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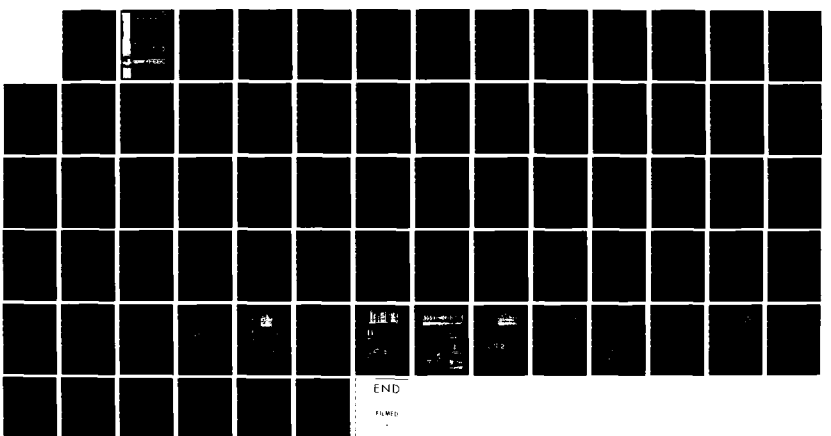

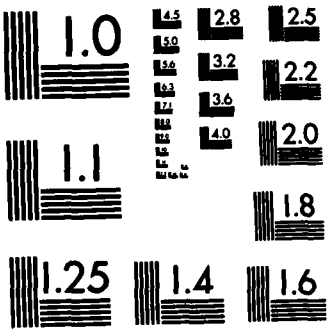

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AUTOMATIC OSCILLATING TURRET

MR. JOHN GAGLIARDO, MR. JAMES O'REGAN,
MR. JOSEPH L. WALKER, CAPT ANTHONY KWAN

FEECON CORPORATION
ONE WALKUP DRIVE
WESTBORO, MA 01581

MARCH 1981

FINAL REPORT
FEBRUARY 1978 - SEPTEMBER 1980

AFESC

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The objective of this project was to provide a more effective fire fighting capability by the driver/operator of the AS 32/P-4. An AS 32/P-4 aircraft crash rescue vehicle was reconfigured with a 300 gallon per minute (gpm) automatic, non-air-aspirating, bumper turret. This turret was evaluated as a replacement unit for the existing manually operated 300 gpm bumper turret. Twelve operational tests were conducted to determine the best oscillating rates and the agent discharge patterns. All tests used 6 percent Aqueous Film Forming Foam (AFFF) as the extinguishing agent. Three live-fire tests were

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conducted for comparative turret and nozzle effectiveness on large scale fires. The automatic, non-air aspirating, oscillating turret was shown to have twice the effective discharge range, and achieved fire extinguishment 30 percent faster then the existing turret.

PREFACE

This report was prepared by the FEECON Corporation, One Walkup Drive, Westboro, MA 01581; and the Air Force Engineering and Services Center, Air Force Engineering and Services Laboratory (RDCS) Tyndall AFB, Florida, 32403, under contract number FY 8952-79-6009 and JON 2505-1009.

This report summarizes work done between February 1978 and September 1980. The Project Officer was Mr. Joseph L. Walker.

Appreciation is expressed to Mr. James O'Regan and Mr. John Gagliardo, FEECON Corp., for their assistance and technical support. The excellent cooperation and assistance provided by the members of the Eglin Air Force Base, Florida, Fire Department under Fire Chief Bob Barrows is gratefully acknowledged.

This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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SECTION I

INTRODUCTION

1. Objective

The objective of this project was to develop a more efficient method of applying Aqueous® Film Forming Foam (AFFF) from crash rescue vehicle bumper turrets.

2. Background

The AS 32/P-4 aircraft crash rescue vehicle, (henceforth called P-4 vehicle) used on most Air Force installations, was designed to be manned by three persons, including the driver. The P-4 bumper turret control system is awkward to operate and in general, applies AFFF ineffectively. Advanced technology makes it possible to develop a firefighting system superior to the one originally installed in the P-4 vehicle.

3. Approach

A statement of work for an Oscillating Turret System on a P-4 vehicle was prepared for the design and testing of an automatic oscillating bumper turret (henceforth called bumper turret). One of the requirements was that the P-4 vehicle's driver be able to operate the bumper turret with the vehicle in motion. A P-4 vehicle from Eglin Air Force Base, Florida, was sent to the FEECON Corp., 1 Walkup Drive, Westboro, Maine, for the purpose of having a new bumper turret installed and field-tested at the contractor's location. This was to be done in accordance with the statement of work and the National Fire Protection Association (NFPA) Pamphlet 412, using an air-aspirating nozzle.

In November 1979, four live fire tests were conducted at Eglin AFB, Florida, using only the bumper turret for agent application; a non-air-aspirating nozzle was used to demonstrate the longer reach and faster fire control time of this type nozzle. Three fires were used to determine the fire suppression capability of the bumper turret. A fourth fire was conducted to compare the fire suppression capability of the new bumper turret with the bumper turret originally installed on P-4 vehicles; for this test only, another P-4 vehicle, with the original bumper turret installed, was used.

SECTION II

TEST DESCRIPTION

Turret ground pattern tests were conducted to determine the maximum stream reach, width, and application. These tests were accomplished using only the bumper turret; and using the bumper turret simultaneously with both one and two roof foam/water tubes.

A water discharge capacity test was conducted to determine the gallons per minute (gpm) available from the bumper turret. Water was discharged from the bumper turret for 3 minutes from a full water tank and then refilled from a calibrated tank, in order to measure the amount used.

Foam quality tests were taken during the foam pattern tests. They consisted of finding the expansion ratio and drainage time of the AFFF. A standard expansion ratio of five is established in the NFPA pamphlet No. 414, and a minimum drainage time of 4.5 minutes was established, by the statement of work for the bumper turret.

The pattern tests (agent system foam discharge, and agent water system discharge) were conducted by discharging the bumper turret along a measured grid for a certain length of time, 30 seconds for all foam tests, and 1 minute for all water tests. The grid consisted of several 11-inch diameter pans at premeasured points. The amount of discharge collected in each pan during the run was measured to determine the coverage per square foot. The effective pattern was determined to be the area in which the application rate was at least .2 gpm.

The road tests (rough terrain) were conducted in an open field near the contractor's plant. The P-4 vehicle was driven 30 times over a 0.2-mile course at 10 mph to determine whether the new bumper turret would leave its stowed position when subjected to the bumps and vibrations of the P-4 vehicle.

SECTION III

TEST CRITERIA

The oscillating bumper turret consists of a hydraulically operated air-aspirating turret mounted on the front of an AS 32/P-4 fire vehicle. It was designed to be powered by the P-4 fire truck's original hydraulic and electrical systems. Other criteria requirements were:

1. Turret controls inside cab.

2. Automatic oscillation with fixed elevation to range from 20° below the horizontal to 45° above the horizon.

3. Oscillation and direction of oscillation to vary through any arc up to 170° in front of the vehicle, and the speed of oscillation to be regulated from 0° per second to 60° per second.

4. That AFFF solution (94-percent H_2O and 6-percent AFFF) or plain water can be discharged.

5. That manual override controls be installed to operate the turret during hydraulic or electrical system failure.

The live fire tests were presoaked with 1000 gallons of water prior to the first test. Four hundred gallons of fuel were used for each of the four tests. The fuel was spilled in a 110-foot diameter burn area around a 60-foot boiler plate mock-up. Fire suppression was limited to the bumper turret. The preburn time was from 30 to 35 seconds. Refractometer tests were conducted after each test fire to insure a true 6-percent AFFF solution.

The results of all tests conducted are contained in this report.

SECTION IV

TEST RESULTS

On 6 June 1979, 12 operational tests (no fires) were conducted at the contractor's location. The purpose of these tests was to evaluate the automatic, oscillating, bumper turret's discharge patterns, maximum stream ranges and widths. First, tests were conducted using plain water, and then a mixture of 6-percent AFFF and 94-percent water. Test procedures consisted of discharging the bumper turret along a measured grid. Water patterns were first checked and then AFFF patterns were evaluated. The grid used for this test consisted of several 11-inch pans placed at premeasured points. The amount of agent collected in each pan was measured immediately after agent discharge was stopped. The effective pattern was determined to be the area that had at least 0.2 gallon of agent in the pans. National Fire Protection Association (NFPA) Pamphlet Number 412 and the statement of work were used as source documents for these tests (see Tables 1 through 12 for test results). The author and a representative from AFESC/DEF monitored these tests.

A water discharge capacity test was conducted to determine the max gpms available from the self-oscillating turret. The water tank on the P-4 fire truck was filled and water was discharged from the bumper turret for 3 minutes. The water tank was then refilled from a 1900 gallon calibrated water tank to determine the gallons used in 3 minutes (see Tables 13 through 20 for test results).

The road test (rough terrain) was conducted in an open field near the contractor's plant. The truck was driven 30 times over a 0.2-mile course at 10 mph. The operator removed the turret from the stowed position and discharged it a total of ten times during this test. The turret was operated in both the manual and automatic positions. The driver demonstrated an ability to drive the vehicle and simultaneously operate the bumper turret in the automatic position. The turret did not inavertently leave its stowed position when returned to that position after use, even though the terrain was rougher than that normally encountered off the runway on an air force base.

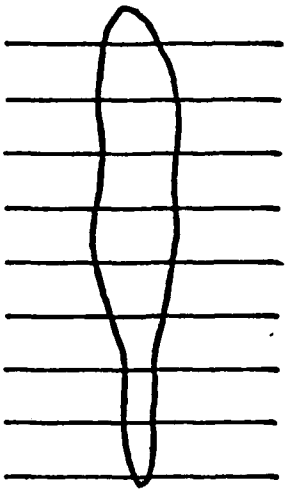
Three live fire tests were conducted at Eglin AFB, Florida, after the P-4, which had been modified to include the automatic self-oscillating bumper turret, was returned from the contractor. A non-air-aspirating bumper turret provided by the contractor was used during all three of these tests. The ambient temperature varied from 55°F to 68°F and the water temperature from 70°F to 78°F. Windspeeds of 4-5 knots from a northeasterly direction prevailed throughout these tests. The excellent fire control times obtained during the test fires can be attributed partially to the use of the non-air-aspirating nozzle; i.e., non-air-aspirating

nozzles provide longer reach streams and fire control is accomplished in approximately 50 percent of the time required for an air-aspirated turret nozzle. Conducted burn back resistance time tests compared resonably to the test results previously established in CEEDO-TR-78-22, "Comparative Nozzle Study for Applying Aqueous® Film Forming Foam on large scale fires"; i.e., burn-back resistance of both types (air-aspirated and non-air-aspirated) of AFFF were considered relatively equal for the test conditions used. Fire control and extinguishment of these fires were accomplished using only the automatic self-oscillating bumper turret. An upwind approach was used on all fires. The turret operator used a straight stream on the initial approach changing to an intermediate or full fog pattern. Progressive extinguishment (a visible reduction in the magnitude of the fire) was obtained in 4 seconds on each fire. A delay in fire control time (90-percent extinguishment) was noted during the second test fire due to the turret operator changing to a full fog stream instead of the intermediate fog stream. Maximum ranges of 130 feet for straight stream, 51 feet for intermediate fog and 30 feet for full fog were obtained during these fires. After these tests were completed another fire was conducted to compare the fire suppression capability of the self-oscillating bumper turret with the originally installed bumper turret on the P-4 fire truck. Progressive extinguishment remained the same (4 seconds); however, time to obtain fire control was delayed considerably. The same basic techniques used in test fires One and Three were used in this fire. This delay was undoubtedly caused by the turret operator's inability to apply firefighting agent to the fire areas as well as the automatic turret feature (see Table 21 for test results). The author and a representative of AFESC/DEF monotored these tests.

TABLE 1. WATER DISCHARGE STRAIGHT STREAM BUMPER TURRET ONLY, 220 PSI TURRET PRESSURE

Maximum Range – 157'
Maximum Width – 12'

Pattern

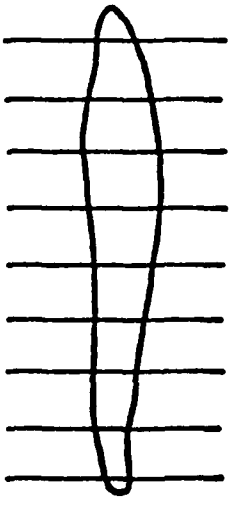


Range (Feet)	Width (Feet)
150	8
40	12
30	12
20	12
110	11
100	8
90	5
80	4
70	2

TABLE 2. WATER DISCHARGE STRAIGHT STREAM BUMPER TURRET AND ONE ROOF TURRET WATER TUBE, 200 PSI TURRET PRESSURE

Maximum Range – 154'
Maximum Width – 11'

Pattern



Range (Feet)	Width (Feet)
150	6
140	8
130	11
120	11
110	11
100	10
90	9
80	7
70	4

TABLE 3. WATER DISCHARGE STRAIGHT STREAM BUMPER TURRET AND TWO ROOF TURRET WATER TUBES, 165 PSI TURRET PRESSURE

Maximum Range – 151'
Maximum Width – 10'

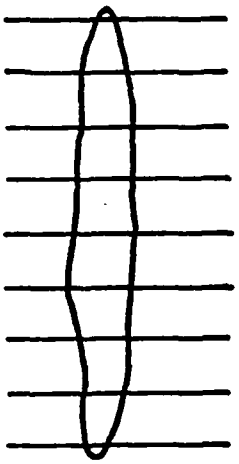
Pattern	(Feet)	(Feet)
	150	3
	140	8
	130	9
	120	10
	110	10
	100	11
	90	9
	80	6
	70	2

TABLE 4. WATER DISCHARGE DISPERSE PATTERN BUMPER TURRET ONLY, 220 PSI TURRET PRESSURE

Maximum Range – 74'
Minimum Range – 17'
Maximum Width – 26'

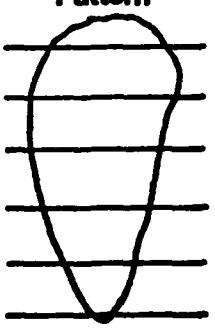
Pattern	Range (Feet)	Width (Feet)
	70	15
	60	26
	50	24
	40	14
	30	10
	20	4

TABLE 5. WATER DISCHARGE DISPERSE PATTERN BUMPER TURRET AND ONE ROOF TURRET WATER TUBE, 200 PSI TURRET PRESSURE

Maximum Range – 69'
Minimum Range – 15'
Maximum Width – 28'

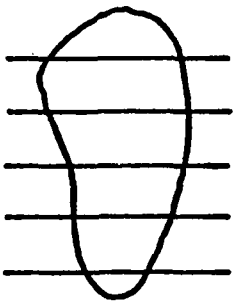
Pattern	Range (Feet)	Width (Feet)
	60	27
	50	26
	40	19
	30	14
	20	6

TABLE 6. WATER DISCHARGE DISPERSE PATTERN BUMPER TURRET AND TWO ROOF TURRET WATER TUBES, 165 PSI TURRET PRESSURE

Maximum Range – 66'
Minimum Range – 17'
Maximum Width – 27'

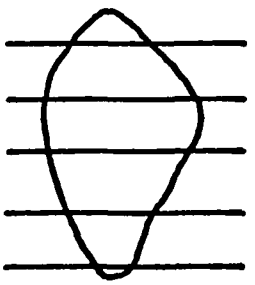
Pattern	Range (Feet)	Width (Feet)
	60	15
	50	25
	40	26
	30	15
	20	5

