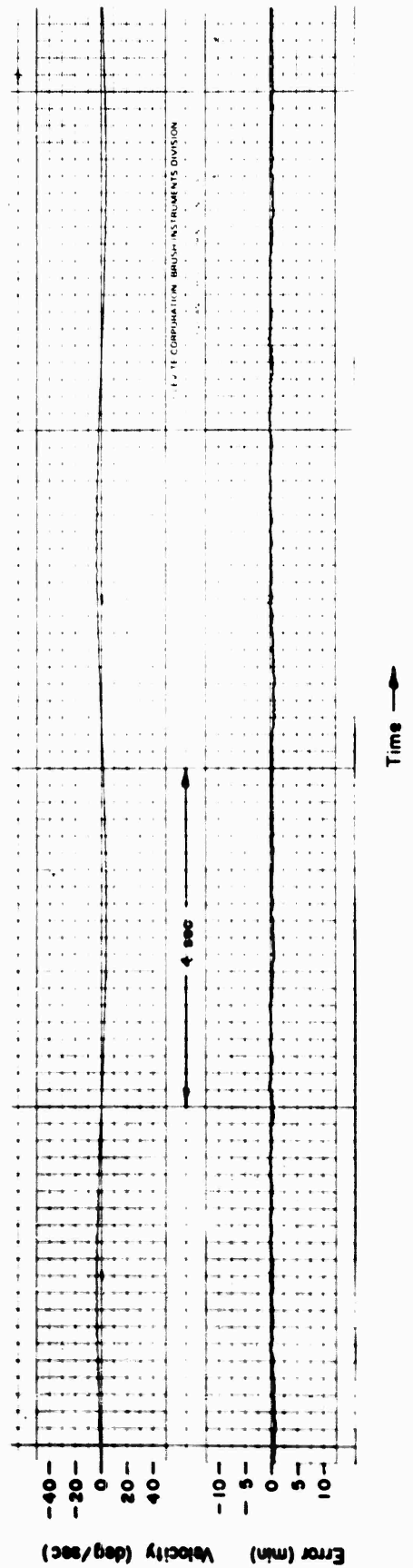


Figure 9. Accuracy Test, SHM Input signal of 10° amplitude and 9 sec period.

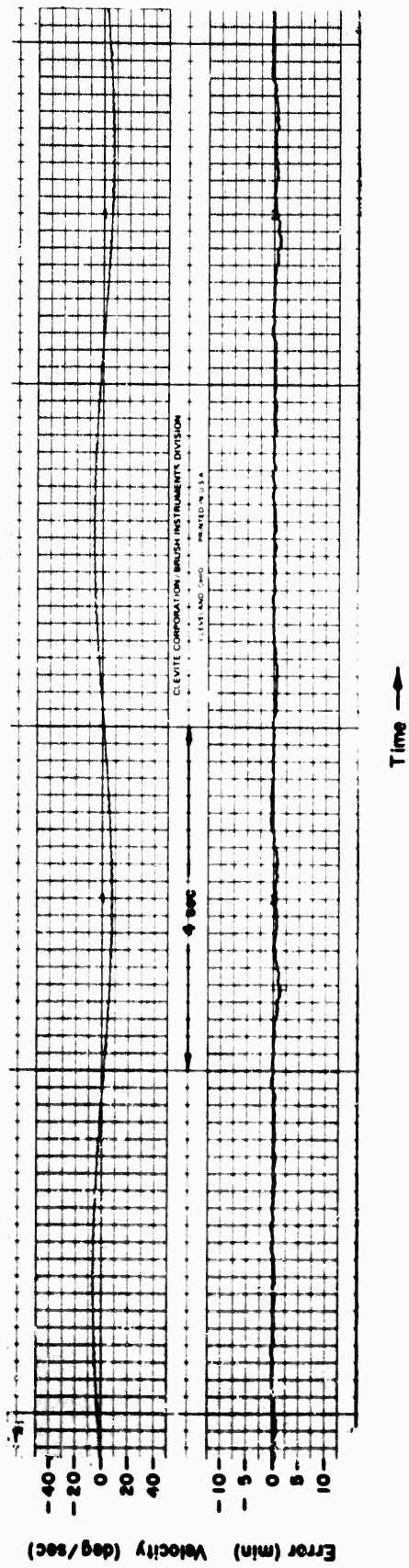


Figure 10. Accuracy Test, SHM Input signal of 15° amplitude and 9 sec period.

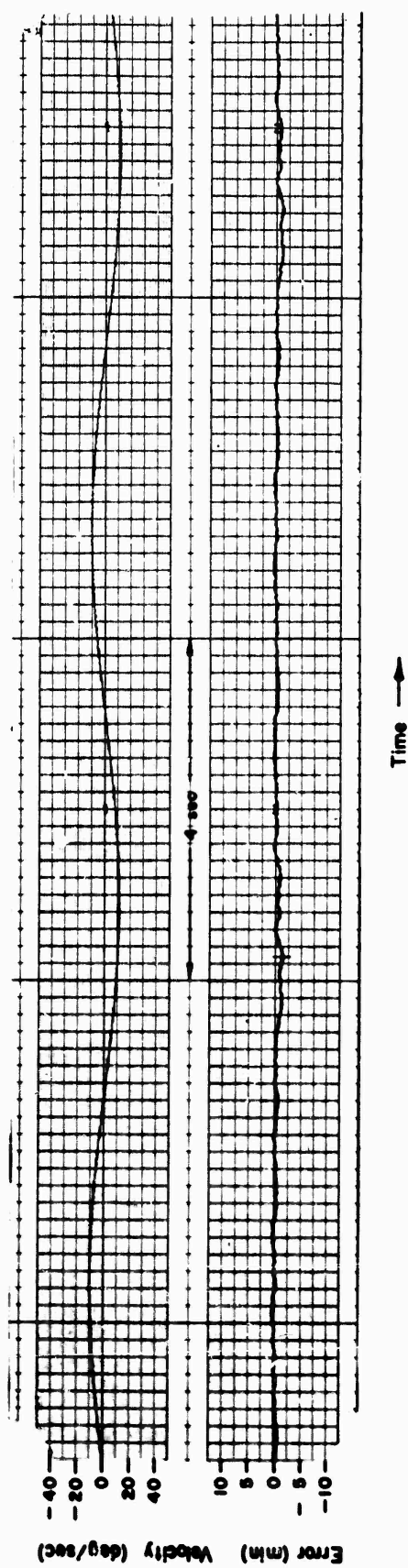
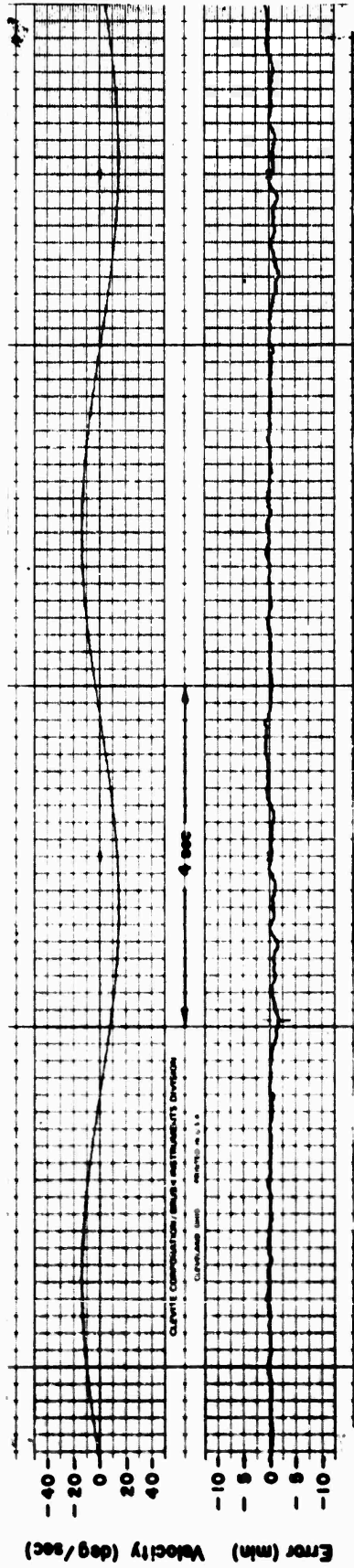
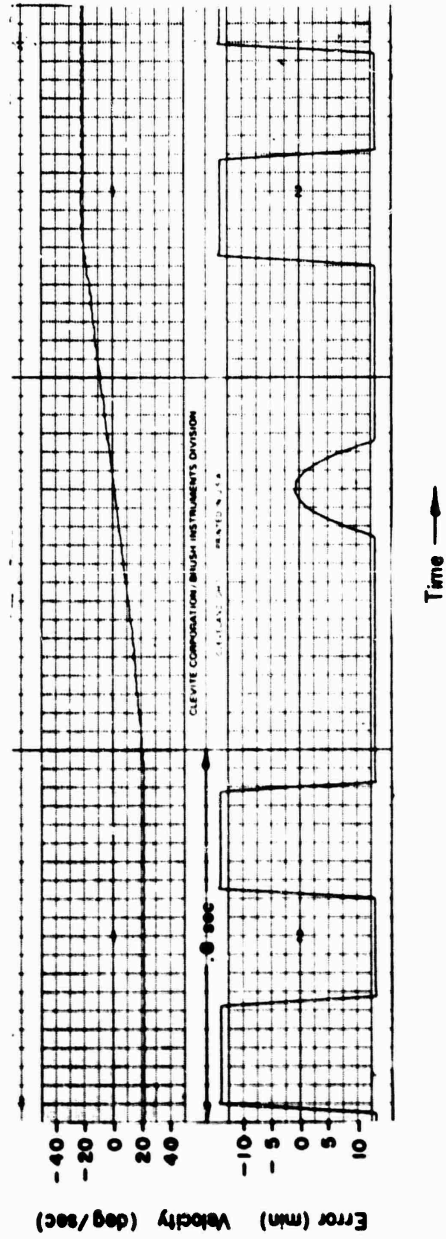


Figure 11. Accuracy Test, SHM input signal of 20° amplitude and 9 sec period.



Time →

Figure 12. Maximum Velocity and Acceleration Test, stationary input signals: Fixed point to a higher fixed point and back (after maximum depressing velocity is reached) to the original point.



Time →

Figure 13. Maximum Velocity and Acceleration Test, stationary input signals. Fixed point to lower fixed point and back (after maximum depressing velocity is reached) to the original point.

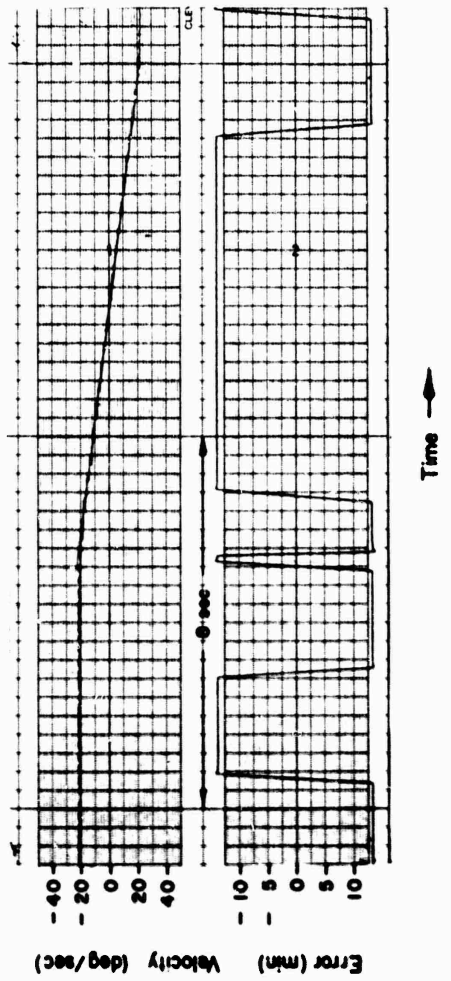


Figure 14. Synchronizing Time Test, stationary input signal 5° high (gun elevates).

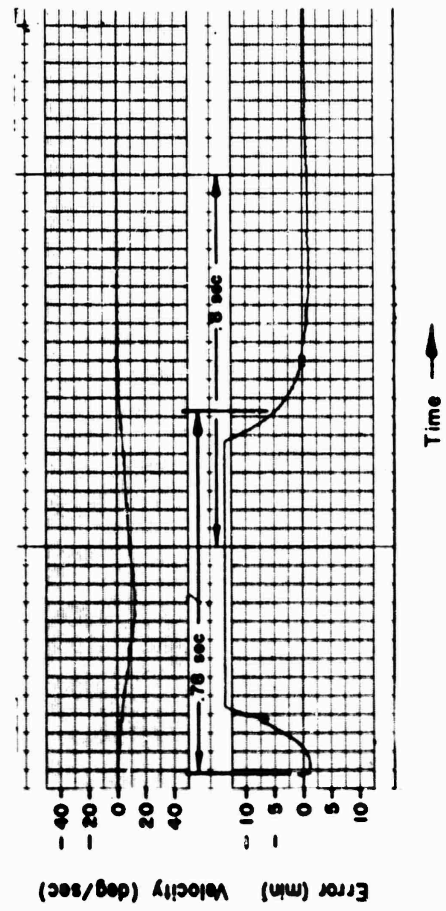


Figure 15. Synchronizing Time Test, stationary input signal 5° low (gun depresses).

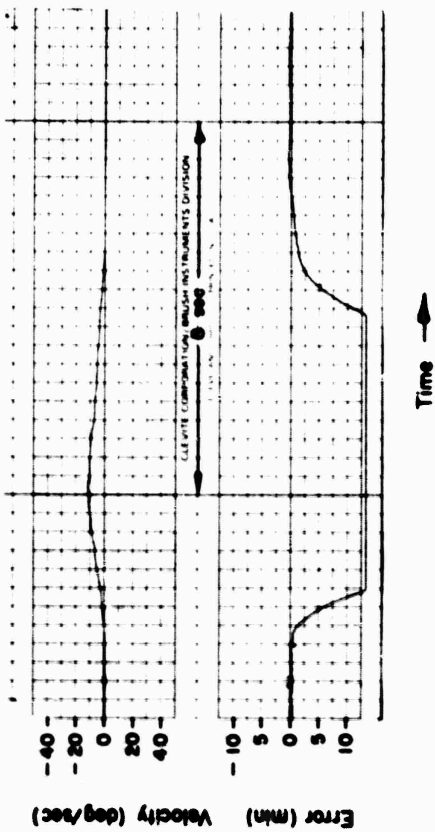


Figure 16. Synchronizing Time Test, stationary input signal 20° high.

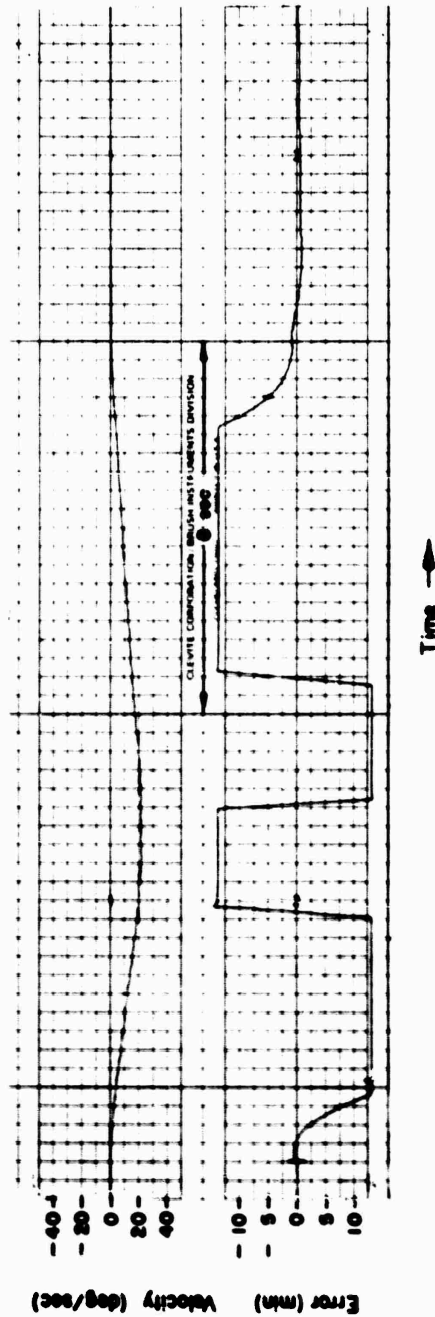


Figure 17. Synchronizing Time Test, stationary input signal 20° low.

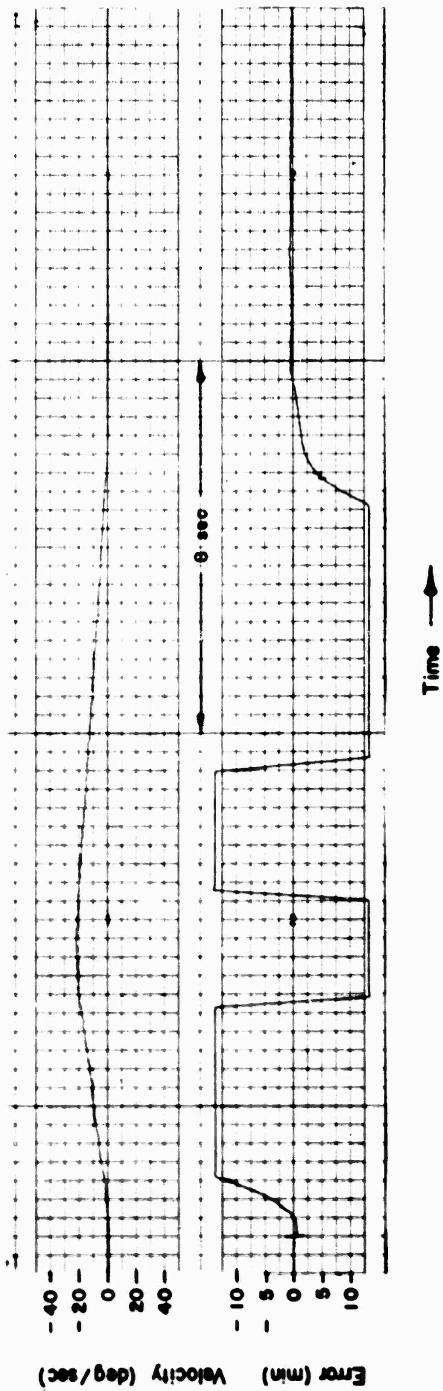


Figure 18. Synchronizing Time Test, stationary input signal 45° high.

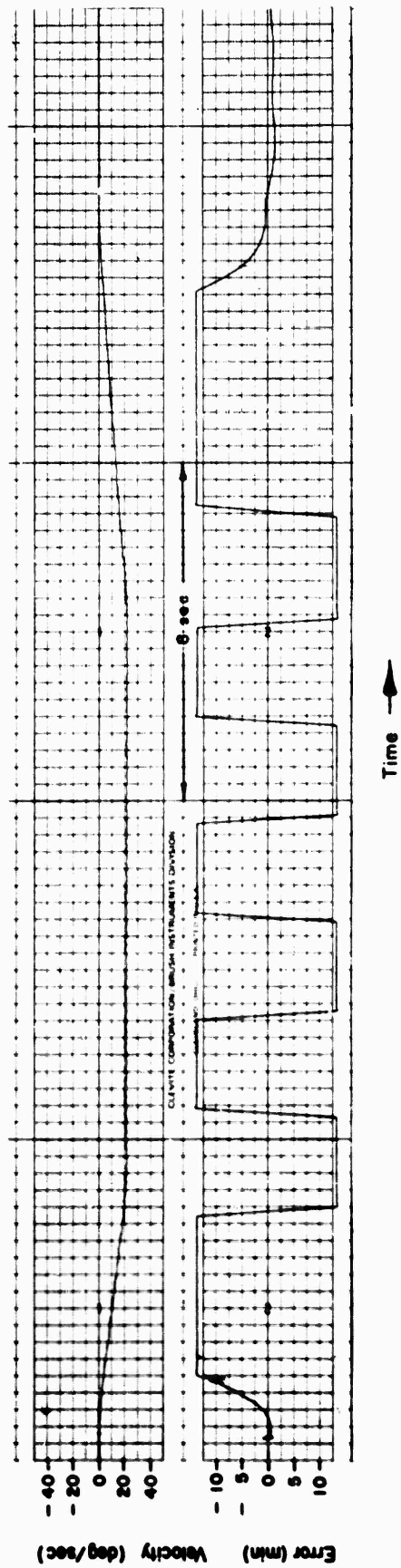
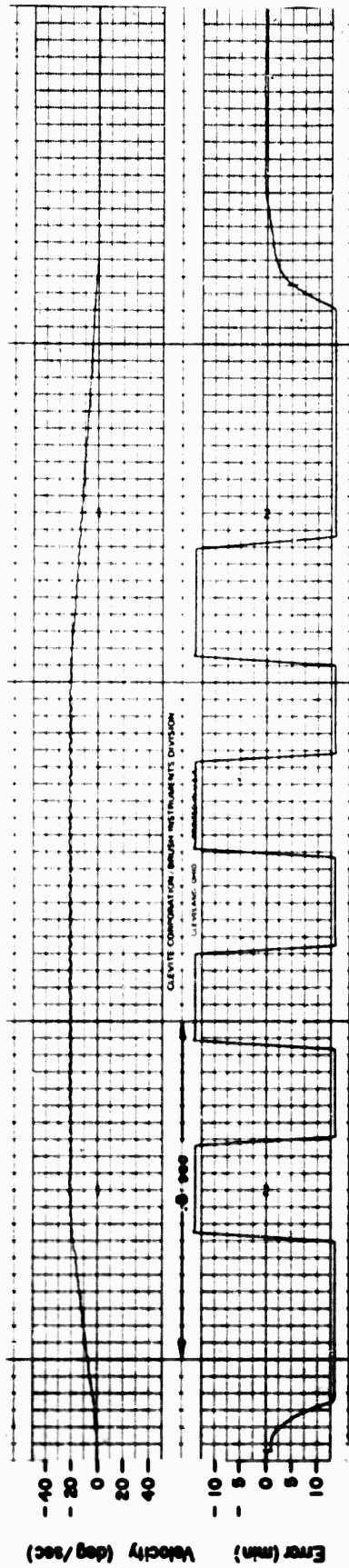


Figure 19. Synchronizing Time Test, stationary input signal 45° low.



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Figure 20. Synchronizing time test, Constant velocity input signal of 5°/sec, initial error of 0°.

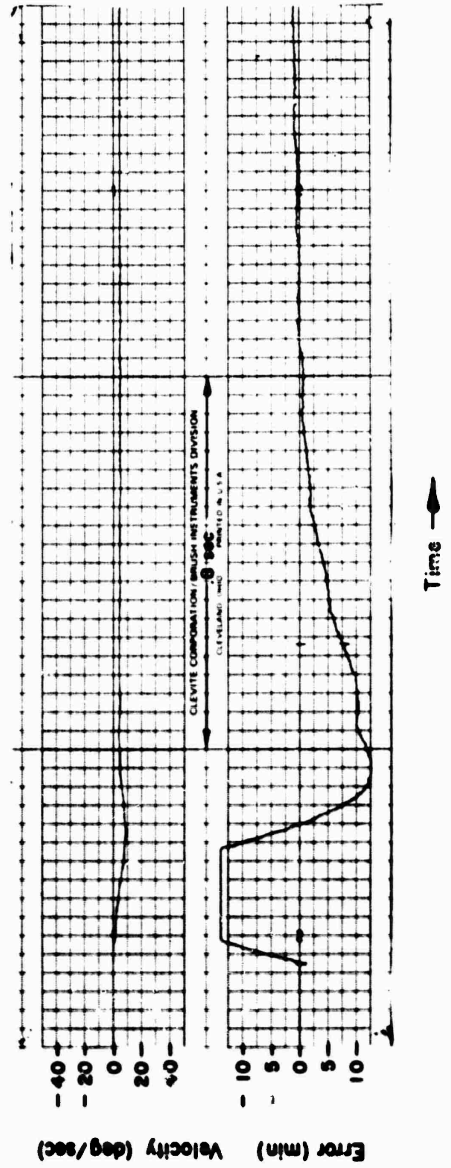


Figure 21. Synchronizing Time Test, constant velocity input signal approaching gun position of $5^\circ/\text{sec}$, initial error of 30° (gun depresses to synchronize, then elevates at $5^\circ/\text{sec}$).

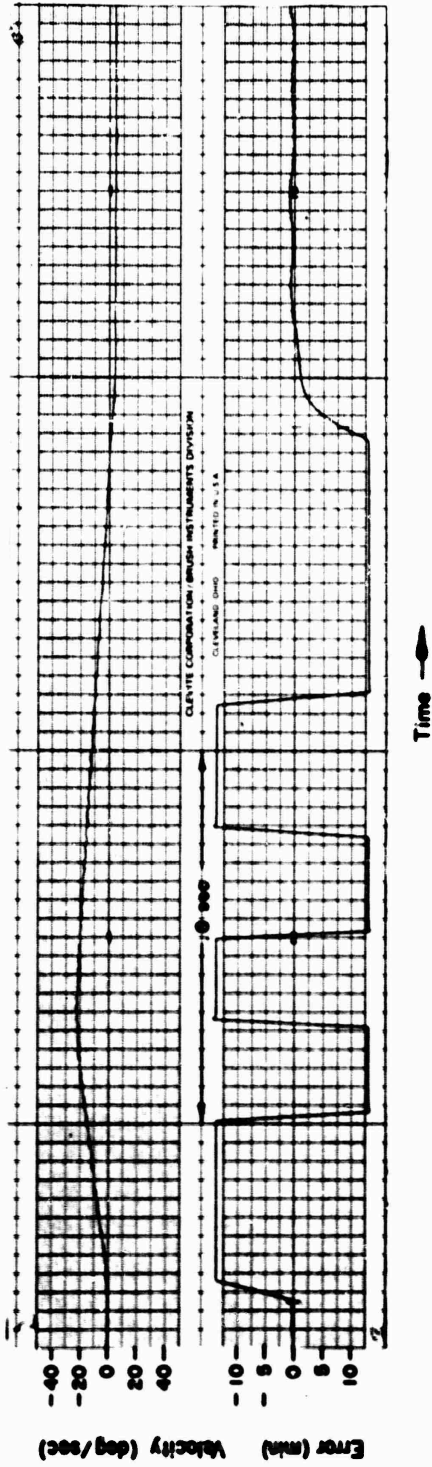


Figure 22. Synchronizing Time Test, constant velocity input signal departing gun position of $5^\circ/\text{sec}$, initial error of -60° (gun elevates to synchronize, then depresses at $5^\circ/\text{sec}$).

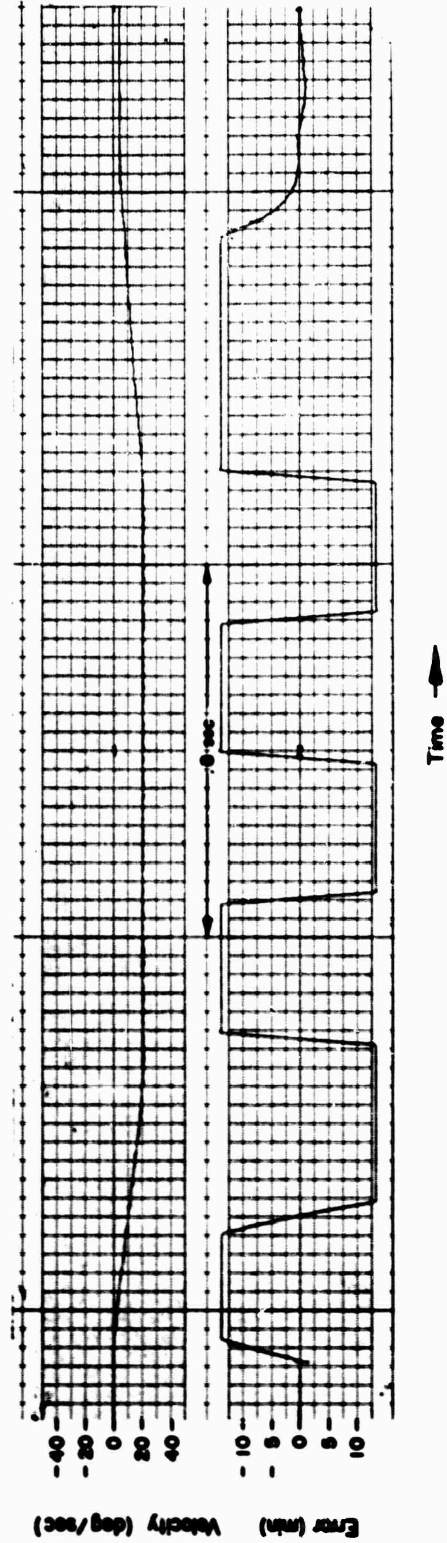


Figure 23 Synchronizing Time Test, Constant velocity input signal approaching gun position of 60° (gun depresses to synchronize, then elevates at 5°/sec)

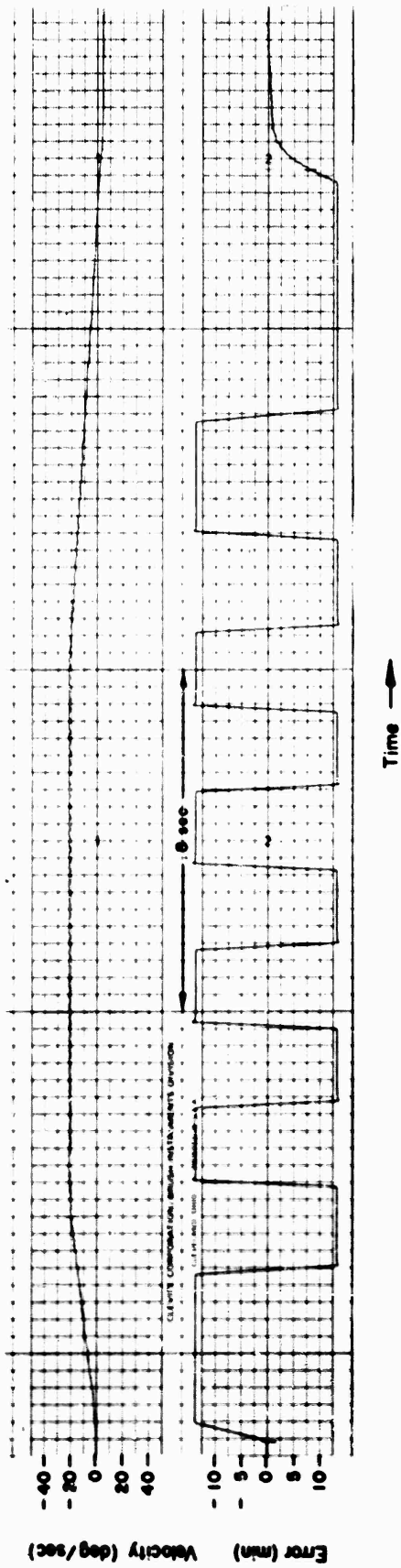


Figure 24. Synchronizing Time Test, Constant velocity input signal approaching gun position of 10°/sec, initial error of 30° (gun depresses to synchronize, then elevates at 10°/sec)

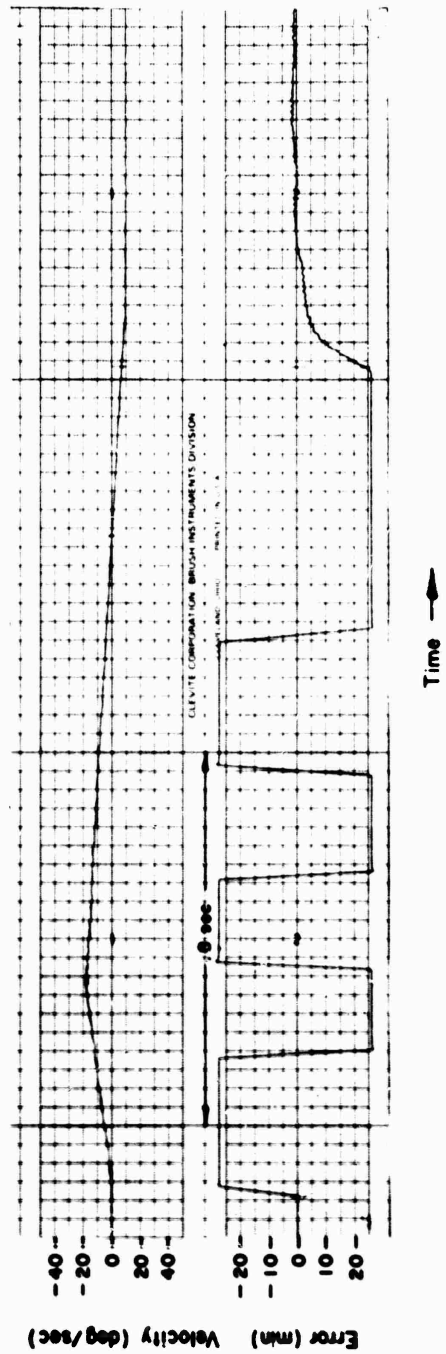


Figure 25. Synchronizing Time Test, Constant velocity input signal of 10°/sec, initial error of 0°.

