# S9593-BE-MMM-010/19190-MSD-MKII

TECHNICAL MANUAL

ARS

# OPERATION AND MAINTENANCE INSTRUCTIONS WITH PARTS BREAKDOWN

## SEWAGE SYSTEM, GATX

DUPLICATE

**MANUFACTURED BY**
**GARD, INC, subsidiary of GATX Corporation**

**Contract: N00024-81-C-2022**

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# FOREWORD

This technical manual describes Marine Sanitation Device MK II (MSD-MK II). The technical manual includes reference data, parts identification, and procedures for installation, operation, and maintenance of the complete system. The MSD-MK II is specifically designed to prevent discharge of shipboard sewage into lakes and navigable waters. The system, as installed on U.S. Navy boats or service craft, collects sanitary waste in reduced-volume-flush water closets, holds the sewage in a special holding tank during operations in navigable waters, and pumps the sewage to proper shore facilities or into waters outside those restricted from such discharge.

This manual is divided into 8 chapters as follows:

**CHAPTER 1. GENERAL INFORMATION AND SAFETY PRECAUTION.** This chapter provides an overall view of the Marine Sanitation device and includes Safety Precautions that must be observed when performing maintenance on the equipment.

**CHAPTER 2. OPERATION.** This chapter provides user instructions for operation of the Commode and overall system operations. This includes identification of the Control and indicators associated with the equipment.

**CHAPTER 3. FUNCTIONAL DESCRIPTION.** This chapter provides a detailed look at the overall operation. Included are explanations of all electrical circuit operations and the waste collection system.

**CHAPTER 4. SCHEDULED MAINTENANCE.** This chapter provides detailed coverage of all required Preventive Maintenance procedures.

**CHAPTER 5. TROUBLESHOOTING.** This chapter contains information to aid the technician in quickly locating a faulty component. Troubleshooting is based on the use of fault logic diagram.

**CHAPTER 6. CORRECTIVE MAINTENANCE.** This chapter contains the recommended procedure for performing repairs on components of the system.

**CHAPTER 7. PARTS LIST.** This chapter provides illustration identifying all replaceable parts and includes parts lists identifying the parts by part number and listing the FSCM for the manufacture of the parts.

**CHAPTER 8. INSTALLATION.** This chapter provides information to aid in properly installing the components of the equipment. Included is information on Site Selection, Installation of each component and Installation Checkout Procedure.

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# SAFETY SUMMARY

Operator and Maintenance personnel working on Marine Sanitation Equipment must follow all safety precautions to minimize possible contamination. Section II has been added to chapter 1 to cover these precautions. All personnel should review this section before servicing the components of this equipment.

# CHAPTER 1
# GENERAL INFORMATION AND SAFETY PRECAUTIONS

## Section I. GENERAL INFORMATION

### 1-1. INTRODUCTION.

This technical manual describes Marine Sanitation Device MK II (MSD-MK II). The technical manual includes reference data, parts identification, and procedures for installation, operation, and maintenance of the complete system including the sewage holding tank and its associated parts.

### 1-2. EQUIPMENT DESCRIPTION.

The MSD-MK II is specifically designed to prevent discharge of shipboard sewage into lakes and navigable waters. The system, collects sanitary waste in reduced-volume-flush water closets, holds the sewage in a special holding tank during operations in navigable waters, and pumps the sewage to proper shore facilities or into waters outside those restricted from such discharge. Refer to figure 1-1 to identify the major components of the MSD-MK II. Each complete system includes the components listed in table 1-1.

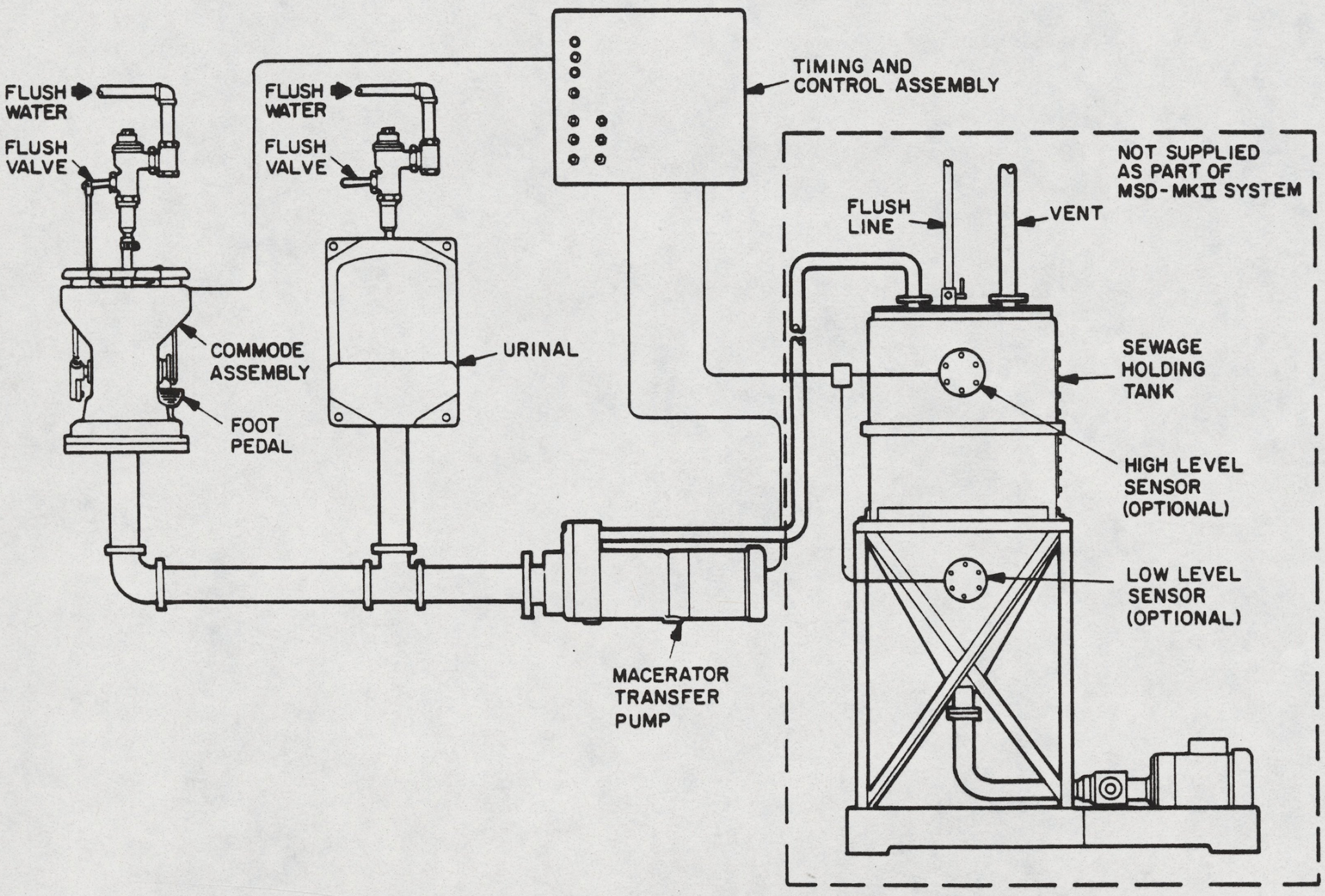


Figure 1-1. Marine Sanitation Device, Unit Relationship

**Table 1-1. Dimensions and Weights**

| QUANTITY | ITEM NAME OR NOMENCLATURE | CID RIC OR UNIT NO. | UNCRATED H (in.) | UNCRATED W (in.) | UNCRATED D (in.) | UNCRATED Wt (lb.) | UNCRATED V (cu. ft.) | CRATED H (in.) | CRATED W (in.) | CRATED D (in.) | CRATED Wt (lb.) | CRATED V (cu. ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Commode Assy 10168200200 (2-28-14679) | | 18 | 15 | 21 | 80 | 3.28 | 21 | 18 | 24 | 95 | 5.25 |
| 5 | Urinals 10168200300 (2-28-14837) | | 16 | 12 | 10 | 35 | 1.11 | 19 | 15 | 13 | 50 | 2.14 |
| 8 | Macerator/Transfer Pump Assy A3-11-100 (2-28-16776) | | 10 | 26 | 8 | 120 | 1.20 | 12 | 30 | 12 | 125 | 2.50 |
| 3 | Timing and Control Assy AC 10169500102-1 (2-22-16771) | | 24 | 24 | 7 | 60 | 2.90 | 36 | 30 | 10 | 70 | 6.25 |

## 1-3. USER OPTION.

The audible alarm is a user option. If an audible alarm is not installed, disregard any reference to the alarm in this publication.

## 1-4. REFERENCE DATA.

Refer to table 1-2 for water data and electrical requirements for the MSD-MK II. Table 1-3 provides dimensional data for each of the components.