TABLE 7. FOAM DISCHARGE STRAIGHT STREAM BUMPER TURRET ONLY, 220 PSI TURRET PRESSURE

Maximum Range — 136'
Maximum Width —

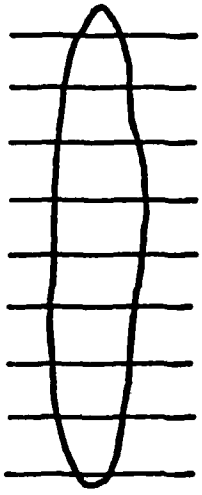
Pattern	(Feet)	(Feet)
	130	7
	120	10
	110	12
	100	14
	90	14
	80	13
	70	11
	60	8
	50	3

TABLE 8. FOAM DISCHARGE STRAIGHT STREAM BUMPER TURRET AND ONE ROOF TURRET FOAM TUBE, 200 PSI TURRET PRESSURE

Maximum Range — 134'
Maximum Width — 13'

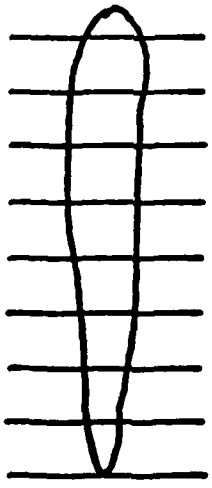
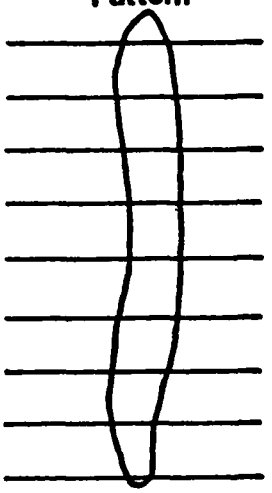
Pattern	Range (Feet)	Width (Feet)
	130	8
	120	13
	110	13
	100	13
	90	12
	80	10
	70	8
	60	6
	50	2

TABLE 9. FOAM DISCHARGE STRAIGHT STREAM BUMPER TURRET AND TWO ROOF TURRET FOAM TUBES, 165 PSI TURRET PRESSURE

Maximum Range – 135'
Maximum Width – 12'

Pattern

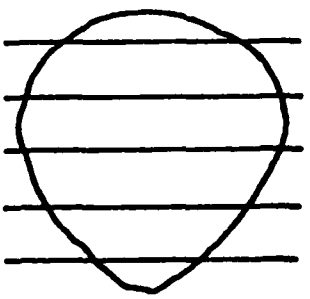


Range (Feet)	Width (Feet)
130	7
120	11
110	11
100	12
90	10
80	10
70	10
60	7
50	4

TABLE 10. FOAM DISCHARGE DISPERSE PATTERN BUMPER TURRET ONLY, 220 PSI TURRET PRESSURE

Maximum Range – 64'
Minimum Range – 12'
Maximum Width – 43'

Pattern



Range (Feet)	Width (Feet)
60	20
50	40
40	44
30	40
20	21

TABLE 11. FOAM DISCHARGE DISPERSE PATTERN TURRET AND ONE ROOF TURRET FOAM TUBE, 200 PSI TURRET PRESSURE

Maximum Range – 62'
Minimum Range – 13'
Maximum Width – 40'

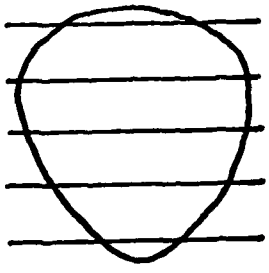
Pattern	Range (Feet)	Width (Feet)
	60	15
	50	39
	40	38
	30	33
	20	18

TABLE 12. FOAM DISCHARGE DISPERSE PATTERN BUMPER TURRET AND TWO ROOF TURRET FOAM TUBES, 165 PSI TURRET PRESSURE

Maximum Range – 63'
Minimum Range – 8'
Maximum Width – 40'

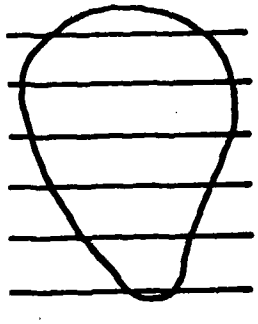
Pattern	Range (Feet)	Range (Feet)
	60	22
	50	35
	40	38
	30	28
	20	17
	10	7

TABLE 13. DISCHARGE CAPACITY CALCULATION

Discharge Capacity

1900 Gallon Tank Calibrations

Tank Diameter = 72 Inches

$$\text{Gallons/Feet} = \frac{\text{Area x Height (In Inches)}}{\text{231 Cubic Inches/Gallons}}$$

$$= \frac{(72")^2}{4} \times 12" = 211.5 \text{ Gallons/Feet}$$

231 Cubic Inches/Gallon

Gallons of Water Available in the 1900 Gallon Tank

Water Level Dropped 4.9

4.9 x 211.5 = 1,035 Gallons

Discharge Time = 3.0 Minutes

$$\text{Discharge Rate} = \frac{1{,}036 \text{ Gallons}}{3.0 \text{ Minutes}}$$

= 345 Gpm

TABLE 14. FOAM QUALITY TEST RESULTS

Expansion Standard Minimum of 5.0	
Expansion Minimums Derived From Tests:	
Bumper Turret Only	7.0
Bumper Turret and One Roof Turret Foam Tube	7.3
Bumpter Turret and Two Roof Turret Foam Tubes	6.5
25% Drainage Time Standard (Minimum)	4.5 Minutes
25% Drainage Time Derived From Test Results (Minimum)	
Bumper Turret Only	5.7 Minutes
Bumper Turret and One Roof Turret Foam Tube	5.7 Minutes
Bumper Turret and Two Roof Turret Foam Tubes	5.3 Minutes

TABLE 15. FOAM EXPANSION TEST RESULTS OF BUMPER TURRET ONLY, STRAIGHT STREAM PATTERN

Volume of Foam Sampling Cylinder	1000 Milliliters
Weight of Foam Sample and Cylinder	388 Grams
Weight of Cylinder	266 Grams
Weight of Foam Sample = 388 Grams - 266 Grams =	122 Grams
Weight of Foam Solution if it Filled the Pan	1000 Grams

Expansion = 1000 grams/122 grams = 8.2

TABLE 16. FOAM EXPANSION TEST RESULTS OF BUMPER TURRET AND ONE ROOF TURRET FOAM TUBE, STRAIGHT STREAM PATTERN

Volume of Foam Sampling Cylinder	1000 Milliliters
Weight of Foam Sample and Cylinder	373 Grams
Weight of Cylinder	266 Grams

Weight of Foam Sample = 373 Grams - 266 Grams = 107 Grams

$$\text{Expansion} = \frac{1000 \text{ Grams}}{107 \text{ Grams}} = 9.3$$

TABLE 17. FOAM EXPANSION TEST RESULTS OF BUMPER TURRET AND TWO ROOF TURRET FOAM TUBES, STRAIGHT STREAM PATTERN

Volume of Foam Sampling Cylinder	1000 Milliliters
Weight of Foam Sample and Cylinder	391 Grams
Weight of Cylinder	277 Grams
Weight of Foam Sample = 391 Grams - 277 Grams =	114 Grams
Weight of Foam Solution if it Filled the Pan =	1000 Grams

$$\text{Expansion} = \frac{1000 \text{ Grams}}{114 \text{ Grams}} = 8.8$$

TABLE 18. FOAM EXPANSION TEST RESULTS OF BUMPER TURRET ONLY, DISPERSED PATTERN

Volume of Foam Sampling Cylinder	1000 Milliliters
Weight of Foam Sample and Cylinder	408 Grams
Weight of Cylinder	266 Grams
Weight of Foam Sample = 408 Grams - 266 Grams =	142 Grams
Weight of Foam Solution if it Filled the Pan =	1000 Grams

$$\text{Expansion} = \frac{1000 \text{ Grams}}{142 \text{ Grams}} = 7.0$$

TABLE 19. FOAM EXPANSION TEST RESULTS OF BUMPER TURRET AND ONE ROOF TURRET FOAM TUBE, DISPERSED PATTERN

Volume of Foam Sampling Cylinder	1000 Milliliters
Weight of Foam Sample and Cylinder	413 Grams
Weight of Foam Sample = 413 Grams - 277 Grams =	136 Grams
Weight of Foam Solution if it Filled the Pan =	1000 Grams

$$\text{Expansion} = \frac{1000 \text{ Grams}}{136 \text{ Grams}} = 7.3$$

TABLE 20. FOAM EXPANSION TEST RESULTS OF BUMPER TURRET AND TWO ROOF TURRET FOAM TUBES, DISPERSED PATTERN

Volume of Foam Sampling Cylinder	1000 Milliliters
Weight of Foam Sample and Cylinder	429 Grams
Weight of Cylinder	277 Grams
Weight of Foam Sample = 429 Grams - 277 Grams =	152 Grams
Weight of Foam Solution if it Filled the Pan =	1000 Grams

$$\text{Expansion} = \frac{1000 \text{ Grams}}{152 \text{ Grams}} = 6.6$$

TABLE 21. LIVE FIRE TEST RESULTS

Test[d.]	Ambient Temperature	Wind Temperature Tank	Wind Direction and Speed	Preburn Time	Straight Stream Maximum Reach	Dispersed Stream Maximum Reach	Time Progressive Extinguishment	Control Time (90% Extinguished)	Burnback Resistance Time	Refractometer Test Results
1[a.]	55°F	70°F	040 at 4 Knots	30 Sec	130'	51' Intermediate Fog	4 Sec	10 Sec	OK	(1.0 Sample) (1.0 Test)
2[b.]	68°F	78°F	090 at 4 Knots	30 Sec	130'	30' Full Fog	4 Sec	25 Sec	OK	(1.0 Sample) (1.0 Test)
3[a.]	68°F	78°F	060 at 5 Knots	35 Sec	130'	51' Intermediate Fog	4 Sec	14 Sec	OK	(1.0 Sample) (1.0 Test)
4[c.]	68°F	78°F	060 at 5 Knots	35 Sec	130'	51' Intermediate Fog	4 Sec	60 Sec	OK	(1.0 Sample) (1.0 Test)

a. A straight stream was utilized for the initial attack on this fire with the operator changing to an intermediate fog pattern to obtain fire control and extinguishment.

b. A straight stream attack was utilized during the initial attack on this fire with the operator changing to a full fog pattern to obtain fire control and extinguishment.

c. The originally installed bumper turret was used during this test.

d. All fires were conducted utilizing no-air aspirating turret and extinguishment efforts were limited to the bumper turret.

SECTION V

ANALYSIS

All requirements of the Statement of Work (SOW for the "Oscillating Bumper Turret System AS 32/P-4 Fire Vehicle," dated 16 February 1978; and the current Fire Protection Association Pamphlet Number 412, "Test Procedures for Aircraft Rescue and Fire Fighting Vehicles," were met or exceeded during tests conducted at the contractor's location or at Eglin AFB, Florida.

Discharge Capacity Tests conducted indicated that satisfactory discharge results were obtained in gpm, maximum turret range, pattern width, and angle cone requirements. These tests were accomplished utilizing both plain water and a solution of 94 percent water and 6 percent AFFF.

Foam expansion of 5 was exceeded for all turret operational selections available.

Twenty-five percent minimum drainage time of 4.8 minutes was exceeded for all turret operational selections available.

Road test results indicated that operational problems would not be encountered during off-the-road operation. In addition, the ability of the driver to operate the oscillating bumper turret with the vehicle in motion was displayed. During critical personnel shortages, this feature would enhance the P-4's operational capability. Foam Pattern Tests (Tables 1 through 12) indicated that an excellent variety of options are available for use and that acceptable patterns were produced during all of the field tests conducted at the contractor's location.

Excellent results were obtained during tests using the bumper turret. Fires were extinguished in minimum time utilizing less foam concentrate than normally is used with the original equipment installed. Use of the non-air-aspirated turret enhanced fire control and extinguishment, and burn-back times were acceptable during these test fires. The fourth fire conducted demonstrated that superior fire suppression capability is available when the automatic self-oscillating bumper turret feature is used.

SECTION VI

CONCLUSIONS

The self-oscillating bumper turret feature is a major technological breakthrough in fire suppression capabilities. It minimizes or eliminates the possibility of human error: i.e., even distribution of AFFF was always achieved and no agent build-up or waste was experienced during any of the tests conducted.

All requirements of the statement of work (SOW) for the oscillating turret system were met or exceeded during tests conducted. Power for the oscillating turret system was provided by the truck's standard 24-volt electrical system and 500 psi hydraulic system. Reliability of the system was demonstrated during operational tests, as no breakdowns were experienced. Maintenance of these systems requires no special skills or training.

This system provides a fire suppression capability that is superior to the man/machine method previously available.

SECTION VII

RECOMMENDATIONS

It is recommeded that all USAF AS 32/P-4 fire vehicles be equipped with the automatic, self-oscillating bumper turret feature. Further, it is recommended that consideration be given to converting the roof turret to the automatic self-oscillating type.

Additionally, it is recommended that all future crash fire apparatus be equippped with non-air-aspirating turrets. These recommendations are considered to be cost effective, when the advantages gained are considered.

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APPENDIX

P-4 OSCILLATING BUMPER TURRET

APPENDIX

A. DESCRIPTION

1. Turret Controls. The turret controls are located inside the cab. The manual override lever controls the pressure in the turret hydraulic system (refer to Figure A-1) and the elctrical system of the turret. Lifting the lever to the manual position allows the turret to be operated manually.

The turret shutoff valve is opened by pulling back on the manual shutoff valve handle. The shutoff valve is closed by pushing the valve handle forward. The turret is aimed by the manual control handle and is synchronized to discharge in the direction in which the handle is pointing.

Lowering the manual override lever to the automatic position activates the hydraulic and electrical systems. The turret shutoff valve is operated by the shutoff valve toggle switch. The speed of oscillation can be regulated from 0° per second to 60° per second by the oscillation speed control knob. Turning the knob clockwise slows down the speed of oscillation to where it can be stopped; turning the knob counterclockwise increases the speed. The arc and direction of oscillation are regulated from 0° to 170° by sliding the stop levers to the desired settings. The turret elevation is controlled by the manual control handle and locked in place by rotating the elevation lock lever clockwise. Rotating the lock lever counterclockwise unlocks the turret elevation.

The discharge pattern is regulated by the pattern control lever. Raising the lever to the top of the slot gives a straight stream pattern while lowering the lever gives a dispersed pattern. The lower the lever, the wider the pattern becomes.

2. Turret Elevation. The turret elevation is regulated by the manual control handle which raises or lowers the elevation control rod that is attached to one end of the elevation control link (refer to Figure A-7). The elevation control link pivots on the pivot link. The elevation shaft is attached to the turret end of the pivot link. The bottom of the elevation shaft has gear teeth to drive the elevation gear that is attached to the turret head. By lowering the manual control handle, the elevation control rod is raised. The elevation shaft is lowered, rotating the head upward, and causing the turret steam to be elevated. Raising the handle lowers the stream.