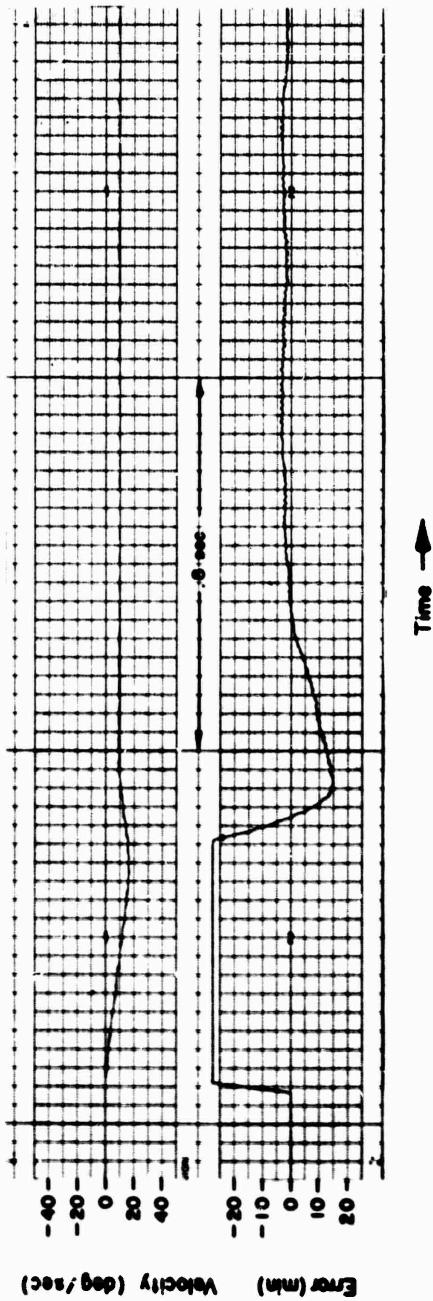


Figure 26. Synchronizing Time Test, constant velocity input signal approaching gun position of 60° (gun depresses to synchronize, then elevates at 10°/sec).

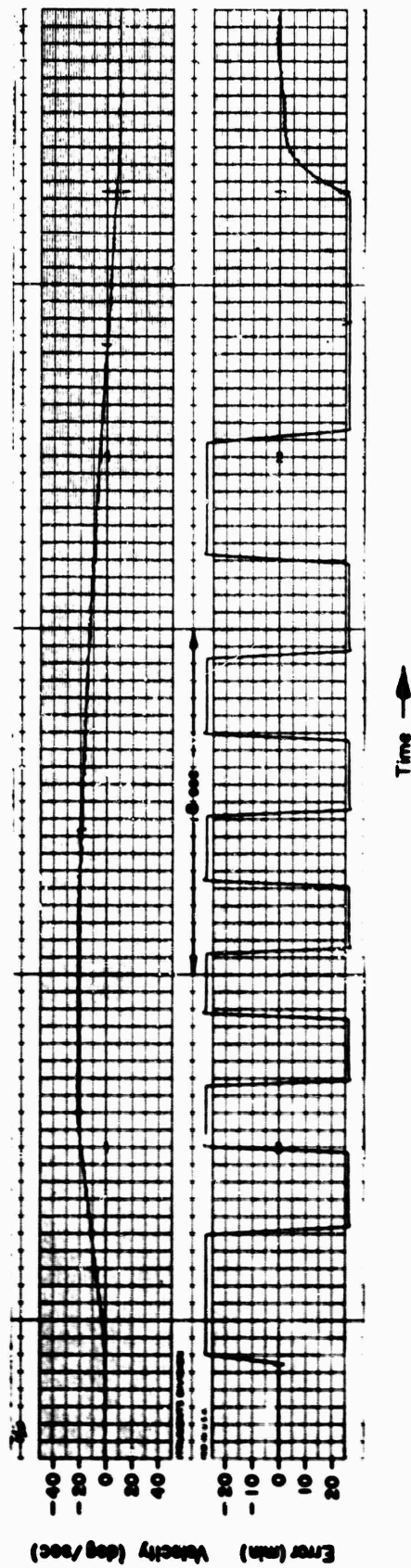


Figure 27. Synchronizing Time Test. constant velocity input signal; approaching gun position of 90°, (gun depresses to synchronize, then elevates at 10°/sec).

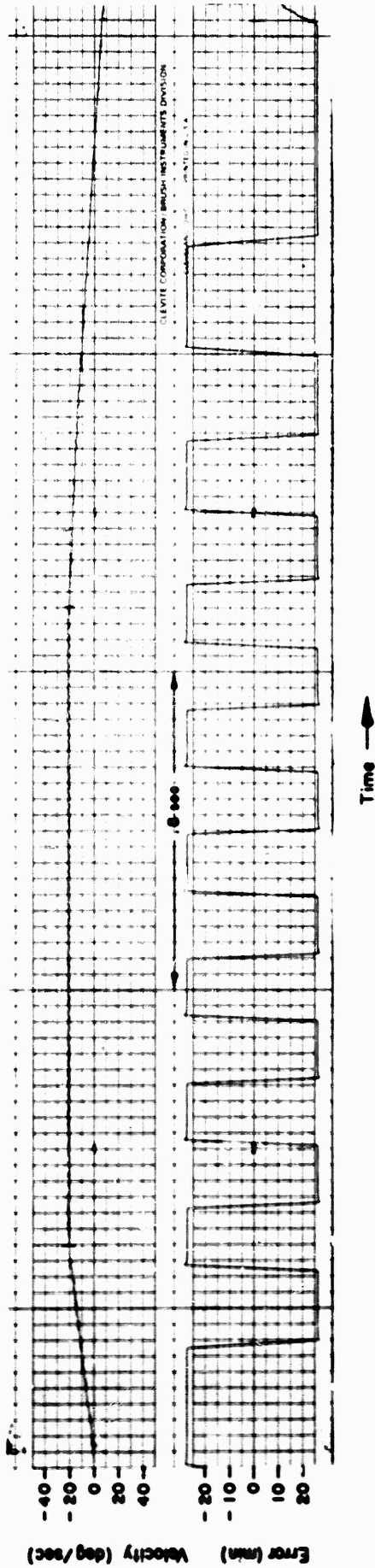


Figure 28. Synchro Power Failure Test, stationary input signals. Fixed point to a higher fixed point. Pip on position trace indicates interruption of synchro power.

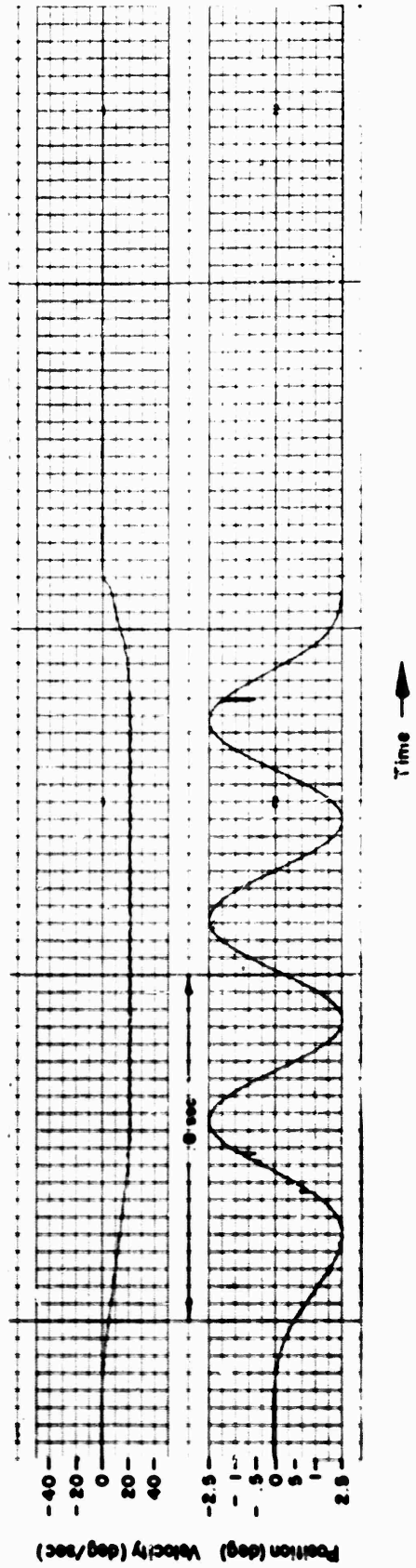


Figure 29. Synchro Power Failure Test, stationary input signals: Fixed point to a lower fixed point. Pip on position trace indicates interruption of synchro power.

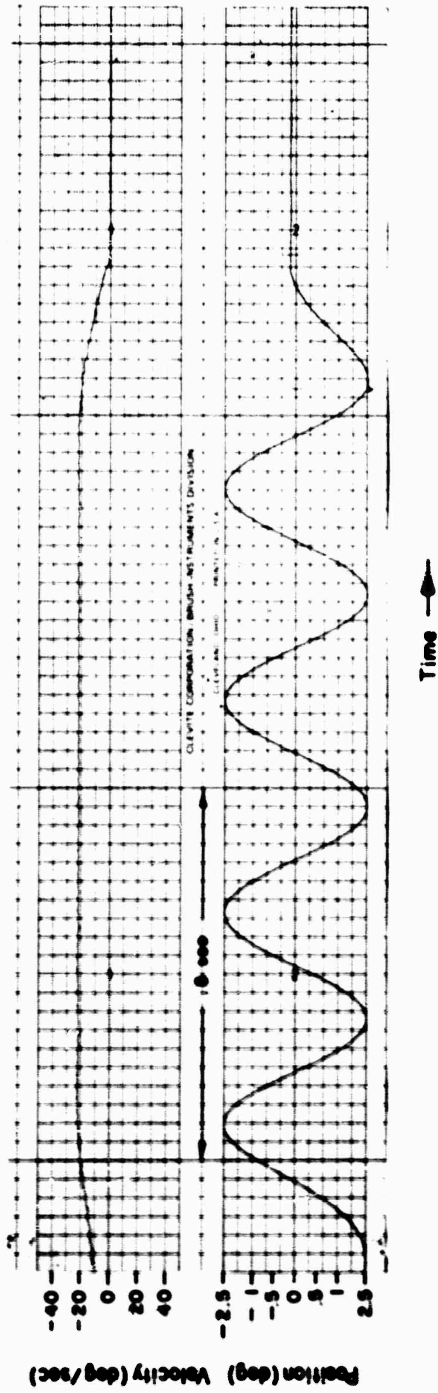


Figure 30. Limit Stop Test, constant velocity input signal of 10°/sec (elevated into upper limit stop).

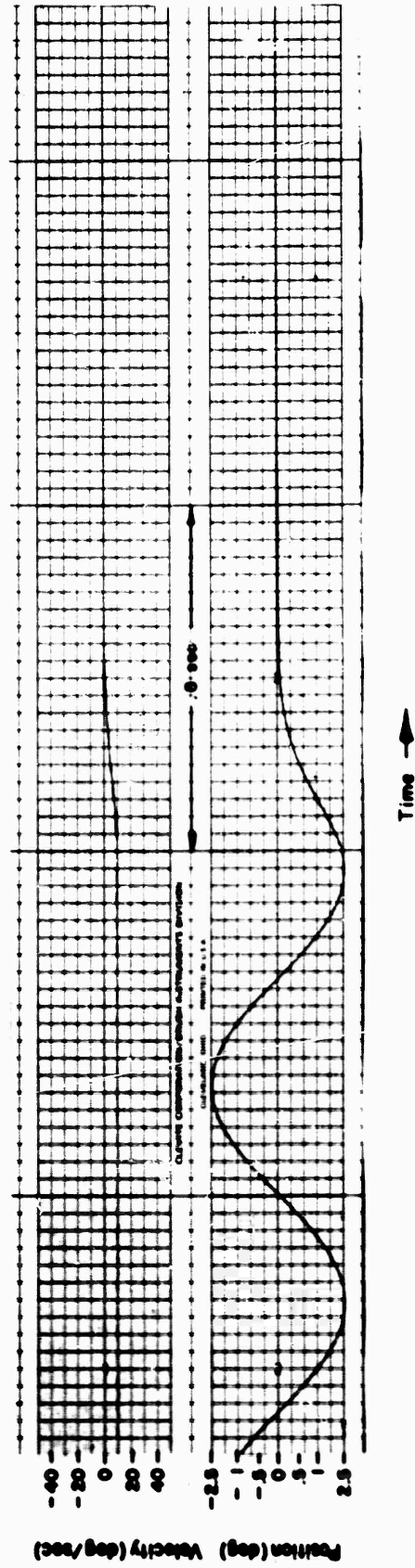
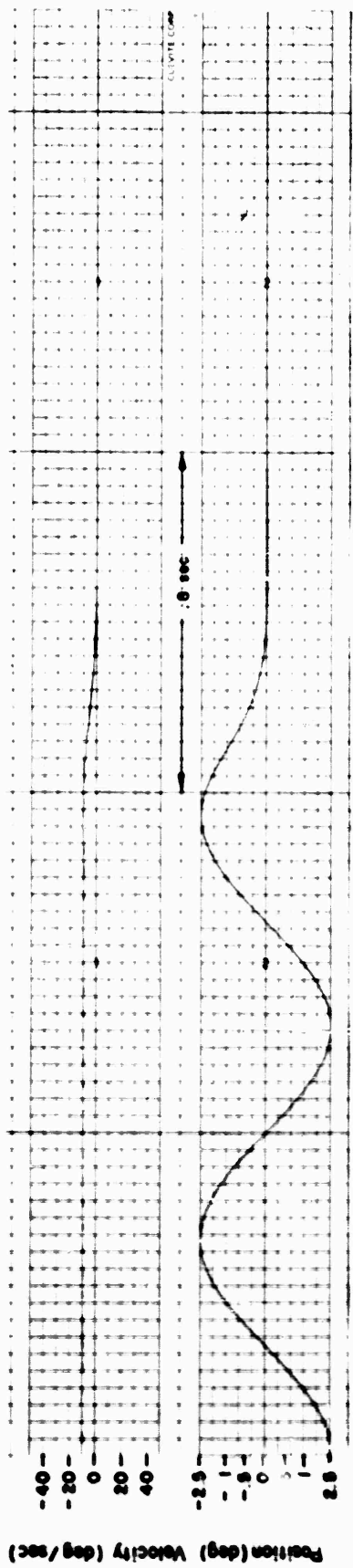
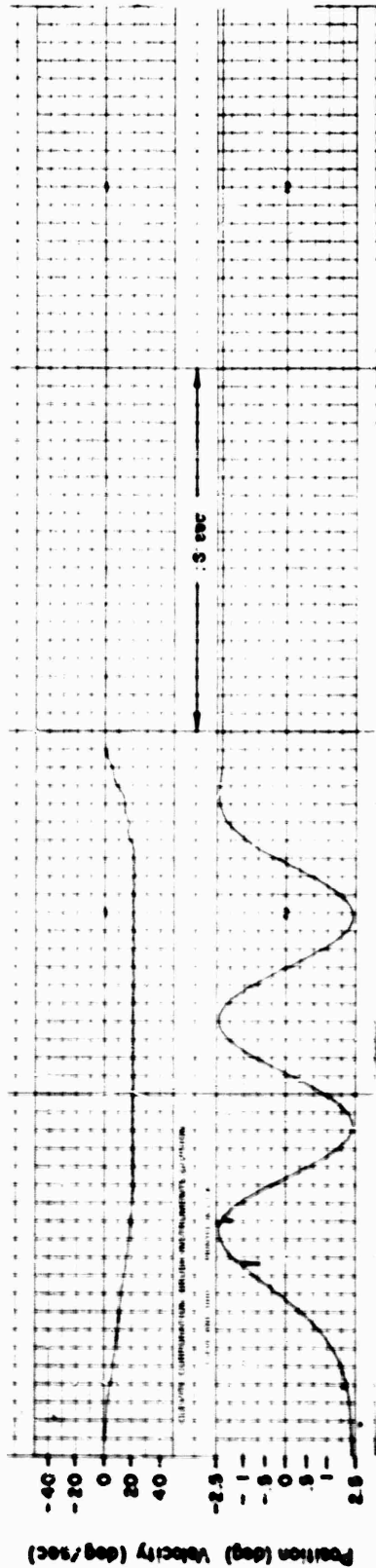


Figure 31. Limit Stop Test, constant velocity input signal of $-10^\circ/\text{sec}$ (depressed into lower limit stop).



Time →

Figure 32. Limit Stop Test, stationary input signals: fixed point to a higher fixed point beyond the upper limit stop (elevated into upper limit stop of maximum velocity).



Time →

Figure 33. Limit Stop Test, stationary input signals: Fixed point to a lower fixed point beyond the lower limit stop (depressed into lower limit stop at maximum velocity).

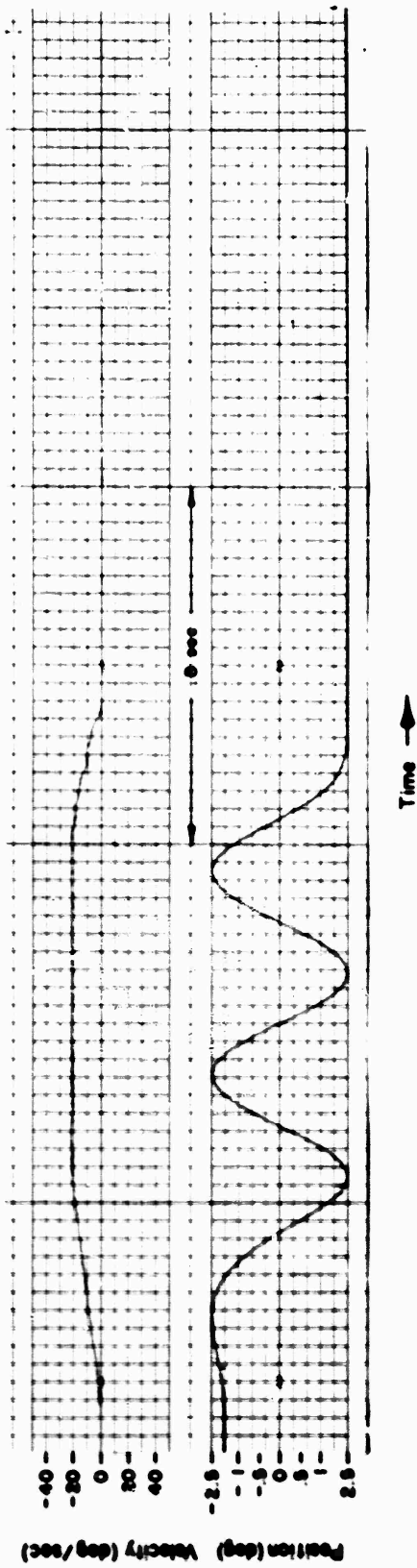


Figure 34. Limit Stop Test, constant velocity input signal of 10°/sec (gun elevated out of lower limit stop).

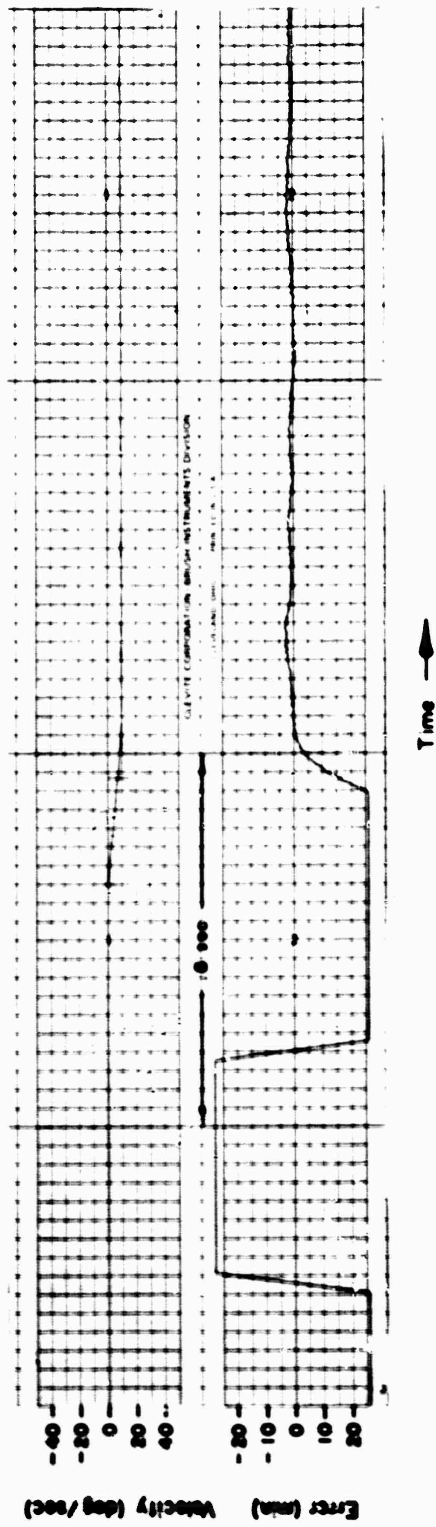
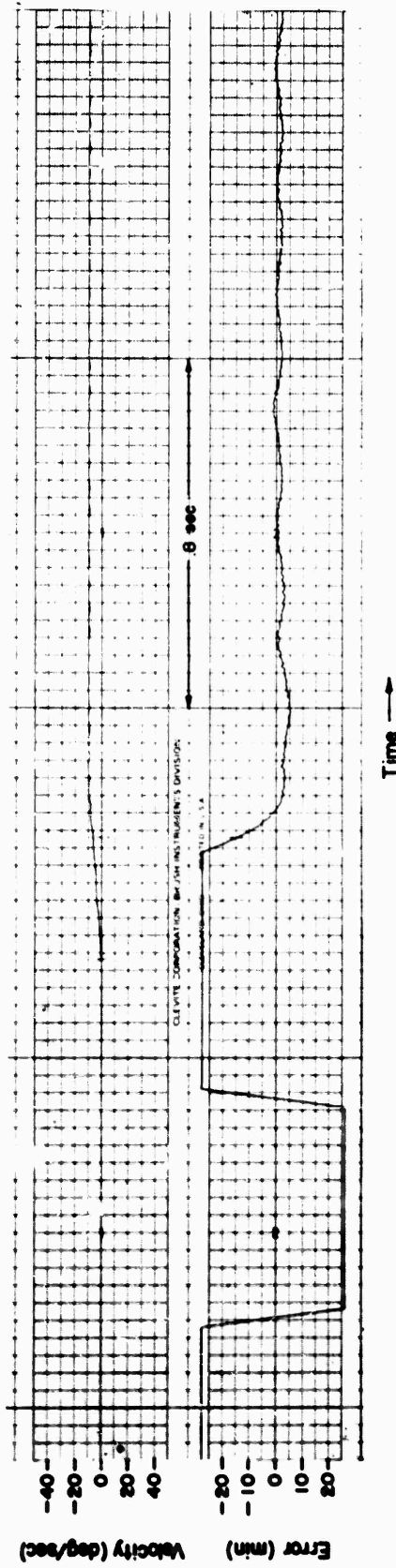


Figure 35. Limit Stop Test, constant velocity input signal of $-10^\circ/\text{sec}$ (gun depressed out of upper limit stop).



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Figure 36. Emergency Limit Stop Test, Constant velocity input signal of $10^\circ/\text{sec}$ (gun elevated into upper emergency limit stop).

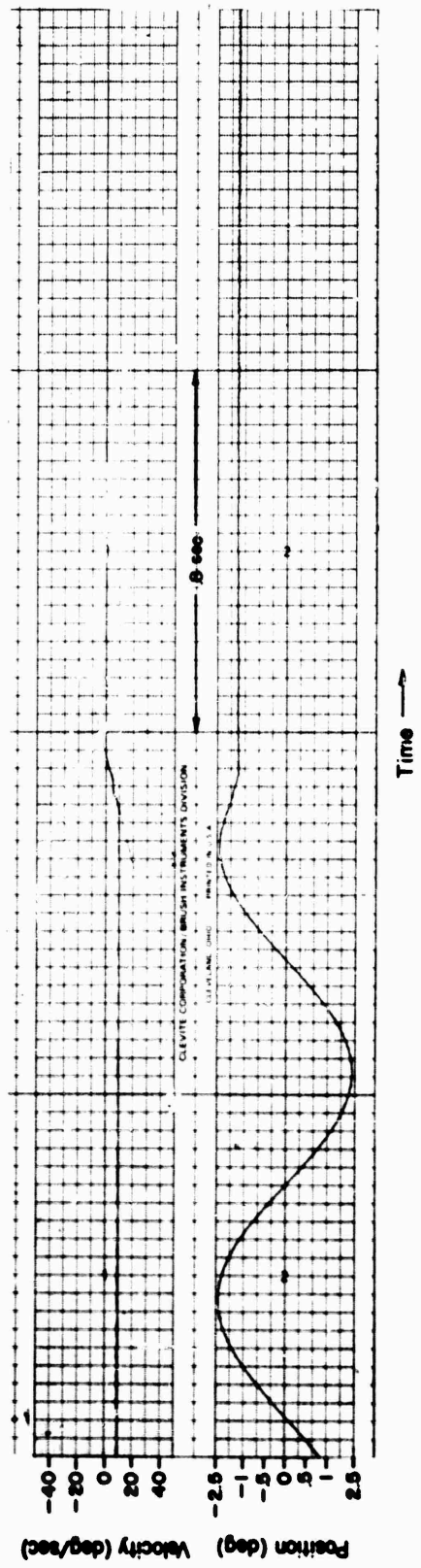


Figure 37. Emergency Limit Stop Test, constant velocity input signal of $-10^\circ/\text{sec}$ (gun depressed into upper emergency limit stop).

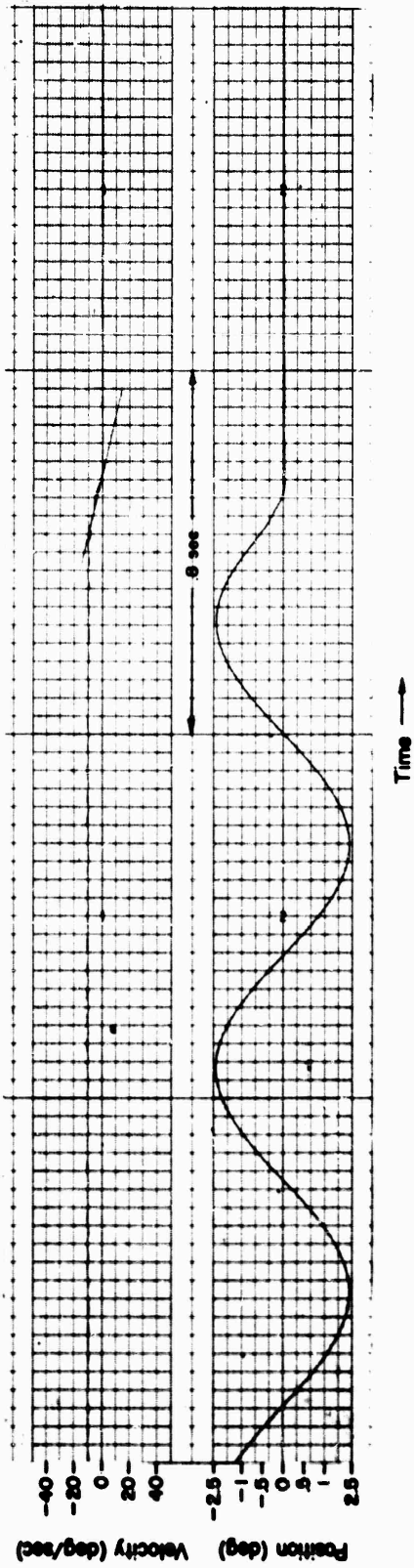


Figure 38. Emergency Limit Stop Test, stationary input signals: Fixed point to a higher point above the upper emergency limit stop (gun elevated into the upper emergency limit stop at maximum velocity).

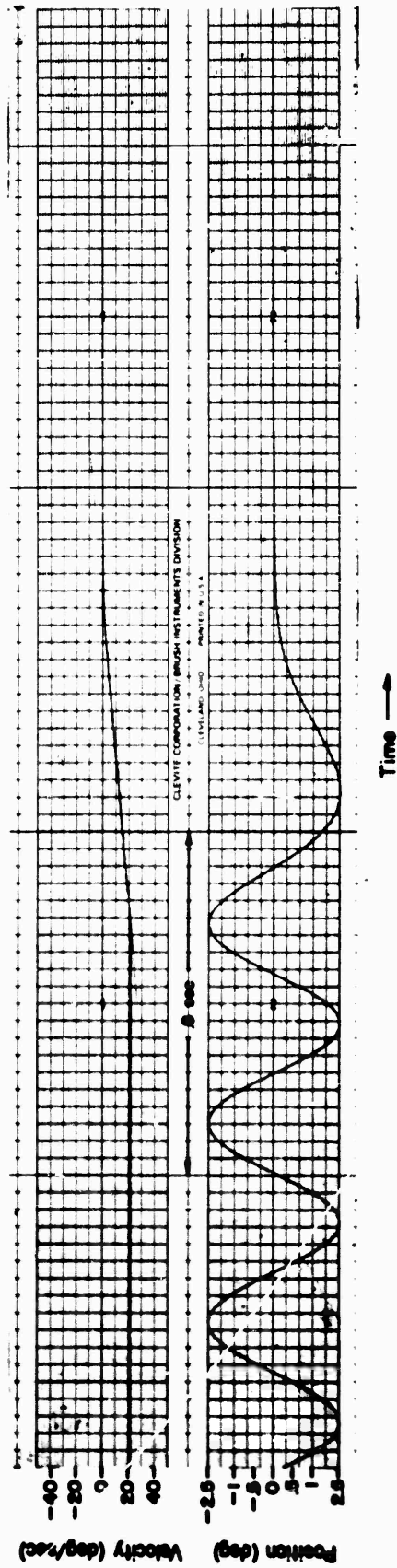


Figure 39. Emergency Limit Stop Test, stationary input signals: Fixed point to a lower point below the lower emergency limit stop (gun depressed into the lower emergency limit stop at maximum velocity).