**Table 1-2. Water Data and Electrical Power Requirements.**

Water Data
- Pressure per Commode (psig) ..... 30
- Volume per Commode
  - Discharging Liquids (pint) ..... 1
  - Discharging Solids (pint) ..... 2
- Holding Tank Capacity (gal.) ..... As required

Power Requirements
- Input ..... 440 VAC
- Macerator Pump (KVA) ..... 2.8
- Timing and Control Assembly (KVA) ..... 0.7

## Section II. SAFETY PRECAUTIONS

### 1-5. SCOPE.

This section contains the precautions which must be observed by operators and maintenance personnel of Marine Sanitation Systems. Some of the precautions are descriptions of how to perform certain procedures, and some of the precautions are procedures that must be performed before or after contact with any part of the system. Supervisory personnel should become familiar with all health and safety precautions and should ensure that only qualified operators and maintenance personnel are permitted to operate and maintain this system.

### 1-6. SEWAGE HANDLING.

Contact with raw sewage can be a health hazard unless good personal hygiene is practiced. The following precautions should be obeyed when operating or maintaining sewage handling equipment:

- Wear protective rubber gloves, rubber boots, and overalls while working with sewage handling equipment.
- Thoroughly wash face and hands with soap and water before eating, drinking, and/or smoking.
- Drain and flush soil drains before servicing any sewage handling equipment.
- Wash sewage spills and solids found on sewage hose connections and the exterior of sewage handling equipment with warm water containing a stock detergent.

**WARNING**

Disconnecting sewage hose or pipe while it is pressurized is hazardous. System should be depressurized prior to any disconnection.

- Personnel engaged in sewage transfer hose operations shall not connect or disconnect potable water hoses.

### 1-7. ELECTRICAL EQUIPMENT.

**WARNING**

Arcing in electrical systems can cause eye injury or severe burns. Mishandling electrical equipment or connections can cause electrical shock or other injuries.

**NOTE**

Refer to NAVSEA Technical Manual 0901-LP-300-0000, Chapter 300 for additional information on handling electrical equipment.

a. Keep unauthorized personnel away from electrical equipment; set up warning signs, barricades, or watch personnel in the area where equipment is to be opened or exposed.
b. De-energize circuit at fuse or circuit breaker; remove fuse or secure circuit breaker in the OFF position, and attach warning tag(s) when working on electrical equipment.
c. Test the circuit to make sure voltage has been removed.
d. Discharge capacitors by shorting across the capacitors.

**NOTE**

Equipment may have more than one source of power.

e. Check that all possible sources of power have been de-energized before handling electrical equipment.
f. Use only authorized portable electrical equipment.
g. Wear rubber gloves when handling electrical equipment.
h. Use insulated tools when possible, and avoid wearing or using such electrically conductive objects such as watches, rings, metal pens, and pencils.
i. When required to work on energized equipment, obtain permission from the officer/P.O. responsible and follow special precautions noted in NAVSEA Technical Manual 0901-LP-300-0000, Chapter 200.

## 1-8. DISINFECTANTS.

In the event equipment or personnel are contaminated with sewage to an extent that disinfection is required, the referenced items are included in the Federal stock system and are recommended for shipboard use. Solids must be removed from the equipment or surface before using a disinfectant. Care must be exercised in the storage, mixing, and use of all of these items and all of the manufacturer's instructions must be followed explicitly.

While other disinfectants presently in the stock system may perform equally as well, substitutions should not be made unless interchangeability has been verified.

**NOTE**

If in doubt concerning the use of disinfectants, a Medical Officer should be consulted.

a. Decks - Bulkheads and Equipment.
   (1) Phenol Base. Germicidal and fungicidal concentrate phenolic, dry type NSN 9G840-00-753-4797: 1 ounce packet per 4 gallons water.
   (2) Combined. Disinfectant and fungicidal concentrate (i.e. pine oil) NSN 9G6840-00-530-7109: 1 gallon jug.
   (3) Iodine Base. Disinfectant, germicidal, and fungicidal concentrate (i.e. Wesodyne G tamed iodine) NSN 9G6840-00-526-1192: 1 ounce of concentrate per gallon of water.

b. Hands.
   (1) Iodine Base. Detergent, surgical antiseptic sudsing skin cleanser. Predodyne surgical scrub (use like liquid hand soap - full strength with water and lather). NSN 9P7930-00-282-9699: 1 gallon, NSN 9P7930-00-985-6911: 5 gallons, NSN 9P7930-00-282-9700: 50 gallons.

**WARNING**

Surgical soap can injure or damage the face or eyes.

   (2) Surgical Soap. Betadine NSN 9G6505-00-914-3593.

## 1-9. DECONTAMINATION OF PERSONNEL AND EQUIPMENT.

The following information is presented as a decontamination guide for personnel and equipment which may have been exposed to raw sewage:

## 1-10. EQUIPMENT REQUIRED.

(1) Coveralls (one set for each individual).
(2) Goggles (one set for each individual).
(3) Hood-type hats (one for each individual).
(4) Rubber boots having pants integral with boots (one pair for each individual).
(5) Dissolvable laundry bags (NSN 8465-00-436-9652).
(6) Canvas laundry bags.
(7) Respirators.

## 1-11. PERSONNEL DECONTAMINATION AFTER WORKING IN CONTAMINATED SPACES.

(1) Remove protective clothing and equipment.

**NOTE**

Neither dissolvable nor canvas laundry bags shall enter contaminated space; pass all clothing through entry way.

(2) Place clothing in dissolvable laundry bags stored outside of the contaminated space; use caution not to contaminate the outside of the bag.
(3) Secure dissolvable bag, insert (top down) in canvas laundry bag, and secure canvas bag.

(4) Disinfect boots, goggles, and respirators.
(5) Disassemble equipment for complete cleaning.
(6) Place disinfected equipment outside contaminated space as it is cleaned.
(7) Disinfect entire contaminated space.
(8) Place paper towels or other remaining waste or cleaning materials in plastic trash can liners and discard with trash.
(9) Personnel may then exit space and don personal clothing.
(10) Immediately transfer canvas bag with enclosed dissolvable laundry bag and contaminated clothing to the laundry for washing.

**1-12 LAUNDRY PROCEDURE.**

(1) Dump dissolvable laundry bag with clothing directly into washer.
(2) Place canvas bag in washer and wash in accordance with standard procedures.

**1-13. FOLLOW UP.** Resanitize contaminated areas (decks, bulkheads, overheads, etc.) several hours after the first treatment. Use the same procedures that were used for the first treatment.

**1-14. CERTIFICATION OF SPACE SUITABILITY.** Upon completion of sanitization of a contaminated space, a senior medical department representative must inspect the space and certify, in writing to the OIC/POIC, that it has been adequately decontaminated. Until certification is obtained, the space shall be considered contaminated and all personnel entering shall follow the decontamination safety procedures outlined previously.

**1-15. ADDITIONAL PROCEDURES.**

(1) Provide for acquisition, maintenance and storage of all protective clothing and equipment.
(2) Conduct an inspection of holding tank, pumping systems, and piping to insure watertight integrity and the absence of contamination leaks, overflow, or spillage once each watch. These inspections shall be logged and any discrepancies noted shall be reported immediately to the OIC/POIC.
(3) Provide for instruction and training in the procedures for decontamination of personnel and spaces in the event of contamination by raw sewage. In addition, any personnel who in the line of duty, occupy or transit spaces susceptible to contamination shall receive the above training.
(4) Provide for certification of satisfactory sanitization of contaminated spaces.

# CHAPTER 2
# OPERATION

## 2-1. INTRODUCTION.

This chapter is divided into two sections. Section I provides all information needed by the actual on board users of the Marine Sanitation System. The commode and urinal are similar to those found in domestic or industrial applications except that their use demands certain concessions to water conservation. Section II details the procedures that system operating personnel must follow to accommodate pier side and open sea conditions. Operation of the MSD-MK II beyond its collection of wastes, is accomplished automatically by its electrical controls.

## Section I. USER INSTRUCTIONS

## 2-2. OPERATING MODES.

**2-3. "DRY" BOWL.** The commode is used "dry" bowl for urination. The lower section of the commode bowl normally contains a small amout of water in the "dry" bowl mode, and is ready to be used at any time for urination. After urination, the manual control level (foot pedal), which opens a valve to drain the commode, is depressed. Then, releasing the pedal allows the lower action to be refilled with water (see figure 2-1).

**2-4. "WET" BOWL.** The commode is used "wet" bowl for defecation. When the commode is used for defecation, it is necessary that the user add an additional amount of water to fill the bowl, both to provide aesthetic acceptability and to minimize the possibility of soiling the bowl surface. Filling is accomplished by actuating the valve flush handle (see figure 2-1). Actuating this handle allows water, under pressure from the supply line, to flow into the bowl. The volume of water in each operation mode is automatically determined by a control chamber within the flush valve.

**2-5. URINAL.** The wall mounted urinal (see figure 2-1) is flushed by actuating the flush handle. Each flush operation releases approximately one pint of water into the urinal. The volume of water in each operation is automatically determined by a control chamber within the flush valve.