The turret can be locked in any elevation position by the elevation lock lever which is attached to a cam. Rotating the lever clockwise causes the cam to push the elevation control rod against

The column tube, allowing it to bind. The turret will still rotate. Rotating the lock lever counterclockwise releases the lock.

3. Turret Hydraulic System. The turret is powered by the truck's hydraulic system which is activated by putting the agent selector valve in either the "Foam" or "Water" position. There is a bypass valve in the truck hydraulic system which opens and allows the oil to circulate when neither the bumper turret nor roof turret are in hydraulic operations. This circulation of oil prevents the hydraulic pump from overheating. The bypass valve is closed when the roof turret decontrol valve is placed in the "Turret Hydraulic" position and the roof lock is in the "Unlock" position, or the bumper turret manual override lever is in the "Auto" position.

Placing the manual override lever in the "Auto" position pushes a rod that rotates the decontrol valve shaft. The shaft has three ports to allow oil to pass through the valve. The lower port allows oil to pass from one end of the shutoff valve actuator to the other end. The middle port allows oil to flow from one end of the rotation actuator to the other end. The top port allows oil to flow from the pressure feedline to the two four-way solenoid valves that control the rotation and shutoff valve actuators. The pressure feedline port is open and the lower ports are closed when the manual override lever is in the "Auto" position. When the manual override lever is in the "Manual" position, the pressure line port is closed. The ports allowing the oil to flow between each end of the shutoff valve actuator and rotation actuator are open. The turret can then be operated manually.

4. Turret Rotation.

a. Manual Operation. The manual control handle operates turret rotation. Rotating the handle left or right causes the elevation control rod to rotate. Keyed to the rod is a sprocket that rotates the drive sprocket by means of a chain. The drive sprocket is attached to the rotation shaft that rotates the turret body. Pointing the manual handle to the left aims the stream to the left. Pointing the handle to the right aims the stream to the right.

b. Automatic Operation. The rotation hydraulic actuator is a cylinder with an internal gear rack that can oscillate back and forth. At both ends of the cylinder is a port for the hydraulic lines which connect to the four-way solenoid valve. The solenoid valve directs the oil flow from the pressure line downstream of the decontrol valve, to either end of the cylinder. The oil pressure pushes the piston rack to the other end of the cylinder. The oil on the other side of the piston rack is forced out of the cylinder and through the return line of the solenoid valve. Between the decontrol and solenoid valves is the speed control

valve, which regulates the flow of oil into the cylinder. The greater the flow of oil, the faster the cylinder moves. In the center of the cylinder is a cutout, so the teeth of the piston rack are exposed. The piston rack drives a gear that is keyed to the rotation tube. The rotation tube is keyed to the turret body and causes the turret to rotate. The actuator has enough stroke to rotate the turret 170°.

As the rotation tube rotates, the sprocket on the tube rotates, causing the elevation control rod and control handle to rotate. Connected to the control handle is the contact bracket that rotates between the two stop levers on the column base. On each stop lever is a microswitch. The turret rotates in one direction until the contact bracket hits a microswitch on one of the stop levers. This activates the solenoid valve and changes the direction of the actuator and turret rotation. The turret will continue to rotate in this direction until the contract bracket hits the microswitch located on the other stop lever, and the solenoid reverses the flow of oil and turret direction.

5. Shutoff Valve Assembly. The shutoff valve actuator is similar to the rotation actuator and works the same way. The flow of oil is directed into either end of the actuator by a four-way solenoid valve that is controlled by the shutoff valve toggle switch. The actuator drives a gear that is keyed to the upper stem. The upper stem rotates the ball inside the shutoff valve. On one end of the actuator is a bracket with a switch on it. This switch controls the bumper turret foam shutoff valve. The foam valve is closed when the discharge valve is closed. When the shutoff valve is closed, the valve handle depresses the switch.

6. Pattern Control. On the downstream end of the foam tube is a housing that contains two deflectors. These deflectors are plates that pivot on the top and bottom of the housing. The deflectors have a leg on both sides of the plate that mesh with the two legs of the mating deflector. If one deflector is rotated so the plate moves out of the path of the stream, one leg will push the other deflector out of the path of the stream also. Likewise, if a deflector is rotated into the path of the stream, one leg will push the other deflector into the path of the stream. These deflectors are operated by a deflector control rod that attaches to a cable. The cable attaches to the deflector control lever that is located on the control box inside the cab. Raising the lever to the straight stream position pulls the cable and deflector control rod backwards. The deflectors are rotated out of the path of the stream for a straight stream pattern. The straight stream pattern provides maximum range. Lowering the lever pushes the cable and deflector control rod forward and the deflectors are rotated into the stream for a dispersed pattern. The dispersion of the stream produces a flat fan-shaped pattern with less range than the straight stream. The more the lever is lowered, the wider the fan becomes and the shorter the discharge range.

7. Removal of Shroud and Existing P-4 Bumper Turret.

a. From inside the cab, remove the attaching screws and turret cover plates. The screws will be used later to attach the new cover plate.

b. Remove the attaching screws and lockwashers from the inlet flange.

c. Disconnect the #414 wire from the electric floodlight in the shroud covering of the bumper turret.

d. Inside the shroud there are two tubing lines. One is made of copper and the other is made of rubber. Each ine has a tee. Disconect the middle line of each tee.

e. From outside the truck, disconnect the two clamps that hold the windshield washers.

f. Remove attaching screws, lockwashers and shroud assemblies.

g. Remove attaching screws and lockwashers from bumper turret mounting bracket to take off turret. Screws and lockwashers will be used later to install new oscillating bumper turret.

CAUTION

The turret is heavy and more than one person is required to remove the turret.

B. TURRET INSTALLATION

1. Oscillating Bumper Turret Disassembly.

a. Put the manual override lever in the manual position.

b. Close the shutoff valve (push the handle toward the turret).

c. Take off the gear cover on the shutoff valve assembly by removing the four #4 screws (see Figure A-3).

d. Unscrew the hex nut from the top of the shutoff valve assembly. Then remove the handle, gear and key from the upper stem.

e. Remove the mounting plate from the shutoff valve by unscrewing the four 1/4-20 screws and lockwashers.

f. Pull out the upper stem. Do not lose the thrust washer positioned on the upper stem. Note the position of the stem's keyway, so the stem will be reassembled in the same position later.

g. Disconnect the hydraulic coupling.

h. Unscrew the 2-inch elbow by the hydraulic coupling from the upper portion of the piping.

i. From inside the cab, disconnect the switch bracket from the turret main valve.

j. Disconnect the main valve from the bumper turret feedline.

NOTE

The water tank should be drained before removing the shutoff valve.

k. Connect the mounting bracket and turret to the truck using the same screws used to mount the other turret.

l. Connect the oscillating bumper turret shutoff valve and upper portion of the piping assembly to the bumper turret feedline. The ball valve should be in the closed position and the hole for upper stem should be straight up on top. The nipple just after the 2-inch elbow should be aimed straight down.

NOTE

Use Piping compound when connecting all pipe threads.

m. Put the 2-inch pipe of the feedline piping assembly through the 2-5/8-inch hole on the bottom of the bumper turret mounting bracket and connect the 1-inch elbow and victaulic nipple to it.

n. Connect the piping assembly to the turret with the 2-inch victaulic coupling.

o. Reassemble the stem, thrust washer and mounting plate to the shutoff valve with the four 1/4-20 screws and lockwashers. Lubricate and be careful not to damage the "O" ring on the stem while assembling. Be sure the position of the stem's keyway is the same as before the valve was disassembled.

p. Reassemble the gear, key, handle, roll pins and the 5/8-11 nut to the valve. The handle should be assembled on the opposite side of the actuator.

q. Assemble the gear cover to the shutoff valve assembly with the four #4 self-trapping screws.

2. Roof Turret Modification (To be performed as necessary).

a. Disconnect the ball valve handle and the two knobs for the roof lock and decontrol valve; remove the one section of false ceiling.

b. Using a #30 drill (0.128 diameter), drill two holes as shown in Figure A-4 for the relay bracket.

c. Using a #28 drill (0.140 diameter), drill a hole as shown in Figure A-4 for the tie clip.

d. Add a 3/8-inch NPT tee and 3/8-inch x 1-1/2-inch nipple between each of the two hydraulic lines and the roof turret. Do them one at a time so as not to cross the lines. Aim the middle port of the tees toward the front of the truck.

e. Connect a 3.8-inch x 1/4-inch NPT bushing to the middle port of each tee.

f. Connect a 1/4-inch x 3/8-inch tube fitting to each bushing.

g. Connect a length of 3/8-inch tubing to the tee on the pressure line that runs to the front corner of the roof turret (approximately 22 inches in length).

h. Connect a length of 3/8-inch tubing to the tee on the return line that runs to the front corner of the roof turret (approximately 18 inches in length).

i. Add a 3/8-inch x 3/8-inch x 90° tubing elbow to each line. Aim the other end of each elbow towards the center of the windshield.

j. Connect a 3/8-inch length of tubing approximately 17 inches long to each line.

k. Connect a 3/8-inch x 3/8-inch x 90° tubing elbow to both lines. Aim the other end of each elbow towards the floor.

l. Connect a 3/8-inch length of tubing (approximately 3-1/2 feet long) from the pressure line to the port of the bumper turret manifold. Run the tubing through the big tube on the center of the windshield.

m. Connect another length of tubing from the return line to the return port of the bumper turret manifold.

n. Attach the hydraulic tubing lines to the roof turret, using two "P" clips (see Figure A-4).

o. Approximately 10 inches from the 3/8-inch tee in the pressure line and just below the 90° elbows in the center of the windshield, connect the two hydraulic lines together with cable ties.

p. Attach the relay, socket, and holddown spring to the relay bracket.

q. Using two 1/8-inch pop rivets attach the relay assembly to the roof turret panel as shown.

r. Cut the hydraulic pressure line inside the roof turret panel 1 inch downstream of the manifold.

s. Add a 1/4-inch NPT x 3/8-inch tube straight fitting to both sides of the two-way solenoid valve.

t. Assemble the solenoid valve into the pressure line at the break.

u. Assemble one of the solenoid lead wires to the #5 post on the relay. Ground the other lead.

v. Connect a wire to the letter "B" post on the relay and ground the other end.

w. Disconnect the roof lock switch lead from ground and connect it to the letter "A" post on the relay.

x. Connect another wire from the power side of the roof lock switch to the #9 post on the relay.

3. Rewiring Relay for Turret Hydraulic Relief Valve, Foam and Control Valves which are located in Ladder Compartment.

a. Remove the #376 wire from the #8 and #3 post.

b. Remove the #439 wire from the #7 post and connect it to the #8 post and the #407 wire.

c. Connect the #376 wire to the #7 post and ground the other end.

d. Connect a wire from the #3 post to the roof turret relay's #6 post.

e. Attach another wire on the #6 post on the roof turret relay, that connects to the bottom of the first row closest to the cab on the bumper turret terminal strip (see Figure A-5).

f. Connect a wire from the #8 post on the roof turret relay to the middle row (24-volt power post) on the bumper turret terminal strip.

g. Remove the attaching screws and circuitry panel next to the driver's seat.

h. Connect a wire from the top middle post on the bumper turret to the #448 wire and the circuitry panel.

i. Reassemble the false ceiling and knobs to the roof turret.

j. Replace the circuitry panel and attaching screws.

k. Assemble the shroud and attaching screws to the bumper turret mounting bracket and the front of the truck.

l. Reconnect the two clamps that hold the windshield washers to the front of the truck.

m. From inside the truck, reconnect the #414 wire to the floodlight.

n. Reconnect the rubber and copper tubing lines.

o. Attach the one-piece dash board cover plate using the screws which used to hold the two-piece cover plate.

C. OPERATING PROCEDURES

1. Automatic Oscillation

a. Unlock the turret elevation. Remove turret from storage lock position by raising the turret and rotating it to the right so that the storage lock bracket on the turret is free of the bumper bar. Rotate turret to approximate direction of discharge desired.

b. Set levers controlling arc of oscillation to desired postions.

c. Set turret on desired height by moving control handle up or down and lock into position with locking lever.

d. Set pattern selector to desired pattern.

e. Move discharge switch to the "Open" position.

NOTE

This can be preset. Discharge valve will not open until manual override lever is on "Auto."

f. Place agent selector (located on the equipment operator's control panel) in the desired position - "Foam" or "Water."

g. Move manual override lever to "Auto." Turret will begin to oscillate and discharge valve will be open.

h. Adjust speed of oscillation for best fire control (this can be preset at a desired speed).

i. Adjust pattern control to desired pattern for best fire control.

j. Adjust arc of oscillation, height setting, and stream pattern as truck moves closer to fire, to obtain best fire control.

k. After fire suppression operation is completed, move discharge switch to "Close" position.

l. Move manual override lever to "Manual."

m. Return the turret to the stored postion by elevating and rotating the turret to the left until it hits the bumper bar. Lower the turret until the lock bracket slides around the bumper bar. Lock the turret elevation.

n. After returning to station, flush turret, proportioner, piping, handlines, etc., with plain water.

2. Manual Operation.

a. Remove turret from storage lock position by raising the turret and the bumper bar. Rotate turret to approximate direction of discharge desired.

b. Check to see that manual auto lever is on "Manual."

c. Set pattern selector to desired pattern.

d. Place agent selector (located on the equipment operator's control panel) in the desired postion - "Foam" or "Water."

e. Manually open discharge valve by rotating valve handle clockwise.

f. Aim turret with the manual control handle.

NOTE

Turret can be locked vertically with locking lever if desired.

g. Adjust pattern control to the desired pattern for best fire control.

h. After fire suppression operation is completed, shut off valve manually.

i. Return the turret to the stored position by elevating and rotating the turret to the left until it hits the bumper bar. Lower the turret until the lock bracket slides around the bumper bar. Lock the turret elevation.

j. After returning to station, flush turret, proportioner, piping, handlines, etc. with plain water.

D. MAINTENANCE

1. Preventive Maintenance.

a. Thoroughly flush turret with plain water after each operation.

b. During periodic vehicle servicing, remove front end outside cover panels and check all mounting and nuts for tightness. Check all hydraulic connections for leakage. Check all wire connections for tightness.

c. Check all screws and nuts on foam tube for tightness.

d. All main turret seals are "O" rings as shown on parts identification drawings in the manual. When replacing "O" rings, lubricate and insert mating parts carefully to prevent cutting or damaging seals.

2. Elevation Adjustment. Turret should have an arc of elevation from 15° below the horizontal to 45° above the horizon. The turret handle should point in the same direction as the turret. The elevation can be adjusted using the following procedure:

a. Disconnect stud and locknuts from the elevation control link so that the turret is free of the manual control handle.

b. Pull up on elevation shaft until it clears the gear segment on the head.

c. Move the gear segment one or two teeth in necessary direction and push shaft down until gears re-engage.

d. Push shaft down and reassemble the stud and locknut.

e. Check to see that manual control handle and turret are aimed in approximately the same direction.

f. If turret and manual control handle are not synchronized, repeat procedure.

3. Rotation Adjustment. The turret should be capable of a minimum arc of rotation of 170°, 85° to the left or right of the truck centerline. The turret handle should point in the same direction as the turret. The turret rotation can be adjusted using the following procedures:

a. Aligning the Turret and Rotation Actuator.

(1) Place turret in "Manual" mode.

(2) From outside the truck, rotate the turret until the piston rack tooth with the "X" stamped on it is in the center of the cylinder.