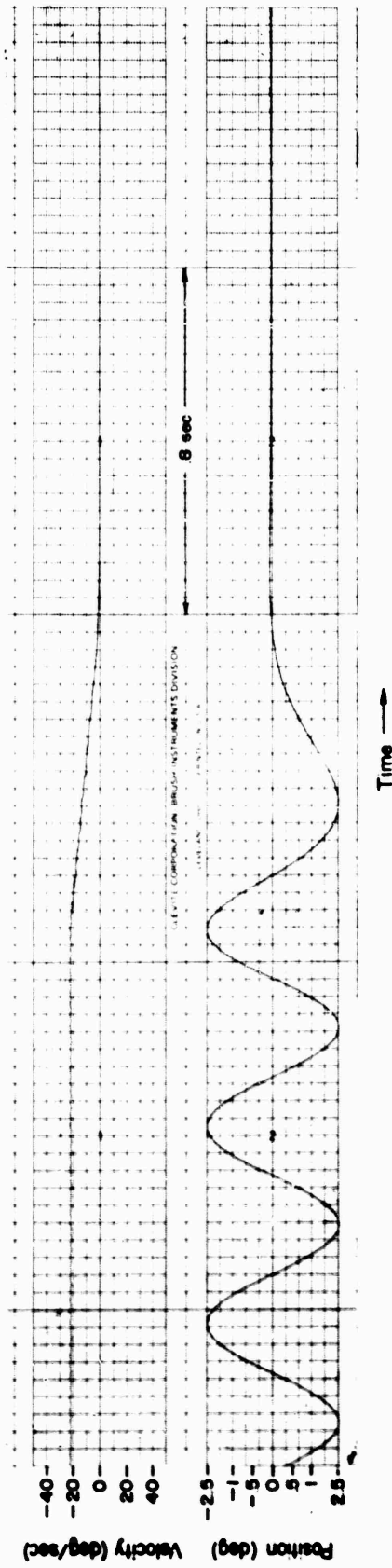


Figure 40. Frequency Response Test, SHM input of 3' amplitude, 0.2 Hz frequency.

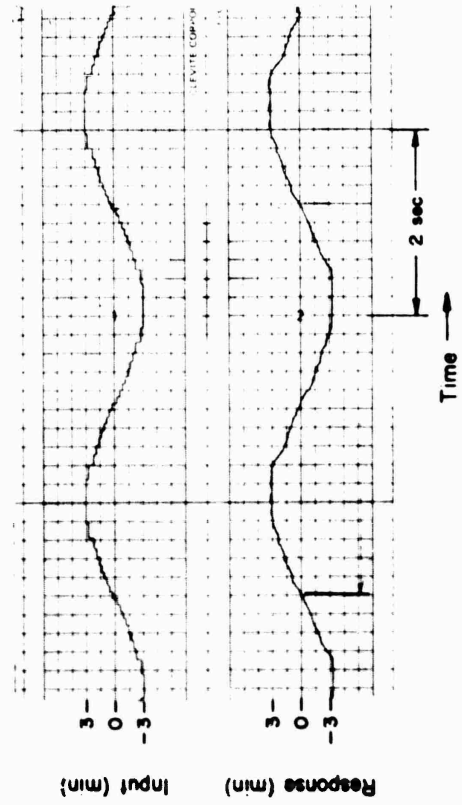


Figure 41. Frequency Response Test, SHM input of 3' amplitude, 0.49Hz frequency.

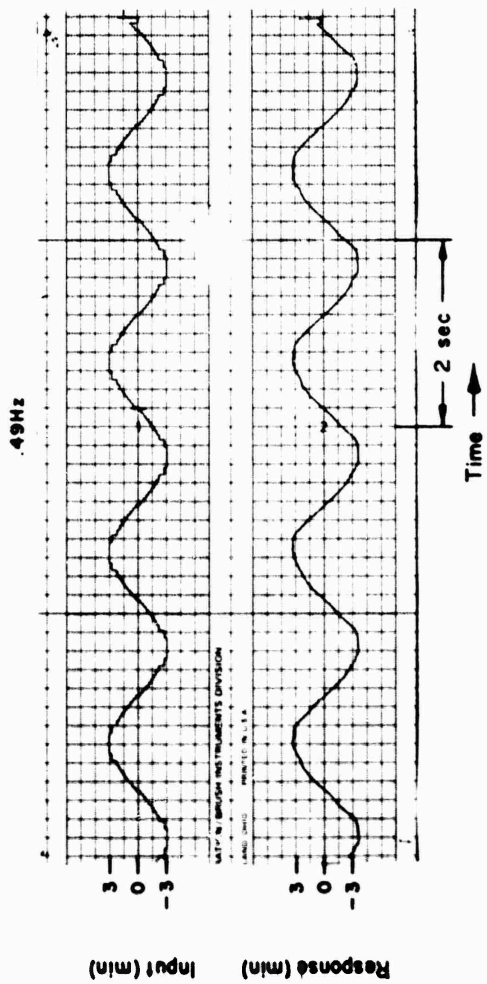


Figure 42. Frequency Response Test, SHM input of 3' amplitude, 0.68Hz frequency.

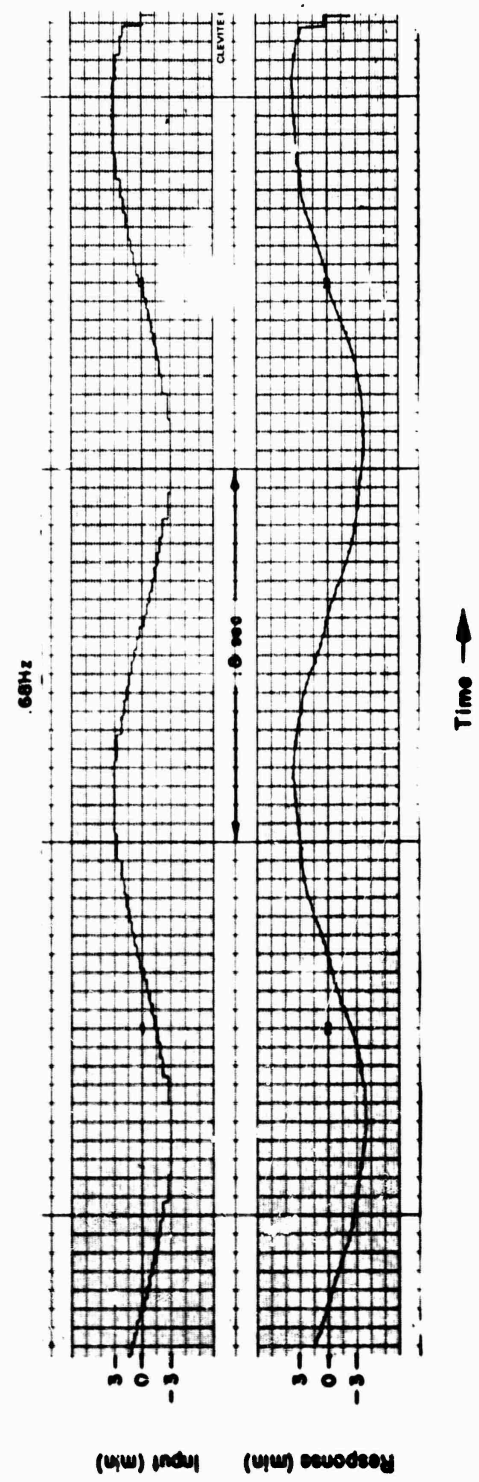


Figure 43. Frequency Response Test, SHM input of 3' amplitude, 1.8Hz frequency.

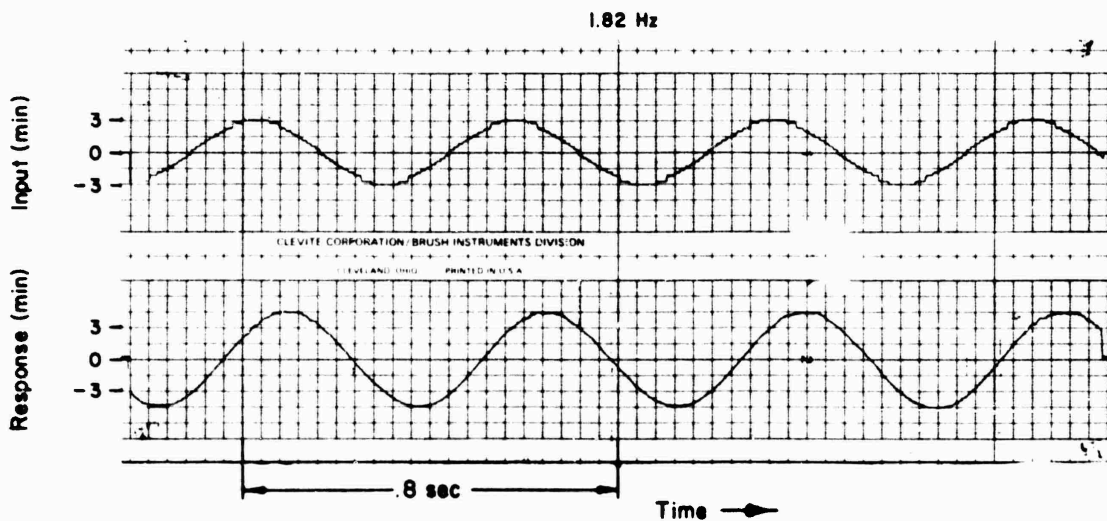


Figure 44. Frequency Response Test, SHM input of 3' amplitude, 2.0Hz frequency.

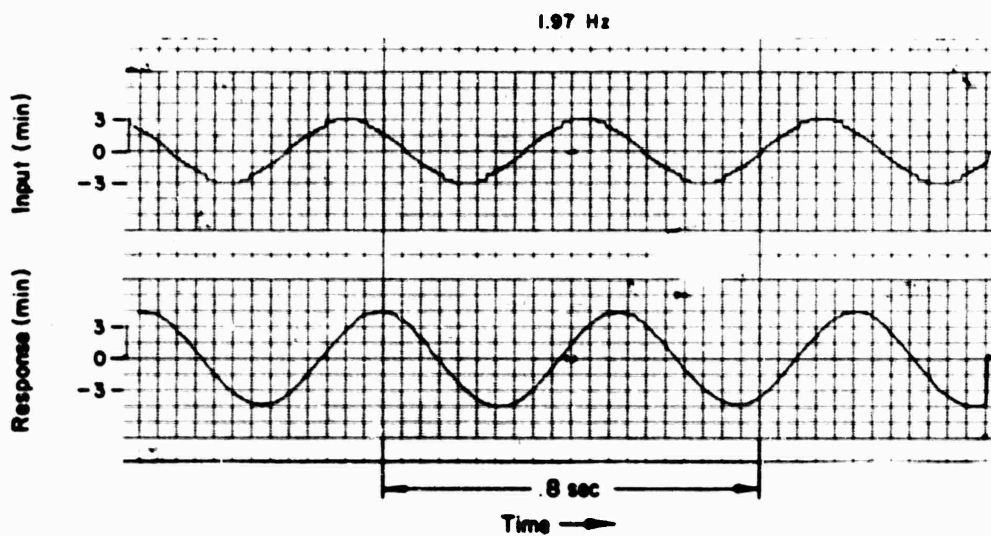


Figure 45. Frequency Response Test, SHM input of 3' amplitude, 2.5Hz frequency.

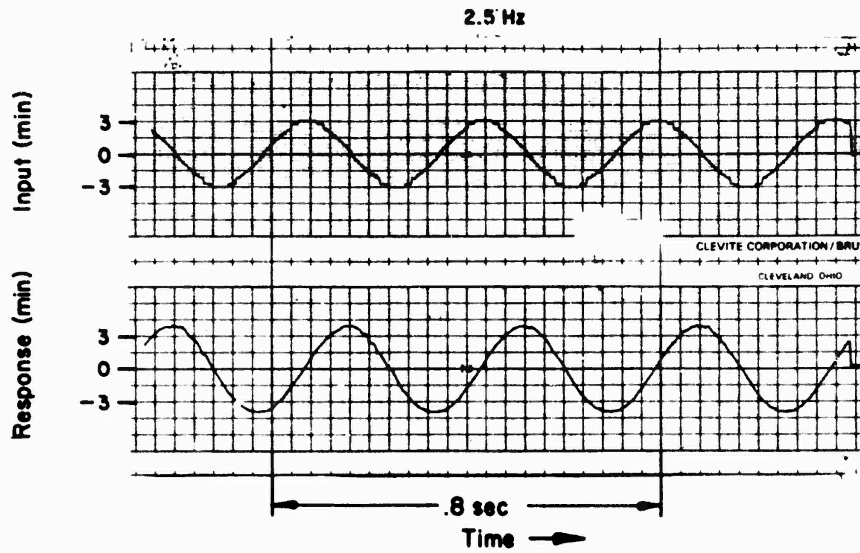


Figure 46. Frequency Response Test, SHM input of 3' amplitude, 2.8Hz frequency.

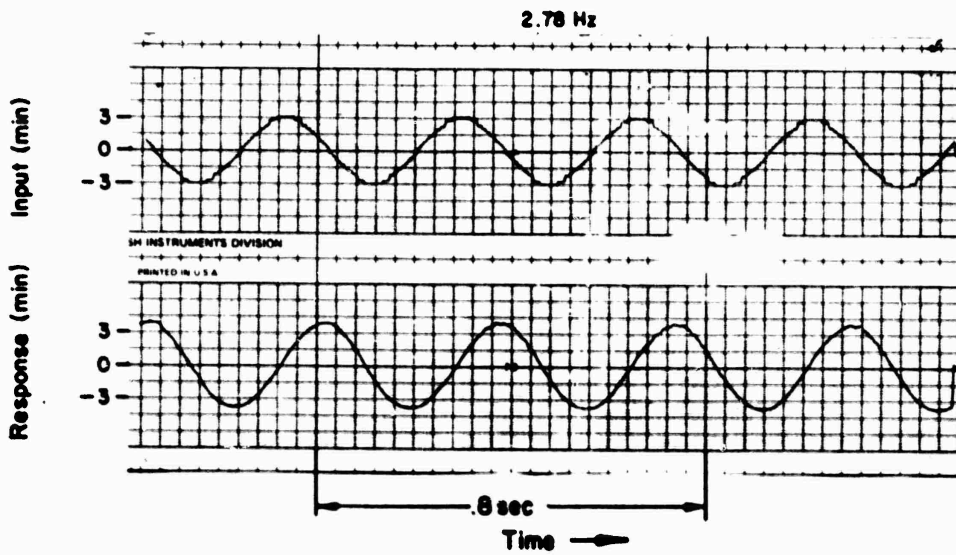


Figure 47. Frequency Response Test , SHM input of 3' amplitude , 4.0Hz frequency .

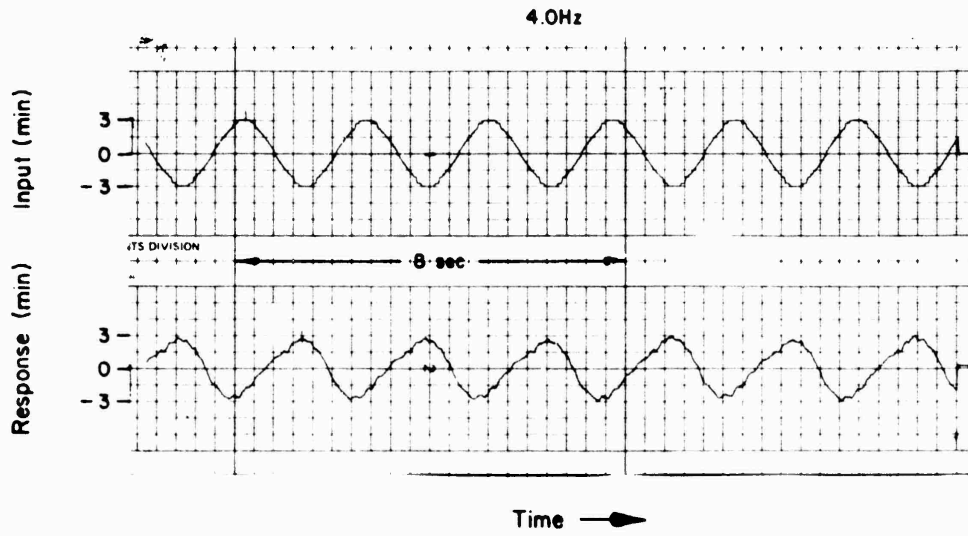


Figure 48. Frequency Response Test , SHM input of 3' amplitude , 5.6Hz frequency .

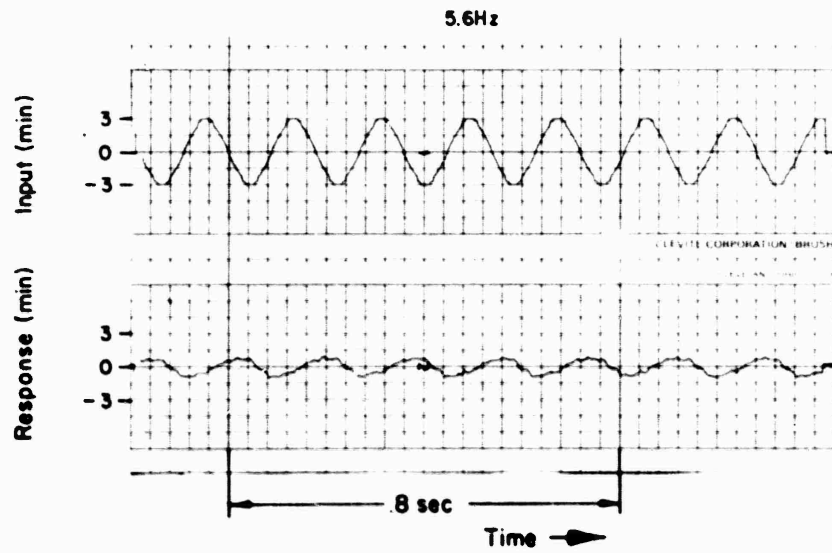
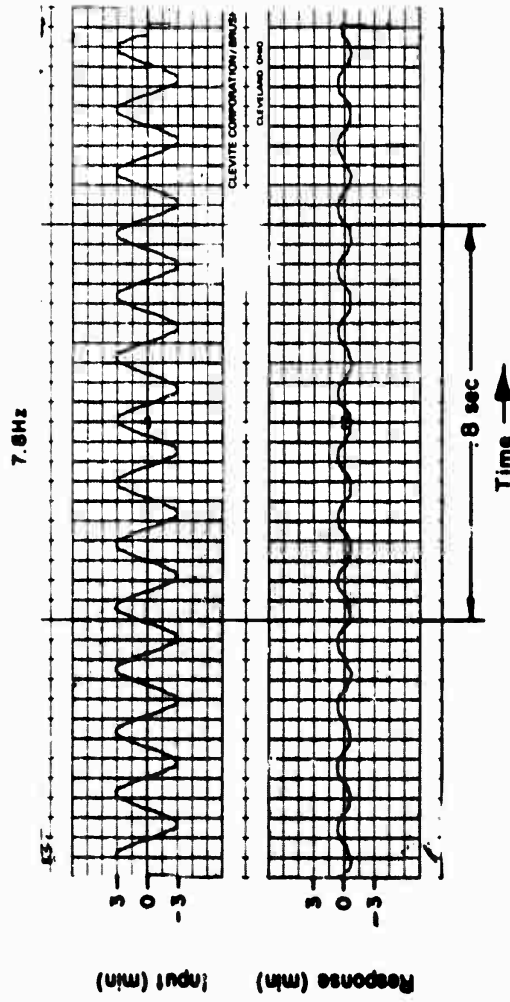


Figure 49. Frequency Response Test, SHM input of 3' amplitude, 7.8Hz frequency.



APPENDIX F

Loading System Test Data

Table F-1

Figures 1 through 24

C

TABLE F-1

**8"/55 MCLGM TECHNICAL EVALUATION
LOADING SYSTEM TEST DATA**

Figure Number	Component Operation	Cycle Time (sec)	Maximum Velocity
	Drum Indexing		
1	Empty, CW	1.10	32.4°/sec
2	Empty, CCW	1.48	34.8°/sec
3	Loaded (75 rds) CW	1.12	34.1°/sec
4	Loaded (75 rds) CCW	1.56	34.8°/sec
	Clip Transferring		
5	Loaded (3 rds) clip from transfer station to cell one at hoist	0.96	9.8 ft/sec
6	Loaded (2 rds) clip from cell one at hoist to cell two at hoist	0.81	2.6 ft/sec
7	Loaded (1 rd) clip from cell two at hoist to cell three at hoist	0.84	2.6 ft/sec
8	Empty clip from cell three at hoist to transfer station	1.04	11.6 ft/sec
	Hoist Operation (Short Flight)		
9	Empty Hoist Raised	1.17	14.1 ft/sec
10	Empty Hoist Lowered	1.00	16.9 ft/sec
11	Loaded Hoist Raised	1.24	13.8 ft/sec
12	Loaded Hoist Lowered	1.23	14.4 ft/sec
	Cradle Operation with Gun at 0° Elevation		
13	Empty Cradle Raised	1.34	120°/sec
14	Empty Cradle Lowered	0.96	210°/sec
15	Loaded Cradle Raised	1.40	115°/sec
16	Loaded Cradle Lowered	0.93	200°/sec
17	Loaded Cradle Raised with Gun Elevating at 20°/sec (motion relative to slide)	1.01	140°/sec
18	Loaded Cradle Raised with Gun Depressing at 20°/sec	1.32	100°/sec
	Breechblock Operation with Gun at Battery		
	Opened	0.19	—
	Closed	0.29	—
	Empty Case Tray Operation		
19	Empty Case Tray Lowered Empty	0.56	46.9°/sec
20	Empty Case Tray Raised Loaded	0.95	240°/sec
	Rammer Operation		
21	Extended Empty at 0° Elevation	0.66	21.1 ft/sec
22	Retracted at 0° Elevation	0.60	23.1 ft/sec
23	Extended Loaded at 0°30' Elevation	0.79	18.5 ft/sec
24	Extended Loaded at 65° Elevation	0.86	15.8 ft/sec

TABLE F-1 (Continued)

Figure Number	Component Operation	Cycle Time (sec)	Maximum Velocity
	Hoist Pawl Positioner Operation		
	Extended	0.17	-
	Retracted	0.17	-
	Round Centering Snubber & Latch Operation		
	Extended	0.29	-
	Retracted	0.29	-

Figure 1. Empty loader drum indexed one cell clockwise.

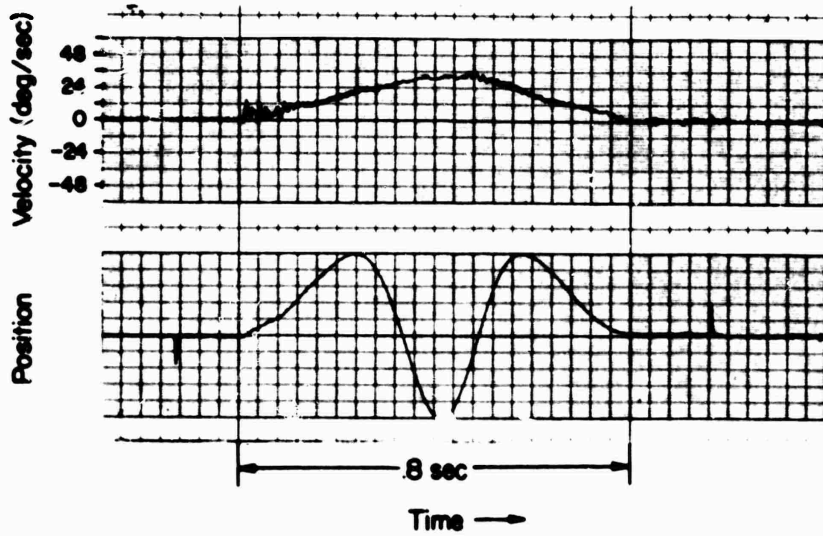


Figure 2. Empty loader drum indexed one cell counterclockwise.

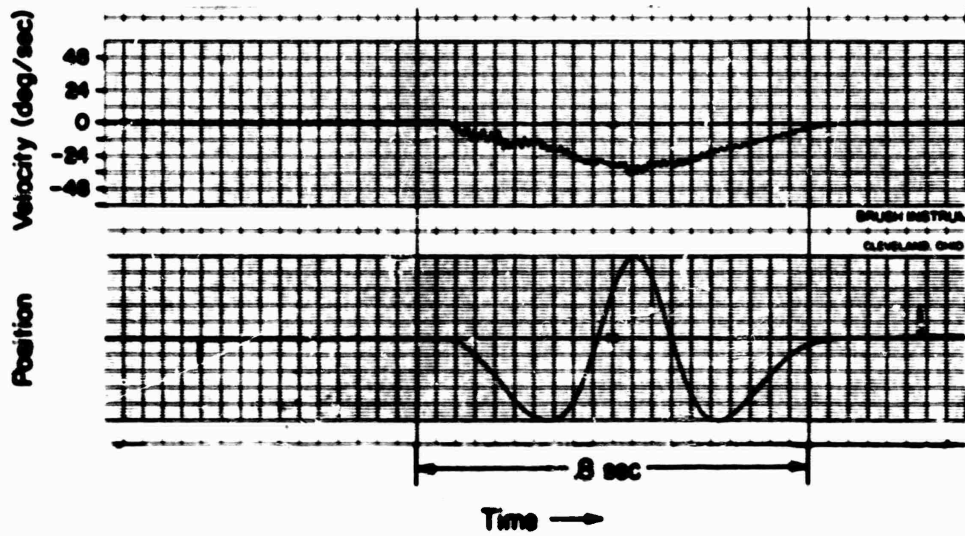


Figure 3. Drum loaded with 75 rounds indexed one cell clockwise.

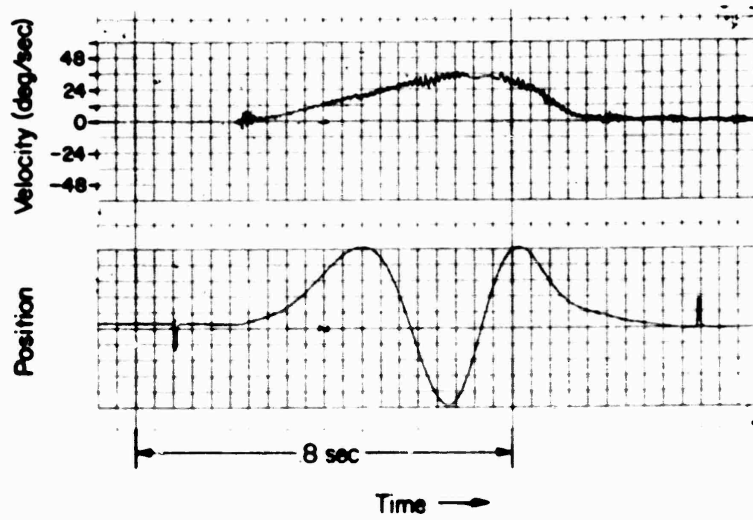


Figure 4. Drum loaded with 75 rounds indexed one cell counterclockwise.

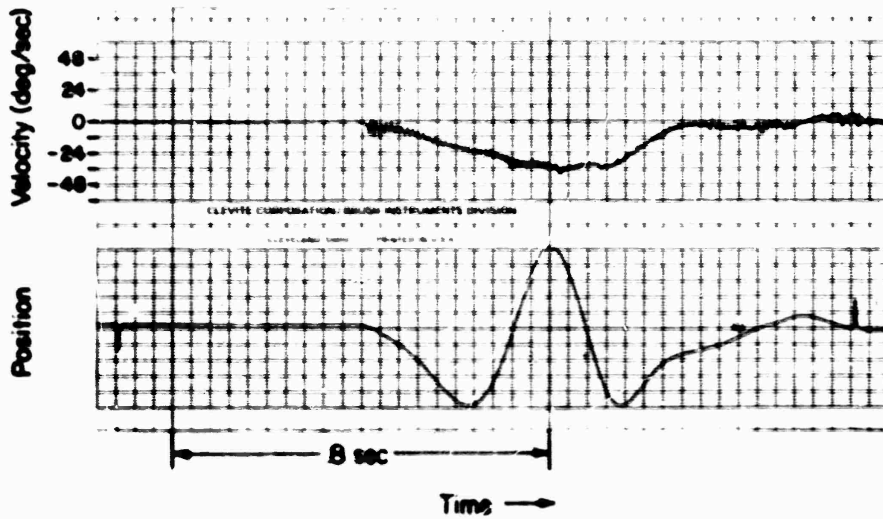


Figure 5. Clip transferred from transfer station to cell one at hoist with three rounds in the clip.

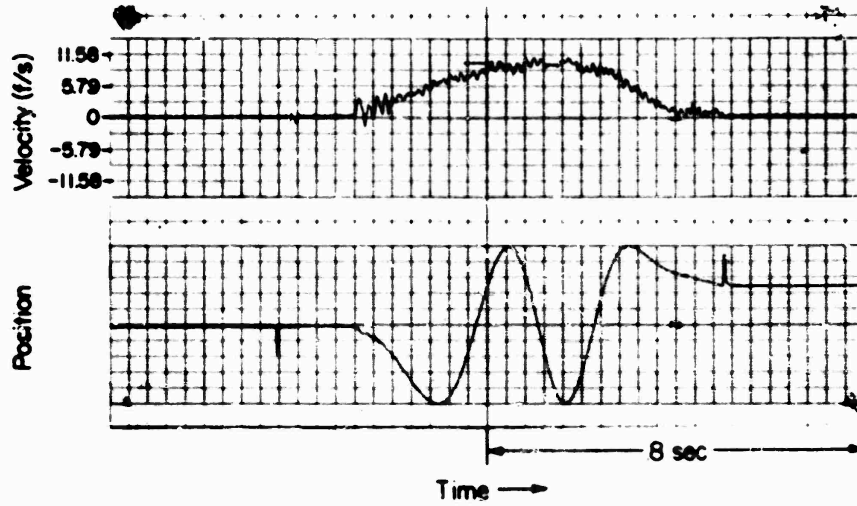


Figure 6. Clip transferred from cell one at hoist to cell two at hoist with two rounds in the clip.

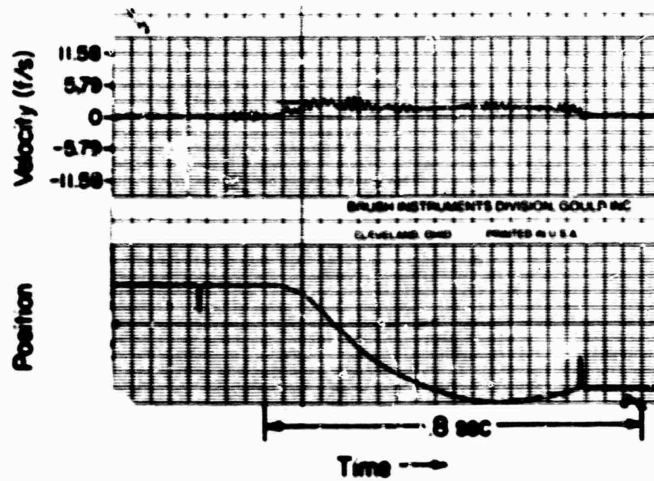


Figure 7. Clip transferred from cell two at hoist to cell three at hoist with one round in the clip.