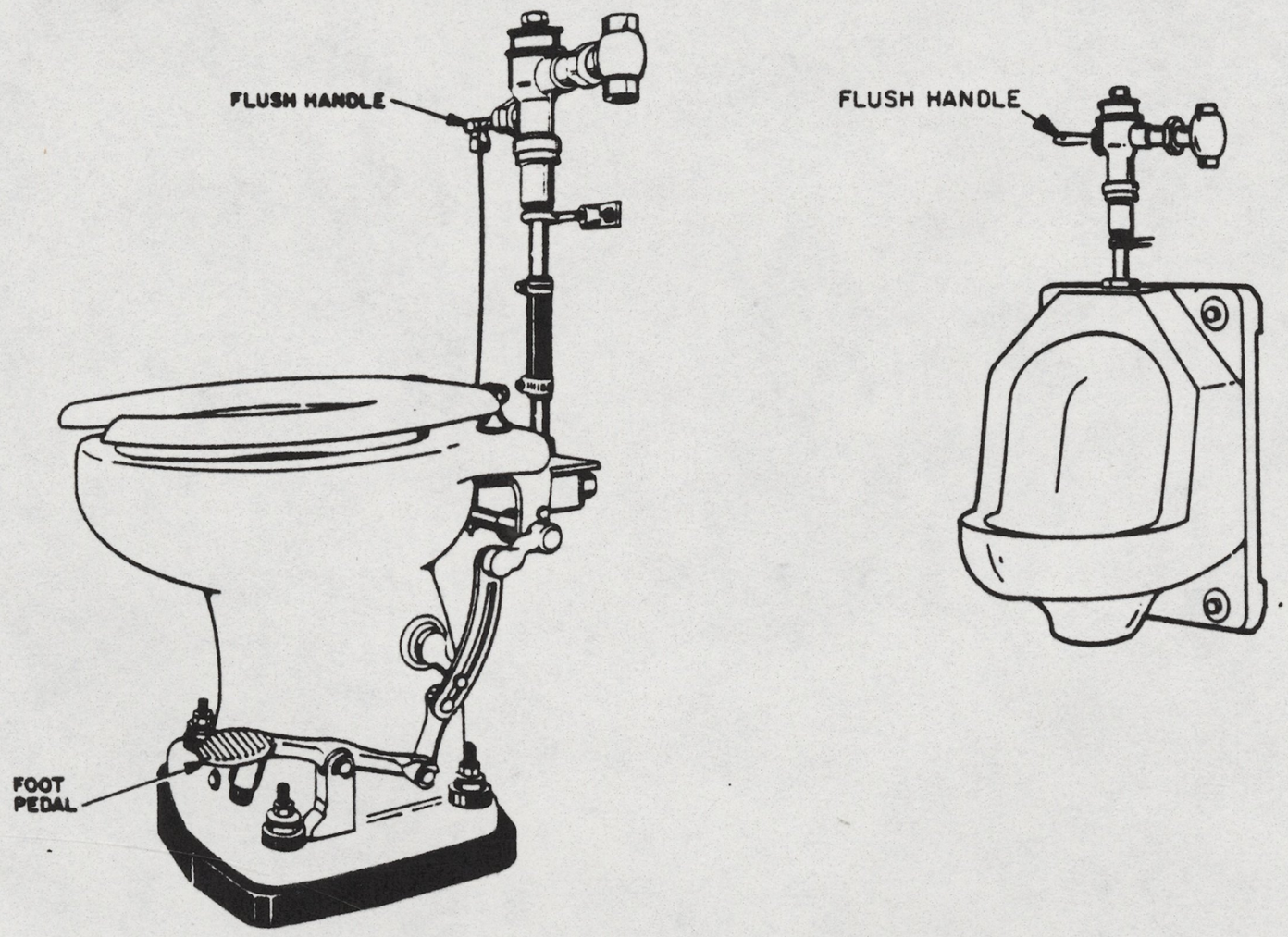


Figure 2-1. Commode and Urinal Operator Controls

## Section II. SYSTEM OPERATION

### 2-6. CONTROLS AND INDICATORS.

Table 2-1 and figure 2-2 list and identify the operator controls and indicators.

**Table 2-1. Controls and Indicators**

| NAME | ITEM | FUNCTION |
|---|---|---|
| POWER ON | Green lamp assy | Indicates that the equipment is energized. |
| HIGH LEVEL (User Option) | Amber lamp assy | Indicates that the holding tank contents should be discharged. |
| LOW LEVEL (User Option) | Amber lamp assy | Indicates that the holding tank contents are low. |
| ALARM SILENCE (User Option) | Pushbutton actuator | Turns off the audible alarm which indicated that the holding tank was discharged sufficiently to resume normal operation. |
| HAND/OFF/AUTO | Selector Switch | Selects function of Macerator/Transfer (M/T) pump. |
| HAND START | Pushbutton actuator | Starts M/T pump in hand mode. |

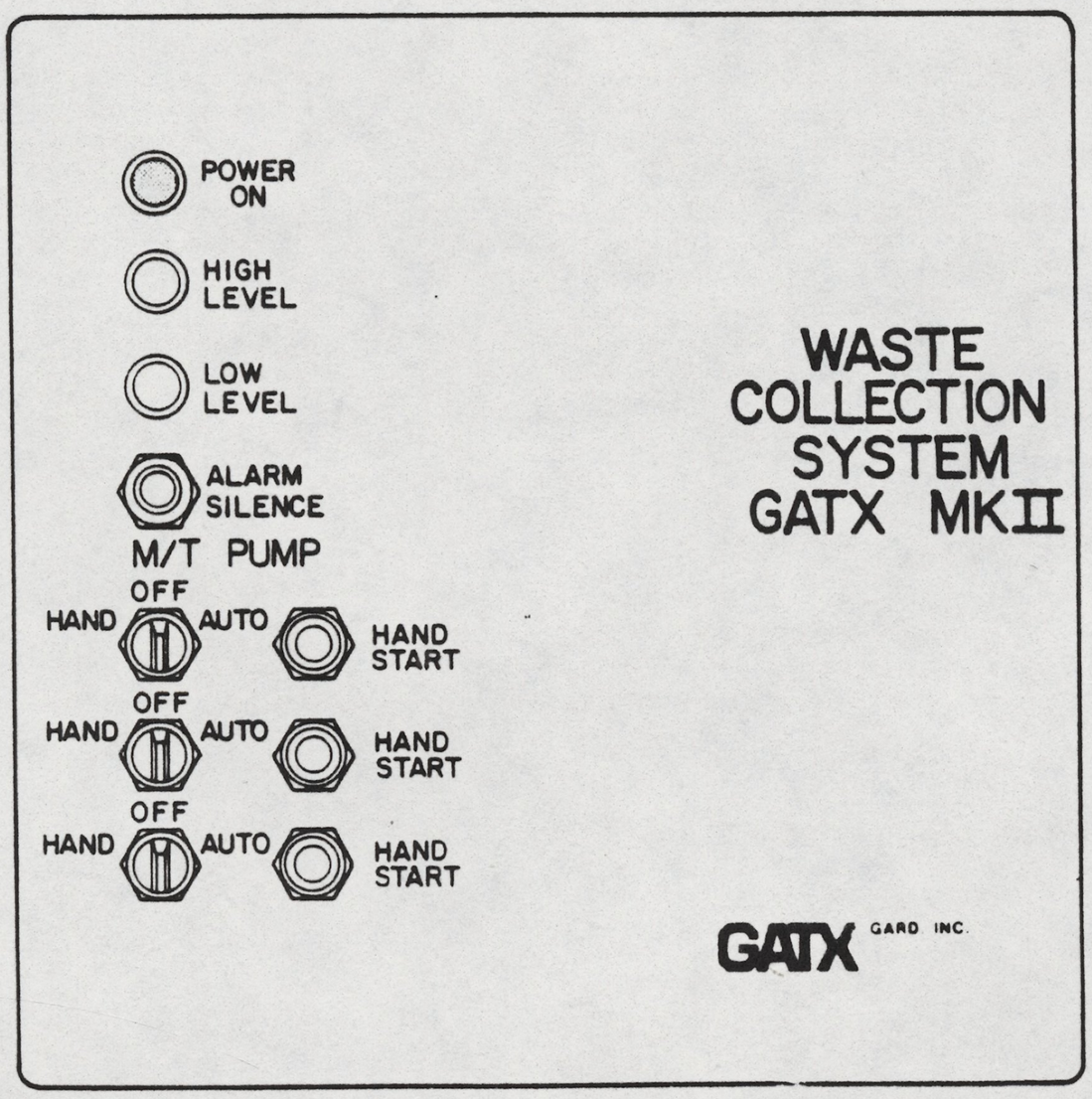


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Figure 2-2. Controls and Indicators

## 2-7. OPERATING MODES.

**2-8. VALVE OPERATION SETTINGS.** Refer to table 2-2 for proper valve operation settings for the various operating modes. Figure 2-3 shows the interconnection plumbing and identifies the functional location of each of the valves.

**2-9. NORMAL COLLECTION.** Set the valves as indicated in table 2-2.

**2-10. EMERGENCY COLLECTION.** In the unlikely event that all macerator/transfer pump assemblies fail, the system allows for manual flushing of at least one commode discharge line. This will allow temporary use of at least one commode until the macerator/transfer pump assemblies can be repaired. The following procedure details this manual flush mechanism (refer to figure 2-3).