(3) Loosen the attaching screws to the rotation actuator and slide the actuator away from the gear until the teeth are no longer in contact with the piston rack gear teeth.

(4) Rotate the turret so the foam tube is centered in front of the truck.

(5) Slide the actuator toward the gear until the piston rack teeth mesh with the gear teeth. The foam tube might have to be rotated slightly to the right or left for the teeth to mesh properly. Tighten the screws so the actuator will stay in place.

(6) Rotate the turret all the way to the left and right to be sure of equal motion to both sides. If the motion is not equal to both sides, repeat step a.(3). Move the turret so the gear rotates the number of teeth required in the desired direction and repeat step a.(5).

b. Aligning the Turret and Manual Control Handle.

(1) Disconnect the chain by removing the clip from the master link and sliding the master link from the chain. Remove the chain from the sprockets.

(2) Rotate the handle so it is pointing in the same direction as the turret.

(3) Reconnect the chain to the two sprockets and reassemble the master link and clip to the chain.

4. Pattern Control Adjustment. The deflectors should be capable of being opened wide enough to be out of the path of the stream and being closed to within 1/4 inch of each other. If they do not, the pattern control should be adjusted accordingly:

a. Pattern Control Lever Adjustment.

(1) Move the lever all the way up and down. The lever should not be restricted by either end of the slot.

(2) From behind the control bracket, remove the screw and nut that attach the rod end bearing on the end of the deflector control cable to the handle bracket.

(3) Loosen the nut that locks the rod end bearing onto the cable.

(4) Thread the bearing in or out so the lever is clear of the ends of the slot, and lock the rod end bearing in place with the locking nut.

(5) Reassemble the rod end to the handle bracket with the attaching screw and nut.

b. Deflector Control Rod Adjustment.

(1) From outside the cab, punch out the roll pin that connects the deflector control rod to the lower deflector.

(2) From inside the cab, push the pattern control lever down as far as it can go (widest disperse position).

(3) Loosen the nut that locks the deflector control rod onto the cable.

(4) Move the deflectors so they close to within 1/4-inch of each other.

(5) Thread the deflector control rod in or out until the roll pin holes in the control rod line up with the holes in the lower deflector. The cable thread length is 7/8 inch. Be sure there is sufficient thread after adjustment to engage the deflector control rod. Lock the control rod in place with the locking nut.

(6) Pin the control rod to the deflector with the roll pin.

5. Turret Head Removal.

a. Remove the shroud assembly.

b. Disconnect the attaching nuts and stud from the elevation shaft link so the turret is free of the manual control handle.

c. Pull up on the elevation shaft until it is clear of the gear and lift out completely.

d. Punch out the roll pin that connects the deflector control rod to the lower deflector.

e. Remove the attaching screws and cable holder bracket from the turret head.

f. Disconnect the counterbalance spring from the eyebolt on the turret base.

g. Remove the retaining ring and end cap from the side of the body.

h. Disconnect the attaching screw and Stat-O-Seal from the turret head.

i. Slide out the elevation bearing from inside the body and head. Remove the head from the body. Hold the foam tube and head when removing the bearing.

6. Turret Head Reassembly (see Figure A-6).

a. Examine the "O" rings on the elevation bearing and replace if they are damaged. Lubricate the "O" rings before reassembling the bearing.

b. Place the head and foam tube between the arms of the body. Slide the bearing into the body and head. Note the cutout in the bearing should be oriented to line up with the foam tube.

c. Assemble the Stat-O-Seal and attaching screw to the head and elevation bearing. The head or bearing might have to be rotated slightly so the two holes line up.

d. Follow the elevation adjustment procedures for aligning the manual control handle with the turret.

e. Connect the counterbalance spring to the eye hook on the turret base.

f. Assemble the cable holder bracket to the head.

g. Pin the deflector control rod to the lower deflector with the roll pin.

h. Reassemble the shroud assembly.

7. Turret Body Removal.

a. Remove the shroud assembly.

b. Disconnect the attaching nuts and stud from the elevation shaft link so the turret is free of the manual control handle.

c. Pull up on the elevation shaft until it is clear of the gear segment on the head and lift out completely.

d. Remove attaching screws and cable bracket holder from turret head.

e. Punch out the roll pin that attaches the deflector control rod to the lower deflector.

f. Disconnect the counterbalance spring from the eyebolt on the turret base.

g. Remove the chain from the drive sprocket by disconnecting the attaching clip and master link.

h. Remove the nut from the top of the rotation tube.

i. Remove the key, sprocket, spacer, key gear, and second spacer from the rotation tube.

j. Remove the #340 "O" ring, rotation tube, rotation bearing and body from the turret.

8. Turret Body Reassembly (see Figure A-7).

a. Lubricate the rotation bearing "O" rings before assembly.

b. Mount the rotation bearing, #340 "O" ring, body and rotation tube to the turret, with attaching screw.

c. Assemble the spacer, gear, key, second spacer, sprocket and key onto the rotation tube with the attaching nut.

d. Follow the instructions for aligning the turret and rotation actuator.

e. Follow the instruction for aligning the turret and manual control handle.

f. Follow the instructions for the elevation adjustment.

g. Connect the counterbalance spring to the eyehook on the base.

h. Assemble the cable holder bracket to the head with the attaching screw.

i. Pin the deflector control rod to the lower deflector with attaching roll pin.

j. Reassemble the shroud assembly.

9. Turret Base Removal.

a. Remove the shroud assembly.

b. Disconnect the attaching nuts and stud from the elevation shaft link so the turret is free of the manual control handle.

c. Pull up on the elevation shaft until it is clear of the gear and lift out completely.

d. Remove the nut from the top of the rotation tube.

e. Remove the chin from the drive sprocket by disconnecting the attaching clip and master link.

f. Remove the key, sprocket, spacer, and gear from the rotation tube.

g. Remove attaching screws and cable holder bracket from the turret head.

h. Punch out the roll pin that attaches the deflector control rod to the lower deflector.

i. Disconnect the counterbalance spring from the eyebolt on the turret base.

j. Disconnect the hydraulic coupling.

k. Remove the four screws and lockwashers that hold the base onto the mounting plate. Hold onto the base while removing the screws.

10. Turret Base Reassembly.

a. Assemble the base to the mounting plate with the four attaching screws and lockwashers.

b. Attach the hydraulic coupling to the turret and piping assembly.

c. Assemble the spacer, gear, key, second spacer, sprocket and second key onto the rotation tube with the attaching nut.

d. Follow the instructions for aligning the turret and rotation actuator (3.a).

e. Follow the instructions for aligning the turret manual control handle (3.b).

f. Follow the instructions for the elevation adjustment (2.).

g. Connect the counterbalance spring to the eye hook on the base.

h. Assemble the cable holder bracket to the head with the attaching screws and lockwashers.

i. Pin the deflector control rod to the lower deflector with the attaching roll pin.

j. Reassemble the shroud assembly.

11. Foam Tube Assembly Removal.

a. Punch out the pin that connects the deflector control rod to the lower deflector.

b. Loosen the locking nut on the back of the deflector control rod. Unthread the deflector control rod from the cable.

c. Remove the nut and spring from the cable.

d. Unthread the foam tube from the head.

e. Remove the "O" ring from the head.

12. Foam Tube Reassembly.

a. Assemble the "O" ring over the threads of the head.

b. Thread the foam tube assembly onto the head. The foam tube assembly should snug up to the "O" ring. The deflector housing should be oriented so that the lower deflector is on the bottom.

c. Slide the spring over the cable.

d. Thread the locking nut and deflector control rod onto the cable.

e. Follow the instructions for adjusting the deflectors.

E. TROUBLESHOOTING

Problem	Reason	Solution
Turret will not oscillate and toggle switch operates shutoff valve.	Bad relay. Bad microswitch. Bad solenoid. Loose or damaged wire.	Replace defective part.
Turret will not oscillate and shutoff valve will not open when agent selector valve is in "Foam" or "Water" position, manual override lever is on "Auto," and roof turret operates hydraulically.	Rod stop not making contact with flexible leaf switch.	Adjust rod end on decontrol valve.
	Clogged oil filter.	Replace oil filter.
	Clogged decontrol valve "C" port.	Disconnect both "C" port lines and clean out the valve port.
Roof and bumper turret will not operate hydraulically.	Loose or damaged power wire to bumper turret.	Tighten the wiring connection.
	Bad pressure relief solenoid.	Replace damaged part.
	Bad relay in foam compartment or loose defective wire.	
Shutoff valve will not open and turret oscillates.	Bad solenoid. Loose or damage wire	Replace defective part. Replace or tighten the wire Connection.
Either actuator leaks.	Bad seal.	Replace seal.

F. BUMPER TURRET ASSEMBLY

DRAWINGS

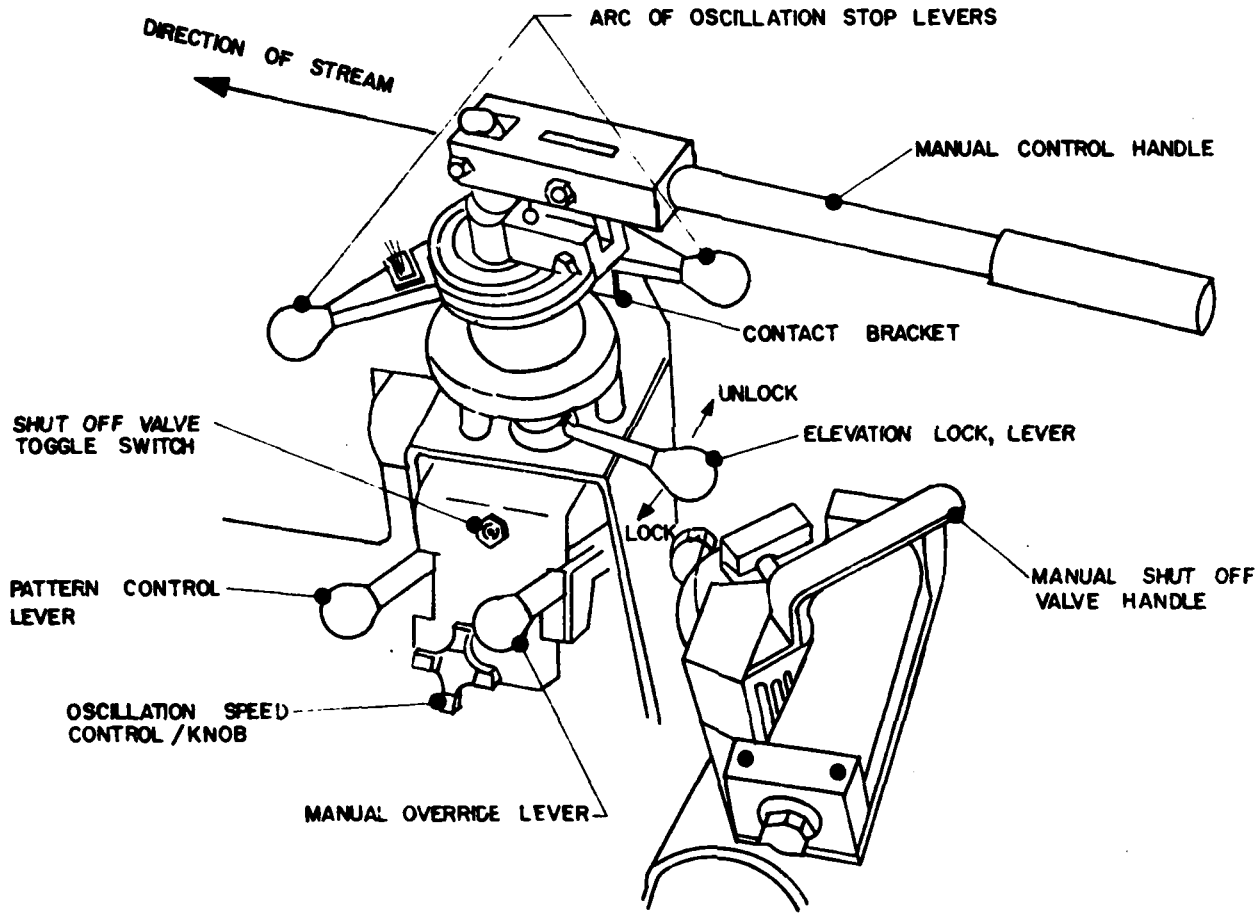
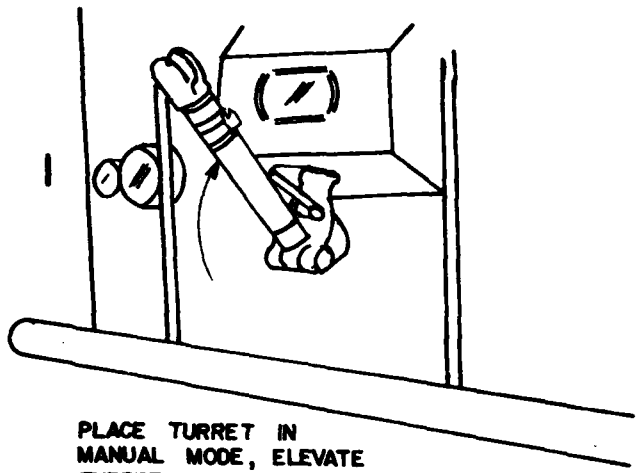
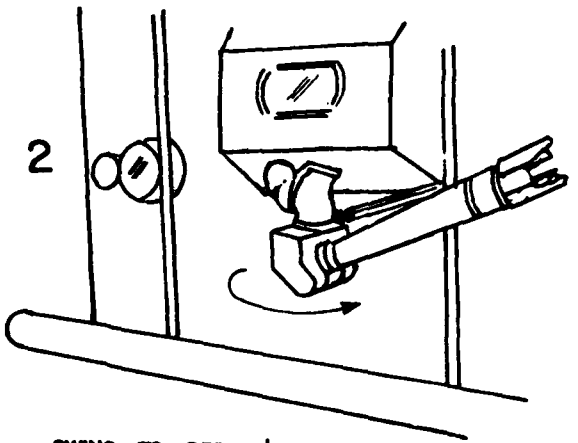


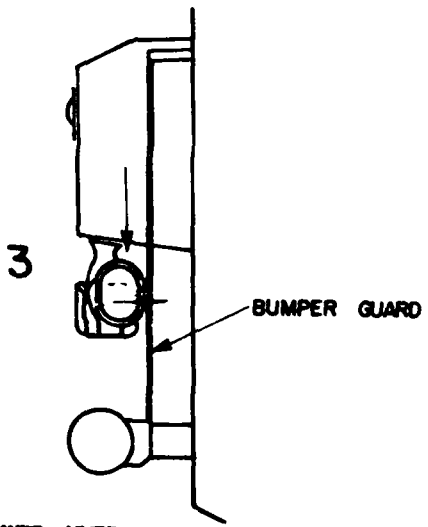
Figure A-1. Control Mechanism



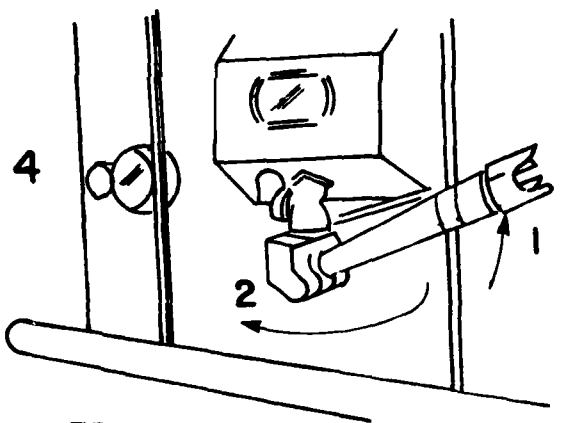
PLACE TURRET IN MANUAL MODE, ELEVATE TURRET TO MAXIMUM HEIGHT.