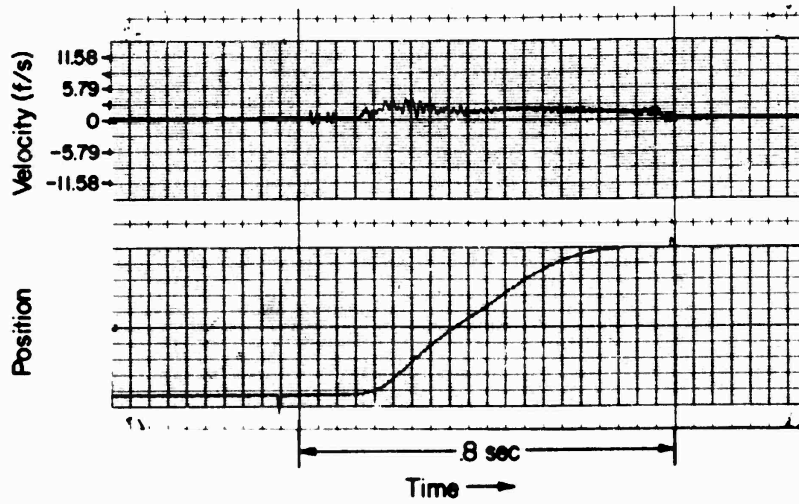


Figure 8. Empty clip transferred from cell three at hoist to clip at transfer station.

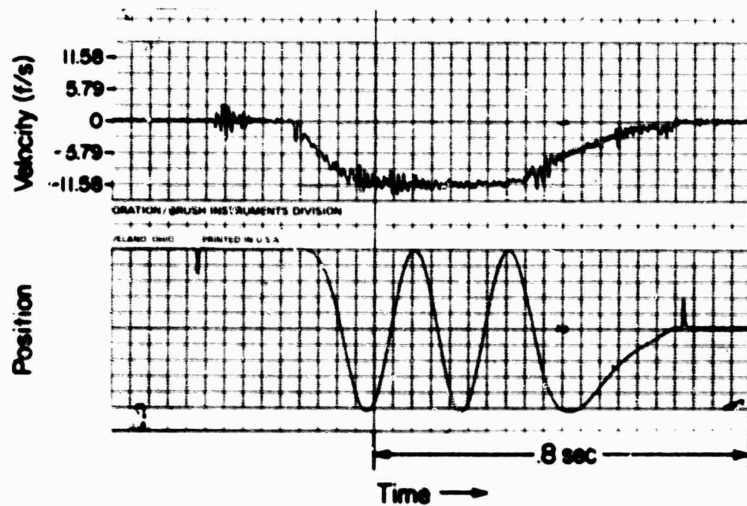


Figure 9. Empty hoist raised (Short Round Flight).

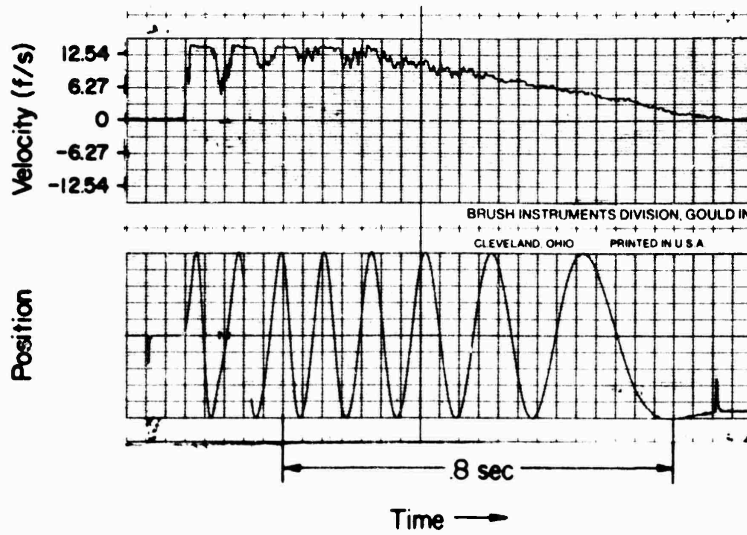


Figure 10. Empty hoist lowered (Short Round Flight).

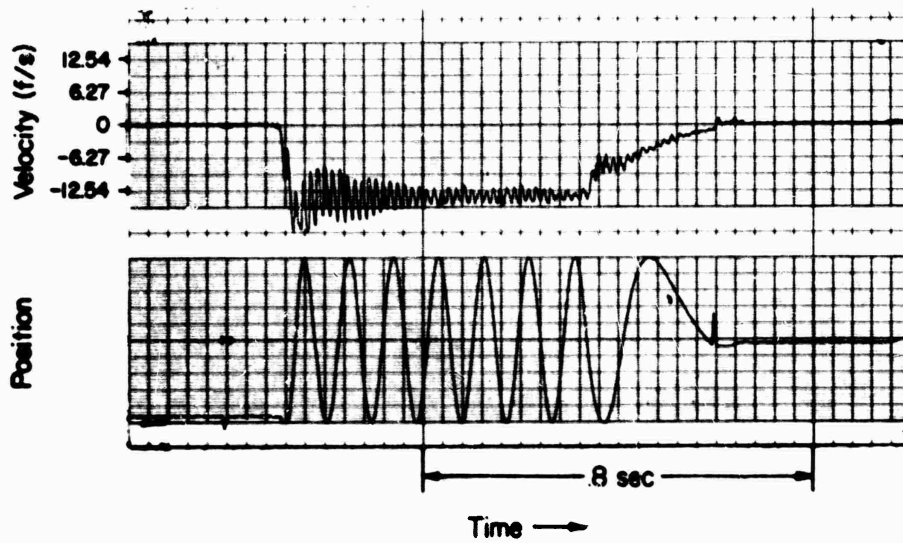


Figure 11. Hoist raised loaded with a short round.

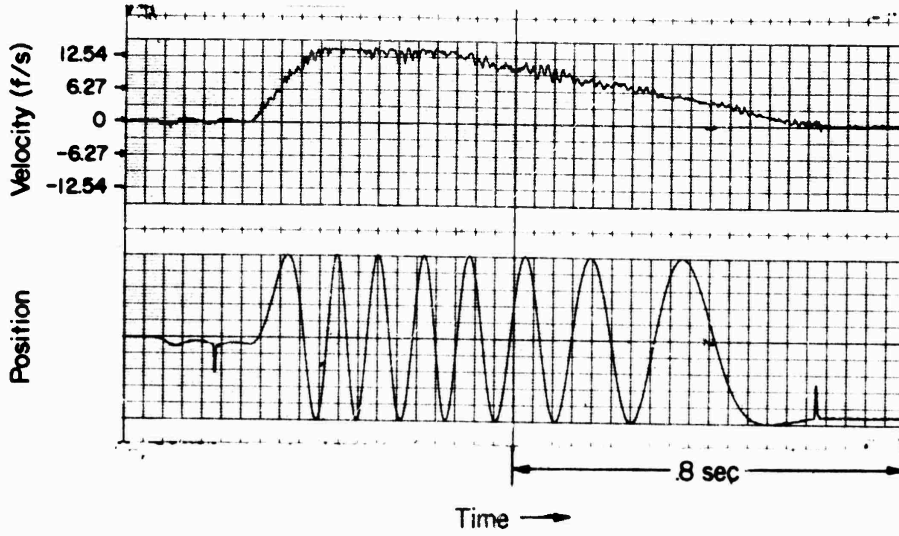


Figure 12. Hoist lowered with a short round.

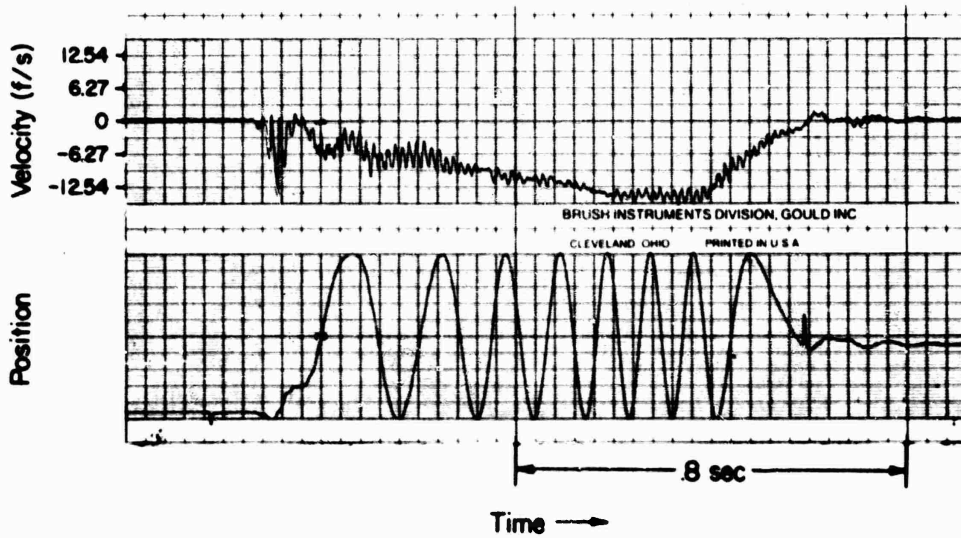


Figure 13. Empty cradle raised with the gun at 0° elevation.

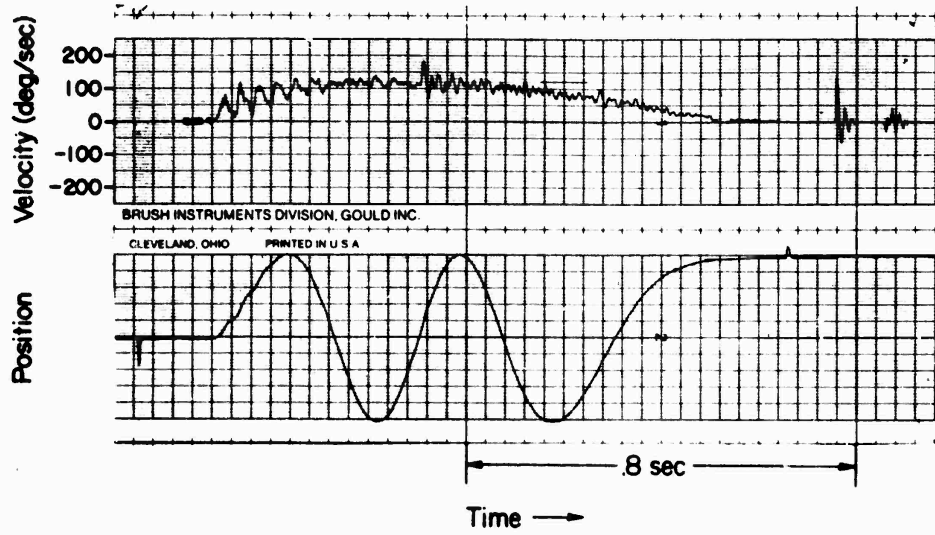


Figure 14. Empty cradle lowered with the gun at 0° elevation.

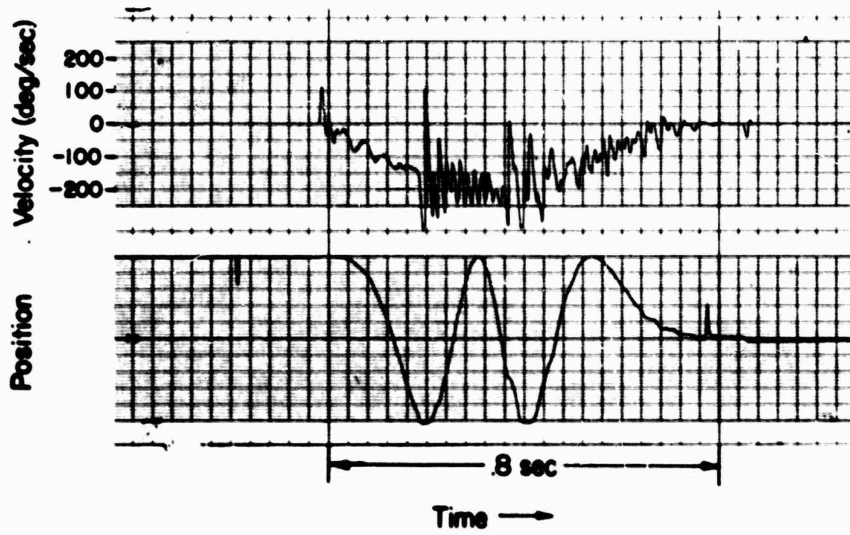


Figure 15. Loaded cradle raised with the gun at 0° elevation.

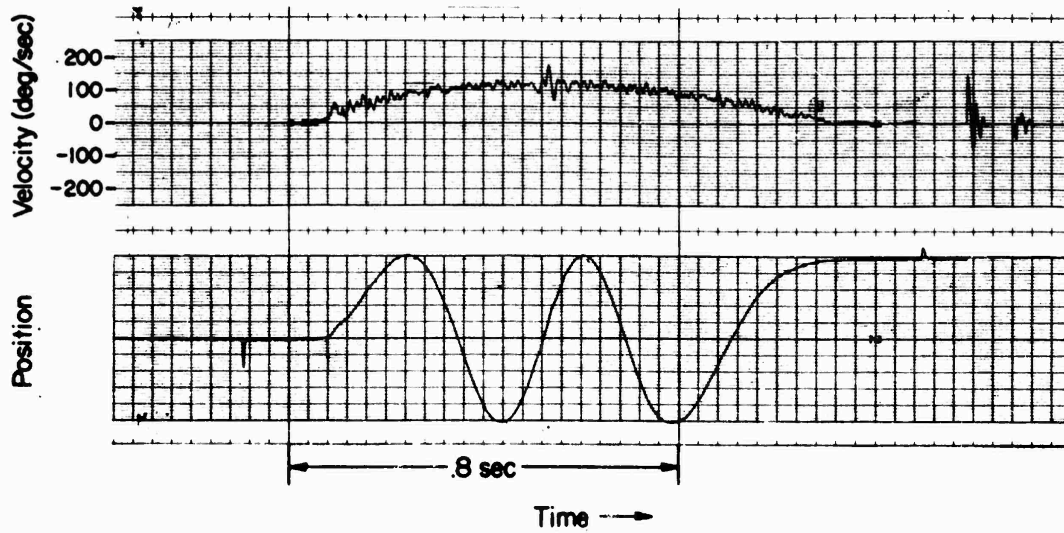


Figure 16. Loaded cradle lowered with the gun at 0° elevation.

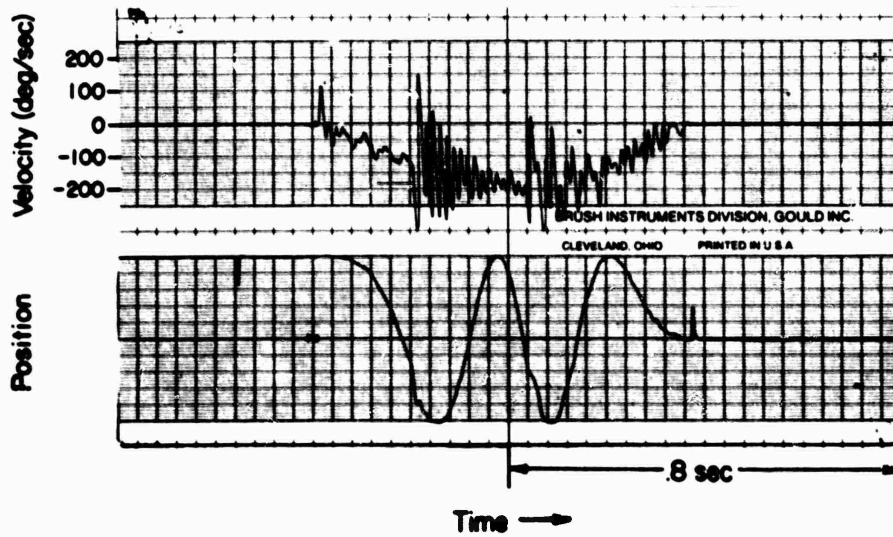


Figure 17. Loaded cradle raised with the gun elevating, 10°/sec (cradle velocity and position are relative to the slide).

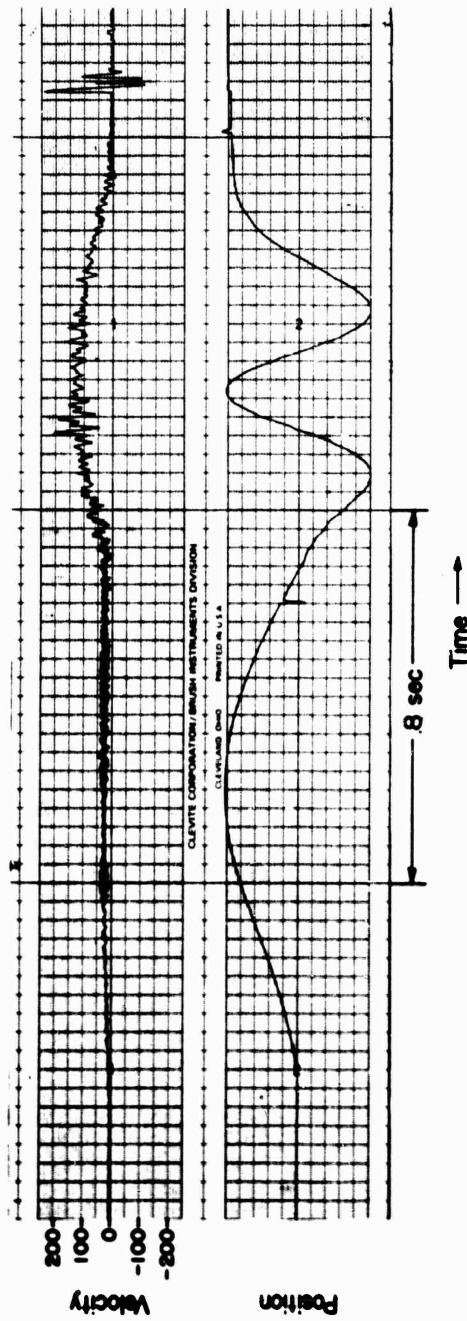


Figure 18. Loaded cradle raised with the gun depressing at 20°/sec (cradle velocity and position are relative to the slide).

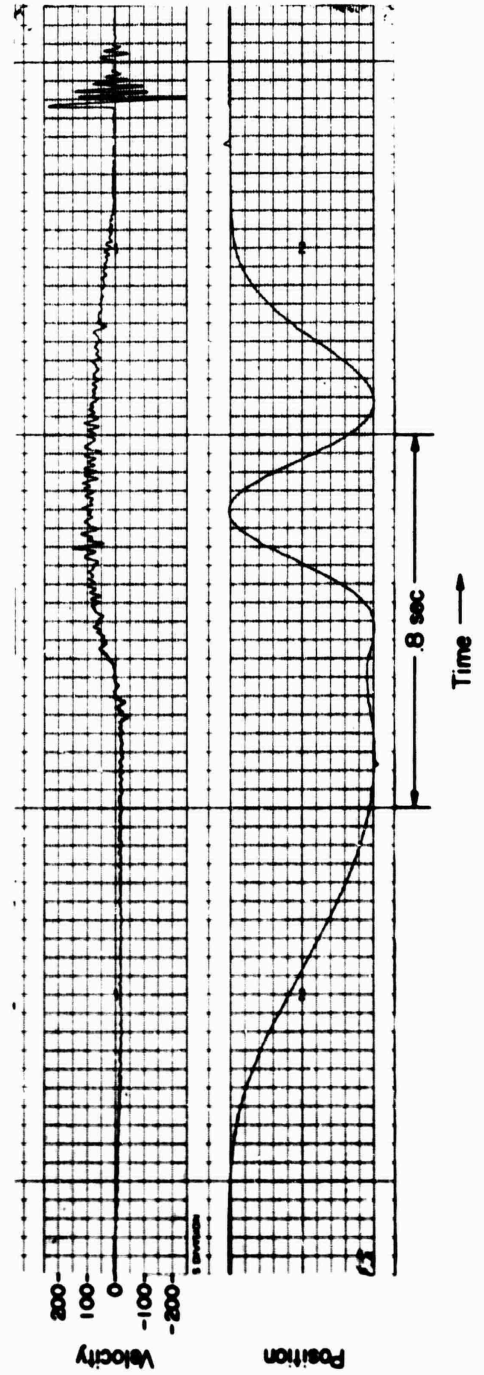


Figure 19. Empty case tray lowered.

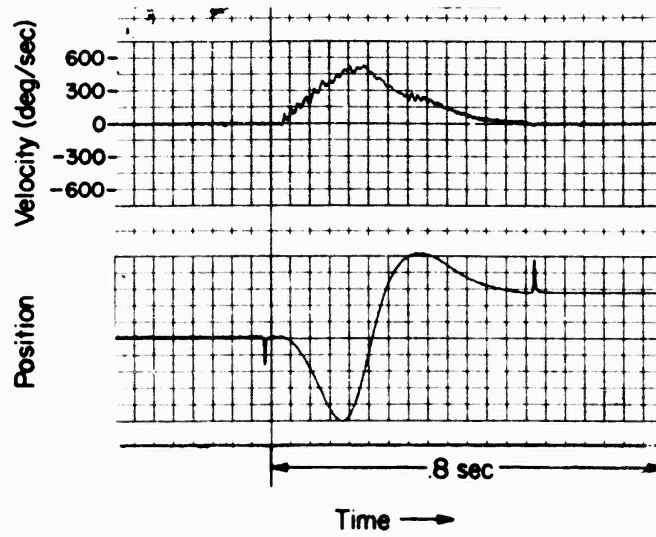


Figure 20. Loaded empty case tray lowered.

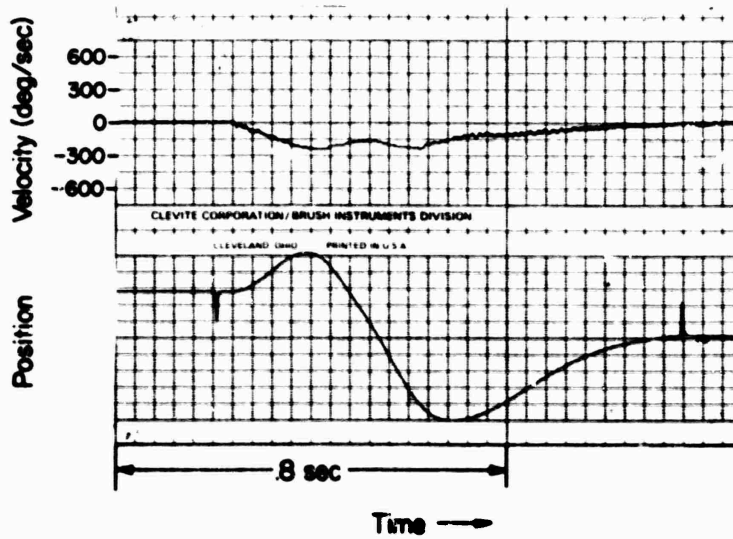


Figure 21. Rammer extended empty with the gun at 0° elevation.

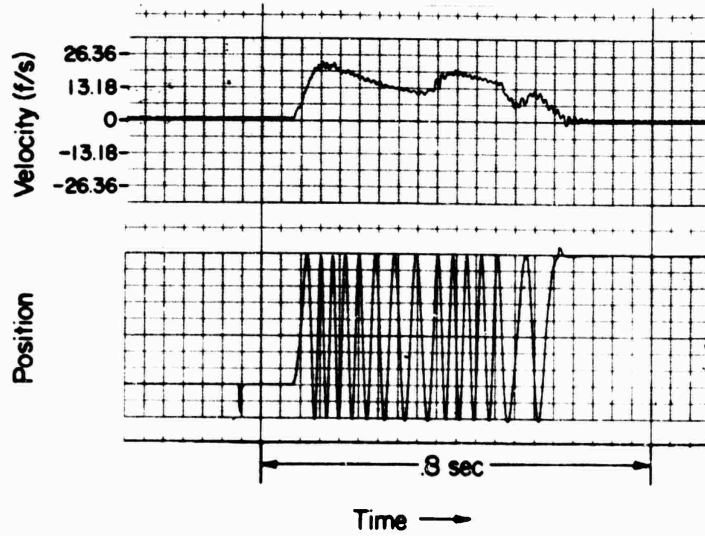


Figure 22. Rammer retracted with the gun at 0° elevation.

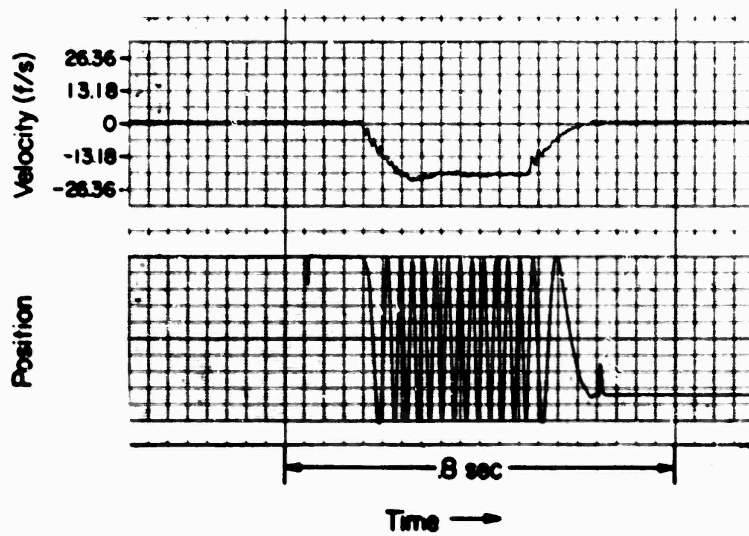


Figure 23. Rammer extended loaded with the gun at 0°30' elevation.

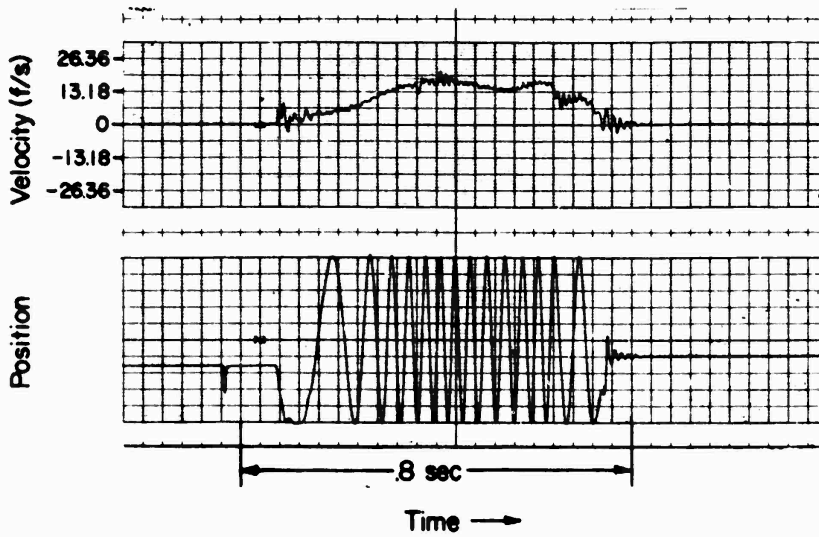
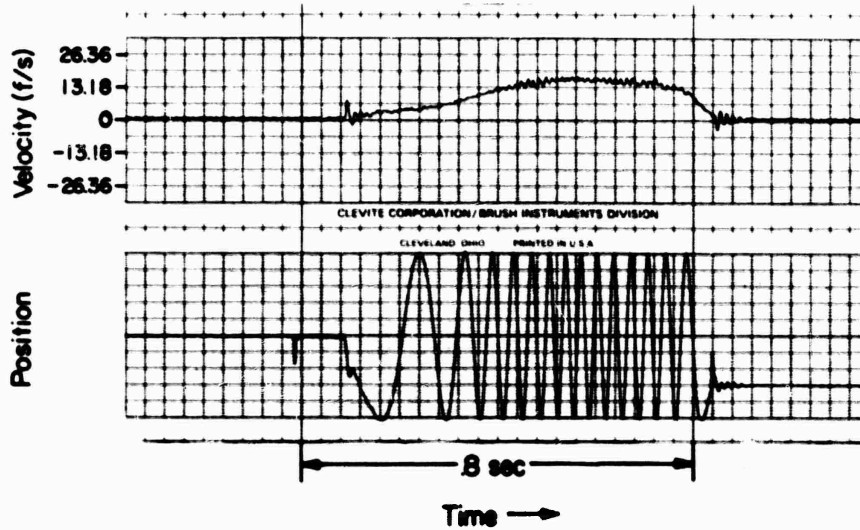


Figure 24. Rammer extended loaded with the gun at 65° elevation.



APPENDIX G

**Tabulated Firing Data
Tables G-1 Through G-3**

TABLE G-1
8"/55 MAJOR CALIBER LIGHTWEIGHT GUN MOUNT MARK 71 MOD 0
SUMMARY OF TEST DATA

Date Fired	Test	Remarks Shot Fired	Com Elevation (Deg/Min)	Bore Engagement Origin (in)	Bore Engagement Muzzle (in)	Bore Erosion Gauge Reading (in)	Charge Type	Mean ⁽¹⁾ Chamber Pressure - Std Dev (inRCS)	Mean ⁽¹⁾ Transon Velocity - Std Dev (ft/sec)	Mean Rate of Fire (R/M)	Mean ⁽¹⁾ Transon Range - Std Dev (Yds)	Mean ⁽¹⁾ Corr Range - Std Dev (Yds)	Range Table Range (Yds)	Uncorr D/R(1) (R)	Corr D/R(1) (R)
9/03	Proof of Mount	3	00 30	.001	.001	1:2	Proof Series	-	-	-	-	-	-	-	-
9/08	Velocity Check	3	05 00	.003	.000	N.T	Full	18 1:4	2739±10	-	N.T	-	-	-	-
9/13	Range Fire Check	3	05 00	.005	.001	N.T	Near Reduced	N.T	2551±15	11.91	N.T	-	-	-	-
9/14	Demonstration	5	10 00	.009	.002	N.T	Near Reduced	N.T	N.T	N.T	N.T	-	-	-	-
9/15	Com Test	3	10 00	.008	.001	N.T	Proof Series	-	-	-	N.T	-	-	-	-
9/16	Range Fire Check	3	10 00	N.T	N.T	N.T	Full	N.T	10±16	12.08	N.T	-	-	-	-
9/17	Com Test	3	10 00	.008	.002	N.T	Full	N.T	2720±19	N.T	N.T	-	-	-	-
9/21	Sustainability	11	00 30	.012	.012	N.T	Proof Series	N.T	2708±9	3.96(4) 4.24(4)	N.T	-	-	-	-
9/28	Rate of Fire	12	10 00	.014	.003	N.T	Full	-	9.15(5)	-	-	-	-	-	-
10/04	Shot Field	5	00 30	.022	.003	N.T	Full	N.T	N.T	-	N.T	-	-	-	-
10/06	Clearing Charge Shot Field	1	00 30	N.T	N.T	N.T	Near Reduced	N.T	2784±10	-	N.T	-	-	-	-
		2	00 30				Full		2316		N.T				
		1	00 30				Full		2340		N.T				
	Com Test	3	00 30				Proof	23.9	2827		N.T				
10/07	Shot Field	5	00 30	N.T	N.T	N.T	Full	N.T	2721±15	-	N.T	-	-	-	-

TABLE G-1 (Continued)

Date Prod PVT	Test	Shots Per	Prod Per	Rev Per	Rev (Deg/Min)	Bar Origin (in)	Bar Muzzle (in)	Bar Length (in)	Change Type	Mass ⁽¹⁾ Chamber Pressure - Std Dev (ksi/ft)	Mass ⁽¹⁾ Transverse Velocity - Std Dev (ft/sec)	Mass ⁽¹⁾ Rate of Fire (R/M)	Mass ⁽¹⁾ Unrec'd Range - Std Dev (yds)	Mass ⁽¹⁾ Core Range - Std Dev (yds)	Range Table Range (yds)	Uncert D/R ⁽¹⁾ (%)	Comp D/R ⁽¹⁾ (%)
10/28	Car Test	2		0	N.T.	N.T.	N.T.	N.T.	Proof Series								
10/17						.024	.004	N.T.					N.T.				
10/13	Proof of Load	5		10	00	.002	.003	N.T.	Proof Series				N.T.				
10/14	Chamber Check	1		10	00	.001	.002	N.T.	Near Full	15.6			N.T.				
10/22	Dismount	6		10	00	N.T.	N.T.	N.T.	Near Reduced		2225±11		N.T.				
11/02	Car Test	3		03	00	.005	.001	-4.67	Full	N.T.	2740		6720	6383	6312		.83
	Rate of Fire	12		10	00				Full	N.T.	2701±11	12.01	15435±109	15415±166	15336	.53	.83
11/04	Change Distribution	6		08	30	.003	.002	4.63	Red Probity	N.T.	2711±11	12.03	22585±188	22814±143	22200	.69	.51
		10		20	00				Full	N.T.			N.T.				
11/08	Car Check	12		00	30	N.T.	N.T.	N.T.	Full	N.T.		11.72	N.T.				
11/09	Fire-test	12		10	00	.008	.002	4.60	Full	N.T.	2705±7	11.86	15115±90	15433±83	15336	.45	.41
		12		10	00				Full	N.T.							
11/12	Fire-test	20/21		10	00	.011	.004	4.45	Full	N.T.							
		21		10	00												
		20		10	00												
		2		10	00												
11/16	Rate of Fire (4)	12		27	00	.048	.013	-1.37	Full	N.T.	2700±14	11.90	15273±138	15344±83	15336	.80	.44
11/22	Rate of Fire	15		08	00	N.T.	N.T.	N.T.	Full	N.T.	2694±16	12.42	26288±258	26043±116	25500	.86	.35
	Rate of Fire	10		08	00				Full	N.T.	2675±10	11.88	13174±82	13553±59	13400	.45	.32
	Rate of Fire	10		08	00				Full	N.T.	2674±14	N.T.	13103±152	13492±107	13400	.87	.55
11/23	Rate of Fire	15		27	00	N.T.	N.T.	N.T.	Full	N.T.	2695±16	12.26	25475±197	26080±106	25500	.63	.30
	Subsidiary	5		OKC					Full	N.T.							
11/30	Rate of Fire	15		08	00	.054	.017	2.70	Full	N.T.	2692±19	11.47(7)	13297±178	13389±79	13400	1.02	.48
	Subsidiary	15		OKC					Full	N.T.		4.71(4)					
11/01	Rate of Fire	15		27	00	N.T.	N.T.	N.T.	Full	N.T.	2689±4	12.24	25705±205	26063±135	25500	.61	.34
	Rate of Fire	27		00					Full	N.T.							