(1) Set valves for emergency disposal as shown in table 2-2.
(2) Attach a fire hose to the vent-line connection located outside the deck house near the applicable commode.
(3) Employ the normal commode flushing techniques when using the commode for urination and defecation.
(4) Apply water pressure to the fire hose at the vent-line connection in order to drain sewage from the line below the commode.
(5) Reset the system's valves for normal collection.

**2-11. DISCHARGE TO PIERSIDE FACILITY.** When the sewage holding tank has been filled to 80 percent of its capacity, the HIGH LEVEL lamp glows and the audible alarm in the tank area signals an alert to the need for emptying the holding tank. The following procedure is for discharge to pierside facilities.

(1) Connect the sewage transfer hose between the pier connection and the vessel's topside sewage discharge connection, and cap the opposite discharge connection.
(2) Refer to table 2-2 and set each of the valves to proper position for discharge pierside facility.
(3) Silence the audible alarm by pressing the ALARM SILENCE switch.
(4) Open the holding tank flushing valve (figure 2-3), and flush the tank, piping, and hoses. Close the flushing valve when finished.
(5) Reset the valves for normal sewage collection.
(6) Remove the sewage transfer hose, recap the vessel's topside sewage discharge and uncap the opposite discharge connection before getting underway.

**2-12. DISCHARGE OVERBOARD.** Discharge of tank contents directly overboard into washers not prohibited from such discharge is accomplished by use of the following procedure (refer to figure 2-3).

(1) Set the valves for overboard disposal as shown in table 2-2.
(2) Silence the audible alarm by pressing the ALARM SILENCE switch.
(3) Open the holding tank flushing valve, and flush the tank, piping, and hoses. Close the flushing valve when finished.
(4) Reset the system's valves for normal sewage collection.

**2-13. FLUSHING SEWAGE HOLDING TANK.** During periods of limited usage the volume of sewage collected may be insufficient to activate the alarm system, but may cause accumulation of gas. Pump down and flush the holding tank at least once every four days according to the following procedures.

**WARNING**

Accumulation of gas in the holding tank is a health and safety hazard.

(1) Reset valves for shore or overboard discharge as described in table 2-2.
(2) Pump the tank down to the low water level.

**CAUTION**

Dry operation of the macerator/transfer pump assembly can cause damage to its internal parts.

(3) Open the tank flushing valve (figure 2-3).
(4) Run pump as the salt water sprays inside of the tank.
(5) Continue flushing for five minutes.
(6) Close the tank flushing valve.
(7) Pump the tank down to the low water level.

**NOTE**

If the LOW LEVEL lamp lights, stop the pump until the indicator lamp goes out. If the HIGH LEVEL lamp lights, close the tank flushing valve and start over at step (2).

**NOTE**

In the event that the water level does not rise to the high water level sensor during the flushing, check the sensor by stopping the pump long enough for the HIGH LEVEL lamp to operate. As soon as the HIGH LEVEL lamp comes on immediately shut the tank flushing valve, and repeat step (7).

(8) Reset the system's valves for normal sewage collection.

**2-14. NORMAL/EMERGENCY OFF-LOADING-HOSE FLUSHING.** After the holding tank has been pumped down, set the valves as shown in Table 2-2 for Flush Discharge Line & Hose. Flush out the off-loading-hose with sea water.

**Table 2-2. Valve Operation Setting**

| OPERATING MODE | VALVE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | J | K | L | M |
| Collection: | | | | | | | | | | | | |
| Normal | ▲ | ○ | ● | ● | ● | ● | ● | ○ | ● | ○ | ● | ● |
| Emergency | X | ● | ● | ● | ● | ● | ● | ○ | ○ | ● | ● | ● |
| Discharge: | | | | | | | | | | | | |
| Pierside Facility | ▲ | ○ | ○ | ● | ● | ○ | ○ | ○ | ● | ● | ● | ○ |
| Overboard | ▲ | ● | ○ | ● | ○ | ● | ● | ○ | ○ | ● | ● | ○ |
| Emergency — Pierside Facility | ▲ | ○ | ● | ○ | ● | ○ | ○ | ○ | ● | ● | ● | ○ |
| Emergency — Overboard | ▲ | ● | ● | ○ | ○ | ● | ● | ○ | ○ | ● | ● | ○ |
| Flush Discharge Line & hose | ▲ | ● | ○ | ● | ● | ● | ○ | ○ | ● | ○ | ○ | ● |

Code: Valve A
▲ Macerator/Transfer Pump setting
X Overboard setting

Code: Valve B through M
○ Open setting
● Closed setting

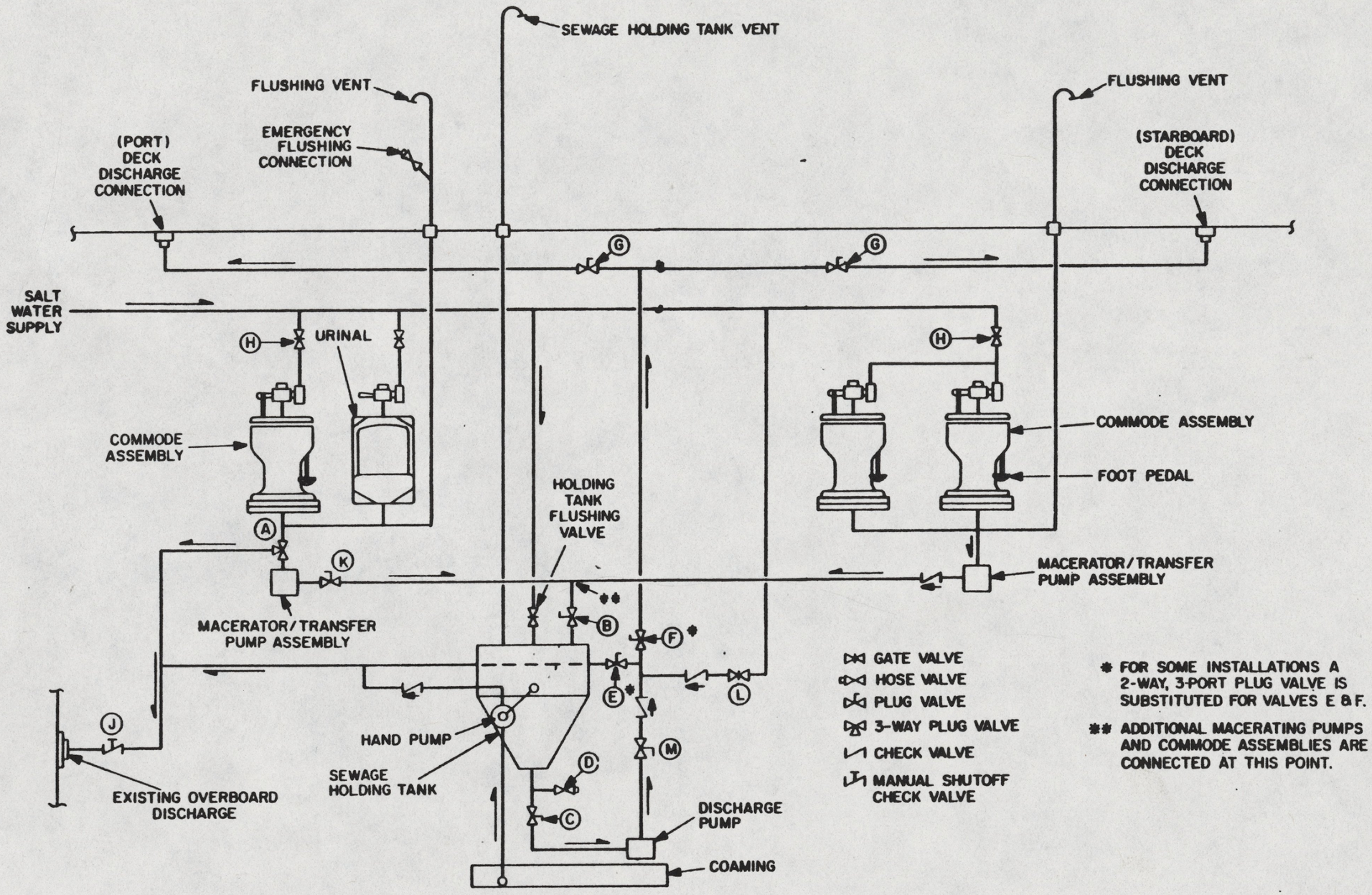


Figure 2-3. Valve Identification with Interconnection Plumbing

# CHAPTER 3
# FUNCTIONAL DESCRIPTION

## 3-1. INTRODUCTION.

This chapter describes the operation of an MSD-MK II. Paragraph 3-2 describes the electrical controls that form the machine-operator interface while paragraph 3-3 covers the balance of the system.