SWING TO DRIVER'S SIDE UNTIL IT HITS BUMPER GUARD.



LOWER UNTIL TURRET STORAGE LOCK BRACKET. SLIDES AROUND THE BUMPER GUARD THEN LOCK THE TURRET ELEVATION



TURRET IN MANUAL MODE (DO NOT PLACE MANUAL OVERIDE LEVER IN AUTO POSITION WHILE THE TURRET IS IN STORAGE/LOCK POSITION). UNLOCK TURRET ELEVATION. ELEVATE TURRET AS HIGH AS POSSIBLE & SWING AWAY FROM GUARD, TURRET CAN THEN BE PLACED IN AUTO MODE.

Figure A-2. Bumper Turret Storage

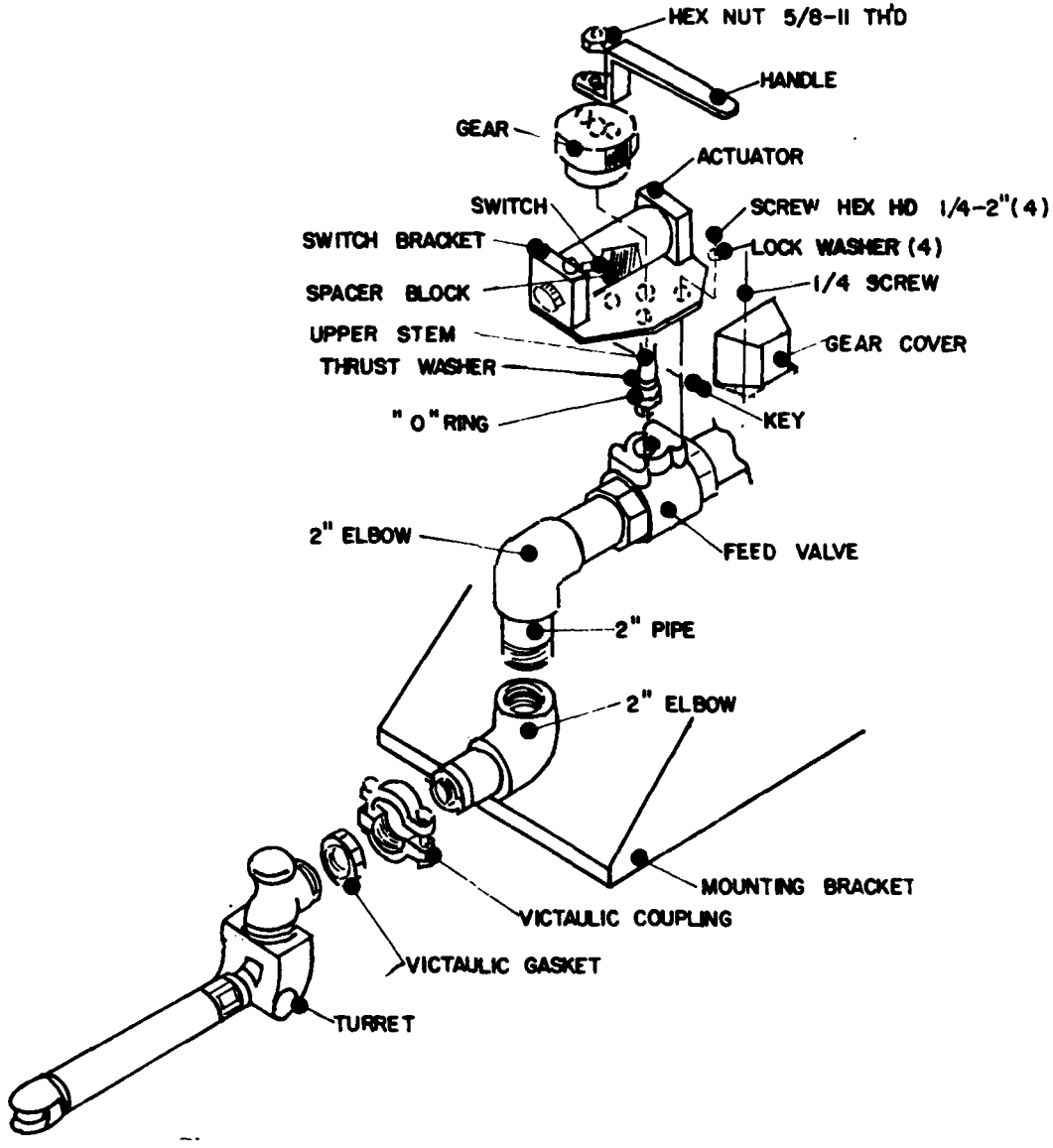
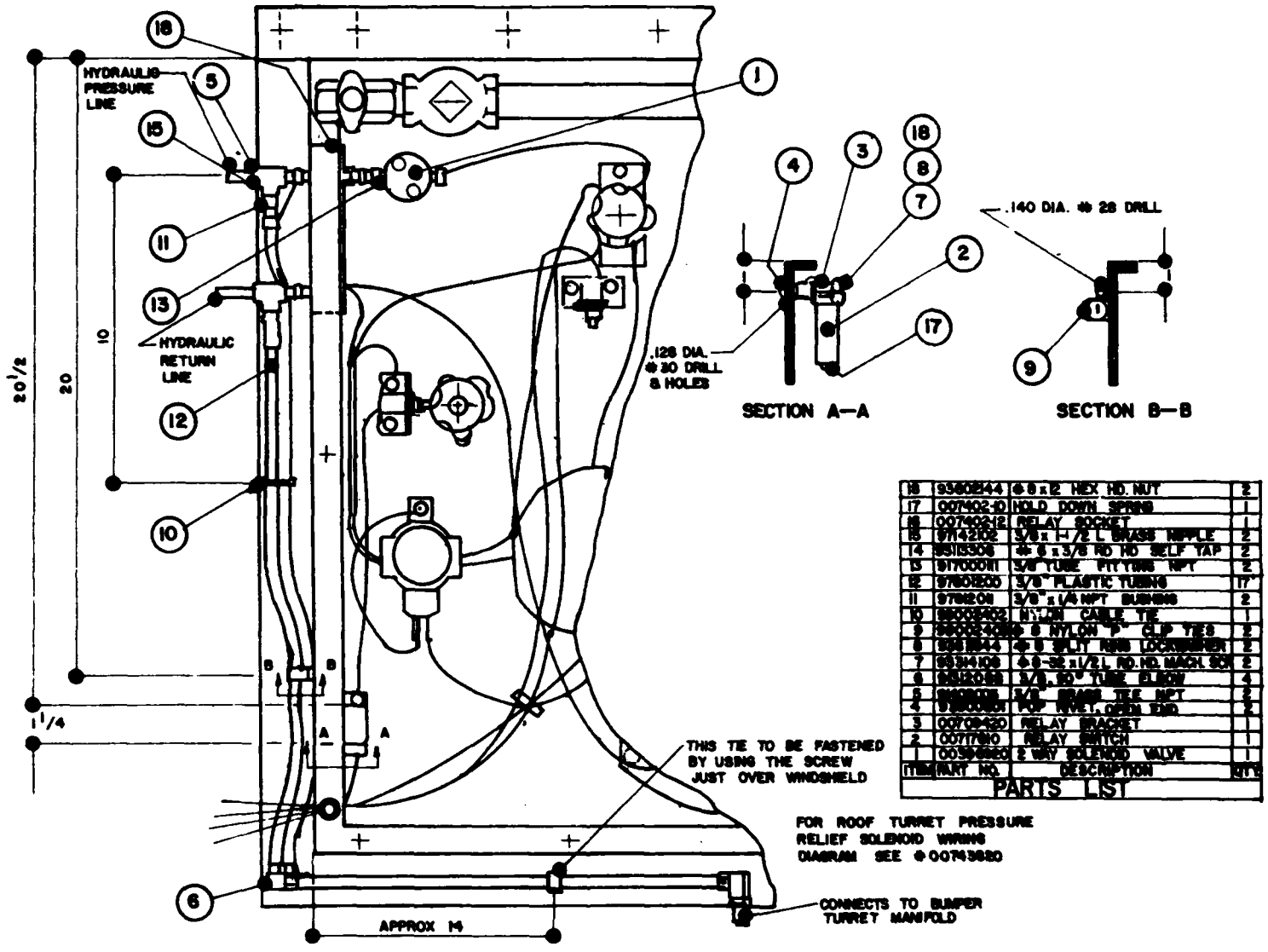


Figure A-3. Feed Line Assembly



ITEM	PART NO.	DESCRIPTION	QTY
		PARTS LIST	
18	9360844	Ø 8 x 12 HEX HD. NUT	2
17	007402-10	HOLD DOWN SPRING	1
16	00740212	RELAY SOCKET	1
15	9742102	3/8 x 1-1/2 L BRASS NIPPLE	2
14	9515506	Ø 8 x 3/8 RD HD SELF TAP	2
13	9170001	3/8" TUBE FITTING NPT	2
12	9760EC0	3/8" PLASTIC TUBING	17'
11	9768201	3/8" x 1/4 NPT BUSHING	2
10	9500	NYLON CABLE TIE	1
9	9500	8 NYLON "P" CLIP TIES	2
8	936	Ø 8 SPLIT RING LOCKWASHER	2
7	933	Ø 8-32 x 1/2 L RD HD MACH SCR	2
6	9762	3/8, 90° TUBE ELBOW	4
5	9760	3/8 BRASS TEE NPT	2
4	9	POP RIVET, OPEN END	2
3	007	RELAY BRACKET	1
2	0077	RELAY SWITCH	1
1	0076	2 WAY SOLENOID VALVE	1

Figure A-4. Roof/Bumper Turret Kit Conversion

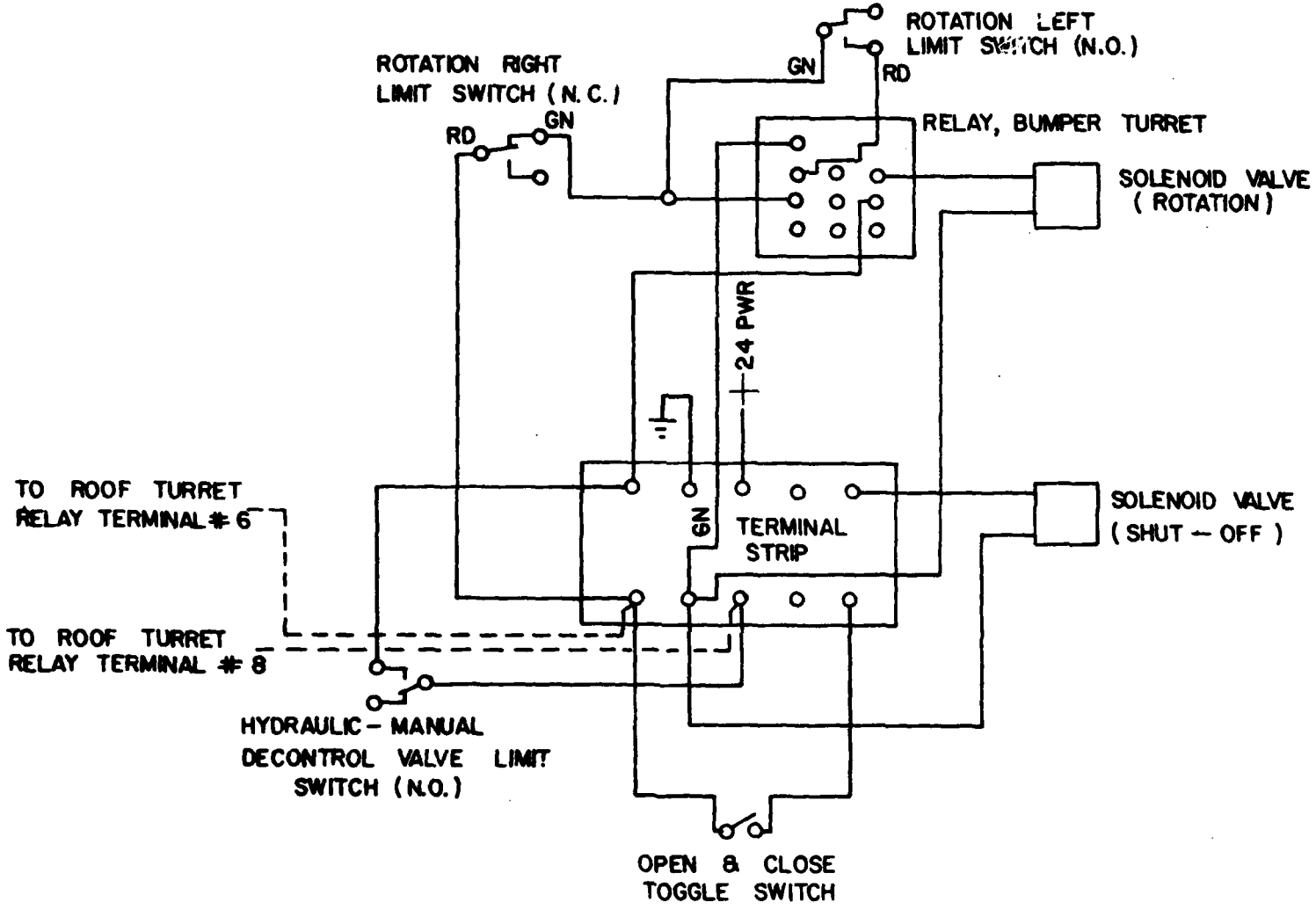
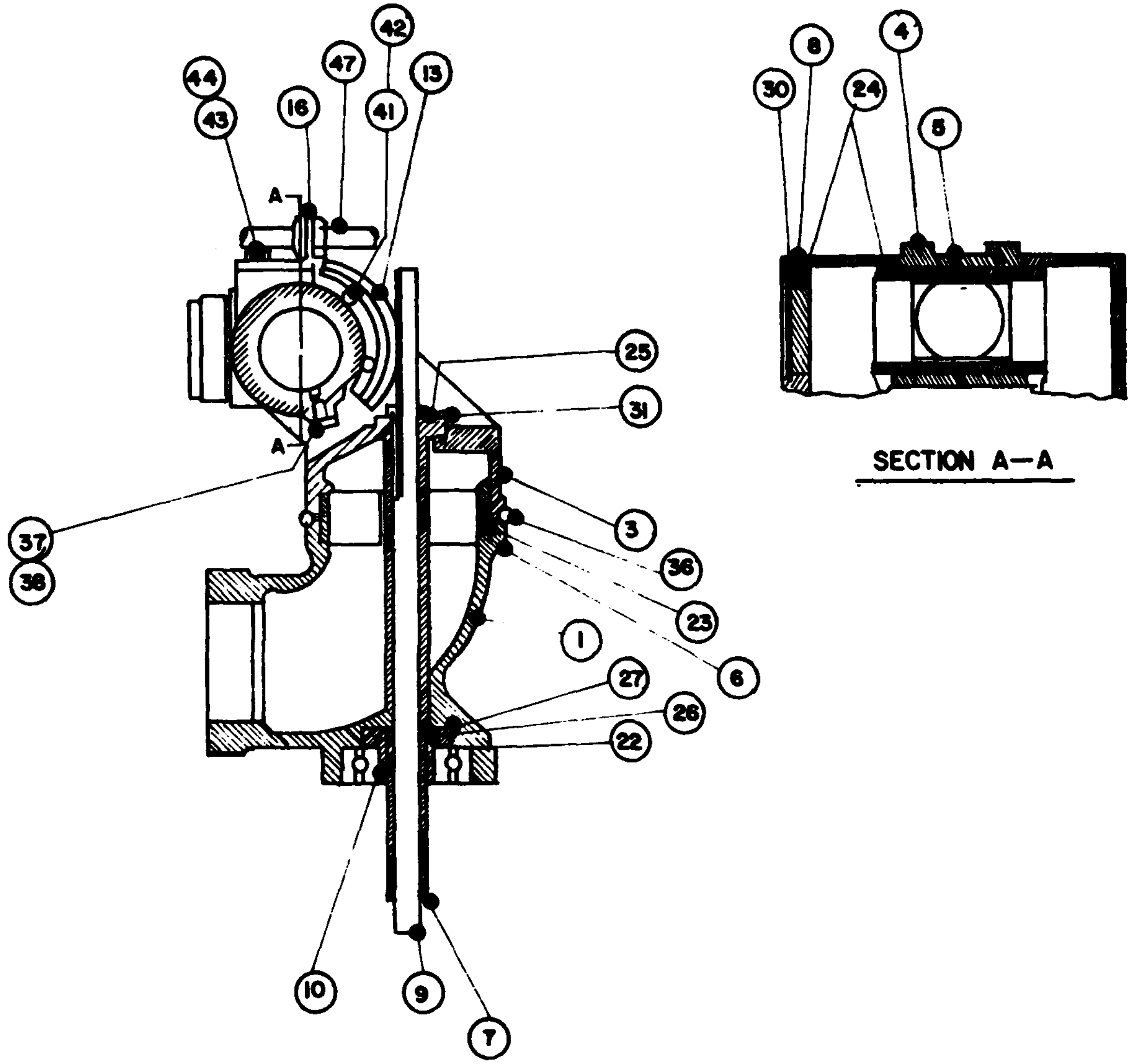