TABLE G-1 (Continued)

Shot Pistol 1971	Test	Range Pistol Pistol	Gas Blowby (Inch/Min)	Base Expenditure Output (Inch)	Base Expenditure Output (Inch)	Base Expenditure Output (Inch)	Change Type	Mean ⁽¹⁾ Chamber Pressure + Std Dev (in/In)	Mean ⁽¹⁾ Transition Velocity + Std Dev (ft/sec)	Mean Rate of Fire (R/Min)	Mean ⁽¹⁾ Uncor Range + Std Dev (Yds)	Mean ⁽¹⁾ Corr Range + Std Dev (Yds)	Range Table Range (Yds)	Uncor DVR ⁽¹⁾ (%)	Corr DVR ⁽¹⁾ (%)
12/01	Rate of Fire Change	1	27 00				Full Reduced	N.T. N.T.	2685±16	12.24	25707±256	26213±131	25500	78	43
	Stop Lead Change	1	27 00				Full	N.T.	2681±17	3.65	24964±250	26041±169	25500	76	49
	Rate of Fire	15	45 00				Reduced	N.T.	2160±13	12.45	23042±156	23915±185	23412	48	56
	Rate of Fire	6	45 00				Reduced	N.T.	2156±17	12.49	23018±179	23945±281	23412	43	93
12/11	Spotting Pistol	1	20 00				Full	N.T.	2691±16	12.07	22560±216	22592±101	22200	74	36
	Spotting Pistol	14	19 30				Full	N.T.	2676±11	3.35	21861±237	22269±170	21937	74	59
	Change Pistol	1	19 30				Full	N.T.	2674±15	3.22	22315±293	22249±148	21937	74	53
	Change Pistol	2	19 30				Full	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
12/15	Subsidiary Pistol	1	13 00				Full	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Subsidiary Pistol	15	35 00				Full	N.T.	N.T.	4.93(4)	N.T.	N.T.	N.T.	N.T.	N.T.
	Change Pistol	14	35 00				Reduced	N.T.	2168±7	12.57	22806±175	22200±105	22100	47	40
	Change Pistol	1	35 00				Reduced	N.T.	2183	12.57	23074	22382	22210	56	25
12/22	Change Pistol	15	35 00				Reduced	N.T.	2167±12	12.55	22818±165	22214±71	22100	56	25
	Change Pistol	1	60 00				Reduced	N.T.	2168	11.99	19438	20188	20620	46	74
	Change Pistol	14	60 00				Reduced	N.T.	2140±19	11.99	20120±137	21230±224	20620	46	74
	Change Pistol	1					Reduced	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
12/27							Full	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
							Full	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.

(1) The first round of each group was considered a conditioning round and not used in the analysis of data.
 (2) All four barrels are considered one group for this analysis because delays were a half hour or less between barrels.
 (3) Base chamber pressure readings were taken on the F1 15 MOD 1 P-10 rifle. Negative readings indicate the pressure gauge did not go far enough into the bore for the zero
 mark on the pressure gauge scale to reach the side of the breach face. The F1400 base chamber gauge MARK 3 MOD 9 was used (diag. 5-07879).
 (4) Mean of the rate of fire variability test indicates rather long periods when the rifle does not fire in a clip loaded with the selected ammunition type.
 (5) Minimum chamber pressure (MCP) cannot be determined from the data since the rifle does not fire in a clip loaded with the selected ammunition type.
 (6) Progress of the tests during the OPEVAL are identified for compatibility with this table.
 (7) Rate of fire was low due to the fact these three barrels were firing almost one second too long. This was believed caused by an oil film on the light source which is used to
 indicate the rate of fire.
 (8) MCP cannot be determined from the data.
 (9) MCP cannot be determined from the data.

TABLE G-2 (Continued)

DATE FIRED	BARREL NO.	ROUND NO.	LOCAL TIME	ELEVATION (M)	WIND (M/S)	TEMP (C)	MOIST (G/M ³)	BARREL MODE	ORIGIN (M)	NOZZLE (M)	CHARGE	CHAMP PRESS. (PSI)	TRJN. VEL. (FT/S)	MUZZLE FLASH (CM/SEC)	UNDRR. RANGE (YDS)	CORR. RANGE (YDS)	RANGE TABLE RANGE (YDS)	
09/17	28-8	2	1818	10 50	0.00	0.02	M.T.	SPCF-11073	42.63	N.T.	2740	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	
		3	1823						42.63	N.T.	2695	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		4	1827						42.63	N.T.	2727	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		5							42.63	N.T.	2694	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		6							42.63	N.T.	2730	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		7							42.63	N.T.	2739	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		8							42.63	N.T.	2718	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		9	1878						42.63	N.T.	2834	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		10	1837						42.63	N.T.	2805	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		11	1864						42.63	N.T.	2806	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		12	1867						42.63	N.T.	2806	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		09/27	10-8	1	1437	00 30	0.02	0.02	M.T.	SPCF-11073	42.63	N.T.	2894	N.T.	N.T.	N.T.	N.T.	N.T.
2									42.63	N.T.	2739	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
3										42.63	N.T.	2712	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
4										42.63	N.T.	2715	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
5										42.63	N.T.	2694	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
6										42.63	N.T.	2697	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
7										42.63	N.T.	2826	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
8										42.63	N.T.	2726	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
9										42.63	N.T.	2714	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
10										42.63	N.T.	2711	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
11	1580									42.63	N.T.	2715	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
12										42.63	N.T.	2694	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
09/28	20-8	1	1358	10 38	0.04	0.02	M.T.	SPCF-11073	42.63	N.T.	2894	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		2							42.63	N.T.	2739	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		3								42.63	N.T.	2712	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		4								42.63	N.T.	2715	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		5								42.63	N.T.	2694	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		6								42.63	N.T.	2697	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		7								42.63	N.T.	2826	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		8								42.63	N.T.	2726	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		9								42.63	N.T.	2714	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		10								42.63	N.T.	2711	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		11								42.63	N.T.	2715	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.

TABLE G-2 (Continued)

DATE FIRED	BARREL EX-NO	ROUND NO.	LOCAL TIME FIRED	GUN ELEVATION (DEG-MIN)	MODE FIRED	MORE ORIGIN (IN)	ENLARG- MNT (IN)	BOPE PROB (IN)	POWDER INDEX OR DESIG.	CHARGE WEIGHT (LB)	CASUAL PRESS. (PSI)	TRUN. VEL. (FPS)	MUZZLE FLASH (UM/ CM-SEC)	UNCORR. RANGE (YDS)	CORR. RANGE (YDS)	RANGE TARJ. RANGE (YDS)		
11/82	28-1	3	1059	03 33	SLOW	.805	.001	-4.87	SPCF-11073	42.63	M.T.	2716	N.T.	15664	15773	6312		
		4	1428	13 08	RAPID					42.63	M.T.	2729	N.T.	15727	15776	15336		
		5								42.63	M.T.	2734	N.T.	15566	15821	15336		
		6								42.63	M.T.	2717	N.T.	15452	15892	15336		
		7								42.63	M.T.	2680	N.T.	15732	15698	15336		
		8								42.63	M.T.	2700	N.T.	15732	15443	15336		
		9								42.63	M.T.	2597	N.T.	15656	15472	15336		
		10								42.63	M.T.	2702	N.T.	15814	15590	15336		
		11								42.63	M.T.	2705	N.T.	15670	15464	15336		
		12								42.63	M.T.	2710	N.T.	15635	15707	15336		
		13								42.63	M.T.	2715	N.T.	15812	15279	15336		
		14								42.63	M.T.	2695	N.T.	15696	15530	15336		
		15								42.63	M.T.	2698	N.T.	15487	15382	15336		
		11/86	28-1	1	1010	00 38	SLOW	.803	.002	-4.83	SPCF-11073	60.09	M.T.	2096	M.T.	-	-	-
				2	1191							42.63	M.T.	2127	N.T.	-	-	-
3	1110									42.63	M.T.	2190	N.T.	-	-	-		
4	1117									42.63	M.T.	2257	N.T.	-	-	-		
5	1127									42.63	M.T.	2296	N.T.	-	-	-		
6	1127									42.63	M.T.	2296	N.T.	-	-	-		
7	1425			20 00	RAPID					42.63	M.T.	2717	N.T.	-	-	-		
8										42.63	M.T.	2709	N.T.	-	-	-		
9										42.63	M.T.	2717	N.T.	-	-	-		
10										42.63	M.T.	2692	N.T.	-	-	-		
11										42.63	M.T.	2711	N.T.	-	-	-		
12										42.63	M.T.	2716	N.T.	-	-	-		
13										42.63	M.T.	2712	N.T.	-	-	-		
14										42.63	M.T.	2739	N.T.	-	-	-		
15										42.63	M.T.	2706	N.T.	-	-	-		
16								42.63	M.T.	2700	N.T.	-	-	-				
17								42.63	M.T.	2716	N.T.	-	-	-				
18								42.63	M.T.	2706	N.T.	-	-	-				
19								42.63	M.T.	2710	N.T.	-	-	-				
20								42.63	M.T.	2710	N.T.	-	-	-				
11/86	28-1	1	1455	00 33	RAPID	M.T.	M.T.	M.T.	SPCF-11073	42.63	M.T.	M.T.	M.T.	-	-	-		
		2	1541							42.63	M.T.	M.T.	M.T.	-	-	-		
		3								42.63	M.T.	M.T.	M.T.	-	-	-		
		4								42.63	M.T.	M.T.	M.T.	-	-	-		
		5								42.63	M.T.	M.T.	M.T.	-	-	-		
		6								42.63	M.T.	M.T.	M.T.	-	-	-		
		7								42.63	M.T.	M.T.	M.T.	-	-	-		
		8								42.63	M.T.	M.T.	M.T.	-	-	-		
		9								42.63	M.T.	M.T.	M.T.	-	-	-		
		10								42.63	M.T.	M.T.	M.T.	-	-	-		
		11								42.63	M.T.	M.T.	M.T.	-	-	-		
		12								42.63	M.T.	M.T.	M.T.	-	-	-		
		13								42.63	M.T.	M.T.	M.T.	-	-	-		
		14								42.63	M.T.	M.T.	M.T.	-	-	-		
		15								42.63	M.T.	M.T.	M.T.	-	-	-		
11/89	28-1	1	1421	18 03	RAPID	.809	.002	-4.80	SPCF-11073	42.63	M.T.	2691	M.T.	14975	15414	15336		
		2							42.63	M.T.	2691	M.T.	15317	15336				
		3							42.63	M.T.	2716	M.T.	15394	15336				

TABLE G-2 (Continued)

DATE FIRED	BARREL CR-MDC	ROUND NO.	LOCAL TIME	CUN ELEVATION (MGS)	NOSE DIA	NOSE ORIGIN (IN.)	NOSE EMERGENCY ORIGIN (IN.)	NOSE EMERGENCY ORIGIN (IN.)	POWDER INCH OR DESIG.	CHEMICAL PROCES. (CJ)	CHAMBER PRESS. (PSI)	TOURN. VEL. (FPS)	MUZZLE FLASH TIME (M.S.)	UNCOPR. RANGE (YDS)	CORR. RANGE (YDS)	RANGE TABLE RANGE (YDS)
11/12	28-1	28	13 33	0811	0306	0005	SPUP-11073	02-03	M.Y.	2707	1363	15101	15314	15316	15316	15316
		29						02-03	M.Y.	2684				15144	15384	15336
		30						02-03	M.Y.	2707	522	15482	15493	15336	15336	15336
		31						02-03	M.Y.	2645	522	15148	15355	15336	15336	15336
		32						02-03	M.Y.	2648	745	15153	15234	15336	15336	15336
		33						02-03	M.Y.	2648	765	15371	15463	15336	15336	15336
		34						02-03	M.Y.	2649	912	15163	15435	15336	15336	15336
		35						02-03	M.Y.	2643	1043	15102	15386	15336	15336	15336
		36						02-03	M.Y.	2721	912	15307	15278	15336	15336	15336
		37						02-03	M.Y.	2706	522	15241	15281	15336	15336	15336
		38						02-03	M.Y.	2698	912	15199	15362	15336	15336	15336
		39						02-03	M.Y.	2718	912	15423	15348	15336	15336	15336
		40						02-03	M.Y.	2677	912	15117	15394	15336	15336	15336
		41						02-03	M.Y.	2684	745	15243	15349	15336	15336	15336
		42						02-03	M.Y.	2714	1175	15405	15350	15336	15336	15336
		43						02-03	M.Y.	2683	1175	15154	15378	15336	15336	15336
		44						02-03	M.Y.	2711	1043	15383	15362	15336	15336	15336
		45						02-03	M.Y.	2702	390	15154	15211	15336	15336	15336
		46						02-03	M.Y.	2682	1175	15152	15231	15336	15336	15336
		47						02-03	M.Y.	2657	1043	15162	15254	15336	15336	15336
		48						02-03	M.Y.	2671	1175	15172	15284	15336	15336	15336
		49						02-03	M.Y.	2714	390	15315	15278	15336	15336	15336
		50						02-03	M.Y.	2697	390	15169	15278	15336	15336	15336
		51						02-03	M.Y.	2672	785	15011	15332	15336	15336	15336
		52						02-03	M.Y.	2702	522	15255	15312	15336	15336	15336
		53						02-03	M.Y.	2681	1175	15164	15317	15336	15336	15336
		54						02-03	M.Y.	2707	390	15219	15232	15336	15336	15336
		55						02-03	M.Y.	2700	261	15122	15197	15336	15336	15336
		56						02-03	M.Y.	2733	390	15263	15720	15336	15336	15336
		57						02-03	M.Y.	2712	522	15144	15154	15336	15336	15336
		58						02-03	M.Y.	2674	649	15195	15453	15336	15336	15336
		59						02-03	M.Y.	2710	522	15377	15375	15336	15336	15336
		60						02-03	M.Y.	2741	522	15224	15290	15336	15336	15336
		61						02-03	M.Y.	2704	912	15220	15264	15336	15336	15336
		62						02-03	M.Y.	2705	522	15207	15239	15336	15336	15336
		63						02-03	M.Y.	2644	649	15160	15470	15336	15336	15336
		64						02-03	M.Y.	2664	649	15176	15212	15336	15336	15336
		65						02-03	M.Y.	2664	1175	15176	15212	15336	15336	15336
		66						02-03	M.Y.	2636	745	15126	15234	15336	15336	15336
		67						02-03	M.Y.	2686	912	15338	15441	15336	15336	15336
		68						02-03	M.Y.	2681	745	15165	15319	15336	15336	15336
		69						02-03	M.Y.	2690	912	15100	15263	15336	15336	15336
		70						02-03	M.Y.	2678	785	15147	15407	15336	15336	15336
		71						02-03	M.Y.	2700	745	15194	15274	15336	15336	15336
		72						02-03	M.Y.	2648	745	15222	15314	15336	15336	15336
		73						02-03	M.Y.	2719	522	15176	15173	15336	15336	15336

TABLE G-2 (Continued)

DATE	34874	40003	LOCAL	COV.	SCIE	REF	EDITION	INDEX	CHARIE	NUMBER	TRJUN.	MUZZLE	UNCORR.	COPR.	RANGE
1971	ER-030	MO.	TIME	ELEVATION	DRIFT	WIND	WIND	39	M-104	SPCF-11073	(FVS)	(UM/	(WVS)	(VUS)	(RDS)
11/12	20-1	71	13 00	13 00	.011	.036	-6.45	SPCF-11071	02-63	M.T.	261	1043	15232	15674	18336
11/16	20-1	75	1332	27 30	.013	.013	-3.77	SPCF-11073	02-63	M.T.	2497	390	15147	15240	15336
		76							02-63	M.T.	2633	745	15141	15345	15336
		77							02-63	M.T.	2456	0	25661	26033	21500
		78							02-63	M.T.	2604	1	26448	26232	25500
		79							02-63	M.T.	2726	0	26677	26010	25600
		80							02-63	M.T.	2637	0	26950	26020	25600
		81							02-63	M.T.	2711	912	26479	26037	25600
		82							02-63	M.T.	2639	522	26459	26032	25600
		83							02-63	M.T.	2733	0	26433	26138	25600
		84							02-63	M.T.	2652	746	26159	25991	25500
		85							02-63	M.T.	2632	522	26159	25934	25500
		86							02-63	M.T.	2631	0	26321	25939	25500
		87							02-63	M.T.	2659	0	25973	25993	25500
		88							02-63	M.T.	2652	0	13669	13635	14600
		89							02-63	M.T.	2674	0	13165	13555	14600
		90							02-63	M.T.	2665	0	13236	13680	14600
		91							02-63	M.T.	2664	0	13125	13605	14600
		92							02-63	M.T.	2697	0	13274	13560	14600
		93							02-63	M.T.	2670	0	13225	13511	14600
		94							02-63	M.T.	2676	0	13164	13542	14600
		95							02-63	M.T.	2646	0	13267	13577	14600
		96							02-63	M.T.	2689	390	13231	13501	14600
		97							02-63	M.T.	2677	261	13211	13577	14600
		98							02-63	M.T.	2670	649	13113	13463	14600
		99							02-63	M.T.	2670	649	13113	13463	14600
		100							02-63	M.T.	2670	649	13113	13463	14600
		101							02-63	M.T.	2670	649	13113	13463	14600
		102							02-63	M.T.	2670	649	13113	13463	14600
		103							02-63	M.T.	2670	649	13113	13463	14600
		104							02-63	M.T.	2670	649	13113	13463	14600
		105							02-63	M.T.	2670	649	13113	13463	14600
		106							02-63	M.T.	2670	649	13113	13463	14600
		107							02-63	M.T.	2670	649	13113	13463	14600
		108							02-63	M.T.	2670	649	13113	13463	14600
		109							02-63	M.T.	2670	649	13113	13463	14600
		110							02-63	M.T.	2670	649	13113	13463	14600
		111							02-63	M.T.	2670	649	13113	13463	14600
		112							02-63	M.T.	2670	649	13113	13463	14600
		113							02-63	M.T.	2670	649	13113	13463	14600
		114							02-63	M.T.	2670	649	13113	13463	14600
		115							02-63	M.T.	2670	649	13113	13463	14600
		116							02-63	M.T.	2670	649	13113	13463	14600
		117							02-63	M.T.	2670	649	13113	13463	14600
		118							02-63	M.T.	2670	649	13113	13463	14600
		119							02-63	M.T.	2670	649	13113	13463	14600
		120							02-63	M.T.	2670	649	13113	13463	14600
		121							02-63	M.T.	2670	649	13113	13463	14600
		122							02-63	M.T.	2670	649	13113	13463	14600
		123							02-63	M.T.	2670	649	13113	13463	14600
		124							02-63	M.T.	2670	649	13113	13463	14600
		125							02-63	M.T.	2670	649	13113	13463	14600
		126							02-63	M.T.	2670	649	13113	13463	14600
		127							02-63	M.T.	2670	649	13113	13463	14600
		128							02-63	M.T.	2670	649	13113	13463	14600
		129							02-63	M.T.	2670	649	13113	13463	14600
		130							02-63	M.T.	2670	649	13113	13463	14600

TABLE G-2 (Continued)

DATE PIPED	BARREL NO.	ROUND NO.	LOCAL		SUN ELEVATION FAC	WIND DIRECTION SPEED	MOISTURE CONTENT (%)	MIRE ENLIGHTENMENT		ROOF POSITION GAUGE	POWER		CHARGE PRESS. (PSI)	VELOCITY (FPS)	TRIP TIME (SECS)	PUZZLE FLASH TIME (SECS)	UNCDPR RANGE (YDS)	CORR. RANGE (YDS)	RANGE RANGE (YDS)
			TIME	PERCENT				INDEX	INDEX										
11/22	20-1	31	1416	35C.	0056	0.136	0.017	-2.78	SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
11/22	20-1	32							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
11/23	20-1	1	1059						SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		2							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		3							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		4							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		5							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		6							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		7							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		8							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		9							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		10							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		11							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		12							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		13							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		14							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		15							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		16							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		17							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		18							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		19							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		20							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
11/20	20-1	1	0956			0.136	0.017	-2.78	SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		2							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		3							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		4							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		5							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		6							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		7							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		8							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		9							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		10							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		11							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		12							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		13							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		14							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		15							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		16							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		17							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		18							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		19							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		20							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		21							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400
		22							SPOF-11073	42-03	N.T.	2670	1175	17-57	13400	13279	13400	13279	13400

TABLE G-2 (Continued)

DATE FIRE	RAILROAD NO.	ROUND NO.	LOCAL FIRE	CUN ELEVATION (100-1100)	MOY FLY	ORIF ORIGIN (IN.)	POPF ORIF (IN.)	PRDCTR INPLR DESG.	CHARGE WEIGHT (LBS)	CHARGE PRESS. (PSI)	CHARGE VEL. (FT/S)	CHARGE RANGE (YDS)	CHARGE CORR. (YDS)	CHARGE RANGE (YDS)	CHARGE CORR. (YDS)	CHARGE RANGE (YDS)
12/16	20-1	4			00010	M.T.	M.T.	SPCF-11873	42.53	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		9				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		10				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		11				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		12				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		13				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		14				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		15				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		16				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		17				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		18				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		19				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		20				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		21				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		22				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		23				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		24				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		25				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		26				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		27				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		28				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		29				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		30				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		31				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		32				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		33				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		34				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		35				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		36				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		37				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		38				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		39				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		40				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		41				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		42				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		43				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		44				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		45				M.T.	M.T.		42.63	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
12/22	20-1	1	10-52	63 30	0206	M.T.	M.T.	SPCF-11873	42.57	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		2	1135		02013	M.T.	M.T.		42.57	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		3				M.T.	M.T.		42.57	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		4				M.T.	M.T.		42.57	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		5				M.T.	M.T.		42.57	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		6				M.T.	M.T.		42.57	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		7				M.T.	M.T.		42.57	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.

TABLE G-3
8"/66 MAJOR CALIBER LIGHTWEIGHT GUN MOUNT MARK 71 MOD 0
TABULATION OF MOUNT DATA

GUNS	BARREL	ROUND	ELEVATION	MCM	CAMERA	PARTS	COUNT		COUNT		COUNT		EJECT.	INTERVAL
							PER. SEC.	PER. SEC.	PER. SEC.	PER. SEC.	PER. SEC.	PER. SEC.		
00001	20-0	1	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00002	20-0	2	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00003	20-0	3	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00004	20-0	4	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00005	20-0	5	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00006	20-0	6	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00007	20-0	7	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00008	20-0	8	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00009	20-0	9	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00010	20-0	10	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00011	20-0	11	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00012	20-0	12	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00013	20-0	13	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00014	20-0	14	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00015	20-0	15	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00016	20-0	16	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00017	20-0	17	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00018	20-0	18	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00019	20-0	19	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00
00020	20-0	20	01 00	SLOW	PER. SEC.	2170	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.00

TABLE G-2 (Continued)

DATE	BARREL	REG. NO.	TIME	SUM	MODE	ORIGIN	POWDER	CHARGE	CHAMBR	TRUN.	MUZZLE	UNCORR.	CORR.	RANGE
FIGEO	EX-NO.		FIRED	FLUCTUATION	MODE	(IN.)	INDEX	(LBS)	(CU)	(F/S)	(M/S)	(YDS)	(YDS)	(YDS)
1971				(DEG-MIN)	FIRED	(IN.)	OR SIG.		(CU)		(M/S)			
12/22	20-1	6		60 00	RAPID	.344	SPCF-11073	66.07	N.T.	2154	0	20159	21591	20620
		10						66.07	N.T.	2143	0	20171	21591	20620
		11						66.07	N.T.	2156	0	20307	21591	20620
		12						66.07	N.T.	2136	0	20004	21230	20620
		13						66.07	N.T.	2116	912	20176	21500	20620
		14						66.07	N.T.	2125	0	19916	21112	20620
		15						66.07	N.T.	2140	0	20147	21157	20620
12/23	20-1	1	0935	10 00	SLOW	N.T.	SPCF-11073	66.07	N.T.	2107	0	20182	21777	20620
12/27	20-1	1				.864				N.T.				
						.826								

NOTES: (1) VELOCITY COILS DAMAGED BY SPEKUP OF PROJECTILE WINDSHIELD.
 (2) INSTRUMENTATION FAILURE.
 (3) POINT OF IMPACT COULD NOT BE LOCATED WITHIN A REASONABLE TOLERANCE.
 (4) O.C. -- OSCILLATING ELEVATION.
 (5) N.T. -- NOT TAKEN.