## 3-2. FUNCTIONAL ANALYSIS.

Both the water closets (commodes) and the urinal (figure 3-1) receive flush water through a flush valve. The valves limit the water to 1 pint for each flush. For urination only the flush valves are operated by the operator. This washes the urinal or the commode and transfers the liquid to the line connected to the macerator/transfer pump. After the commode is used for defecation the flush pedal is depressed by the user. The flush pedal is mechanically linked to the flush valve. This causes the flush valve to operate releasing about 1 pint of water into the commode. At the same time the flush pedal closes a microswitch on the commode which activates a circuit in the timing and control assembly. This circuit turns on the macerator/transfer pump for about 10 seconds. The macerator/transfer pump pulverizes the waste material and transfers it to the sewage holding tank. The sewage holding tank has both a high level and low level sensing circuit. The high level sensing circuit causes a HIGH LEVEL indicator lamp on the timing and control assembly to light indicating that the tank is 80% full. The low level sensor indicates when the liquid level in the holding tank is near the empty condition. This sensor activates an audible alarm indicating the tank has been emptied.

**NOTE**

The Low Level and High Level Alarm and indicator circuit may not be externally connected depending on the specific installation.

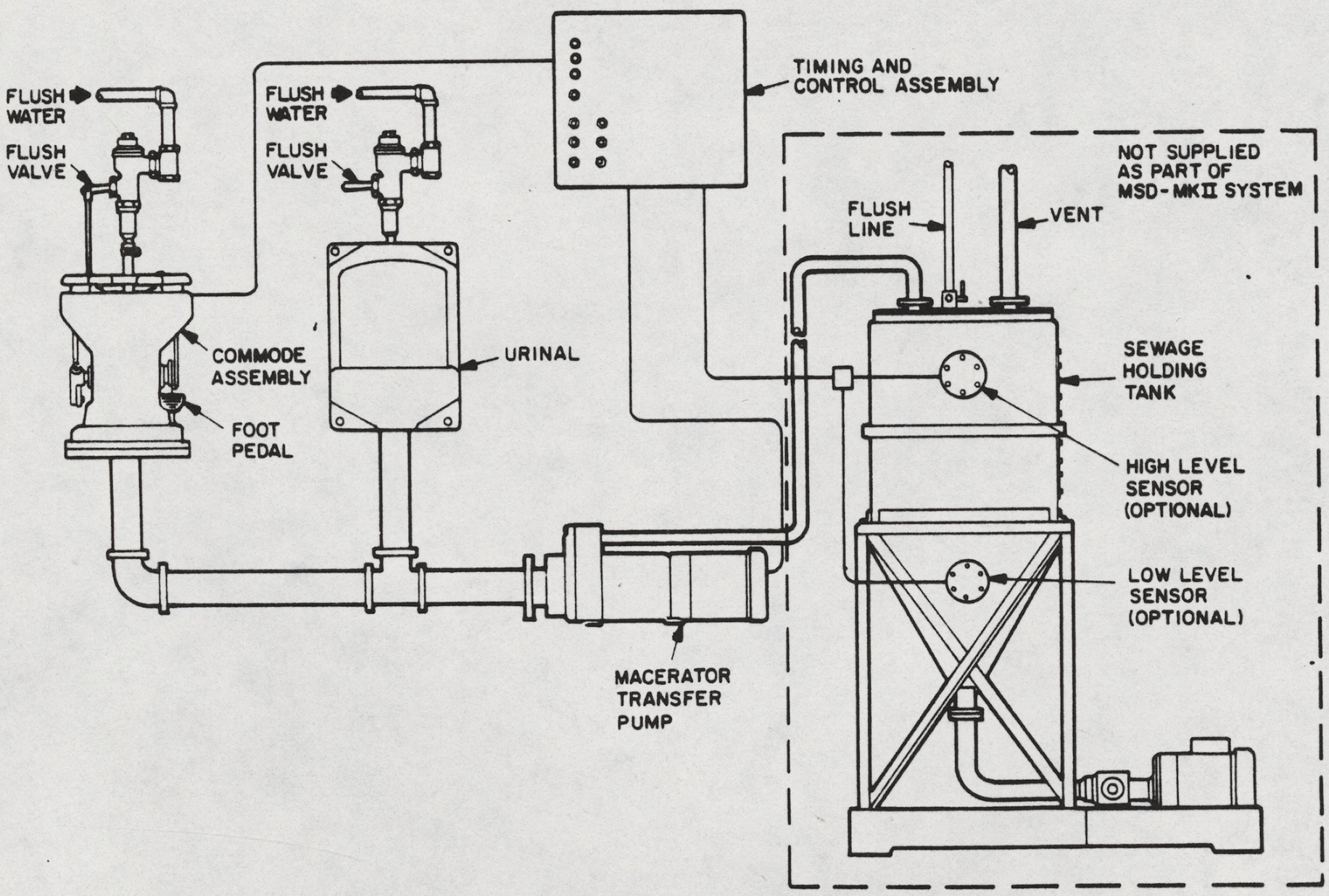


Figure 3-1. Functional Diagram

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## 3-3. ELECTRICAL CONTROLS and INDICATORS, (Refer to Figure 3-2).

**3-4. LOW LEVEL ALARM (USER OPTION).** When the holding tank water level is below the low level sensor, the low level switch (line 3) opens, deenergizing CR2. The normally closed contacts of CR2-B (line 4) energize the LOW LEVEL lamp (LT3) and the normally closed contacts of CR2-A (line 5) sound the audible alarm. Momentarily closing ALARM SILENCE switch S1 (line 7) energizes alarm silence relay CR1 and silences the audible alarm by opening contacts (R1-A1 line 5). When the normally closed contacts of CR1-A open, the audible alarm circuit is deenergized. When the ALARM SILENCE switch is released and opens, relay CR1 (line 7) is held operated by its own contacts CR1-B (line 6). As the water level rises, the low level sensor switch closes, energizing low level relay CR2 (line 3). When relay CR2 operates, contacts CR2-B (line 4) open, deenergizing the LOW LEVEL lamp (LT3) circuit and contacts CR2-A (line 5) open to deenergize alarm silence relay CR1 permitting it to restore.

**3-5. HIGH LEVEL ALARM (USER OPTION).** When the water level rises to close the high level switch, CR3 (line 2) energizes. HIGH LEVEL lamp (LT2) (line 8) and the audible alarm (line 5) become energized through relay contacts CR3-A (line 8). The audible alarm may be silenced as described in the previous paragraph. Pumping the tank down will cause the high level switch to open deenergizing relay CR3 (line 2). Relay contacts CR3-A (line 8) open to deenergize HIGH LEVEL lamp (LT2) and also to reset alarm silence relay CR1 (line 7). When the tank level reaches a level below the low level switch actuating point, then the audible alarm will sound and the LOW LEVEL lamp will light as described earlier.

## 3-6. MACERATOR TRANSFER PUMP CONTROL.

**3-7. General.** The macerator/transfer pumps can be operated automatically or manually. A three position MANUAL-OFF-AUTO switch is used to select the type of operation. In the OFF position of the MANUAL-OFF-AUTO switch the macerator/transfer pumps starter solenoids (MS1, MS2 and MS3) (lines 12, 16, and 19) are disconnected from operating voltage. This prevents either the manual or auto from energizing the starter solenoids. Refer to paragraph 3-8 for auto operation and paragraph 3-9 for manual operation.

**3-8. AUTO Operation.** When the MANUAL-OFF-AUTO switch is in the AUTO position and a commode is flushed, a microswitch (line 9, 10, 13, 14 or 17) closes and completes the circuit between an associated motor starter (line 12, 15, or 19) and an associated time delay (delay on operate) relay (TR) (line 11, 15, or 18). The coil of the motor starter becomes energized and its holding contacs (line 12, 15, or 19) close. This set of contacts maintains power on the coils of the motor starter and the time delay relay after the micros witch opens. Other motor starter contacts (line 20 through 28) start the macerator/transfer pump motors. When the time delay relay completes its timing cycle, normally closed contacts (line 12, 16, or 19) open and interrupt the power to the coil of the magnetic motor starter and the time delay relay turning off the macerator/transfer pump. The length of the operating cycle is controlled by a resistor in the time delay relay circuit. For a 10-second cycle the required resistance is 220k ohms.

**3-9. MANUAL Operation.** When the MANUAL-OFF-AUTO switches are in the MANUAL position the macerator/transfer pump starter solenoids MS1, MS2 and MS3 (lines 12, 16 and 19) are connected to pushbutton switches S5, S6 and S7 (lines 11, 15, and 18) respectively. Thus if pushbutton S5 is pressed motor starter solenoid MS1 is energized closing the circuits at lines 20, 21 and 22 energizing macerator pump number 1. The pump remains energized until the switch is released. Operation of pump number 2 by switch S6 and operation of pump 3 by switch S7 is identical to operation of pump 1 by switch S5.