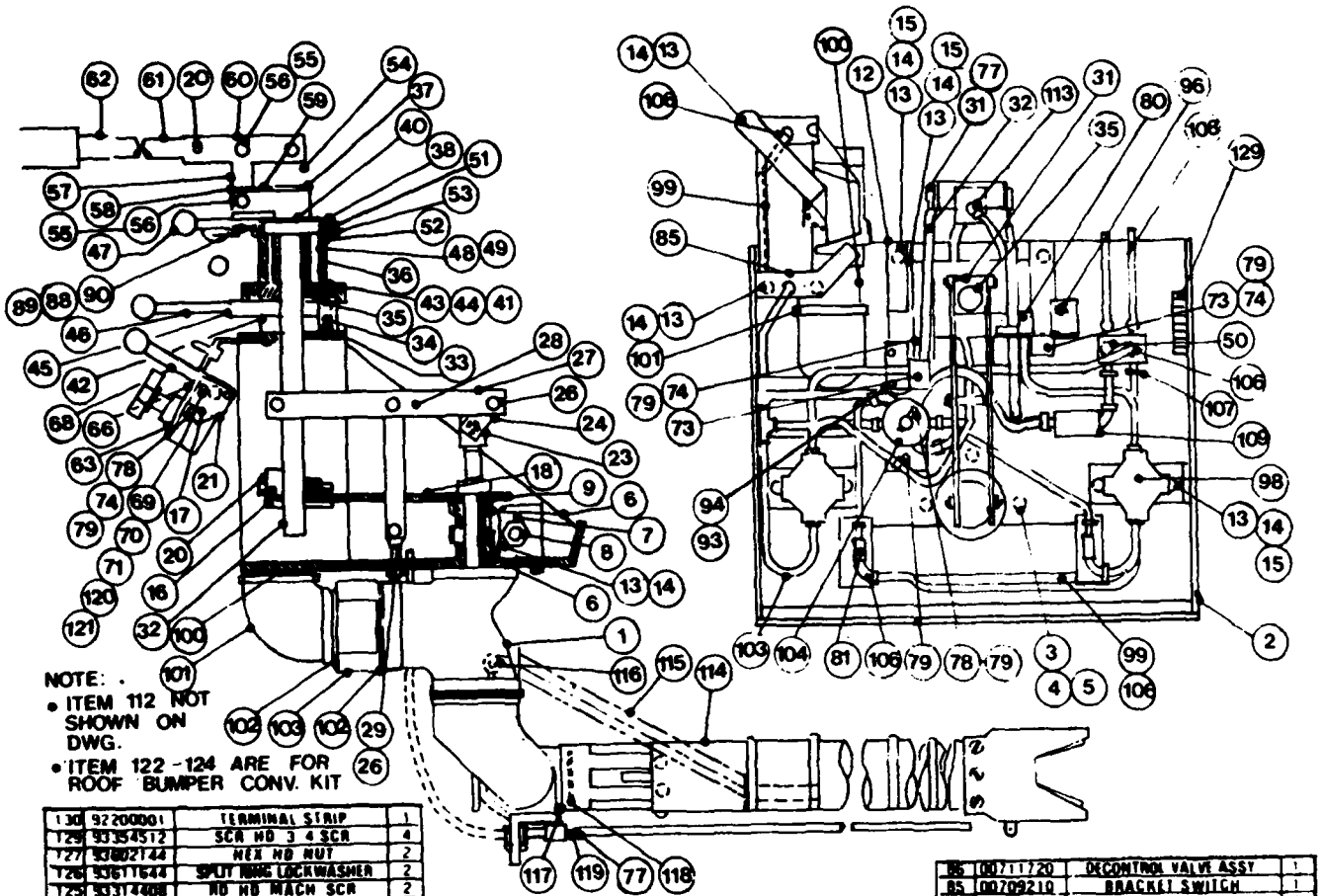
Figure A-5. P-4 Bumper Turret Wiring Diagram



ITEM	PART NO.	DESCRIPTION	QTY
47	003754-10	CABLE 60 #	1
46			
45			
44	[illegible]	LOCKWASHER 1/4 SPLIT pl.	2
43	[illegible]	SCR. HX HD 1/4-20 x 1/2 pl.	2
42	[illegible]	LOCKWASHER #8	2
41	[illegible]	SCR. SOC HD 8-32 x 1/2	2
40			
39			
38	[illegible]	STATO SEAL 1/4 SS	1
37	[illegible]	SCREW-BEARING	1
36	[illegible]	O-RING # 340 BUNAN	1
35			
34			
33			
32			
31	[illegible]	SCR. RD. HD	1
30	[illegible]	RET. RING	1
29			
28			
27	[illegible]	"O" RING-016 BUNAN	1
26	95830050	"O" RING-050 BUNAN	1
25	[illegible]	"O" RING-116 BUNAN	1
24	[illegible]	O-RING-133 BUNAN	5
23	95830150	O-RING-150 BUNAN	2
22	[illegible]	BEARING-BALL #630525	1
21			
20	[illegible]	LOCKWASHER 3/8 SPLIT pl.	2
19	95544312	SCR. HX HD. 3/8 x 16 x 3/4 pl.	2
18			
17			
16	00706510	BRACKET-CABLE HOLDER	1
15			
14			
13	006103-20	GEAR SEGMENT	1
12			
11			
10	[illegible]	SEAL-BEARING	1
9	00706720	SHAFT ELEVATION	1
8	[illegible]	END CAP	1
7	00706420	SHAFT ROTATION	1
6	00615420	BEARING ROTATION	1
5	[illegible]	BEARING ELEVATION	1
4	[illegible]	HEAD	1
3	00613940	BODY	1
2			
1	00705340	BASE	

BILL OF MATERIALS

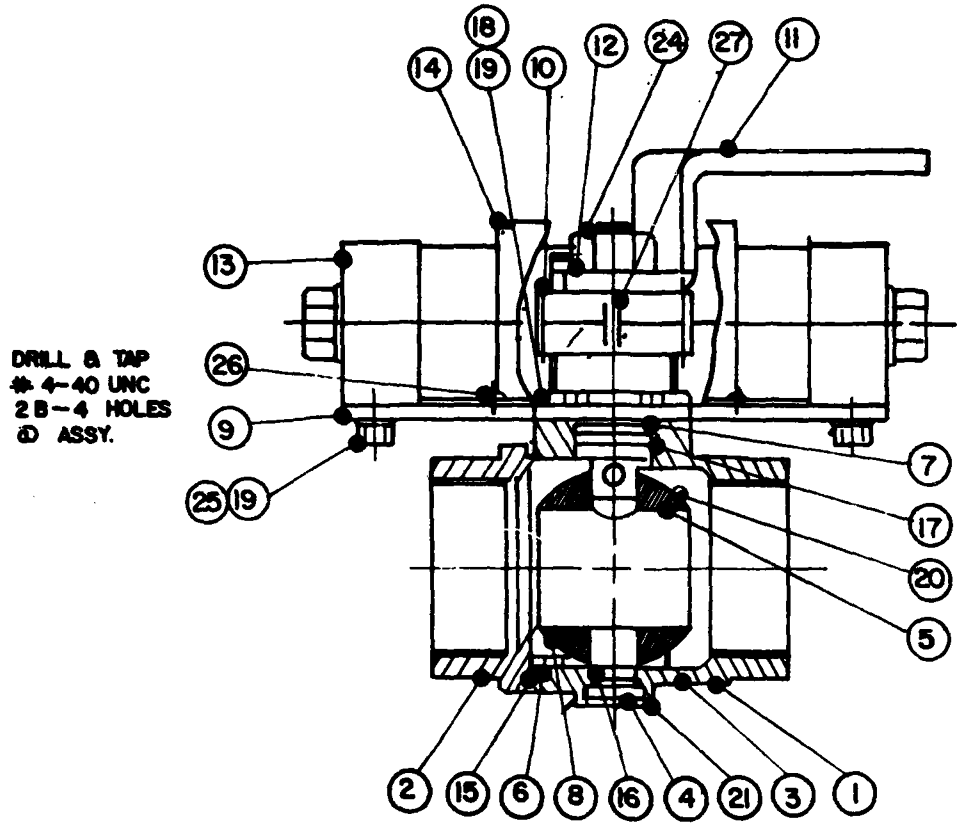
Figure A-6. Bumper Turret Assembly, Hydraulic



NOTE:
- ITEM 112 NOT SHOWN ON DWG.
- ITEM 122 - 124 ARE FOR ROOF BUMPER CONV. KIT

Item	Part No	Description	Qty
130	92200001	TERMINAL STRIP	1
129	93354512	SCR HD 3 4 SCR	4
127	93802144	HEX HD NUT	2
126	93611644	SPLIT RING LOCKWASHER	2
125	93314408	RD HD MACH SCR	2
124	00071130	ROOF BUMPER CONV KIT	ref
123	00743920	TURRET TUBING DIA	ref
122	00744120	OSC BUMPER ROOF WIRE	ref
121	93613745	STAY-D-SEAL 1-2	1
120	93613741	STAY-D-SEAL 1-4	1
119	90722810	SPRING - ROD	1
118	95830134	O RING-134	1
117	95830032	O RING-032	1
116	99002503	BOLT EYE	1
115	00015310	SCR RD HD	1
114	00721940	HANDLE ASSEMBLY	1
113	97300004	ELBOW	2
112	00720430	PLATE COVER DASH	1
111	98204101	LINK CONNECTING 35	1
110	00720520	MANIFOLD	1
109	91200010	FILTER TUBE	1
108	97601301	TUBING 1 4	15
107	97700004	SYNAIGHY CONN	5
106	97300003	ELBOW 90°	8
105	97710001	TEE UNION 1 4 TUBE	2
104	97381109	TEE 1 8 NPT	2
103	97430209	VICTAULIC CONNECTOR	1
102	00708910	NIPPLE FEED	2
101	97312009	ELBOW 2 90°	2
100	97142361	NIPPLE 2X3 LG	2
99	00627030	TRUNNION VALVE ASSEMBLY	1
98	00079920	SOLENOID VALVE ASSEMBLY	2
97	00871030	ACTUATOR	1
96	00709420	BRACKET SWITCH	1
95	00717610	RELAY	1
94	93602403	NUT HEX 32	2
93	93314316	SCR RD HD	2
92	00712620	BRACKET SWITCH	1
91	00717810	SWITCH	1
90	93602141	NUT HEX	2
89	93314108	SCR RD HD	2
88	00750210	SWITCH ASSEMBLY	2
87	00076010	TOGGLE SWITCH	1
86	00711720	DECONTROL VALVE ASSY	1
85	00709210	BRACKET SWITCH	1
84	93594106	SCR ROD SET	2
83	00210110	ROD STRAP	1
82	00709110	ROD CONTROL	1
81	99001204	ROD END	2
80	00705110	BRACKET CABLE	1
79	93602345	NUT HEX	5
78	93313520	SCR RD HD	3
77	93601245	NUT HEX	3
76	99001734	ROD END	1
75	00717710	VALVE NEEDLE	1
74	93611635	LOCKWASHER	6
73	93314508	SCR HEX HD	2
72	00704710	BRACKET HANDLE	2
71	93604341	LOCKNUT	2
70	93613031	WASHER	2
69	93544114	SCR HEX HD	2
68	00704810	HANDLE	1
67	00704910	BRACKET	1
66	93513100	SCR RD HD 1 3 LG	2
65	00722000	NAME PLATE CONTROL	1
64	93544000	SCR HEX HD 3 8 LG	2
63	00702300	BRAKE CONTROL	1
62	00705100	HANDLE CONTROL	1
61	00705500	HANDLE GRIP	1
60	00702220	HANDLE CONTROL	1
59	93329500	SCR RD HD 3 8 LG	2
58	00704300	BRACKET CONTACT	1
57	00187100	COLUMN LINK	1
56	93403300	LOCK NUT 5 16 2	6
55	00037300	STUD	1
54	00704010	BLOCK ELEVATION	1
53	00704100	HANDLE CONTROL	2
52	98110237	KEY RING STUD 28	1
51	95438231	O RING 231	2
50	97500001	PLUG PIPE 1 8NPT	1
49	93324305	SCR FLT HD 1 2 LG	3
48	00704400	HOLDER OSC CONTROL	1
47	00038100	KNOB HANDLE	5
46	00702600	HANDLE CAM	1
45	00702800	CAM	1
44	93813642	LOCKWASHER 5 16	6
43	93542732	SCR HEX HD 5 16	6
42	00702100	SPACER CAM	1
41	00702310	SPACER	5
40	93100225	KEY RING	2
39	98110125	KEY RING	1
38	00036810	BEARING	2
37	00708720	COLUMN TUBE	1
36	00705220	COLUMN BASE	1
35	00702510	SLEEVE BEARING	1
34	00720710	BEARING BALL	1
33	00703110	MOUNT BEARING	1
32	00703210	ROD ELEV CONTROL	1
31	98112087	KEY RING	2
30	00704210	BLOCK SWIVEL	1
29	00801705	ROD END (MALE)	2
28	00703810	LINK PIVOT	2
27	00703810	LINK ELEV CONTROL	1
26	93804312	LOCKNUT 5 16	11
25	00708510	STUD	5
24	00704110	LINK ELEVATION	2
23	00708510	LINK ELEV SHAFT	1
22	93544100	SCR HEX HD 3 8 LG	4
21	00703510	PLATE BEAR RETAINER	1
20	95211820	SCR HEX HD 3 8 LG	2
19	00703710	KEY SPROCKET	1
18	00204100	CHAIN ROLLER RIVETED	2.3
17	00703610	SPROCKET	1
16	00702120	BRACKET SUPPORT	1
15	93804140	NUT HEX	16
14	93613841	LOCKWASHER	24
13	93544112	SCR HEX HD	8
12	00702420	BRACKET COLUMN SUPPORT	1
11	93804343	NUT HEX 3/16	1
10	93802006	KEY 3 4 LG	1
9	00705610	SPROCKET DRIVE	1
8	93802028	KEY 1 1 4 LG	1
7	00573810	GEAR ROTATION	1
6	00708710	SPACER GEAR	2
5	93804140	NUT HEX	4
4	93813898	LOCKWASHER 3 8	4
3	93544318	SCR HEX HD	4
2	00708600	BUMPER TURRET MTG BRKT	1
1	00722140	TURRET BUMPER ASSEMBLY	1