TABLE G-3 (Continued)

DATE FIRE	BARREL EX-NO	ROUND NO.	SUN ELEVATION (DEG-MIN)	MODE FIRED	CHARGE TYPE	CHAMBR PRESS. (TSI) (CU)	TRUM. VEL. (FPS)	PECOIL CYLINDER				COUNTER CYLINDER				MAX. RECOIL DISPL. (IN.)	PECOIL DURA- TION (SEC)	COUNT DURA- TION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)	
								STATYC (PSI)	MAX. (PSI)	STATYC (PSI)	MAX. (PSI)	STATYC (PSI)	MAX. (PSI)	STATYC (PSI)	MAX. (PSI)						
09/28	28-8	10	10 00	RAPID	FULL	M.T.	M.T.	1410	4950	2100	3500	32.2	.170	.370	.030	9.250					
		11				M.T.	M.T.	1418	4950	2100	3500	32.2	.170	.370	.030	5.800					
		12	29 00	SLOW		M.T.	M.T.	1418	4900	2100	3500	32.2	.170	.370	.035	6.910					
		13				M.T.	M.T.	1820	5020	2100	3728	31.6	.175	.640	.035	-					
		14					M.T.	M.T.	1820	4840	2110	3728	31.7	.170	.630	.035	-				
		15					M.T.	M.T.	1434	4950	2210	3728	32.2	.170	.640	.030	4.580				
		16					M.T.	M.T.	1638	4950	2210	3720	32.2	.170	.640	.029	-				
		17					M.T.	M.T.	1650	4950	2210	3720	32.2	.175	.330	.030	4.800				
		18					M.T.	M.T.	1610	4950	2210	3728	32.2	.180	.330	.030	-				
		19					M.T.	M.T.	1610	4950	2210	3720	32.2	.180	.330	.033	4.990				
10/04	28-8	1	09 30	SLOW	FULL	M.T.	M.T.	1410	5100	2200	3720	32.2	.180	.330	.028	-					
		2				M.T.	M.T.	1668	5100	2200	3730	30.5	.175	.330	.030	-					
		3					M.T.	M.T.	2780	5100	2200	3730	30.2	.170	.305	.030	-				
		4					M.T.	M.T.	2776	5170	2260	3730	30.2	.161	.325	.031	-				
		5					M.T.	M.T.	2794	5200	2260	3730	30.2	.170	.320	.030	-				
		6	00 30	SLOW			M.T.	M.T.	2743	5200	2260	3730	30.2	.170	.320	.030	-				
		7				MR-RED. FULL	M.T.	M.T.	2316	5510	2160	3720	26.2	.165	.315	.012	-				
		8					M.T.	M.T.	2751	5170	2160	3640	30.9	.170	.315	.030	-				
		9					M.T.	M.T.	2726	5350	2140	3610	31.4	.170	.315	.030	-				
		10					M.T.	M.T.	2731	5170	2200	3650	31.8	.170	.325	.032	-				
10/07	28-8	1	00 30	SLOW		M.T.	M.T.	2733	5300	2200	3690	31.8	.170	.325	.035	-					
		2					M.T.	M.T.	2726	5100	2220	3690	31.8	.170	.325	.029	-				
		3					M.T.	M.T.	2427	5430	2249	3690	31.4	.165	.325	.029	-				
		4				TRADY FULL	M.T.	M.T.	2649	5120	2170	3630	30.9	.180	.325	.026	-				
		5					M.T.	M.T.	2730	5050	2160	3630	30.9	.185	.350	.030	-				
		6	00 30	SLOW			M.T.	M.T.	2707	5050	2160	3630	30.9	.170	.340	.030	-				
		7					M.T.	M.T.	2711	5250	2160	3640	30.9	.175	.340	.033	-				
		8					M.T.	M.T.	2711	5100	2150	3640	30.9	.175	.330	.029	-				
		9	00 30	SLOW	FULL		M.T.	M.T.	1840	5260	2090	3570	31.8	.170	.350	.024	-				
		10				PROOF	M.T.	M.T.	1620	5340	2090	3570	31.8	.170	.355	.028	-				
10/13	28-1	1	10 00	SLOW	PRF-SER.	15.2	2375	1590	5530	2180	3340	23.8	.170	.560	.030	-					
		2				M.T.	M.T.	2449	1548	3910	3560	25.5	.175	.350	.031	-					
		3					M.T.	M.T.	2594	1649	4440	1614	24.6	.170	.345	.030	-				
		4					M.T.	M.T.	2736	1568	4920	2940	29.7	.170	.345	.023	-				
		5					M.T.	M.T.	2483	1568	5720	2200	29.7	.165	.340	.023	-				
		6	10 00	SLOW	MR-FULL		M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.	M.T.
		7	10 00	SLOW	MR-FULL		M.T.	M.T.	2248	1570	3250	2240	25.7	.170	.345	.036	-				
		8					M.T.	M.T.	2279	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	
		9					M.T.	M.T.	2294	1674	3130	2240	25.7	.170	.330	.035	-				
		10					M.T.	M.T.	2270	1574	3130	2240	25.7	.170	.330	.031	-				
10/22	28-1	1	01 00	SLOW	FULL		M.T.	2238	1570	3190	2240	25.7	.175	.300	.033	-					
		2					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		3					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		4					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		5					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		6					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		7					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		8					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		9					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				
		10					M.T.	M.T.	2238	1570	3190	2240	25.7	.170	.300	.031	-				

TABLE G-3 (Continued)

DATE FIRED	BARREL NO.	ROUND NO.	GUN ELEVATION (DEG-MIN)	MOTIF FIRE	CHARGE TYPE	CHARGE FULL	CARTRIDGE (CALIBER)	FUM. VEL. (FPS)	RECOIL CYLINDER			COUNTER			MAX. DISPL. (IN.)	RECOIL TIME (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)		
									STATIC PRESS. (PSI)	MAX. PRESS. (PSI)	STATYC. PRESS. (PSI)	MAX. PRESS. (PSI)	RECOIL DURATION (SEC)	COUNTDOWN (SEC)						
11/02	29-1	3	81 39	SLOW	FULL		M.T.	2729	1648	4900	2290	1740	29.4	0.10	0.28	-	-	-		
		4	10 00	RAMP	FULL		M.T.	2716	1563	4900	2220	3600	28.4	0.10	0.30	4.760				
		5						M.T.	2704	1478	4410	2400	3600	28.4	0.10	0.28	5.110			
		6						M.T.	2717	1578	4410	2400	3600	28.4	0.10	0.28	5.110			
		7						M.T.	2694	1478	4670	2160	3600	28.7	0.10	0.28	5.100			
		8						M.T.	2701	1478	4760	2160	3600	28.7	0.10	0.28	5.100			
		9						M.T.	2637	1478	4760	2160	3600	28.7	0.10	0.28	5.100			
		10						M.T.	2702	1478	4760	2160	3600	28.7	0.10	0.28	5.100			
		11						M.T.	2695	1440	4730	2160	3600	28.1	0.10	0.28	4.995			
		12						M.T.	2718	1440	4760	2160	3600	29.1	0.10	0.28	4.995			
		13						M.T.	2718	1440	4760	2160	3600	29.1	0.10	0.28	4.970			
		14						M.T.	2685	1440	4760	2160	3600	29.1	0.10	0.28	4.985			
		15						M.T.	2686	1440	4760	2160	3600	29.1	0.10	0.28	4.985			
		16						M.T.	2686	1440	4760	2160	3600	29.1	0.10	0.28	4.985			
		17						M.T.	2686	1440	4760	2160	3600	29.1	0.10	0.28	4.985			
		18						M.T.	2686	1440	4760	2160	3600	29.1	0.10	0.28	4.985			
		11/02	20-1	1	88 39	SLOW	REQ. REQ.		M.T.	2816	1548	2600	2160	1030	22.1	0.10	0.39	-	-	-
				2					M.T.	2127	1645	2970	2170	3030	23.6	0.10	0.28	-		
3							M.T.	2140	1645	3120	2170	3170	24.4	0.10	0.25	-				
4							M.T.	2253	1645	3120	2170	3170	25.4	0.10	0.25	-				
5							M.T.	2246	1645	3440	2900	3230	26.5	0.10	0.25	-				
6							M.T.	2339	1645	3610	2208	3230	26.5	0.10	0.25	-				
7	20 00			RAMP	FULL			M.T.	2717	1578	5100	2130	3440	31.8	0.10	0.22	-			
8								M.T.	2442	1428	4998	2130	3600	32.1	0.10	0.30	4.800			
9								M.T.	2715	1428	4998	2130	3600	32.1	0.10	0.30	4.800			
10								M.T.	2714	1428	4998	2130	3600	32.1	0.10	0.30	4.800			
11								M.T.	2712	1428	4998	2130	3600	32.1	0.10	0.30	4.800			
12								M.T.	2734	1428	4998	2130	3600	32.1	0.10	0.30	4.800			
13								M.T.	2706	1428	4938	2130	3600	32.7	0.10	0.28	4.995			
14								M.T.	2708	1428	4938	2130	3600	32.7	0.10	0.28	4.995			
15								M.T.	2700	1428	4938	2130	3600	32.7	0.10	0.28	4.995			
16								M.T.	2716	1428	4938	2130	3600	32.7	0.10	0.28	4.995			
17								M.T.	2705	1428	4938	2130	3600	32.7	0.10	0.28	4.995			
18								M.T.	2710	1428	4938	2130	3600	32.7	0.10	0.28	4.995			
11/05	24-1	1	37 39	RAMP	FULL		M.T.	2423	1423	4934	2130	3500	32.4	0.10	0.29	-	-	-		
		2					M.T.	2710	1423	4934	2130	3500	32.4	0.10	0.29	-				
		3					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		4					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		5					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		6					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		7					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		8					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		9					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		10					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		11					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		12					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		13					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		14					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		15					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		16					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		17					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
		18					M.T.	2473	1410	5300	2130	3610	33.6	0.10	0.20	4.863				
11/09	20-1	1	10 00	RAMP	FULL		M.T.	2691	1657	5110	2200	3600	30.3	0.10	0.29	-	-	-		
		2					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		3					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		4					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		5					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		6					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		7					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		8					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		9					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		10					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		11					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		12					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		13					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		14					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		15					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		16					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		17					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				
		18					M.T.	1620	1620	5140	2200	3600	31.6	0.10	0.30	4.800				

TABLE G-3 (Continued)

DATE FIRE# 1971	BARREL ER-700	BARREL NO.	GUN ELEVATION (3FG-RTN)	GUN ELEVATION (3FG-RTN)	CHANGE TYPE	MODE FIRED	CHANGE TYPE	CHARGE (CU)	PRESS. (PSI)	TRUN. VEL. (F/S)	BICOIL CYLINDR COUNT# CYLINDR				MAX. DISP. (IN.)	RECOIL DURA- TION (SEC)	COUNTR DURA- TION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)
											STATIC PRESS. (PSI)	MAX. PRESS. (PSI)	FLYING PRESS. (PSI)	MAX. PRESS. (PSI)					
11/29	20-1	3	10 00	10 00				1670	5140	2200	3670	31.5	.140	.370	.031	5.105			
		4						1620	5140	2200	3670	31.5	.170	.370	.031	5.100			
		5						1620	5020	2200	3670	31.5	.175	.360	.030	4.980			
		6						1621	5040	2171	3670	31.5	.180	.370	.029	4.975			
		7						1651	5020	2160	3670	31.5	.164	.36	.031	5.066			
		8						1657	4960	2160	3558	31.2	.182	.401	.032	4.986			
		9						1674	4910	2160	3558	31.5	.188	.405	.031	4.930			
		10						1683	4980	2160	3650	31.5	.172	.413	.030	4.975			
		11						1638	4960	2160	3670	31.5	.179	.411	.030	5.069			
		12						1539	5080	2160	3670	31.5	.177	.424	.031	5.156			
		13						1571	5070	2160	3670	31.5	.177	.424	.031	5.156			
		14						1678	4880	2160	3670	31.8	.177	.423	.034	5.082			
		15						1590	4980	2170	3670	31.4	.161	.431	.033	5.150			
		16						1477	4980	2160	3670	31.8	.157	.433	.033	5.076			
		17						1588	4880	2160	3640	31.5	.161	.441	.028	5.072			
		18						1530	4940	2160	3690	31.0	.153	.447	.032	5.159			
11/12	20-1	20	10 00	10 00		SLOW		1738	5880	2240	3730	30.9	.180	.355	.027	-			
		1				RAPID		1598	5000	2110	3600	30.4	.165	.395	.032	-			
		2						1558	4970	2110	3598	31.4	.165	.380	.034	4.855			
		3						1558	4970	2110	3598	31.4	.170	.380	.033	5.085			
		4						1470	4958	2090	3590	31.7	.163	.390	.034	5.156			
		5						1450	5000	2090	3600	31.7	.160	.372	.032	5.157			
		6						1450	5000	2090	3600	31.7	.160	.372	.032	5.157			
		7						1450	4980	2080	3550	32.0	.180	.369	.032	5.078			
		8						1461	4860	2040	3550	32.0	.172	.348	.031	5.045			
		9						1401	4960	2090	3400	31.7	.169	.395	.030	4.939			
		10						1400	4900	2090	3400	32.3	.170	.400	.030	4.966			
		11						1400	4900	2090	3450	32.3	.171	.401	.037	5.150			
		12						1400	4920	2090	3590	32.0	.172	.406	.035	5.047			
		13						1403	4920	2090	3590	32.3	.173	.415	.030	5.138			
		14						1400	4920	2090	3590	31.7	.174	.417	.030	5.037			
		15						1400	4900	2080	3590	31.7	.178	.421	.029	5.137			
		16						1400	4900	2090	3570	32.3	.169	.431	.031	5.065			
		17						1400	4900	2090	3670	32.3	.164	.439	.031	5.124			
		18						1400	4900	2090	3670	32.0	.170	.429	.031	5.027			
		19						1400	4920	2090	3570	32.0	.171	.432	.035	5.082			
		20						1400	4900	2090	3630	31.9	.171	.432	.035	5.026			
		21						1400	4900	2090	3630	31.9	.177	.431	.036	5.120			
		22						1420	4920	2090	3570	31.4	.172	.426	.033	5.041			
		23						1400	4900	2110	3640	31.1	.172	.436	.030	4.977			
		24						1400	4900	2090	3590	31.7	.175	.433	.032	5.164			
		25						1510	4970	2110	3590	31.4	.176	.426	.034	5.035			
		26						1400	4970	2110	3600	31.1	.173	.430	.033	5.046			
		27						1500	4920	2150	3660	31.4	.173	.420	.032	5.125			
								1500	4920	2150	3660	31.1	.170	.435	.031	-			

TABLE G-3 (Continued)

DATE FIBER	BAYSEL CR-400	YOUNG NO.	GUN ELEVATION (1100-MINI)	GUM 10 00	NONE CHANGE TYPE	CHEMID PFCSS (TSD) ICU)	TRIM. VEL. (F/S)	PFCOIL CYLINDER			COUNIP CYLINDER			MAX. RFOCOIL DISPL. (IN.)	RFOCOIL DURA- TION (SEC)	COUNIP DURA- TION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)
								STATIC (PSI)	WER. (PSI)	PRESS. (PSI)	STATIC (PSI)	MAX. (PSI)	PRESS. (PSI)					
11/12	20-1	29				M.T.	2707	1458	4820	2173	3640	31.1	.175	.345	(1)	4.714		
		30				M.T.	2664	1460	4860	2150	3650	31.1	.170	.345	M.T.	5.073		
		31				M.T.	2787	1490	4960	2148	3650	31.6	.170	.353	M.T.	5.066		
		32				M.T.	2685	1499	4840	2128	3640	31.7	.177	.352	M.T.	5.148		
		33				M.T.	2699	1639	4660	2128	3610	31.4	.164	.370	M.T.	5.030		
		34				M.T.	2690	1640	4818	2118	3610	31.7	.178	.360	M.T.	5.062		
		35				M.T.	2649	1650	4660	2110	3610	31.7	.177	.364	M.T.	5.126		
		36				M.T.	2647	1688	4750	2110	3610	31.6	.167	.373	M.T.	5.115		
		37				M.T.	2721	1683	4620	2110	3640	31.7	.170	.369	M.T.	5.037		
		38				M.T.	2786	1680	4920	2114	3638	31.7	.172	.339	M.T.	5.128		
		39				M.T.	2940	1680	4880	2118	3658	31.2	.173	.371	M.T.	5.038		
		40				M.T.	2716	1680	4920	2118	3658	31.7	.174	.376	M.T.	5.026		
		41				M.T.	2577	1676	4810	2118	3620	31.4	.172	.372	M.T.	5.151		
		42				M.T.	2691	1670	4820	2118	3630	32.1	.175	.369	M.T.	5.030		
		43				M.T.	2716	1668	4920	2118	3630	31.7	.167	.362	M.T.	5.030		
		44				M.T.	2683	1340	4810	2118	3670	31.7	.172	.367	M.T.	5.115		
		45				M.T.	2711	1340	4920	2118	3630	31.7	.172	.371	M.T.	5.038		
		46				M.T.	2702	1340	4920	2118	3638	31.4	.176	.367	M.T.	5.030		
		47				M.T.	2672	1360	4780	2118	3648	31.4	.173	.367	M.T.	5.090		
		48				M.T.	2647	1360	4840	2118	3670	31.6	.173	.367	M.T.	4.922		
		49				M.T.	2673	1540	4720	2120	3640	31.6	.172	.316	M.T.	5.125		
		50				M.T.	2716	1650	4860	2170	3680	32.3	.170	.325	M.T.	5.077		
		51				M.T.	2697	1638	4740	2140	3680	32.7	.168	.325	M.T.	5.036		
		52				M.T.	2702	1650	4640	2120	3694	31.8	.169	.327	M.T.	5.065		
		53				M.T.	2691	1650	4640	2120	3698	31.8	.168	.331	M.T.	5.027		
		54				M.T.	2707	1650	4640	2120	3650	31.8	.172	.330	M.T.	5.015		
		55				M.T.	2709	1630	4670	2110	3660	31.3	.170	.336	M.T.	5.005		
		56				M.T.	2749	1400	4640	2120	3640	31.6	.173	.336	M.T.	5.025		
		57				M.T.	2717	1400	4700	2110	3660	31.3	.179	.330	M.T.	5.040		
		58				M.T.	2670	1400	4640	2113	3650	31.3	.174	.334	M.T.	5.087		
		59				M.T.	2719	1400	4700	2110	3650	31.6	.172	.340	M.T.	4.953		
		60				M.T.	2701	1400	4700	2129	3658	31.6	.170	.330	M.T.	4.930		
		61				M.T.	2704	1470	4720	2129	3658	31.3	.168	.342	M.T.	5.060		
		62				M.T.	2705	1484	4720	2120	3658	31.4	.167	.335	M.T.	5.023		
		63				M.T.	2646	1400	4720	2120	3660	31.8	.162	.358	M.T.	4.920		
		64				M.T.	2603	1400	4780	2110	3664	31.0	.171	.359	M.T.	5.072		
		65				M.T.	2595	1374	4750	2120	3660	31.8	.164	.356	M.T.	5.010		
		66				M.T.	2665	1374	4750	2120	3660	31.3	.171	.349	M.T.	5.067		
		67				M.T.	2691	1600	4810	2120	3660	31.8	.165	.355	M.T.	5.028		
		68				M.T.	2690	1600	4810	2120	3660	32.1	.166	.359	M.T.	5.067		
		69				M.T.	2690	1630	4810	2120	3660	32.1	.182	.361	M.T.	5.017		
		70				M.T.	2690	1630	4960	2120	3688	32.1	.175	.352	M.T.	5.175		
		71				M.T.	2680	1600	4840	2124	3660	31.7	.174	.356	M.T.	5.017		
		72				M.T.	2709	1313	4860	2120	3660	31.7	.172	.353	M.T.	4.895		

TABLE G-3 (Continued)

DATE FIRE	BARREL EX-NOO	ROUND NO.	GUN ELEVATION (DEG-RE)	MODE FIRE	CHARGE TYPE	CHAMBER PRESS. (KSI)	TRUM. VEL. (F/S)	PCOIL CYLINDER			FOUNDER CYLINDER			MAX. RECOIL DURATION (SEC)	RECOIL DURATION (SEC)	RECOIL DURATION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)
								STATIC (PSI)	MAX. (PSI)	STATIC (PSI)	MAX. (PSI)	STATIC (PSI)	MAX. (PSI)					
11/12	20-1	73	10 00	RAPID	FULL	M.T.	2641	3274	4750	2124	3400	31.4	1.60	3.66	(1)	5.070		
		74				M.T.	2497	3570	4440	2491	3700	31.4	1.74	3.70	(1)			
		75				M.T.	2643	3480	4700	2491	3700	31.7	1.78	3.78	(1)	4.697		
		1	27 00	RAPID	FULL	M.T.	2646	3510	4700	2491	3700	31.9	1.75	3.84	0.25			
		2				M.T.	2649	3510	4800	2491	3700	32.5	1.66	3.80	0.26	4.729		
		3				M.T.	2725	3510	4820	2491	3700	32.5	1.85	3.82	0.28			
		4				M.T.	2725	3510	4820	2491	3700	32.5	1.85	3.82	0.28	4.815		
		5				M.T.	2711	3490	4770	2491	3700	32.1	1.81	3.81	0.31	5.068		
		6				M.T.	2711	3490	4770	2491	3700	32.1	1.81	3.81	0.32	4.709		
		7				M.T.	2703	3490	4770	2491	3700	32.1	1.81	3.81	0.32	5.090		
11/22	20-1	8				M.T.	2698	3490	4770	2491	3700	32.1	1.81	3.81	0.32	5.090		
		9				M.T.	2682	3490	4770	2491	3700	32.1	1.82	3.82	0.28	4.776		
		10				M.T.	2682	3490	4770	2491	3700	32.1	1.82	3.82	0.28	4.872		
		11				M.T.	2681	3490	4770	2491	3700	32.1	1.82	3.82	0.29	5.060		
		12				M.T.	2681	3490	4770	2491	3700	32.1	1.82	3.82	0.30	4.766		
		13				M.T.	2682	3490	4770	2491	3700	32.1	1.82	3.82	0.30	5.060		
		14				M.T.	2682	3490	4770	2491	3700	32.1	1.82	3.82	0.31	4.691		
		15	01 00	RAPID	FULL	M.T.	2676	3490	4800	2229	3670	32.4	1.64	3.37	0.42			
		16				M.T.	2665	3490	4830	2204	3690	31.9	1.82	3.34	0.34	4.743		
		17				M.T.	2665	3490	4830	2204	3690	31.3	1.73	3.37	0.32	5.136		
18				M.T.	2666	3490	4830	2188	3690	31.3	1.78	3.20	0.38	5.128				
19				M.T.	2647	3490	4830	2209	3710	31.3	1.78	3.46	0.31	4.476				
20				M.T.	2647	3490	4830	2188	3710	31.3	1.59	3.47	0.32	5.091				
21				M.T.	2676	3490	4770	2188	3710	31.8	1.73	3.31	0.30	5.180				
22				M.T.	2646	3490	4804	2188	3710	31.8	1.68	3.62	0.34	5.093				
23				M.T.	2646	3490	4804	2188	3710	31.3	1.63	3.67	0.33	5.079				
24				M.T.	2677	3490	4770	2188	3690	31.3	1.71	3.68	0.33	5.116				
25				M.T.	2666	3490	4800	2188	3710	31.3	1.78	3.65	0.29	5.066				
26				M.T.	2645	3490	4770	2200	3710	31.3	1.78	3.68	0.29	4.943				
27				M.T.	2645	3490	4770	2200	3710	31.3	1.74	3.69	0.34	5.071				
28				M.T.	2673	3490	4770	2188	3710	31.3	1.74	3.79	0.34	5.081				
29				M.T.	2640	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
30				M.T.	2690	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2661	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2676	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2630	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2656	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2643	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2665	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2666	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2679	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2679	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2651	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2670	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2670	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2710	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				
				M.T.	2710	3490	4800	2188	3710	31.3	1.72	3.66	0.36	5.040				

TABLE 6-3 (Continued)

DATE FIRE	BARREL EX-NO	ROUND NO.	GUN ELEVATION (DEG-MIN)	MOSE FIRE	CHARGE TYPE	CHARGE PRESS. (LBS)	CHARGE (CU)	TRUN. VEL. (FPS)	STATIC PRESS. (PSI)	STATIC PRESS. (PSI)	STATIC PRESS. (PSI)	STATIC PRESS. (PSI)	MAX. DISPL. (IN.)	RECOIL DURA- TION (SEC)	COUNT MUN- ITION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)
11/22	28-1	31	04 00	04010	FULL	N.T.	N.T.	2632	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
11/23	28-1	32				N.T.	N.T.	2632	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
11/23	28-1	33	27 00	04070	FULL	N.T.	N.T.	2670	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
		1				N.T.	N.T.	2699	1500	2100	3710	32.0	-169	-190	-034	4.737	
		2				N.T.	N.T.	2699	1400	2100	3710	32.3	-174	-190	-029	4.900	
		3				N.T.	N.T.	2717	1400	2150	3730	32.9	-177	-190	-031	5.097	
		4				N.T.	N.T.	2701	1400	2150	3730	32.9	-174	-190	-036	4.843	
		5				N.T.	N.T.	2684	1400	2150	3730	32.9	-173	-190	-032	4.826	
		6				N.T.	N.T.	2684	1400	2130	3710	31.7	-177	-181	-031	4.826	
		7				N.T.	N.T.	2684	1400	2130	3710	31.6	-174	-181	-031	4.826	
		8				N.T.	N.T.	2703	1300	2130	3710	31.6	-170	-181	-030	4.826	
		9				N.T.	N.T.	2699	1400	2130	3710	31.6	-175	-181	-030	4.826	
		10				N.T.	N.T.	2729	1400	2130	3710	31.6	-177	-181	-035	4.826	
		11				N.T.	N.T.	2678	1400	2130	3710	31.6	-174	-181	-031	4.826	
		12				N.T.	N.T.	2698	1400	2130	3710	31.6	-176	-181	-031	4.826	
		13				N.T.	N.T.	2708	1400	2130	3710	31.6	-170	-181	-034	4.826	
		14				N.T.	N.T.	2699	1400	2170	3710	31.6	-162	-181	-030	4.826	
		15				N.T.	N.T.	2670	1400	2170	3710	31.6	-162	-181	-030	4.826	
		16				N.T.	N.T.	2670	1400	2170	3710	31.6	-162	-181	-030	4.826	
		17				N.T.	N.T.	2670	1400	2170	3710	31.6	-162	-181	-030	4.826	
		18				N.T.	N.T.	2670	1400	2170	3710	31.6	-162	-181	-030	4.826	
		19				N.T.	N.T.	2670	1400	2170	3710	31.6	-162	-181	-030	4.826	
		20				N.T.	N.T.	2670	1400	2170	3710	31.6	-162	-181	-030	4.826	
11/20	28-1	1	00 00	00010	FULL	N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		2				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		3				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		4				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		5				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		6				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		7				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		8				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		9				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		10				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		11				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		12				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		13				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		14				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		15				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		16				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		17				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		18				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		19				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		20				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		21				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	
		22				N.T.	N.T.	2670	1400	2100	3670	31.7	-172	-172	-032	6.500	

TABLE G-3 (Continued)

DATE FIRING	BARREL SERIAL NO.	CHARGE TYPE	GUN ELF/ATION 10FS-MIN	GUN OSC.	MOT FIELD	CHARGE TYPE	CHAMBER PRESS. (PSI)	TUM. VEL. (FPS)	RECIL CYLINDER CHAMBER CYLINDER			MAX. DISPL. (IN.)	RECIL DURA- TION (SEC)	COUNTER DURA- TION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)						
									STATIC PRESS. (PSI)	MAX. PRESS. (PSI)	STATIC PRESS. (PSI)											
11/78	28-1	RAPID FULL	05C.				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.470						
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.738					
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	24.620				
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.820				
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.900				
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	37.620				
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.820				
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.990				
12/81	28-1	RAPID FULL	27 00	05C.	RAPID FULL		N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.710						
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.730				
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.650			
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.800		
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.880	
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.130
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.880
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.850
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.120
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.868
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.868
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.828
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.888
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.888
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.858
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	-
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	-
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.720
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.840
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.100
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.760
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.850
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.100
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.800
N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.820							
N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.130							
N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.870							
12/83	28-1	SLOW RAPID FULL	27 00	05C.	SLOW RAPID FULL		N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	19.228					
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	14.288			
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	15.788		
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	16.478	
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	14.138	
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	15.028
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	15.128
							N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	19.128

TABLE G-3 (Continued)

DATE	RANGE	COUNT	EXPOSURE	MATERIAL	MATERIAL	MATERIAL	PERIOD CYLINDER COUNTS			MAX. DISPL. (IN.)	RCOIL DURE-TION (SEC)	RCOIL DURE-TION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS
							STATIC (PSI)	STATIC (PSI)	STATIC (PSI)					
12/23	20-1	9	20 00	2002	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	16.750	
		10		2749	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	14.640	
		11		2642	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	20.120	
		12		2666	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	13.320	
		17		2657	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	16.650	
		16		2676	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	21.750	
		15		2674	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	12.790	
		16		N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	-	
		17	65 00	2139	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.800	
		18		2151	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.790	
		19		2174	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.920	
		20		2151	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.780	
		21		2151	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.770	
		22		2155	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.910	
		23		2155	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.760	
		24		2156	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.760	
		25		2156	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.920	
		26		2155	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.770	
		27		2155	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.770	
		28		2174	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.920	
		29		2137	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.780	
		30		2150	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.770	
		31		2150	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.770	
		32		2150	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.810	
		33		2151	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.720	
		34		2151	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.850	
		35		2156	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.810	
		36		2158	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.790	
		37		2158	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.810	
		38		2174	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.810	
		39		2174	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.810	
		40		2155	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.800	
		41		2155	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.800	
		42		2159	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.930	
		43		2152	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.790	
		44		2152	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.810	
		45		2152	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.810	
		46		2167	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.820	
		47		2163	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.820	
12/23	20-1	1	20 00	2647	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	-	
		2		2741	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	-	
		3		2699	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.068	
		4		2596	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.070	
		5		2647	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.910	
		6		2647	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.910	
		7		2670	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.260	

TABLE G-3 (Continued)

DATE FIRMS	QAMPA NO.	ROUND NO.	SUM ELECTRIC MTC	MTC FILED	CHARGE TYPE	CHARGE TYPE	CHARGE TYPE	RECOIL CYLINDER COINTE CYLINDER			RECOIL CYLINDER COINTE CYLINDER			WALK RECOIL DURAT- TION (SEC)	EJECT. TIME (SEC)	INTERVAL BETWEEN ROUNDS (SEC)
								STATIC PRESS. (PSI)	WALK PRESS. (PSI)	WALK PRESS. (PSI)	WALK PRESS. (PSI)	WALK PRESS. (PSI)	WALK PRESS. (PSI)			
1971	20-1	9	2781													4.933
		10	2871													4.820
		11	2878													5.160
		12	2876													4.820
		13	2796													4.840
		14	2893													5.950
		15	2888													4.820
		16	2711													4.930
		17	2788													5.130
		18	2669													4.900
		19	2867													4.900
		20	2728													5.130
		21	2784													4.900
		22	2897													4.910
		23	2677													5.160
		24	2668													4.910
		25	2682													4.920
		26	2781													5.120
		27	2695													4.910
		28	2649													4.900
		29	2667													5.160
		30	2802													4.910
		31	2698													4.930
		32	2693													4.920
		33	2698													4.910
		34	2697													5.140
		35	511													4.900
		36	511													4.900
		37	511													5.130
		38	511													4.900
		39	2706													4.900
		40	2699													21.100
		41	2641													16.620
		42	2679													17.250
		43	2695													20.650
		44	2681													16.330
		45	2682													16.400
		46	2675													24.400
		47	2680													18.360
		48	2667													17.910
		49	2656													17.220
		50	2674													14.420
		51	2656													14.680
		52	2672													16.968

TABLE G-3 (Continued)

DATE	FINGER	BARREL	SOUND	SUE	MUSE	GAGE	CYLINDER	CYLINDER		CYLINDER		RECOIL	EJECT.	INTERVAL
								STATIC	STATIC	PRESS.	PRESS.			
1971	20-1	20-1	NO.	(LBS)	(LBS)	(LBS)	(LBS)	(PSI)	(PSI)	(PSI)	(LBS)	(SEC)	(SEC)	(SEC)
12/13			51	2507	2507	2507	2507	2507	2507	2507	2507	2507	2507	2507
			52	2509	2509	2509	2509	2509	2509	2509	2509	2509	2509	2509
			53	2517	2517	2517	2517	2517	2517	2517	2517	2517	2517	2517
			54	2675	2675	2675	2675	2675	2675	2675	2675	2675	2675	2675
			55	2676	2676	2676	2676	2676	2676	2676	2676	2676	2676	2676
			56	2680	2680	2680	2680	2680	2680	2680	2680	2680	2680	2680
			57	2681	2681	2681	2681	2681	2681	2681	2681	2681	2681	2681
			58	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682	2682
			59	2683	2683	2683	2683	2683	2683	2683	2683	2683	2683	2683
			60	2684	2684	2684	2684	2684	2684	2684	2684	2684	2684	2684
			61	2685	2685	2685	2685	2685	2685	2685	2685	2685	2685	2685
			62	2686	2686	2686	2686	2686	2686	2686	2686	2686	2686	2686
			63	2687	2687	2687	2687	2687	2687	2687	2687	2687	2687	2687
			64	2688	2688	2688	2688	2688	2688	2688	2688	2688	2688	2688
			65	2689	2689	2689	2689	2689	2689	2689	2689	2689	2689	2689
			66	2690	2690	2690	2690	2690	2690	2690	2690	2690	2690	2690
			67	2691	2691	2691	2691	2691	2691	2691	2691	2691	2691	2691
			68	2692	2692	2692	2692	2692	2692	2692	2692	2692	2692	2692
			69	2693	2693	2693	2693	2693	2693	2693	2693	2693	2693	2693
			70	2694	2694	2694	2694	2694	2694	2694	2694	2694	2694	2694
			71	2695	2695	2695	2695	2695	2695	2695	2695	2695	2695	2695
			72	2696	2696	2696	2696	2696	2696	2696	2696	2696	2696	2696
			73	2697	2697	2697	2697	2697	2697	2697	2697	2697	2697	2697
			74	2698	2698	2698	2698	2698	2698	2698	2698	2698	2698	2698
			75	2699	2699	2699	2699	2699	2699	2699	2699	2699	2699	2699
			76	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700
			77	2701	2701	2701	2701	2701	2701	2701	2701	2701	2701	2701
			78	2702	2702	2702	2702	2702	2702	2702	2702	2702	2702	2702
			79	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703
			80	2704	2704	2704	2704	2704	2704	2704	2704	2704	2704	2704
			81	2705	2705	2705	2705	2705	2705	2705	2705	2705	2705	2705
			82	2706	2706	2706	2706	2706	2706	2706	2706	2706	2706	2706
			83	2707	2707	2707	2707	2707	2707	2707	2707	2707	2707	2707
			84	2708	2708	2708	2708	2708	2708	2708	2708	2708	2708	2708
			85	2709	2709	2709	2709	2709	2709	2709	2709	2709	2709	2709
			86	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710
			87	2711	2711	2711	2711	2711	2711	2711	2711	2711	2711	2711
			88	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712	2712
			89	2713	2713	2713	2713	2713	2713	2713	2713	2713	2713	2713
			90	2714	2714	2714	2714	2714	2714	2714	2714	2714	2714	2714
			91	2715	2715	2715	2715	2715	2715	2715	2715	2715	2715	2715
			92	2716	2716	2716	2716	2716	2716	2716	2716	2716	2716	2716
			93	2717	2717	2717	2717	2717	2717	2717	2717	2717	2717	2717
			94	2718	2718	2718	2718	2718	2718	2718	2718	2718	2718	2718
			95	2719	2719	2719	2719	2719	2719	2719	2719	2719	2719	2719
			96	2720	2720	2720	2720	2720	2720	2720	2720	2720	2720	2720
			97	2721	2721	2721	2721	2721	2721	2721	2721	2721	2721	2721
			98	2722	2722	2722	2722	2722	2722	2722	2722	2722	2722	2722
			99	2723	2723	2723	2723	2723	2723	2723	2723	2723	2723	2723
			100	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724

TABLE G-3 (Continued)

DATE	TIME	SARCEL	ROUND	ELEVATION	SUM	CHARGE	Charge		APCOIL CYCLING			APCOIL CYCLING			MAX. DISM. (M)	RECOIL NUMB. (SECS)	COUNTER DURATION (SECS)	EJECT. TIME (SECS)	INTERVAL BETWEEN ROUNDS (SECS)
							PRESS. (PSI)	TEMP. (F)	STATIC (PSI)	MAX. (PSI)	STATIC (PSI)	MAX. (PSI)	MAX. (PSI)						
12/22	20-1		8	93.00	0017	001	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	5.000
			9				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.981
			10				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.996
			11				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.994
			12				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.973
			13				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.989
			14				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.984
			15				N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.982
12/23	20-1		1	10.00	SLW	001	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	

APCOIL (1) INSTRUMENTATION FAILURE.