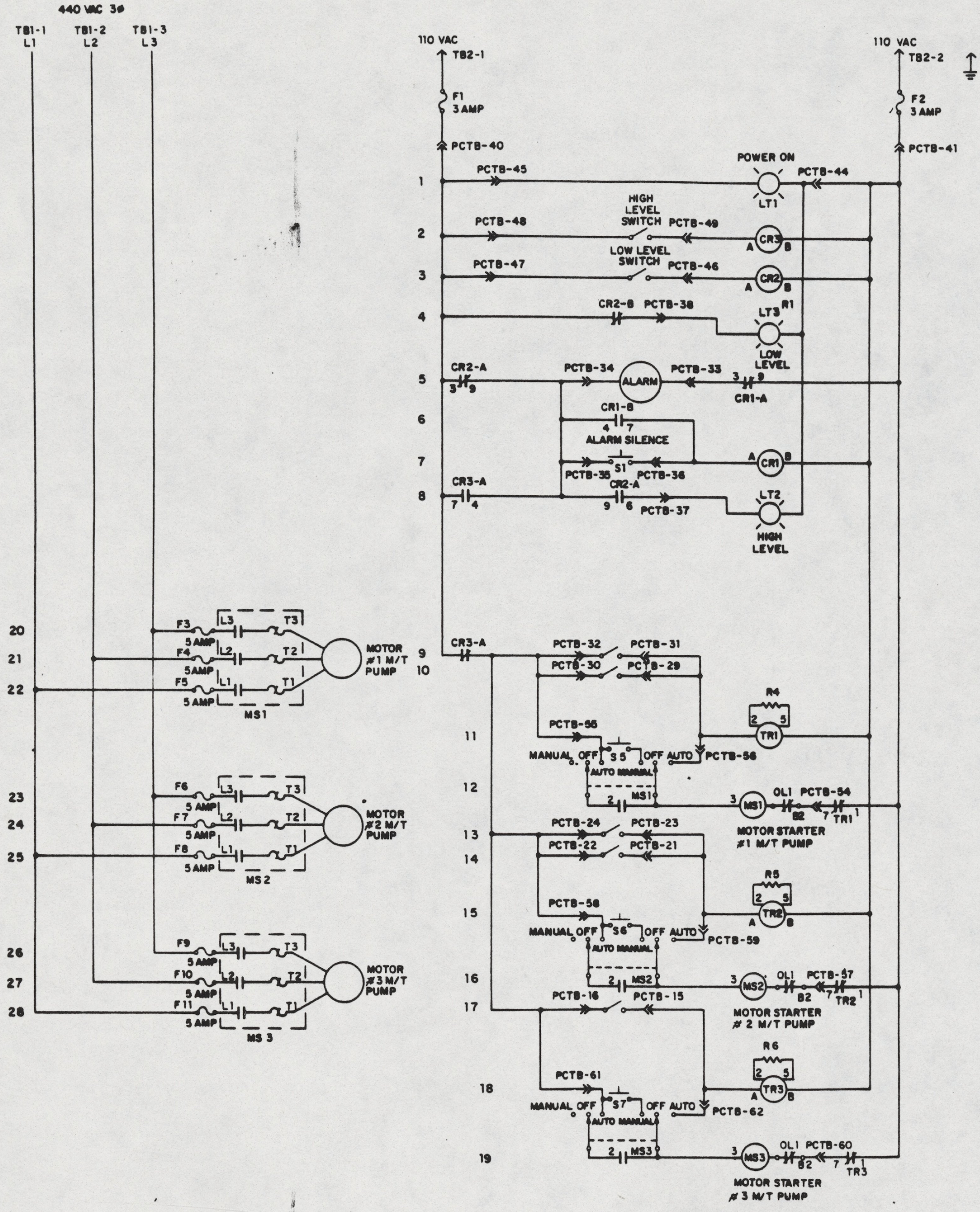



Figure 3-2. Schematic Diagram

**NOTE**

The following descriptions are for a typical installation using a sewage holding tank.

**3-10. WASTE PROCESSING COMPONENTS. (Refer to figure 3-3).**

**3-11. NORMAL COLLECTION.** Pressing the manual flush handle actuates the flush valve, allowing one pint of water from the ship's supply to flow through valve H into the commode bowl for "wet bowl" usage. Stepping on the foot pedal accomplishes several things. First, the flush valve cable assembly, which couples the foot pedal to the manual flush handle, pulls the flush handle allowing a pint of water to enter the commode. Next, a flapper valve at the bottom of the bowl opens, allowing the waste and flush water to drop through valve A beneath the bowl. A flushing vent voids the effect of air pressure changes caused by the fluids rushing through the pipes. Operating the foot pedal also actuates a microswitch, which activates a motor starter that turns on the associated macerator/transfer pump assembly to transport the resulting slurry through valves K and B to the sewage holding tank. The sewage holding tank, vented to the atmosphere to prevent buildup of dangerous gases, holds the sewage until it can be discharged safely and conveniently.

**3-12. EMERGENCY COLLECTION.** With valves set for collection in emergency operating mode (see table 2-2), sewage can flush only from those commodes which are installed with a connection to the ship's overboard discharge. Installed as shown in figure 3-3, three-way plug valve A diverts the sewage out through the opened manual shutoff check valve at the existing overboard discharge when water pressure is applied through a hose connected to the emergency flushing connection.

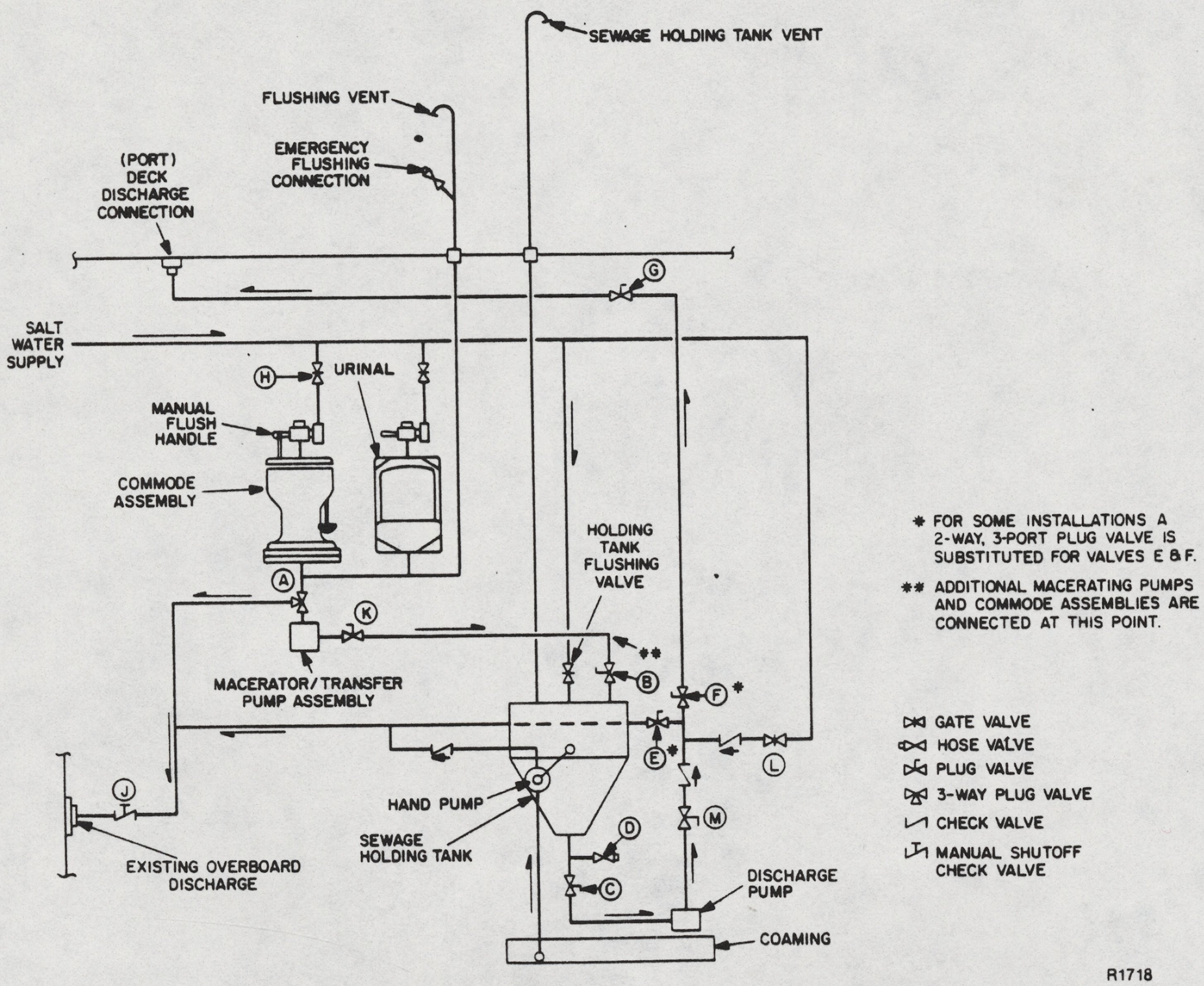



Figure 3-3. Waste Processing Diagram

**3-13. NORMAL DISCHARGE TO PIERSIDE FACILITIES.** With valves set for discharge to pierside facilities in the normal mode (see table 2-2), the system's discharge pump will transfer the collected sewage. Its route will be from the sewage holding tank, past closed hose valve D, through opened plug valve C, past closed valve E, and through opened plug valves M, F and G to the deck discharge connection and disposal at an on-shore facility.