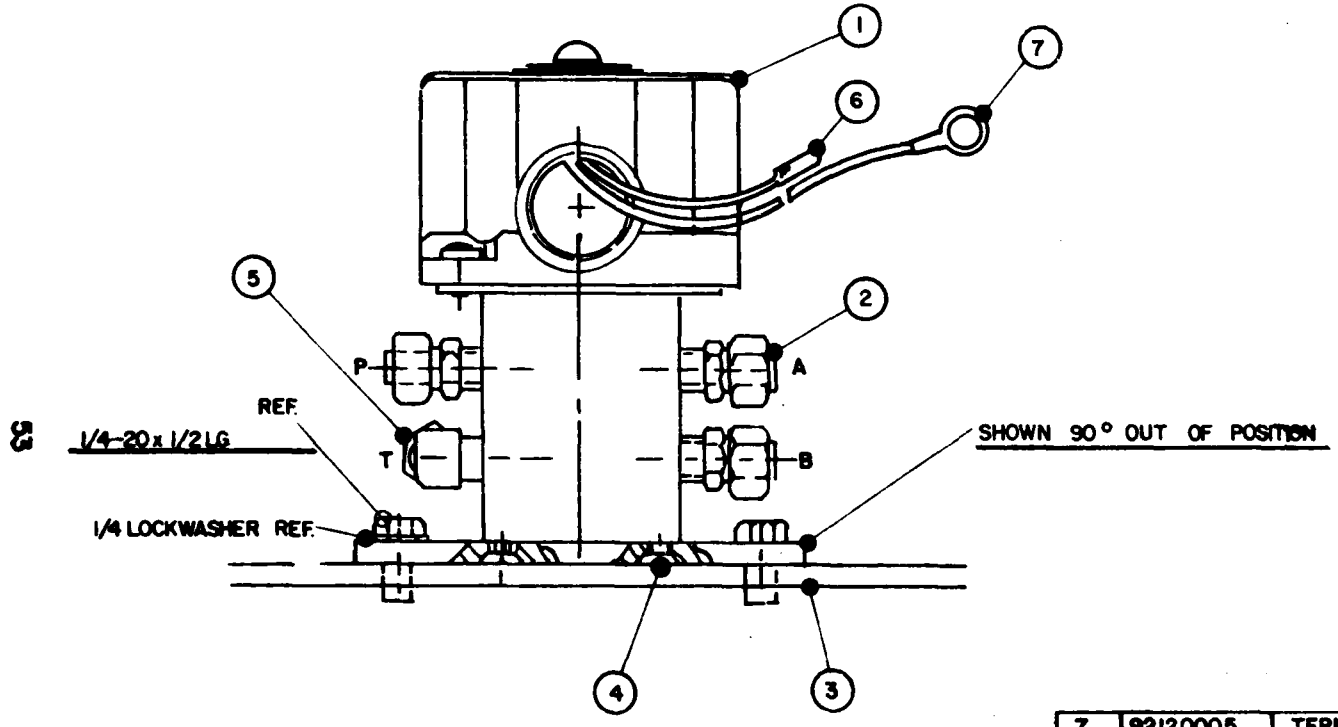
Figure A-7. Bumper Turret



NOTE:
ITEMS 22 & 23 NOT
SHOWN ON DWG.

ITEM	PART NO	DESCRIPTION	QTY
27	93802028	KEY # 625 WOODRUFF	1
26	93384204	SCR. FLATING 1/4-40 x 1/4 LG	4
25	93844112	SCR. HEX HD 1/4-20 x 3/4 LG	4
24	93804147	NUT HEX 5/8 — II	1
23	[illegible]	LOCKWASHER INT 3/16	4
22	93844216	SCR. HEX HD 5/16-18 — 1" LG	4
21	98102075	RET. RING N 5000-75	1
20	96215116	PIN ROLL 3/16 DIA x 1" LG	1
19	93613841	LOCKWASHER 1/4	8
18	93844110	SCR. HEX HD 1/4-20 x 5/8 LG	4
17	96850117	"O" RING — 110 BUNAN	1
16	95680111	"O" RING - 111 BUNAN	1
15	96830039	"O" RING — 039 BUNAN	1
14	00719420	GUARD — GEAR	1
13	[illegible]	ACTUATOR	1
12	[illegible]	PIN ROLL 1/4 DIA x 1" LG	2
11	00638810	HANDLE	1
10	00633810	GEAR (HD—TRUNNION VALVE)	1
9	00632220	PLATE — MOUNTING	1
8	00719110	SPACER — RING	1
7	00626110	WASHER — THRUST	1
6	00718210	SEAT — VALVE	1
5	00633710	STEM — UPPER	1
4	0062190	STEM — LOWER	1
3	00625720	BALL — 2 TRUNNION	1
2	00625420	CAP — BODY	1
1	00593330	BODY — 2 TRUNNION VALVE	1

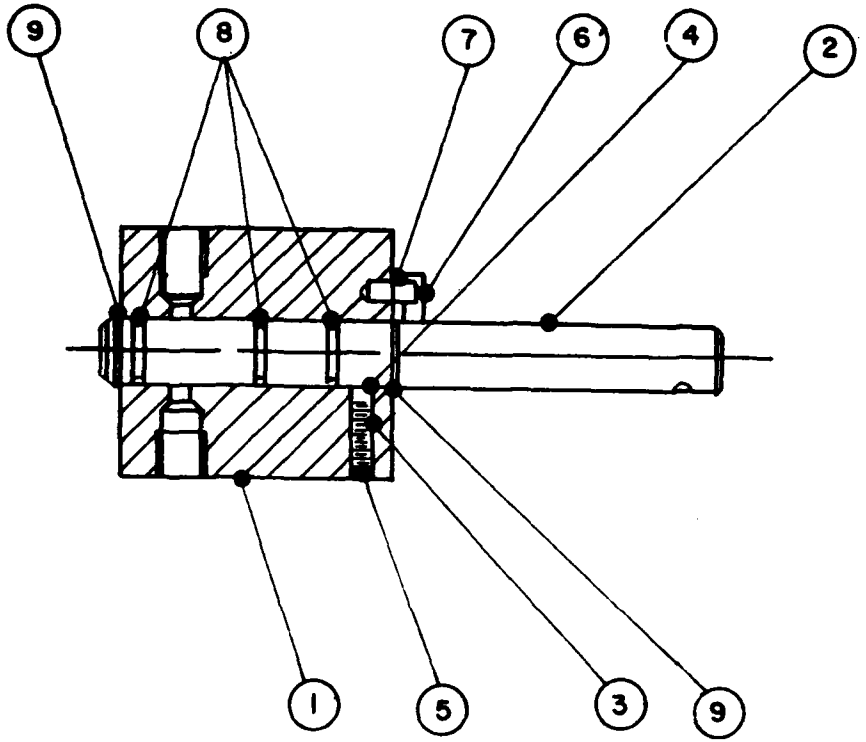
Figure A-8. Turn-on Valve Assembly, Hydraulic

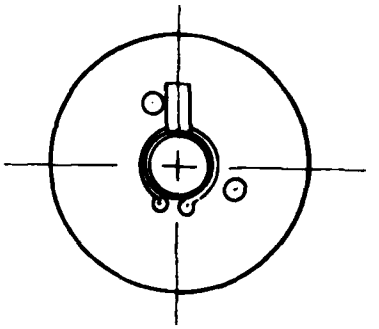


ITEM	PART NO.	DESCRIPTION	QTY
7	92120005	TERMINAL — SOLDERLESS	1
6	92120002	TERMINAL — SOLDERLESS	1
5	97300003	ELBOW — 1/8 NPT x 1/4 TUBE	1
4	93224506	#-10-32 x 3/8 LG. FLT. HD. SCREW	2
3	00044010	SOLENOID MOUNT	1
2	97700004	TUBE FITTING 1/8 NPT x 1/4 TUBE	3
1	00080410	SOLENOID VALVE	1

PARTS LIST

Figure A-9. Solenoid Valve Assembly



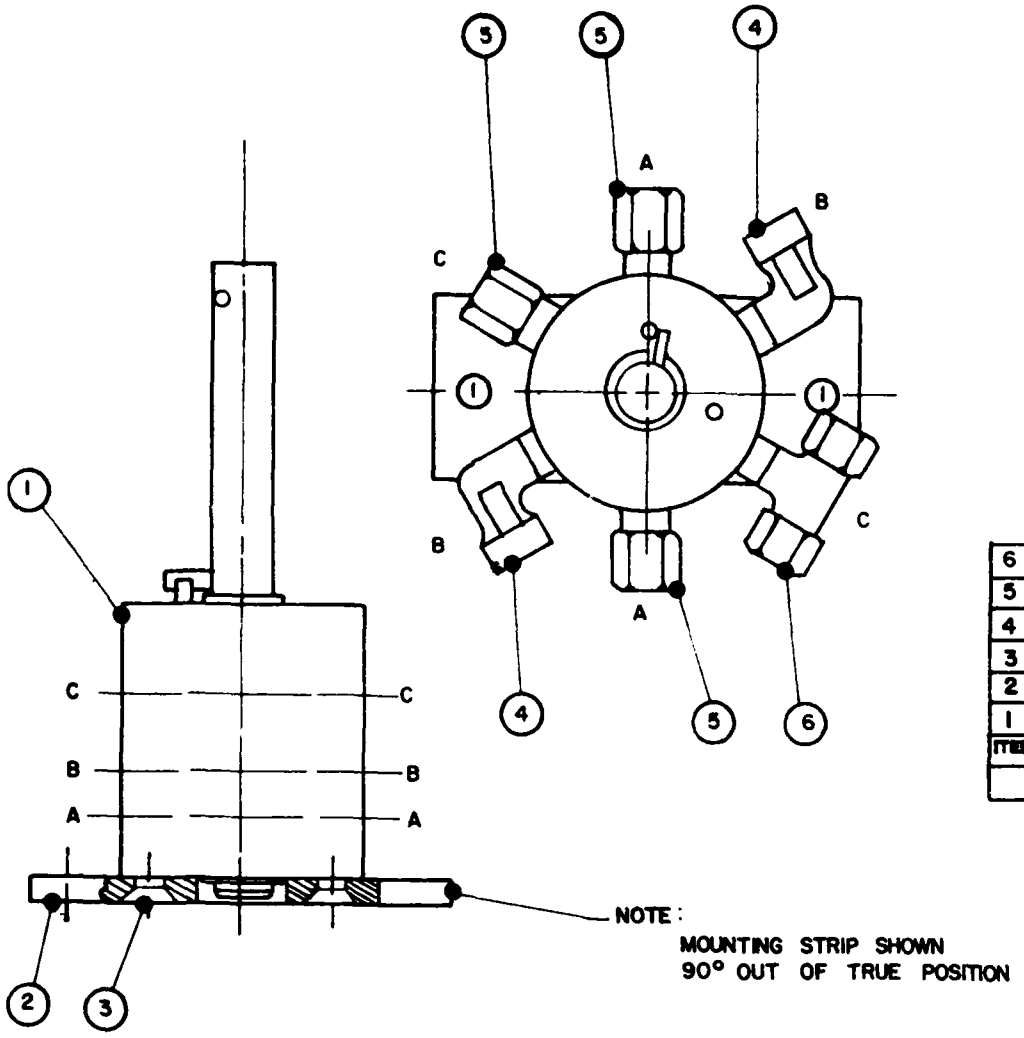


REFERENCE VIEW

ITEM	PART NO	DESCRIPTION	QTY
9	98110050	RETAINING RING— PLT	2
8	95830012	"O" RING 1/2 O.D x 3/8 I.D.	3
7	95211507	ROLL PIN ST. ST 5/32 DIA x 3/16 lg.	2
6	95211512	ROLL PIN ST. ST 5/32 DIA x 3/4 lg.	1
5	93294504	SET SCREW # 10-32 UNF x 1/4 lg.	1
4	96130305	BALL 5/32 DIA. ST. ST.	1
3	00006110	LATCH SPRING	1
2	00711520	DECONTROL VALVE SHAFT	1
1	00022420	DECONTROL VALVE BODY	1

PARTS LIST

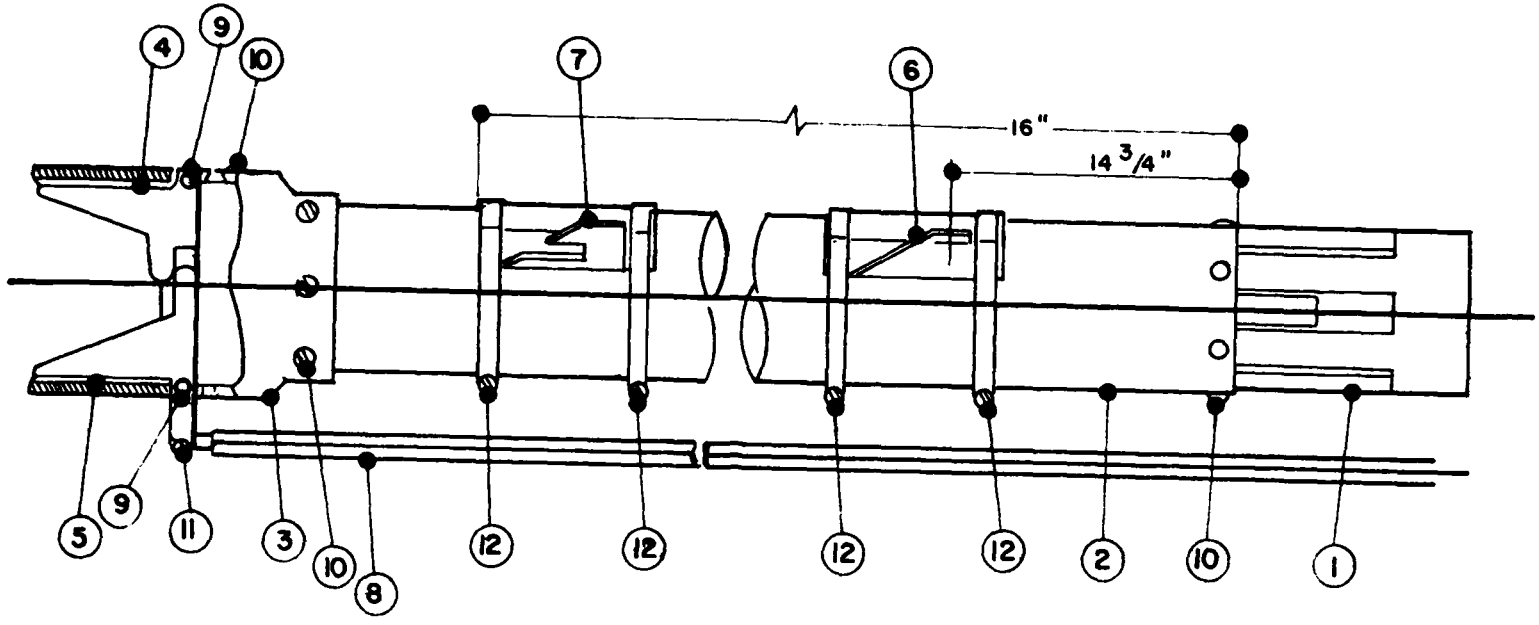
Figure A-10. Decontrol Valve

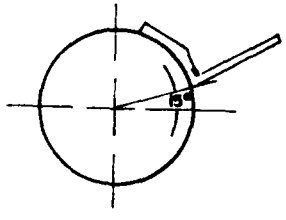


ITEM	PART NO.	DESCRIPTION	QTY
6	97720004	TEE, MALE BRANCH 1/8NPTx1/4TUBE	1
5	97700004	STRAIGHT FITTING 1/8NPTx1/4 TUBE	3
4	97300003	ELBOW, MALE 1/8 NPT x 1/4 TUBE	2
3	93524108	SCR. FLT HD 1/4-20 x 1/2 LG	2
2	00037110	DECONTROL MOUNTING STRIP	1
1	00711620	DECONTROL VALVE	1

PARTS LIST

Figure A-11. Decontrol Valve Assembly





LOCATE SPRING & LOCK BRACKETS AS SHOWN AT ASSY.