APPENDIX H

Power Measurement Data

Table H-1

Figures 1 Through 12

TABLE H-1
8"/55 MCLGM TECHNICAL EVALUATION
TABULATION OF POWER MEASUREMENTS
440 VAC 60 Hz 3-PHASE POWER SUPPLY

MAJOR COMPONENTS	Figure Number	Measurement (KW)
Upper Accumulator		
Start	1	166
Maximum Pumping	1, 2	83
By-Passing	1, 2	10
Lower Accumulator		
Start	3	127
Maximum Pumping	3, 4	64
By-Passing	3, 4	3
Train Power Drive		
Start	5	287
Standby	5, 6	22
Synchronizing	6	367
Synchronized to SHM, 30° ampl. - 9 sec period	6	6 to 92
Elevation Power Drive		
Start	7	220
Standby	7, 8	12
Synchronizing	8	89
Synchronized to SHM, 30° ampl. - 9 sec period	8	0 to 57
Blower on	9	19
Anti-Icing System On	10	38
MOUNT OPERATIONS		
All Motors Star: (Maximum) Loading System Operating in Simulate. laying system synchronizing at maximum velocity, blower on, anti-icing system off (peak power condition except the anti-icing system is off)	11	414
	12	599
110 VAC 400 Hz SINGLE PHASE POWER SUPPLY		
Peak Reading	12	.75