**3-14. NORMAL DISCHARGE OVERBOARD.** With valves set for overboard discharge in the normal mode (see table 2-2), the system's discharge pump transfers sewage from the sewage holding tank past closed hose valve D, through opened plug valves C and M, and diverted by past closed plug valve F, and to the sea through open plug valve E and the opened manual shutoff check valve at the ship's existing overboard discharge.

**3-15. EMERGENCY DISCHARGE.** For emergency conditions, such as those caused by failure of the system's discharge pump, a second pump must be procured. Then, with valves set for discharge in the emergency mode (see table 2-2), sewage will flow from the holding tank, be diverted by closing plug valve C and pumped out through the hose as portable pump connected at opened hose valve D.

**3-16. NORMAL/EMERGENCY OFF-LOADING-HOSE FLUSHING.** After the holding tank has been pumped down, set the valves as shown in Table 2-2 for Flush Discharge Line & Hose. Flush out the off-loading-hose with sea water.

# CHAPTER 4
# SCHEDULED MAINTENANCE

## 4-1. INTRODUCTION.

**4-2. GENERAL.** Preventive maintenance is the systematic care, servicing and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to maintain the equipment in serviceable condition.

1 Operator preventive maintenance to be performed daily and weekly is specified in procedures provided in paragraphs 4-6 and 4-7. Additional preventive maintenance is performed monthly, quarterly, and annually as specified in procedures provided in paragraphs 4-8, 4-9 and 4-10.

2 Defective items that cannot be corrected must be reported to higher category maintenance personnel. Records and reports of repairs and preventive maintenance must be made.

**4-3. Preventive Maintenance Checks and Services Periods.** Preventive maintenance checks and services for an operating MSD-MK II are required weekly and quarterly. These checks and services must be performed during the specified periods.

## 4-4. MAINTENANCE PLAN.

To efficiently maintain the operational capability of the MSD-MK II, the following procedures must be performed at the scheduled intervals.

**GENERAL.** In keeping with good maintenance practices, personnel shall be constantly alert for leaks in any of the system. Since the system piping and holding tank contains raw sewage, which presents a health hazard, leaks must be reported and immediate corrective action taken to stop the leak.

**4-6. DAILY.** Remove clinging solids from the inside of the commode by following these steps.

1 Apply nonfoaming household cleaner or equivalent to the commode.

2 Wipe porcelain area inside commode with a soft, mophead type brush.

3 Unplug any clogged orifices inside commode rim with a stiff, short cleaning wire if unevenness of spray is present.

**CAUTION**

Repeated flushing of the commode during the cleaning process will reduce the useful capacity of the holding tank.

**4-7. WEEKLY.** Check the operation of the alarm circuit in the timing and control enclosure assembly through the following procedure (refer to figure 2-2).

(1) Jump PCTB terminal 48 to terminal 49 to check HIGH LEVEL indicator lamp individually and jump PCTB terminal 46 to terminal 47 to check LOW LEVEL indicator lamp individually.

(2) Alert proper maintenance personnel if any lamp fails to glow under test.

**4-8. MONTHLY.** Lubricate all commode assembly linkages with a suitable water insoluble grease such as "Lubirplate."

**4-9. QUARTERLY.** Insure the continued operating efficiency of the system discharge pump by following these steps.

(1) Check the mounting bolts holding down the dischage pump for tightness.

(2) Tighten any mounting bolts that have worked loose.

**4-10. ANNUAL.** Perform the following steps on the system's commode(s) on a yearly basis or whenever the ship in which it is installed is in for an overhaul.

(1) Check microswitch cam arm adjustment and assure that switch plunger is fully depressed when pedal is at rest (see figure 4-1).

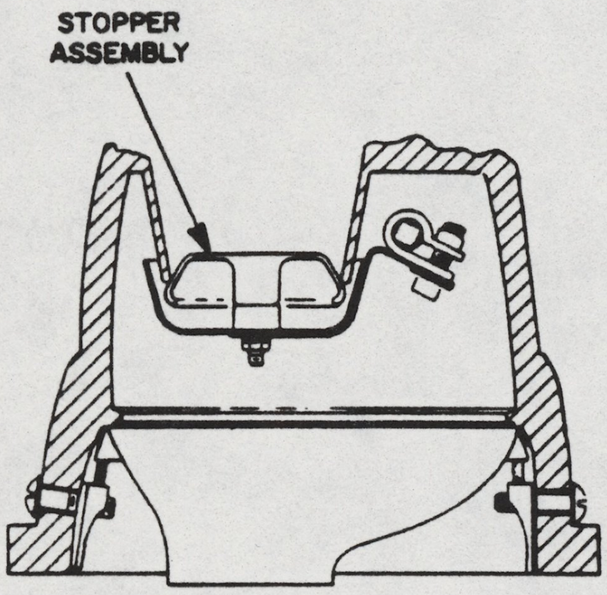
(2) Check volume of water released by flush valve when valve is activated. Volume should be one pint at 20-50 psig input line pressure. Adjust if required as described in paragraph 6-2.

(3) Fill commode bowl with approximately two pints of water and check stopper assembly for leakage. If necessary, remove commode and adjust, or replace stopper if necessary.

(4) Check flush water pattern as sprayed by commode flush pipe.

(5) Open any plugged or restricted orifices in flush pipe with a cleanout wire if required.

(6) Reset flush pipe position if pattern is not uniform.




SECTION A-A

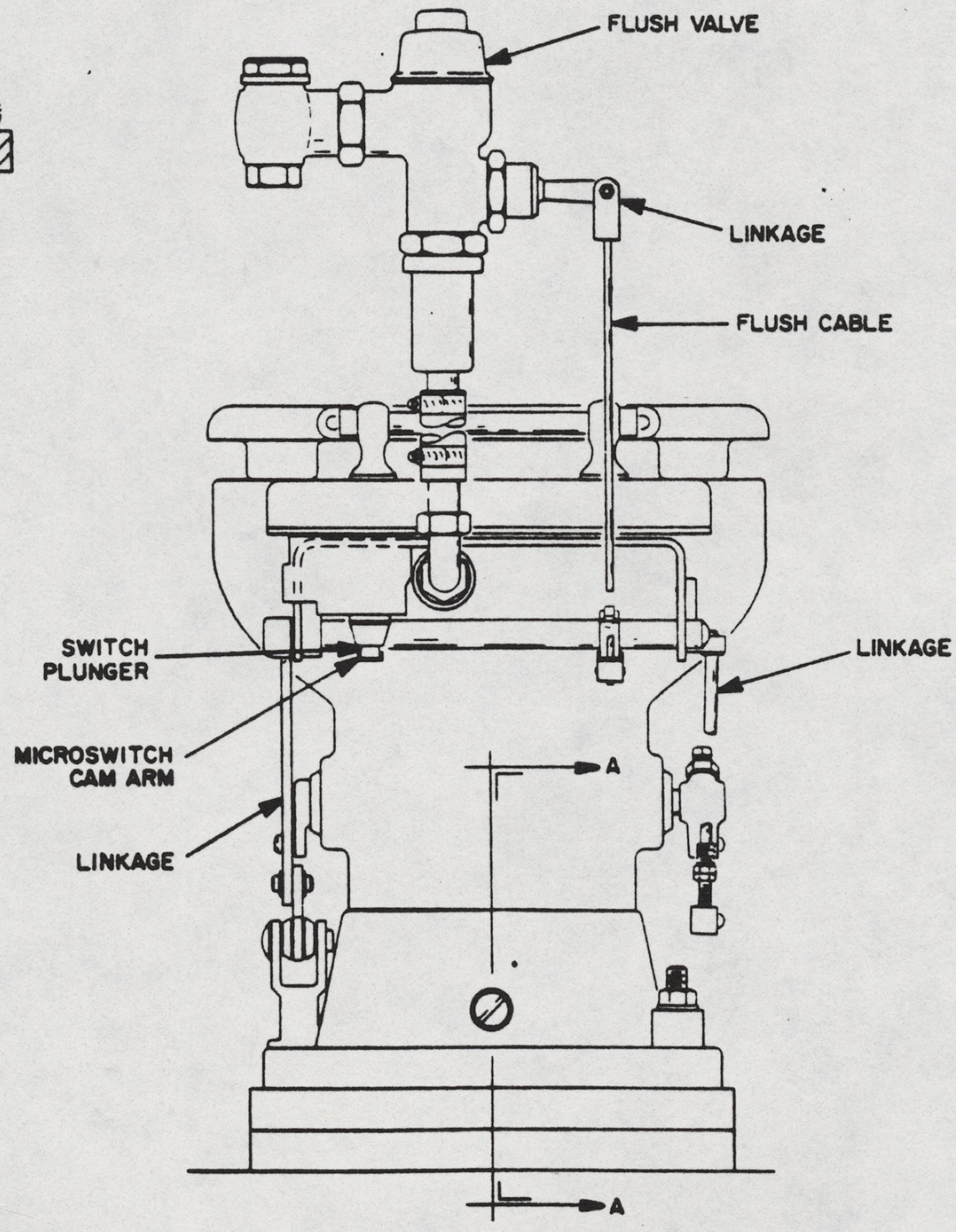



Figure 4-1. Commode Adjustment Parts Location

# CHAPTER 5
# TROUBLESHOOTING

## 5-1. SCOPE.

This chapter contains information intended to help the technician quickly and efficiently locate either the source of an equipment malfunction or the underlying cause of performance deterioration. The information therefore has been arranged into a fault logic diagram, which breaks down the troubleshooting procedure into logical steps. Branching series of "yes-or-no" questions and answers observe to progressively narrow the possible functional area of a fault and finally refer to the portion of the manual that explains the repair.