ITEM	PART NO	DESCRIPTION	QTY
12	9203840	CLAMP (QS 500-M405)	7
11	9520708	PIN-ROD 3/16 DIA x 1/2 LG	1
10	93363505	SCR.RD. HD. #10-24 x 5/16 LG	18
9	9520232	PIN-ROLL 1/8 DIA x 2" LG	2
8	00721720	DEFLECTOR ROD	1
7	0072810	LOCK BRACKET	1
6	0080910	SPRING BRACKET	1
5	003420	DEFLECTOR (LOWER)	1
4	0003510	DEFLECTOR (UPPER)	1
3	0047080	DEFLECTOR HOUSING	1
2	0012120	FOAM TUBE ASSY.	1
1	0072280	NOZZLE BODY	1

Figure A-12. Nozzle Assembly, Air-Aspirating

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G. BILL OF MATERIAL

Assembly #	Subassembly #	Individual P/N	Part Description	QTY
006800-40			TURRET P-4 BUMPER AIR-ASPIRATING	
		007221-40	Turret Bumper Assembly	1
		007096-40	Bumper Turret Mtg.	1
		935443160	Scr. Hex Hd. 3/8-16 x 1 Lg.	4
		936136430	Lockwasher 3/8	4
		936041430	Nut, Hex 3/8-16	4
		007087-10	Spacer Gear	2
		005738-10	Gear Rotation	1
		938020280	Key 1/8 Sq.x 1-1/4 Lg.	1
		007056-10	Sprocket Drive	1
		938020050	Key 1/8 Sq. x 1-1/4 Lg.	1
		936043480	Nut Hex 3/4-16	1
		007024-20	Bracket Column Support	1
		935441120	Scr. Hex Hd. 1/4-20 x 3/4 Lg.	18
		936136410	Lockwasher 1/4	24
		936041410	Nut Hex 1/4-20	16
		007021-20	Bracket Support	1
		007036-10	Sprocket	1
		962041000	Chain Roller #35 Riveted	2.3 (feet)
		007037-10	Key Sprocket	1
		952118-20	Pin Roll 3/16 Dia. x 1-1/4 Lg.	2
		007035-10	Plate Gear Retainer	1
		935441060	Scr. Hex Hd. 1/4-20 x 3/8 Lg.	4
		007065-10	Link Elevation Shaft	1
		007041-10	Link Elevation	2
		006086-10	Stud	5
		936043420	Locknut 5/16-18	11
		007039-10	Link Elevation Control	2
		007038-10	Link Pivot	2
		990017060	Rod End Male 5/16-18	2
		007042-10	Block Swivel	1

BILL OF MATERIAL (Cont.)

Assembly #	Subassembly #	Individual P/N	Part Description	QTY
006800-40 (Cont.)			TURRET P-4 BUMPER AIR-ASPIRATING	
		007023-20	Bracket Control	1
		935441100	Scr. Hex Hd. 1/4-20 x 5/8 Lg.	2
		007222-20	Nameplate Control	1
		935131060	Scr. Rd. Hd. 1/4-20 x 3/8 Lg.	2
		007049-10	Bracket Control Mount	1
		007048-10	Handle	2
		935441140	Scr. Hex Hd. 1/4-20 x 7/8 Lg.	2
		936130310	Washer 1/4	2
		936043410	Locknut 1/4-20	2
		007047-10	Bracket Handle	2
		933145080	Scr. Rd. Hd. #10-24 x 1/2 Lg.	8
		007177-10	Valve Needle PH MV4005	1
		990017040	Rod End (Female) #10-32	1
		936012450	Nut Jam #10-32	3
		933135120	Scr. Rd. Hd. #10-24 x 3/4 Lg.	3
		936023450	Nut Hex #10-24	7
		007051-10	Bracket Cable	1
		990017040	Rod End (Male) #10-32	2
		007091-10	Rod Control	1
		002101-10	Rod Stop	1
		935941060	Scr. Soc. Sec 1/4-20 x 3/8 Lg.	2
		007092-10	Bracket Switch	1
		007117-20	Decontrol Valve Assembly	1
		000760-10	Switch Toggle	1
		007174-10	Switch Subminiature Leaf (JS-2)	2
		933141080	Scr. Rd. Hd. #2-56 x 1/2 Lg.	2
		936021410	Nut Hex #2-56	2
		007173-10	Switch Flexible Leaf (8Z-2RL-A2)	1
		007128-20	Bracket Switch	1

BILL OF MATERIAL (Cont.)

Assembly #	Subassembly #	Individual P/N	Part Description	QTY
006800-40 (Cont.)			TURRET P-4 BUMPER AIR-ASPIRATING	
		933143140	Scr. Rd. Hd. #6-32 x 7/8 Lg.	2
		936021430	Nut Hex #6-32	2
		007176-10	Relay	1
		007094-20	Bracket Switch	1
		005710-30	Actuator	1
		981120870	Ret. Ring	2
		007032-10	Rod Elevation Control	1
		007031-10	Mount Bearing	1
		007207-10	Bearing Ball (R-14)	1
		007025-10	Sleeve Bearing	1
		007052-20	Column Base	1
		007097-20	Column Tube	1
		000369-10	Bearing	1
		981101250	Ret. Ring 5100-125	1
		981002250	Ret. Ring N5000-225	2
		007026-10	Spacer	5
		007027-10	Spacer Cam	1
		935442320	Scr. Hex Hd. 5/16-18 x 2 Lg.	6
		936136420	Lockwasher 5/16	6
		007028-10	Cam	1
		007029-10	Handle Cam	1
		000383-10	Knob Handle	5
		007044-10	Holder Osc. Control	1
		933245080	Scr. Flt. Hd. #10-24 x 1/2 Lg.	3
		975000010	Plug Pipe 1/8 NPT	1
		958302310	"O" Ring - 231 Buna N	2
		981102870	Ret. Ring 5100-287	1
		007046-10	Handle Osc. Control	2
		007043-10	Block Elevation	1
		000373-10	Stud	3

BILL OF MATERIAL (Cont.)

Assembly	Subassembly #	Individual P/N	Part Desciption	QTY
006800-40 (Cont.)			TURRET P-4 BUMPER AIR-ASPIRATING	
		936033420	Locknut 5/16-24	6
		000167-10	Column Link	1
		007045-10	Bracket Contact	1
		933145060	Scr. Rd. Hd. #10-24 x 3/8 Lg.	2
		007022-20	Holder Handler	1
		007088-10	Handle Control	1
		006566-10	Handle Grip	1
		000799-20	Solenoid Valve Assembly	2
		006270-30	Trunnion Valve Assembly	1
		971423610	Nipple 2 x 3" Lg. Brz.	2
		973120090	Elbow 2 x 90° Brz.	2
		007089-10	Nipple Feed	2
		974302090	Hydraulic Connector 2"	1
		973811090	Tee 1/8 NPT	2
		977100010	Tee Union 1/4 Tube	2
		973000030	Elbow (Male) 90° 1/4 Tube x 1/8 NPT	8
		977000040	Straight Conn. 1/4 Tube x 1/8 NPT	5
		976013010	Tubing 1/4	15
		912000100	Filter Inline	1
		007205-20	Manifold	1
		962041010	Link Connecting #35	1
		007204-30	Plate Cover Dash	1
		973000040	Elbow (Male) 90° 1/4 Tube x 1/4 NPT	2
		007219-40	Nozzle Assembly (Air-Aspirating)	1
		000153-10	Counterbalance Spring	1
		990025030	Eyebolt (5/16-18)	1
		958300320	"0" Ring 032 Buna N	1
		958301340	"0" Ring 134 Buna	1
		007228-10	Spring Defl. Rod	1

BILL OF MATERIAL (Cont.)

Assembly #	Subassembly #	Individual P/N	Part Description	QTY
006800-40 (Cont.)			TURRET P-4 BUMPER AIR-ASPIRATING	
		936137410	Stat-O-Seal 1/4	1
		936137450	Stat-O-Seal 1/2	1
		007110-30	Kit Compression	
	007221-40		Turret Assembly Hydraulic Bumper	1
		007053-40	Base	1
		006139-40	Body	1
		006615-30	Head	1
		006198-20	Bearing - Elevation	1
		006154-20	Bearing - Rotation	1
		007064-20	Shaft - Rotation	1
		005744-20	End Cap	1
		007057-20	Shaft - Elevation	1
		006338-10	Seal - Bearing	1
		005103-20	Gear Segment	1
		007055-10	Bracket Cable Hold	1
		935443120	Scr. Hx. Hd. 3/8-16 x 3/4 Lg. Plt.	2
		936136430	Lockwasher 3/8 Split Pltd.	2
		006163-20	Bearing Ball #63052RS	1
		958301500	"0" Ring - 150 Buna N	2
		958301330	"0" Ring - 133 Buna N	5
		958301160	"0" Ring - 116 Buna N	1
		958300300	"0" Ring 030 Buna N	1
		958300160	"0" Ring 016 Buna N	1
		981022120	Ret. Ring N5000 212SS	1
		933435080	Scr. Rd. Hd. #10-24 x 1/2	1
		958303400	"0" Ring 340 Buna N	1
		006141-10	Screw-Bearing	1
		936137310	Stat-O-Seal 1/4 SS	1
		933544100	Scr. Soc. Hd. #8-32 x 5/8 Lg. Plt.	2
		936118340	Lockwasher #8 INT	2
		935441080	Scr. Hx. Hd. 1/4-20 x 1/2 Lg. Pltd.	2
		936136410	Lockwasher 1/4 Split Pltd.	2
		003734-10	Cable 60"	2

BILL OF MATERIAL (Cont.)

Assembly #	Subassembly #	Individual P/N	Part Description	QTY
006800-40 (Cont.)			TURRET P-4 BUMPER AIR-ASPIRATING	
	007117-20		Decontrol Valve Assembly	1
		007116-20	Decontrol Valve	1
		000371-10	Decontrol Mounting Strip	1
		935241080	Scr. Flt. Hd. 1/4-20 x 1/2 Lg.	2
		973000030	Elbow, Male 1/8 NPT x 1/4 Tube	2
		977000040	Straight Fitting 1/8 NPT x 1/4 Tube	3
		977200040	Tee, Male Branch 1/8 NPT x 1/4 Tube	1
	000799-20		Solenoid Valve Assembly	2
		000804-10	Solenoid Valve	1
		977000040	Tube Fitting 1/8 NPT x 1/4 Tube, Str.	3
			Solenoid Valve	1
		000440-10	Solenoid Mount	1
		032245060	Flat Hd. Scr. #10-32 x 3/8 Lg.	2
		973000030	Elbow 1/8 NPT x 1/4 Tube	1
		921200050	Terminal	1
		921200020	Terminal	1
	006270-30		2" Trunnion Valve Assembly Hyd.	1
		005933-30	Body 2" Trunnion Valve	1
		006234-20	Cap - Body	1
		006257-20	Ball 2" Trunnion	1
		006259-10	Stem - Lower	1
		006337-10	Stem - Upper	1
		007192-10	Seat - Valve	1
		006261-10	Washer - Thrust	1
		007191-10	Spacer - Ring	1
		006322-20	Plate - Mounting Cyl.	1
		006336-10	Gear (Hyd. Trunnion Valve)	1
		006335-10	Handle	1
		952125160	Pin, Roll 1/4 Dia. x 1" Lg.	2
		006318-20	Actuator	1
		007194-10	Guard - Gear	1
		958300390	"O" Ring - 039 Buna N	1

BILL OF MATERIAL (Cont.)

Assembly #	Subassembly #	Individual P/N	Part Description	QTY
006800-40 (Cont.)			TURRET P-4 BUMPER AIR-ASPIRATING	
		958301170	"0" Ring - 039 Buna N	1
		935441100	Scr. Hex Hd. 1/4-20 x 5/8 Lg.	4
		936136410	Lockwasher 1/4	8
		952131160	Pin Roll 5/16 Dia. x 1" Lg.	1
		981020750	Ret. Ring N5000-75	1
		935442160	Scr. Hex Hd. 5/16-18 x 1" Lg.	4
		936138420	Lockwasher INT 5/16	4
		936041470	Nut, Hex 5/8-11	1
		935441120	Scr. Hex Hd. 1/4-20 x 3/4 Lg.	4
		933642040	Scr. Pan Hd. #4-40 x 1/4 Lg.	4
		938020280	Key #605 Woodruff	1
	007100-30		Kit Compression	1
		005969-20	Two-Way Solenoid Valve	1
		007176-10	Relay Switch	1
		007094-20	Relay Bracket	1
		936006070	Pop Rivet #43 Open End	2
		974020030	Tee, NPT Brass 3/8"	2
		973120380	3/8" 90° Tube Elbow	4
		933144080	Scr. Mach. Rd. Hd. #8-32 x 1/2 Lb.	2
		936116440	Ring Lock Washer, Split #8	2
		990024030	Clip Ties, #3 Nylon "P"	2
		990024020	Cable Tie, Nylon	1
		975120110	Bushing 3/8" x 1/4 NPT	2
		976012000	Tubing, Plastic 3/8"	17
		977000110	Tube Fitting 3/8" NPT	2
		931133060	#6 x 3/8 PN Hd. Self Tap	2
		971421020	Nipple, 3/8 x 1-1/2 Lg. Brass	2
		007402-12	Relay Socket	1
		007402-10	Holddown Spring	1
		036032440	#8 x 52 Hex Hd. Nut	2

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