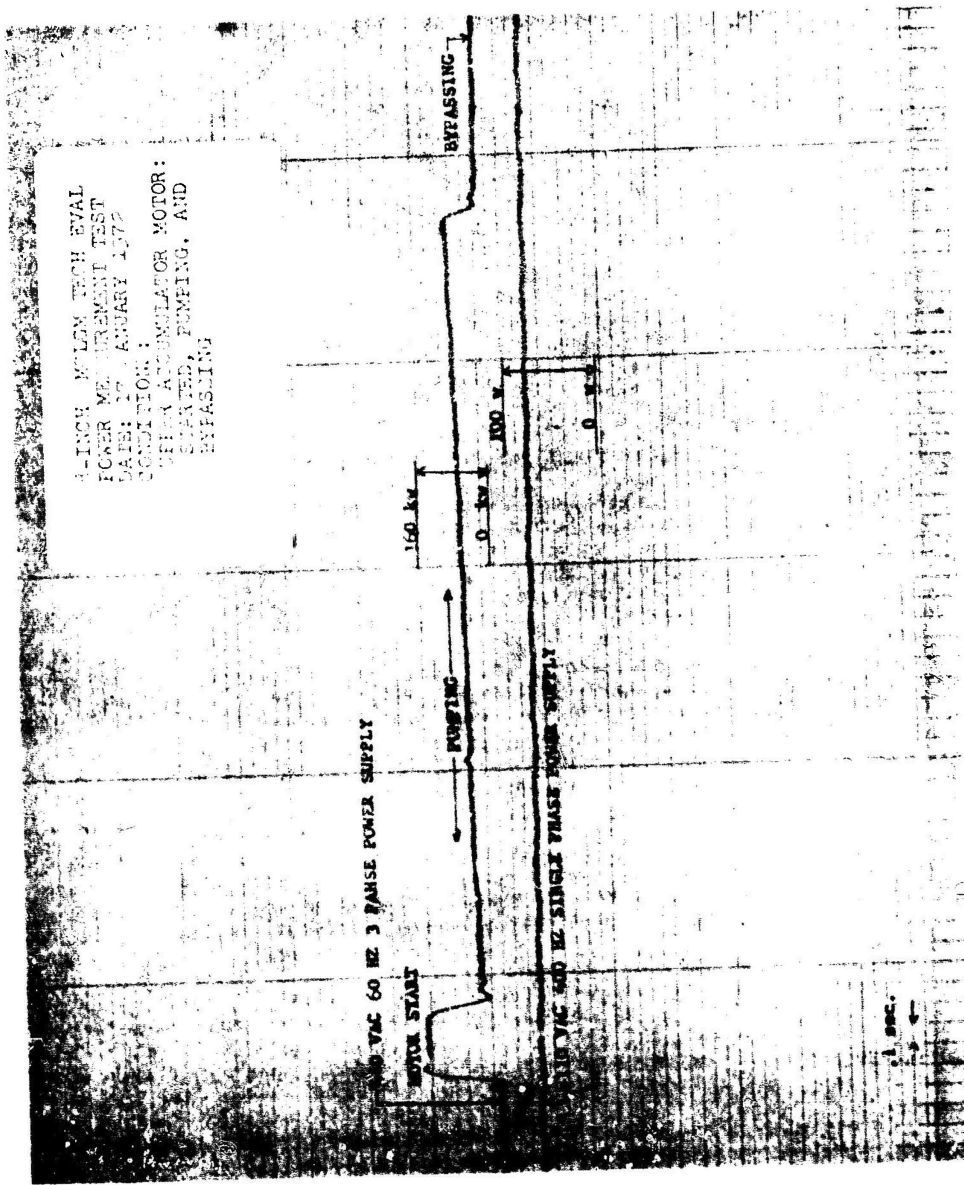


FIGURE 1

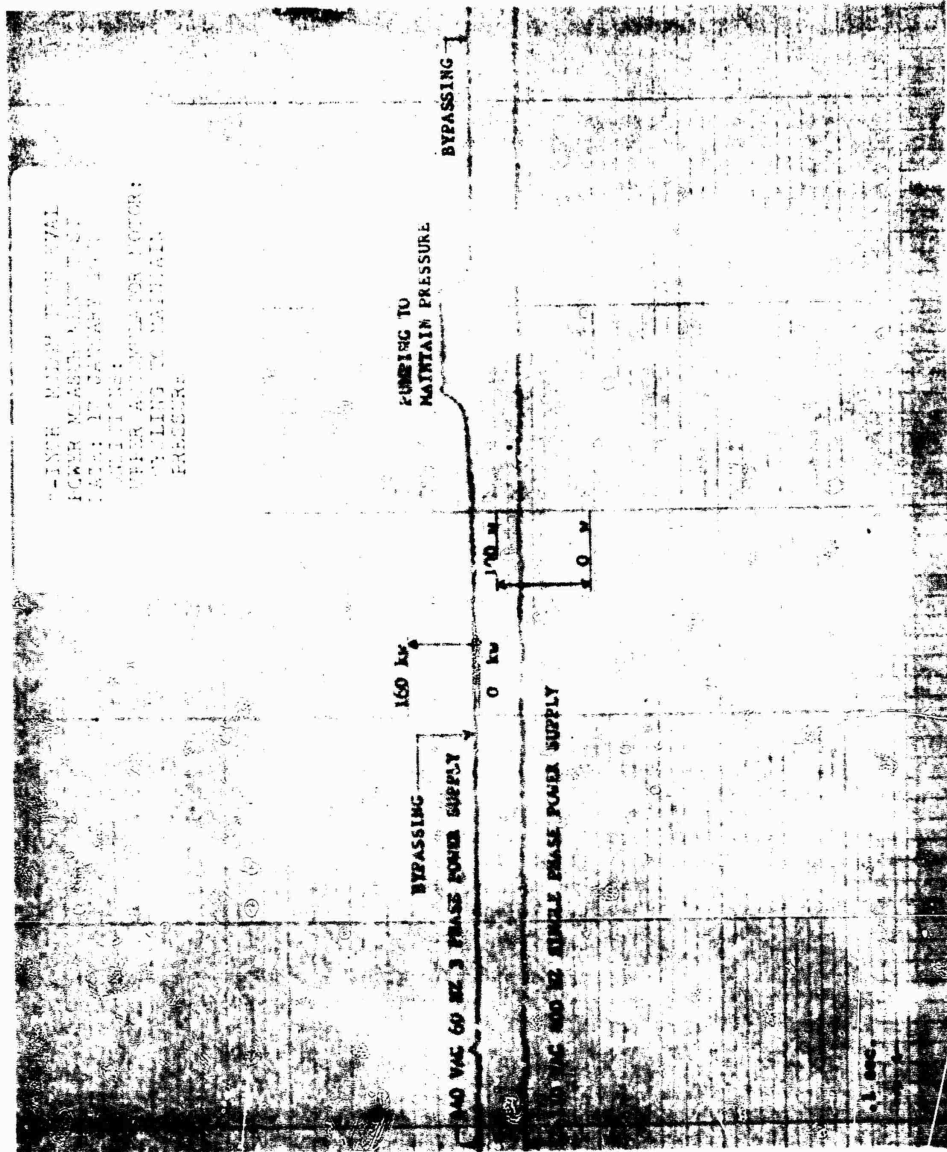


FIGURE 2

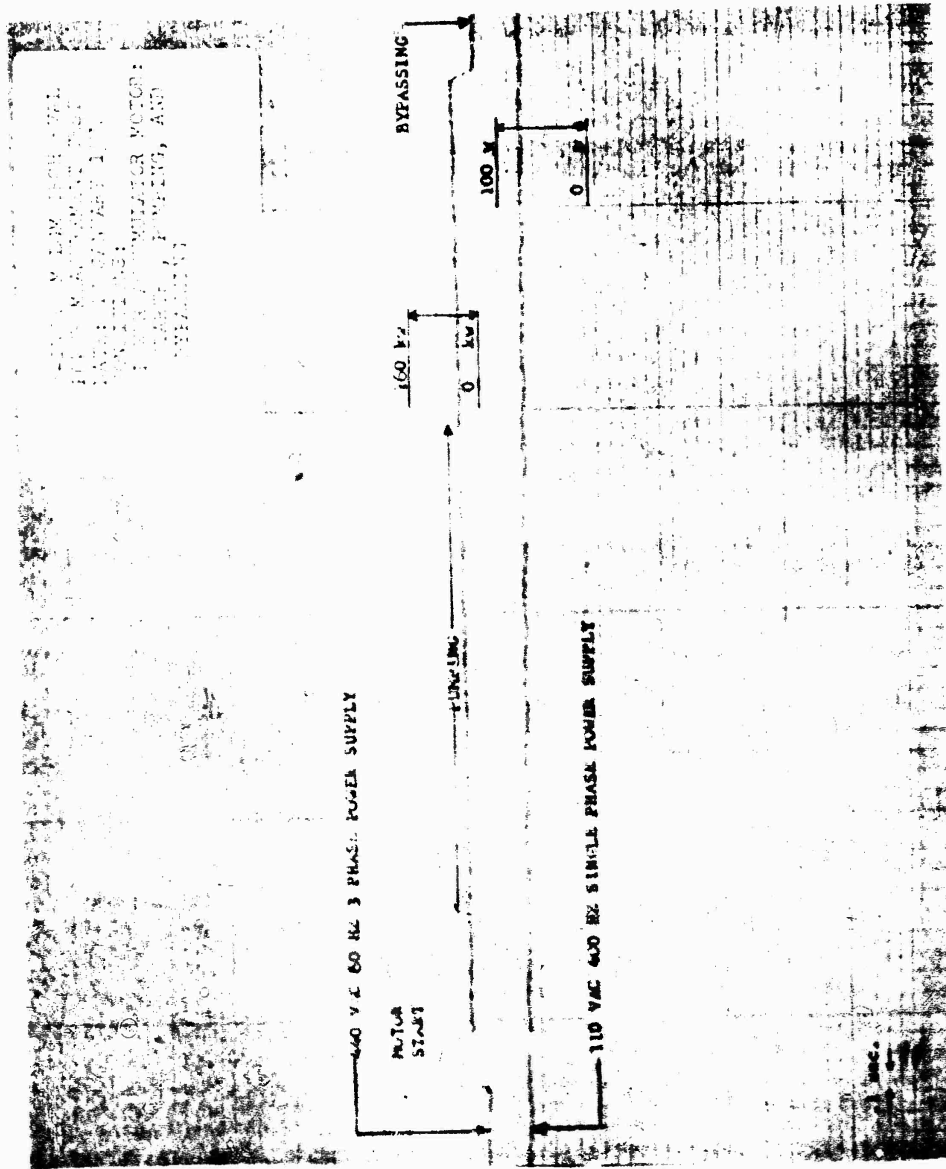


FIGURE 3

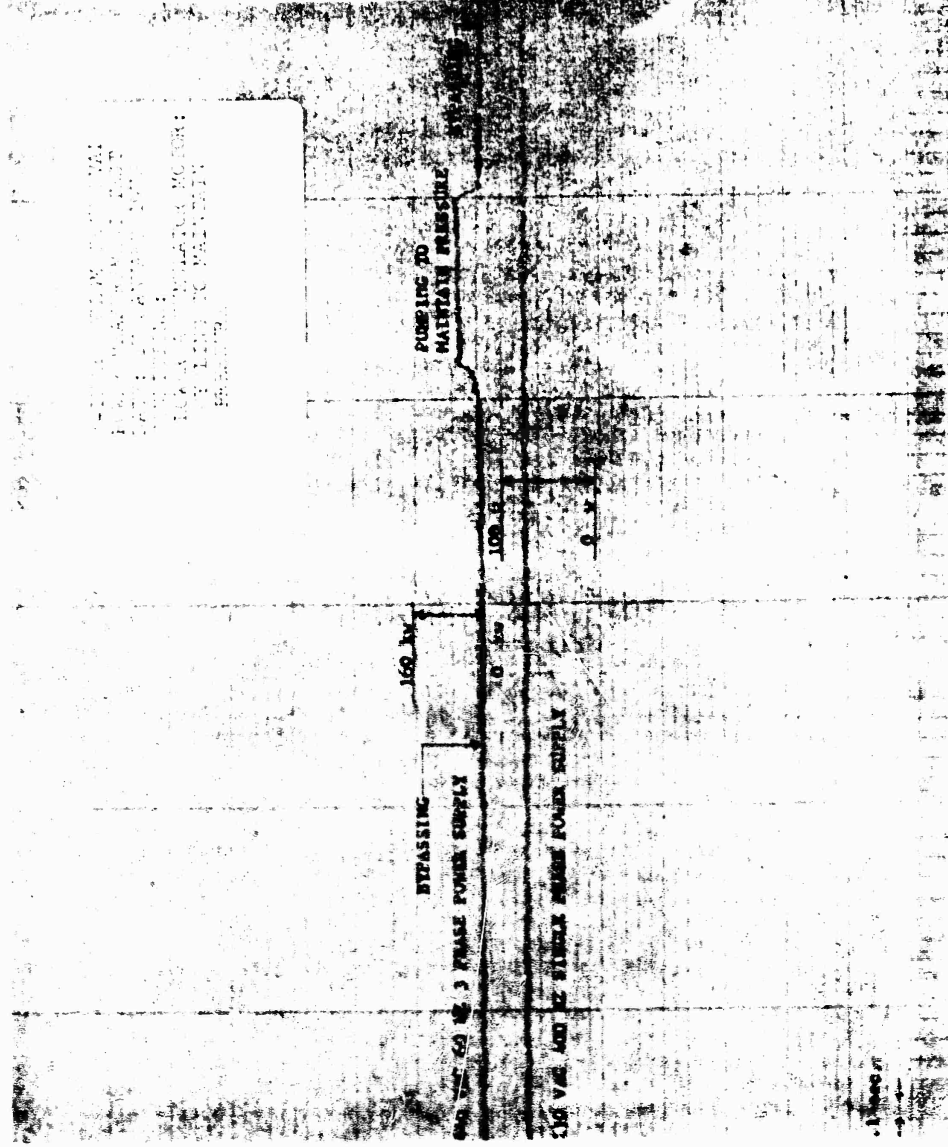


FIGURE 4

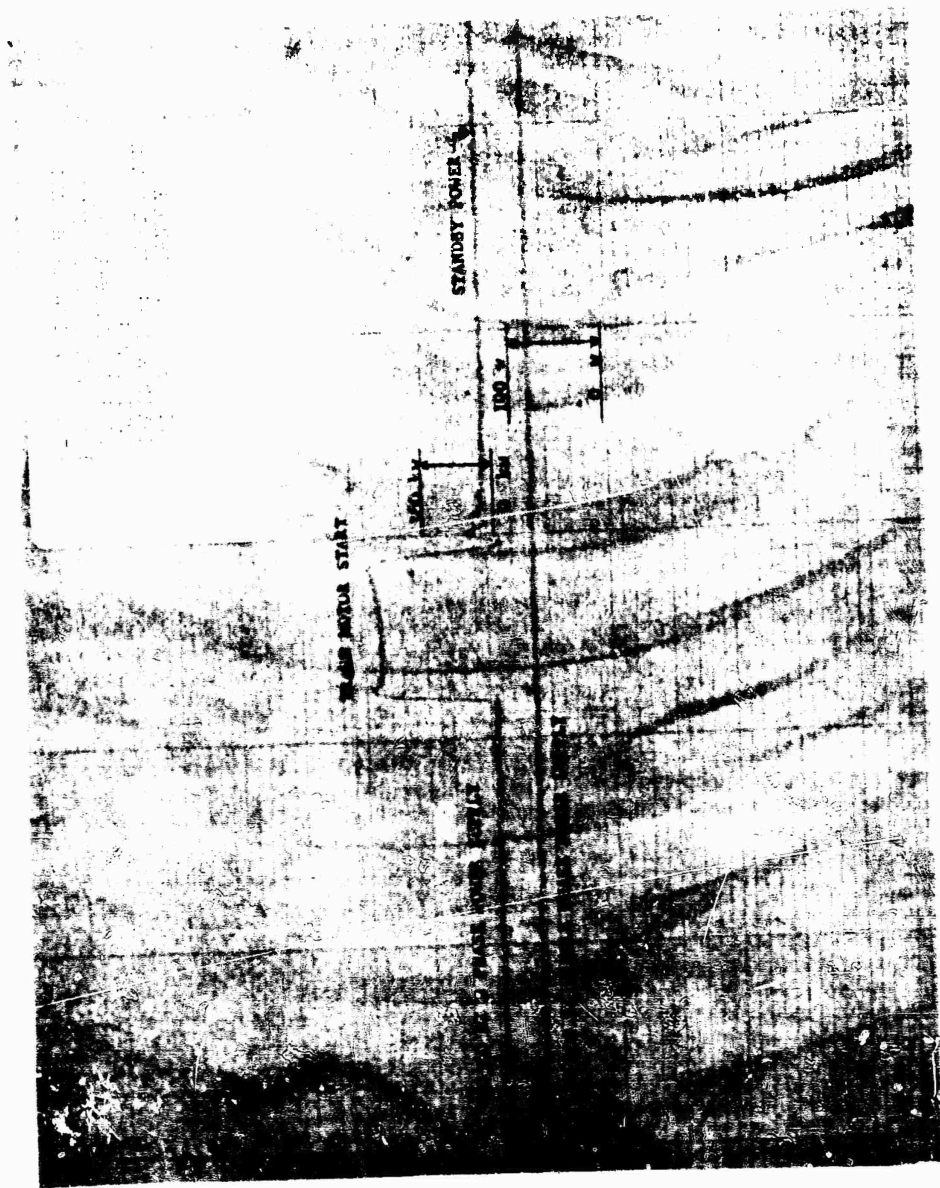


FIGURE 5

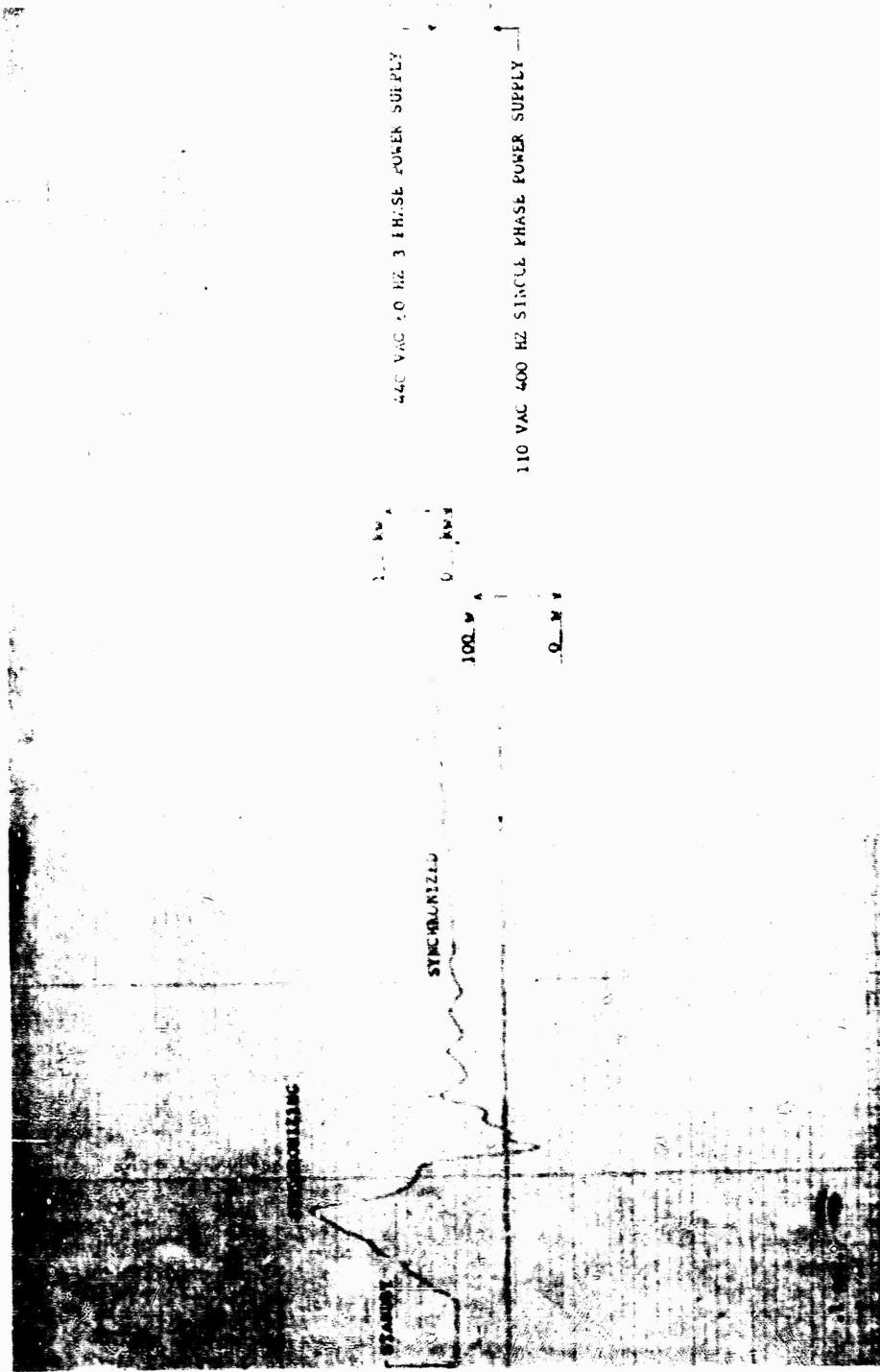


FIGURE 6

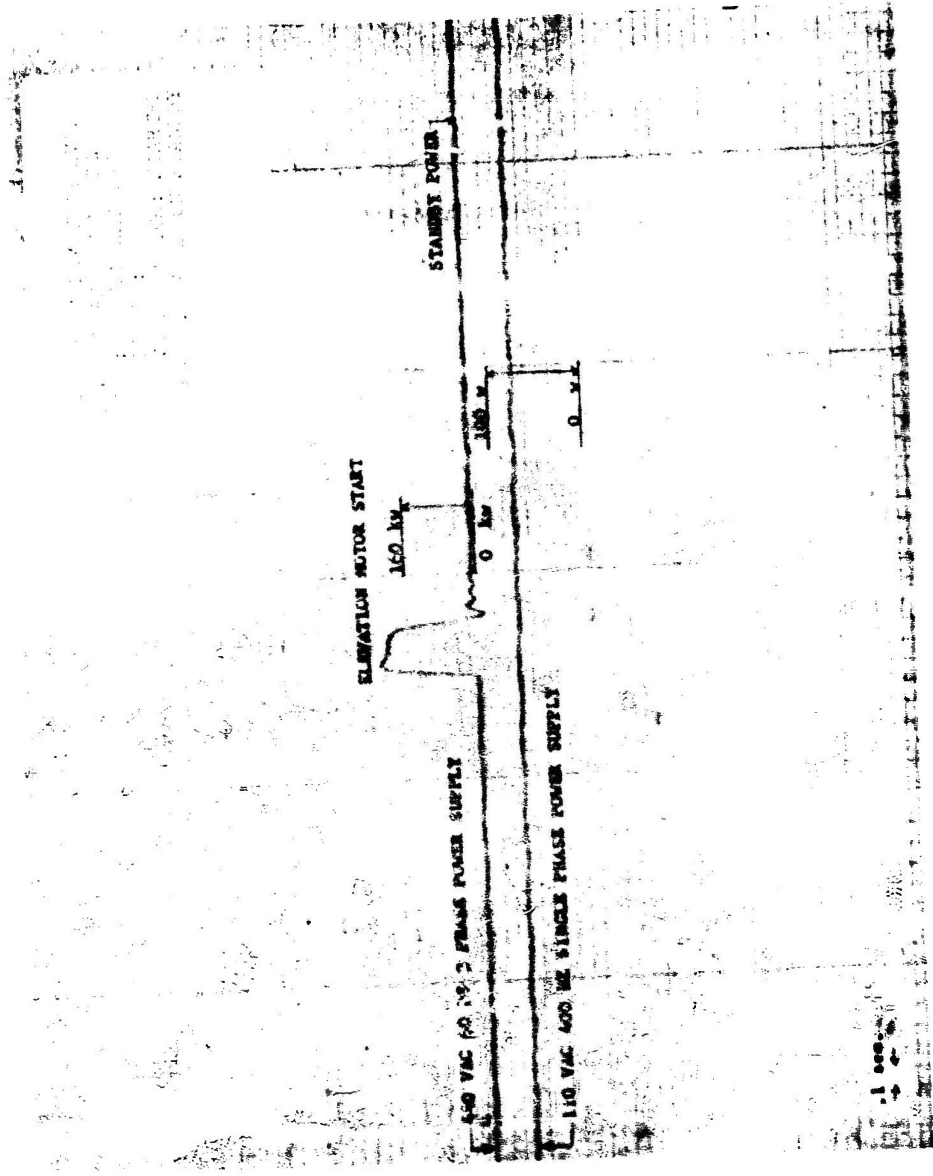


FIGURE 7

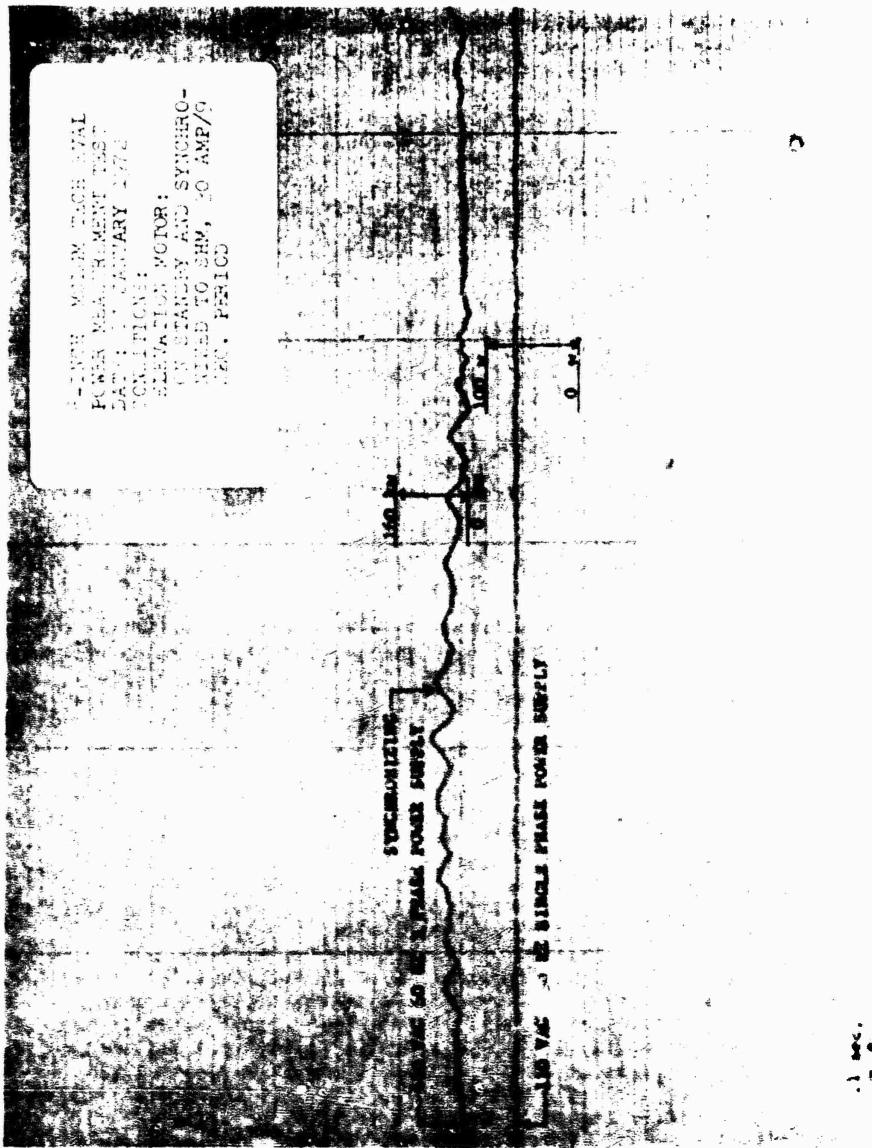


FIGURE 8

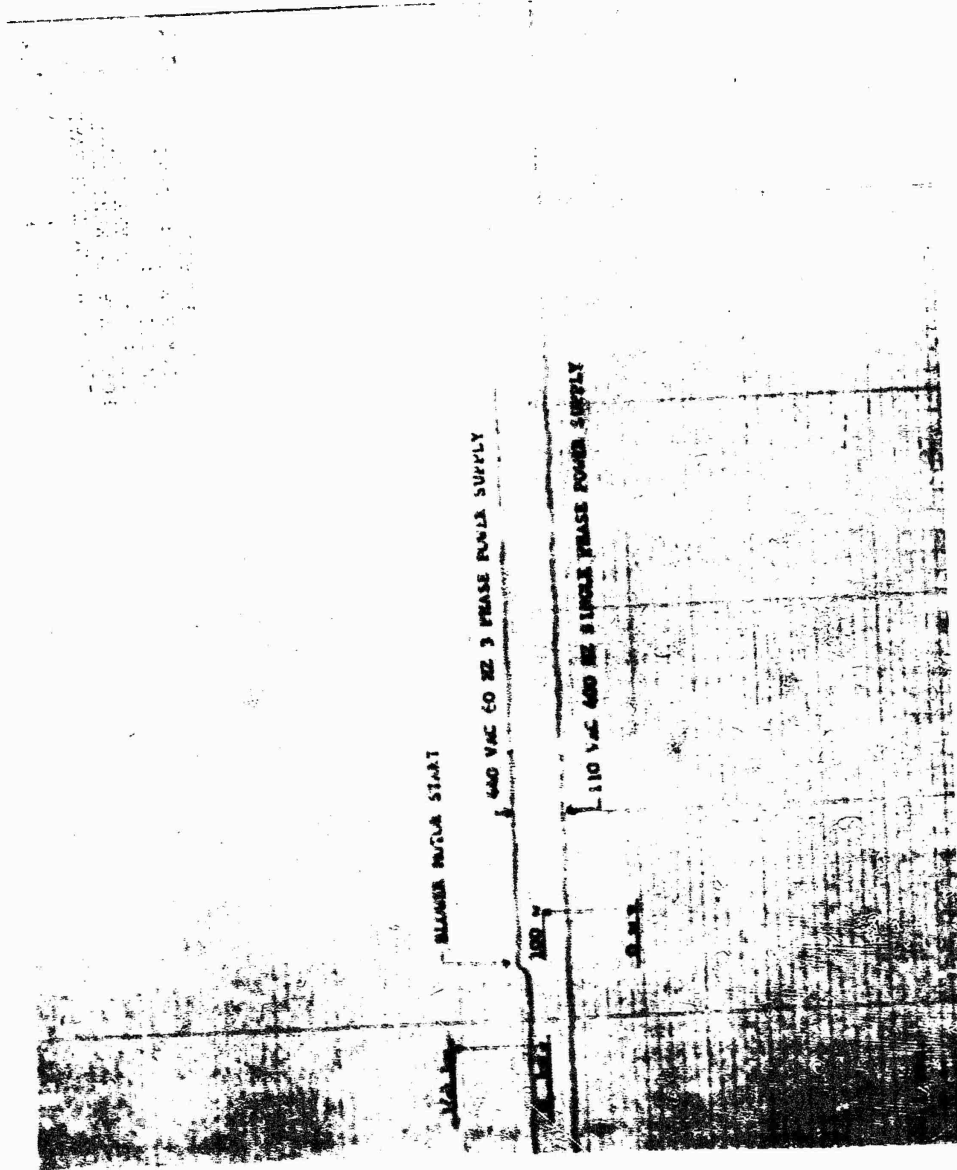


FIGURE 9

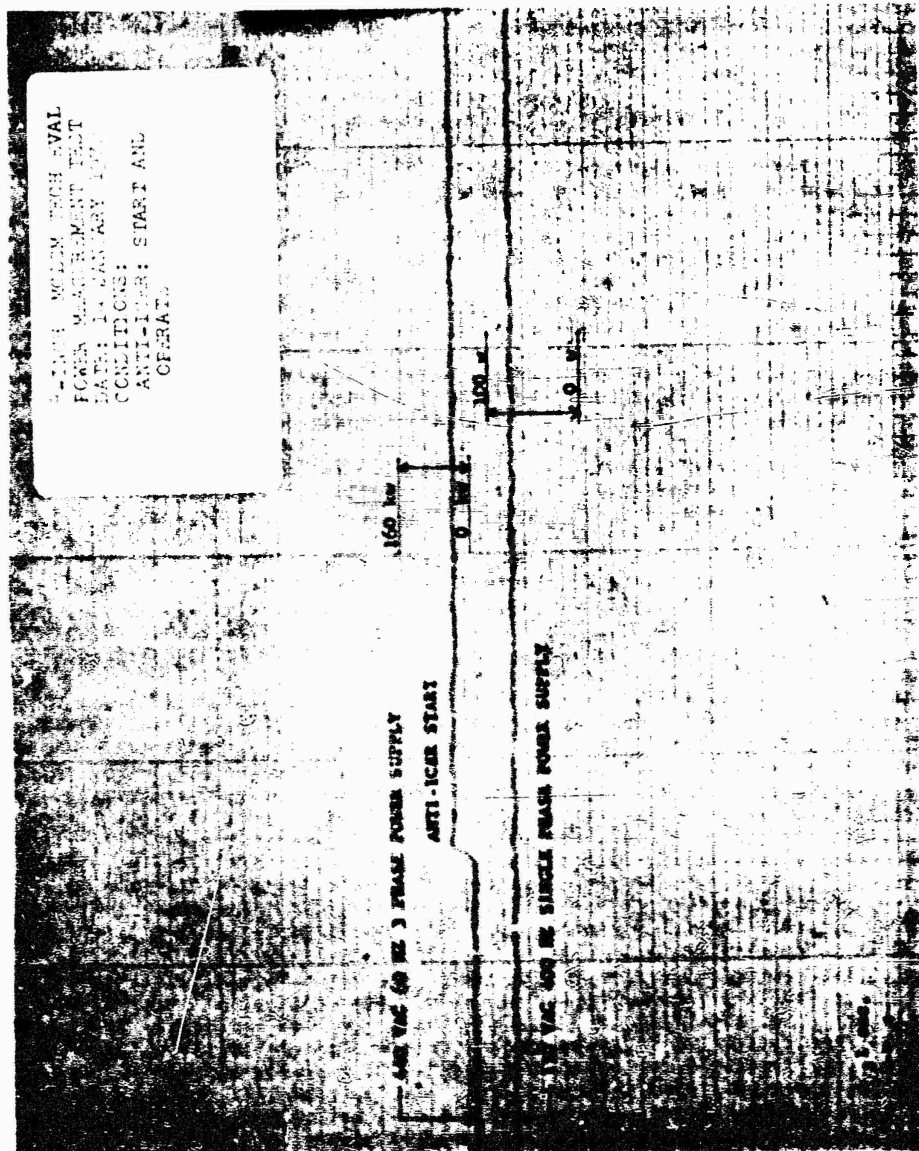


FIGURE 10

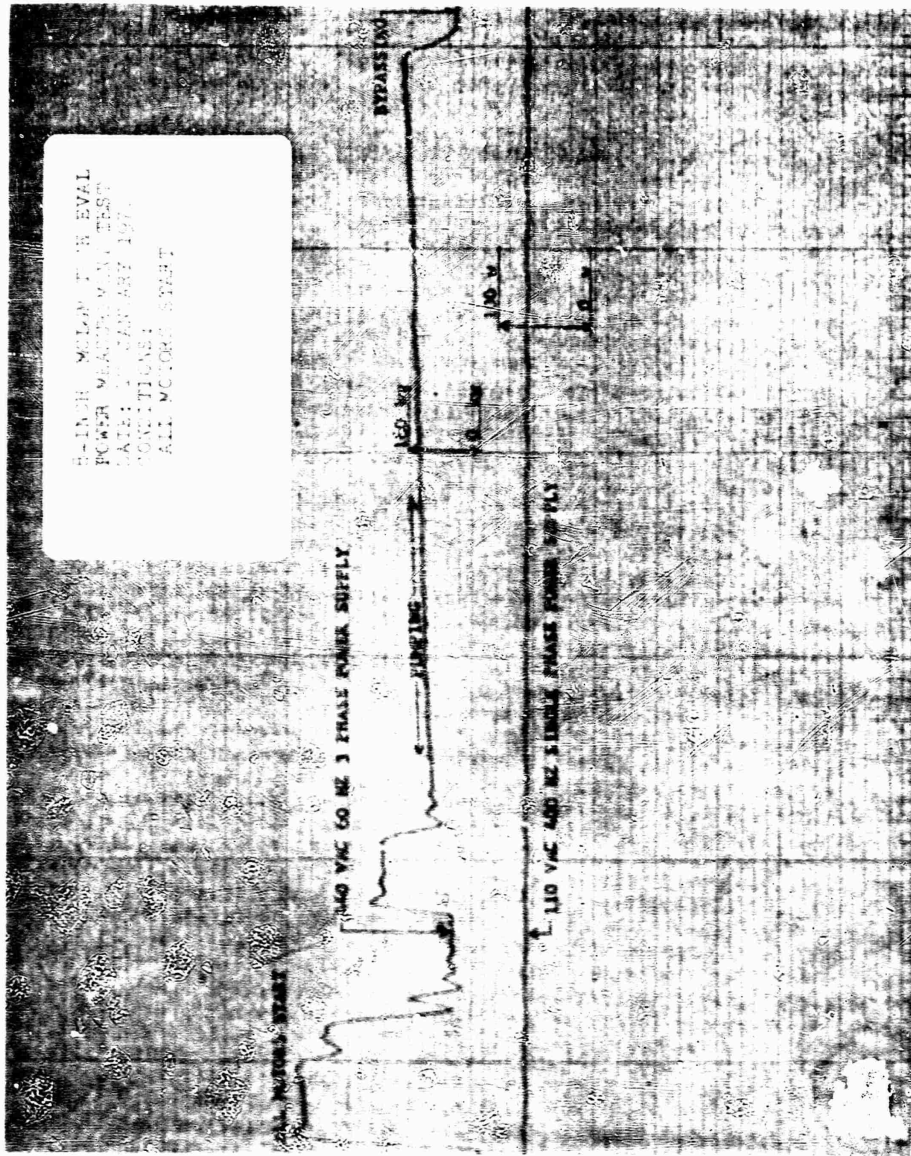


FIGURE 11

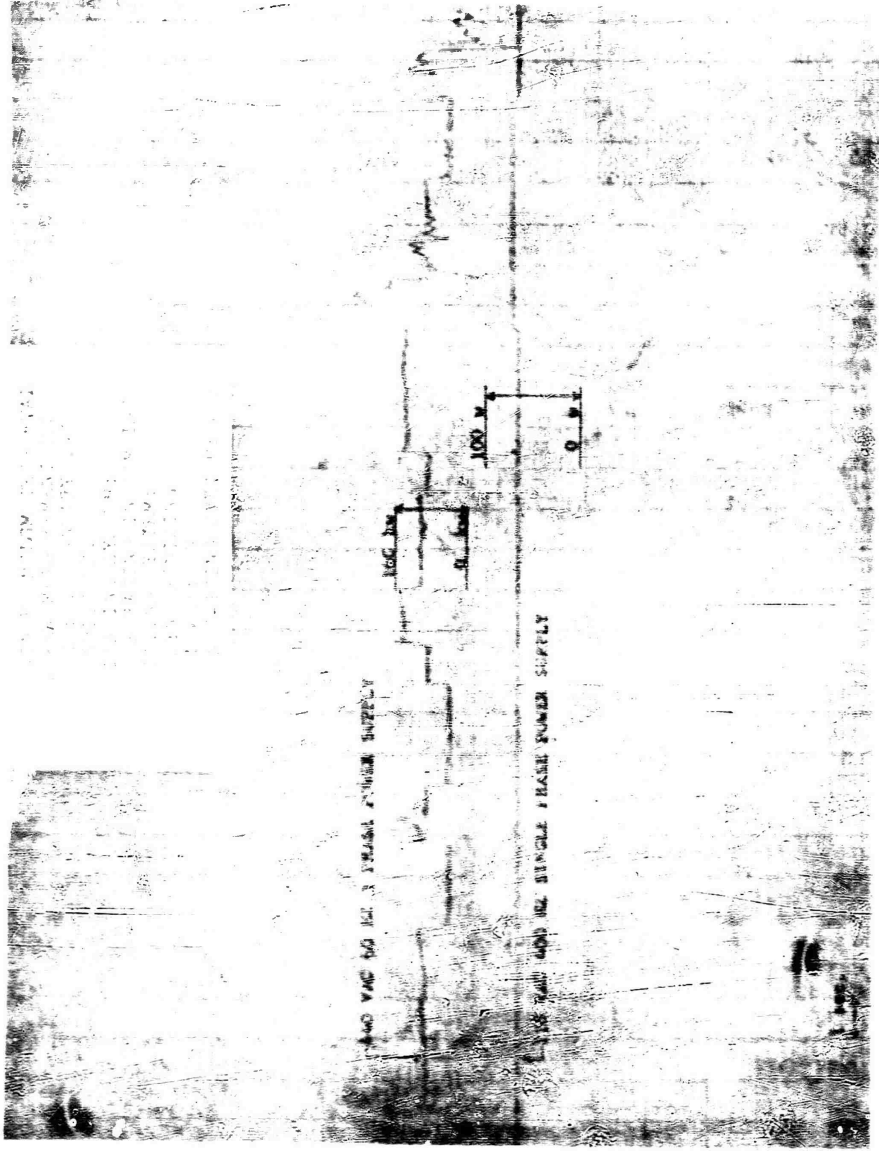


FIGURE 12

APPENDIX I

**Gun Jump Data
Figure 1**

C

8"/55 MCLGM TECHNICAL EVALUATION DISCUSSION OF ATTEMPTS TO MEASURE GUN JUMP

General

It was decided not to include a gun jump test as a discrete Tech Eval test, but to attempt some experimentation prior to the planned rate of fire test of 2 November which might give an approximation of gun jump for one angle of elevation and give some basis for refinement of experimental techniques. Three different methods of determining gun jump were investigated.

Method I

Method I involved placing a camera at point A (Refer to Figure 1) at a distance R behind the gun and a distance H above the gun. The camera was aimed at an angle near α such that point D will be within the field of view. Point D is defined as the point along the trajectory where angle α equals angle θ . Then

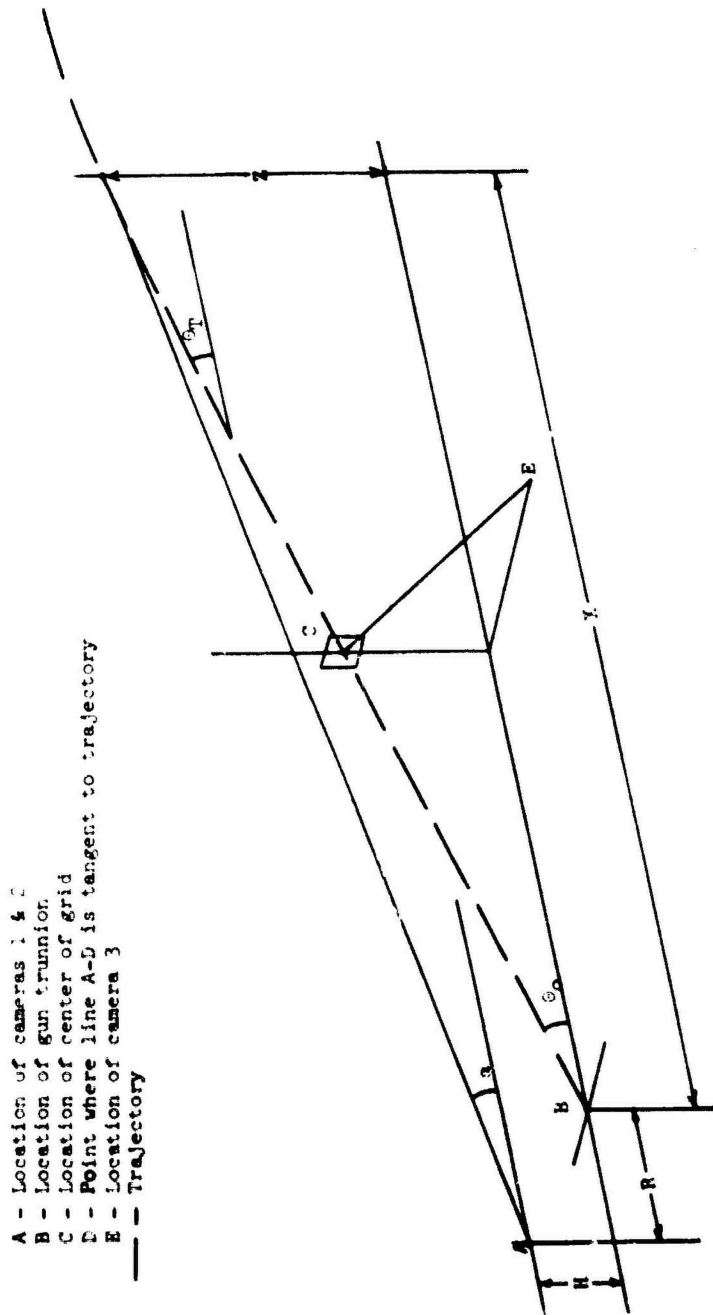
$$\tan \alpha = \tan \theta \quad (1)$$

$$\tan \theta = \frac{\dot{z}}{\dot{x}} \quad (2)$$

$$\tan \alpha = \frac{z - H}{R + x} \quad (3)$$

$$\frac{\dot{z}}{\dot{x}} - \frac{z - H}{R + x} = 0 \quad (4)$$

Equation (4) can be satisfied for a time, t, by using particle trajectory data and interpolating. Using this value of t, z and x can be found from Equation (4) and α can then be obtained from Equation (3). The gun jump value can then be determined by measuring the displacement of the projectile above or below the center of the film (on the frame where the projectile has reached a maximum height).



- A - Location of cameras 1 & 2
- B - Location of gun trunnion
- C - Location of center of grid
- D - Point where line A-D is tangent to trajectory
- E - Location of camera 3
- Trajectory

FIGURE 1
Geometrical Arrangement for Gun Jump Tests

Method II

A scaled rectangular grid was placed at point C and centered by boresighting. The projectile was photographed passing through the grid from points A and E. The displacement of the projectile from the center of the grid after subtracting trajectory drop distance, determined from particle trajectory data, gives the resulting angular displacement.

Method III

This method involves comparing observed ranges with theoretical ranges and computing gun jump based on the difference between the two.

Results

On 2 November, three rounds were fired at three degrees elevation with equipment set for applying the three methods. The camera set to observe point D (Method I) was not successful, however, because the angle α could not be estimated closely enough prior to the test. Method II yielded gun jump values of 4.14 minutes for round one and -1.07 minutes for round two. The camera at point A failed for round three. Method III gave a difference in departure angle between rounds one and two of 2.4 minutes. These results do not demonstrate a consistency needed for a good experiment and additional effort is needed before conclusions can be drawn.

APPENDIX J

8"0 MCLGM TECHEVAL Blast Test Data

Figure 1

Table J-1

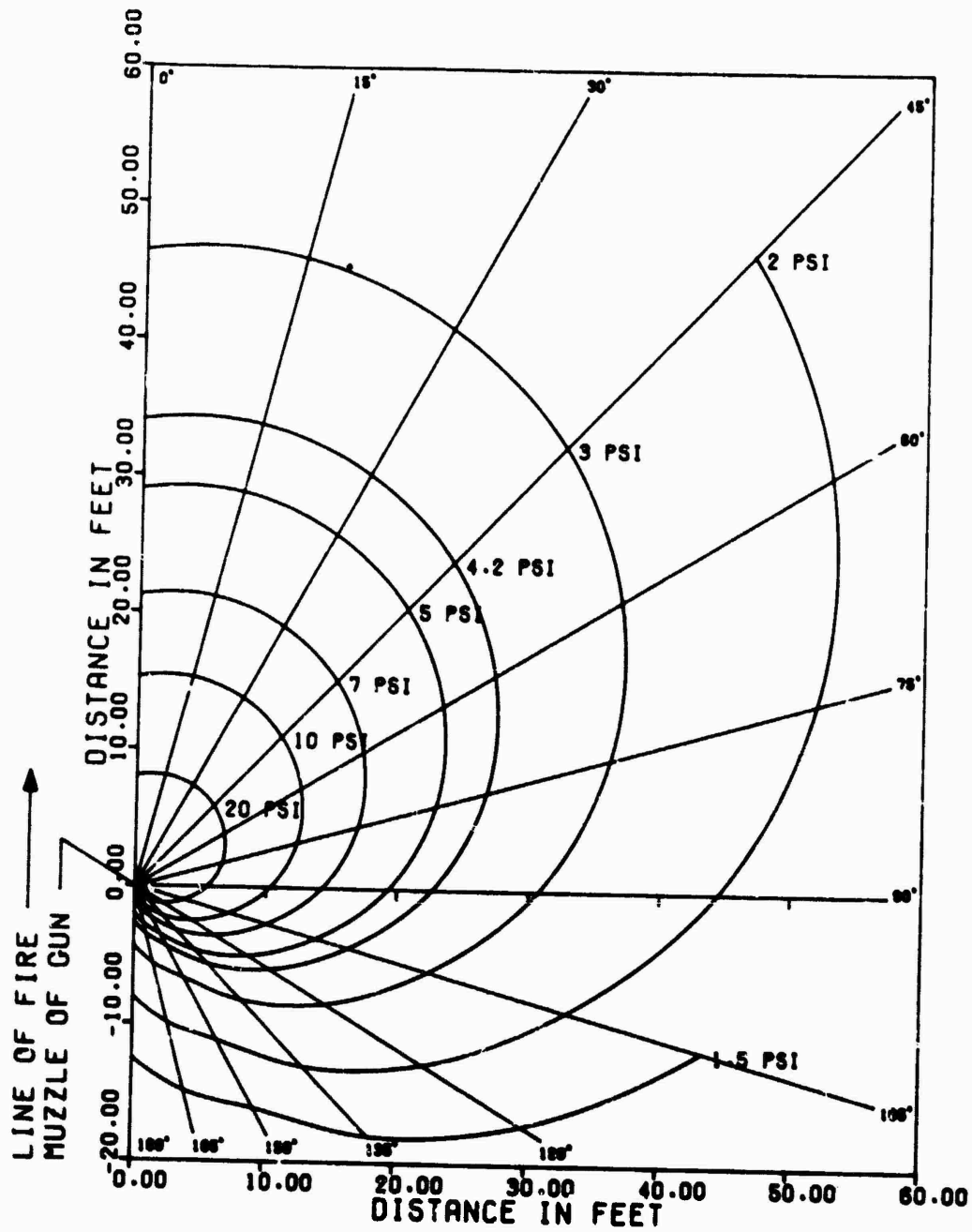


FIGURE 1
Free-Air Peak Overpressures for 8-Inch/55 MCLG Mount

TABLE J-1
EX 71 MOD 0 8"/55 MCLGM
TABULATION OF BLAST DATA

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
7.5	43.0	5	3.7	26.6	6.7	7.3
			3.7	26.0	4.3	
			3.3	26.5	4.7	
			3.6	27.5	6.4	
			3.4	29.2	6.7	
Averages:	3.5	27.2	5.7			
7.5	54.0	5	2.6	36.2	6.3	5.6
			2.4	36.1	4.6	
			2.4	37.1	6.6	
			2.2	35.7	6.8	
			2.5	36.2	7.1	
Averages:	2.4	36.3	6.3			
15	21.5	5	7.5	12.0	3.7	9.9
			7.6	12.2	3.7	
			6.5	13.5	4.1	
			7.0	13.2	4.6	
			6.8	13.4	2.8	
Averages:	7.1	13.4	3.8			
15	44.0	5	3.4	27.7	5.4	6.9
			3.8	27.1	4.9	
			3.5	27.2	5.3	
			3.3	28.6	5.1	
			3.2	30.0	6.4	
Averages:	3.4	28.1	5.4			

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
15	56.5	5	2.6	38.8	6.4	5.6
			2.5	38.7	6.0	
			2.5	39.7	5.3	
			2.4	38.3	5.9	
			2.3	38.7	7.5	
Averages:			2.5	38.8	6.2	
30	22.5	5	6.7	11.9	5.1	10.7
			7.4	11.8	4.4	
			6.4	11.4	4.5	
			6.4	12.9	2.9	
			6.5	14.3	4.3	
Averages:			6.7	13.3	4.4	
30	50.0	5	3.0	34.0	5.5	6.1
			2.7	33.8	7.2	
			3.1	35.0	4.5	
			2.9	33.5	5.4	
			2.9	33.9	5.4	
Averages:			2.9	34.0	5.6	
30	72.5	5	2.0	52.6	2.5	1.9
			1.8	51.0	3.3	
			1.6	51.1	2.9	
			1.5	52.5	3.3	
			1.4	54.1	3.7	
Averages:			1.7	52.3	3.1	

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
45	20.0	5	6.4	12.0	3.9	7.8
			6.7	12.1	3.1	
			5.9	11.9	3.6	
			6.4	11.9	3.3	
			6.2	11.9	2.8	
		Averages:	6.3	11.9	3.3	
45	41.0	5	3.5	28.0	4.1	6.7
			3.7	28.1	5.8	
			3.9	28.0	5.0	
			3.9	27.9	4.7	
			3.6	27.9	4.9	
		Averages:	3.7	28.0	4.9	
45	61.0	4	2.4	42.1	4.0	3.7
			2.3	41.9	4.7	
			2.3	41.8	4.5	
			2.2	41.9	4.3	
			2.3	41.9	4.4	
		Averages:	2.3	41.9	4.4	
45	71.0	1	1.6	52.7	5.7	3.4
60	17.0	5	9.6	10.9	2.6	9.9
			9.8	10.5	3.5	
			9.8	10.5	2.6	
			9.9	10.1	3.0	
			10.1	10.4	1.9	
		Averages:	9.8	10.5	2.7	

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
60	35.5	5	3.7	23.4	4.9	
			4.0	22.8	3.9	
			3.9	22.9	4.7	
			3.5	24.2	4.6	
			3.8	25.7	4.2	6.3
Averages:	3.8	23.8	4.5			
60	52.5	5	3.1	29.8	4.4	
			3.1	29.7	4.1	
			3.2	30.7	4.4	
			3.1	29.3	4.2	
			3.2	29.8	3.8	4.8
Averages:	3.1	29.8	4.2			
75	13.6	5	11.4	8.9	2.2	
			8.8	7.4	2.3	
			8.8	8.8	2.3	
			8.7	10.3	2.2	
			Instrumentation Malfunction on 1 Rd.			7.8
Averages:	9.4	8.8	2.2			
75	30.0	5	3.8	20.9	3.9	
			3.8	20.9	3.7	
			3.7	20.9	3.8	
			3.7	20.5	3.9	
			3.8	20.8	3.6	5.1
Averages:	3.8	20.8	3.7			

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance from Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
75	44.5	5	2.2	31.7	4.9	
			2.5	31.1	5.2	
			2.4	31.2	4.6	
			2.3	32.6	4.1	
			2.3	35.7	3.8	
		Averages:	2.3	32.4	4.5	3.9
90	10.0	5	12.0	7.3	1.6	
			11.3	7.3	2.0	
			10.5	7.1	1.9	
			11.6	7.1	1.7	
			10.9	7.1	1.8	
		Averages:	11.3	7.2	1.8	7.5
90	26.2	5	3.3	19.2	3.4	
			3.3	19.1	4.2	
			3.3	19.0	3.3	
			3.3	19.0	3.9	
			3.5	19.0	4.2	
		Averages:	3.3	19.1	3.8	4.7
90	42.0	5	1.9	32.0	3.7	
			1.8	31.9	4.4	
			2.0	31.7	3.3	
			1.8	31.7	3.2	
			2.0	31.8	3.8	
		Averages:	1.9	31.8	3.7	7.8

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
105	7.0	5	9.3	5.7	1.3	
			10.6	4.2	1.5	
			9.4	4.3	1.4	
			10.3	5.7	1.5	
			9.3	7.1	1.4	
		Averages:	9.8	5.4	1.4	14.3
105	17.0	5	4.0	12.6	2.6	
			4.0	12.6	2.7	
			4.1	12.6	2.5	
			4.4	12.3	2.4	
			4.2	12.8	2.4	
		Averages:	4.2	12.6	2.5	3.9
105	27.0	5	2.4	20.7	3.2	
			2.3	20.7	3.2	
			2.5	20.7	3.2	
			2.2	20.4	3.1	
			2.5	21.0	3.2	
		Averages:	2.4	20.7	3.2	2.8
120	5.6	5	8.7	5.2	1.0	
			7.9	5.2	1.3	
			8.7	5.0	1.1	
			8.6	5.0	1.2	
			8.3	5.0	1.2	
		Averages:	8.5	5.1	1.2	3.6

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
120	14.0	5	3.6	10.6	2.2	
			4.2	10.0	2.4	
			3.5	10.1	2.5	
			3.4	11.6	2.2	
			3.5	12.9	2.2	
		Averages:	3.6	11.1	2.3	3.1
120	26.0	5	1.9	20.9	2.7	
			2.0	20.8	3.1	
			1.9	20.8	2.6	
			2.0	20.5	3.0	
			2.1	20.9	3.1	
		Averages:	2.0	20.8	2.9	2.1
135	4.2	5	5.8	4.4	1.0	
			5.1	4.4	0.9	
			6.8	4.5	1.0	
			6.4	4.1	1.0	
			6.1	4.4	0.9	
		Averages:	6.1	4.4	1.0	2.2
135	11.0	5	3.3	9.8	2.3	
			3.5	9.7	2.5	
			3.1	9.5	2.5	
			3.3	9.5	2.1	
			3.3	9.5	2.1	
		Averages:	3.3	9.6	2.3	2.7

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
135	22.0	5	1.8	18.9	2.4	1.6
			1.7	18.8	2.8	
			1.6	18.6	2.2	
			1.7	18.6	2.6	
			1.7	18.6	2.6	
Averages:			1.7	18.7	2.5	
150	5.0	5	3.8	5.4	1.1	1.6
			4.6	3.9	1.3	
			3.2	4.0	1.1	
			3.6	5.3	1.1	
			3.9	6.7	1.2	
Averages:			3.8	5.1	1.2	
150	9.0	5	2.6	8.4	1.9	1.7
			2.7	8.4	1.9	
			2.8	8.4	1.5	
			2.7	8.1	1.7	
			2.8	8.4	1.6	
Averages:			2.7	8.3	1.7	
150	13.5	5	1.9	11.2	2.5	1.6
			2.1	10.8	2.3	
			1.9	11.0	2.2	
			1.8	12.3	2.1	
			2.0	13.6	2.4	
Averages:			1.9	11.8	2.3	

TABLE J-1 (Continued)

Angle from Trajectory (Degrees)	Radial Distance From Muzzle (Feet)	No. of Rounds Fired	Free-air Peak Overpressure (PSI)	Shock Arrival Time (MS)	Positive Pulse Duration (MS)	Positive Impulse (PSI-MS)
165	5.8	5	2.7	6.4	1.6	
			2.9	6.3	2.2	
			2.8	6.2	2.2	
			2.9	6.1	1.4	
			2.8	6.1	1.8	
		Averages:	2.8	6.2	1.8	1.9
165	9.0	5	2.0	9.1	2.1	
			2.6	7.5	1.9	
			2.4	7.6	1.8	
			2.2	9.0	2.1	
			2.3	10.3	1.7	
		Averages:	2.3	8.7	1.9	1.6
165	13.0	5	1.7	12.2	2.5	
			1.6	12.4	2.4	
			1.7	12.0	2.2	
			1.7	12.0	2.4	
			1.7	12.0	2.4	
		Averages:	1.7	12.2	2.4	1.5

Instrumentation Malfunction on 1 Rd.

APPENDIX K

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13. ABSTRACT			
The prototype 8-Inch Major Caliber Lightweight Gun Mount, MARK 71 MOD 0 was subjected to a technical evaluation from 24 September through 12 November 1972. A description of the evaluation and test results are given, with tabulations of ballistic and mount performance parameters. Results and conclusions are discussed.			