## 5-2. ARRANGEMENT OF DATA.

Questions enclosed in single-line boxes require measurements by special setup of external test equipment; questions in shaded boxes can be answered by observation without changing the test setup. Statements in double-line boxes are conclusions and recommended repair procedures and reference applicable illustrations and text in this manual. A dashed line leading from a box indicates a "no" answer to the question within; an unbroken line leading from a question box denotes a "yes" answer.

## 5-3. TROUBLESHOOTING CHARTS.

The troubleshooting charts are in the form of fault logic diagrams. Refer to Figure 5-1 through Figure 5-4 for these diagrams.

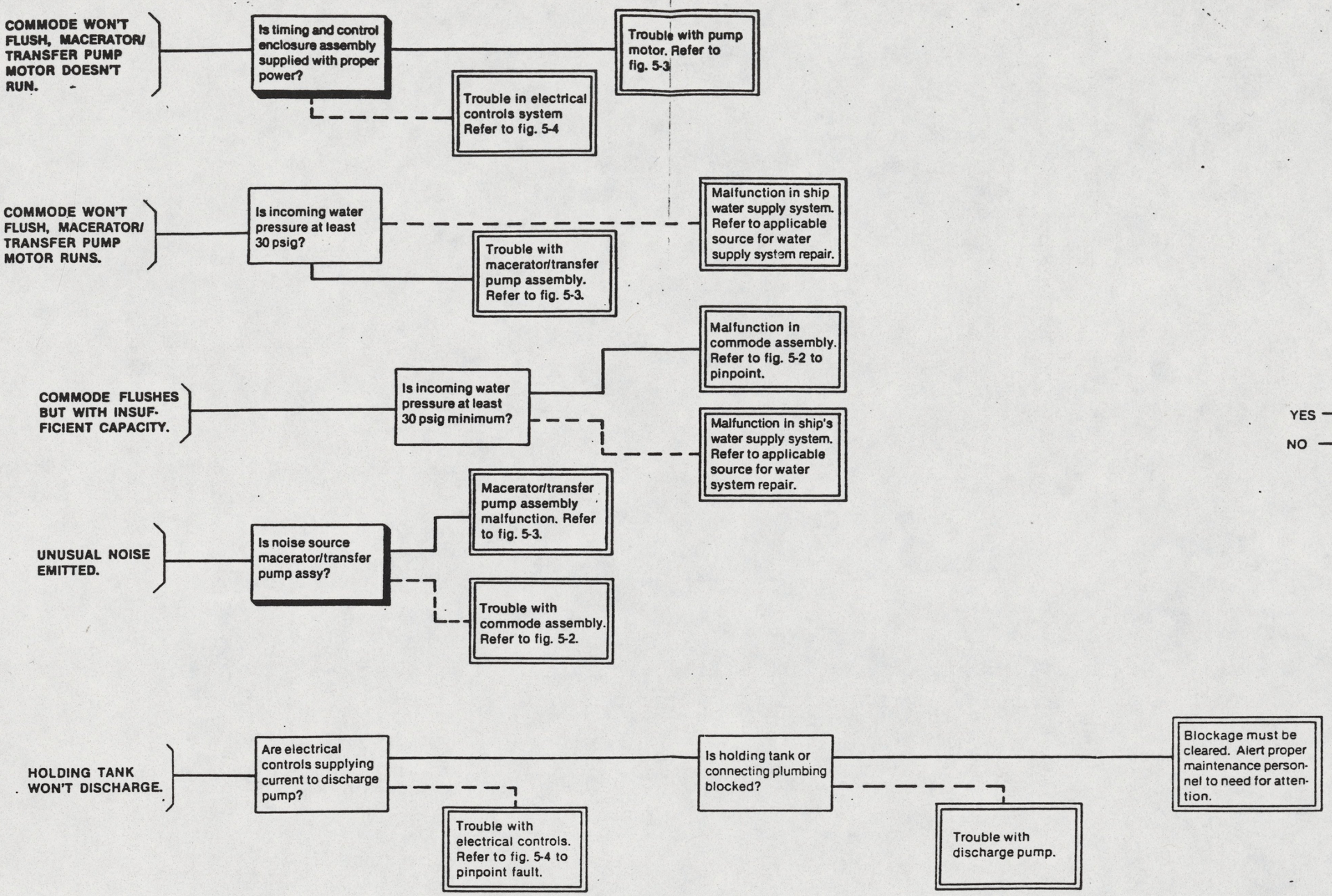



Figure 5-1. Marine Sanitation Device Fault Logic Diagram

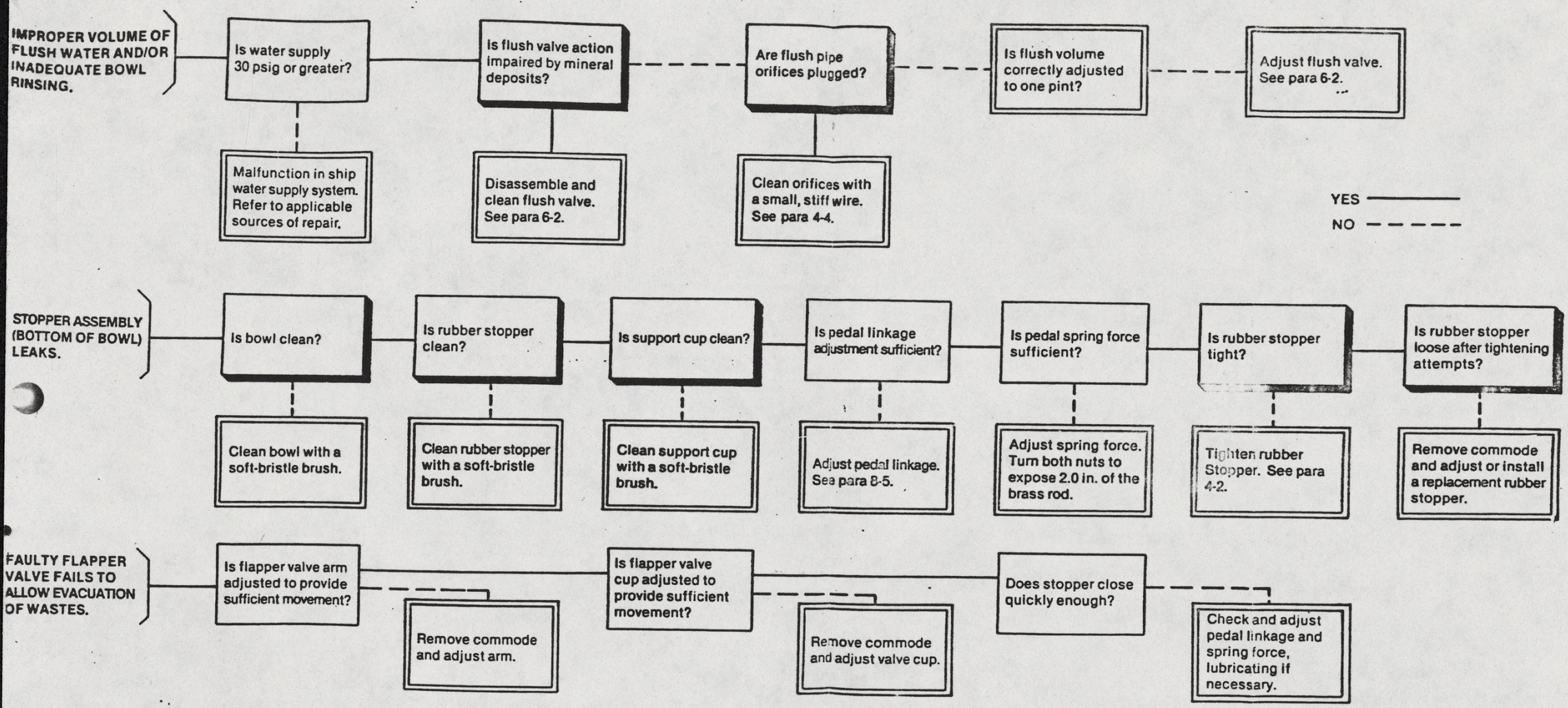



Figure 5-2. Commodore Fault Logic Diagram

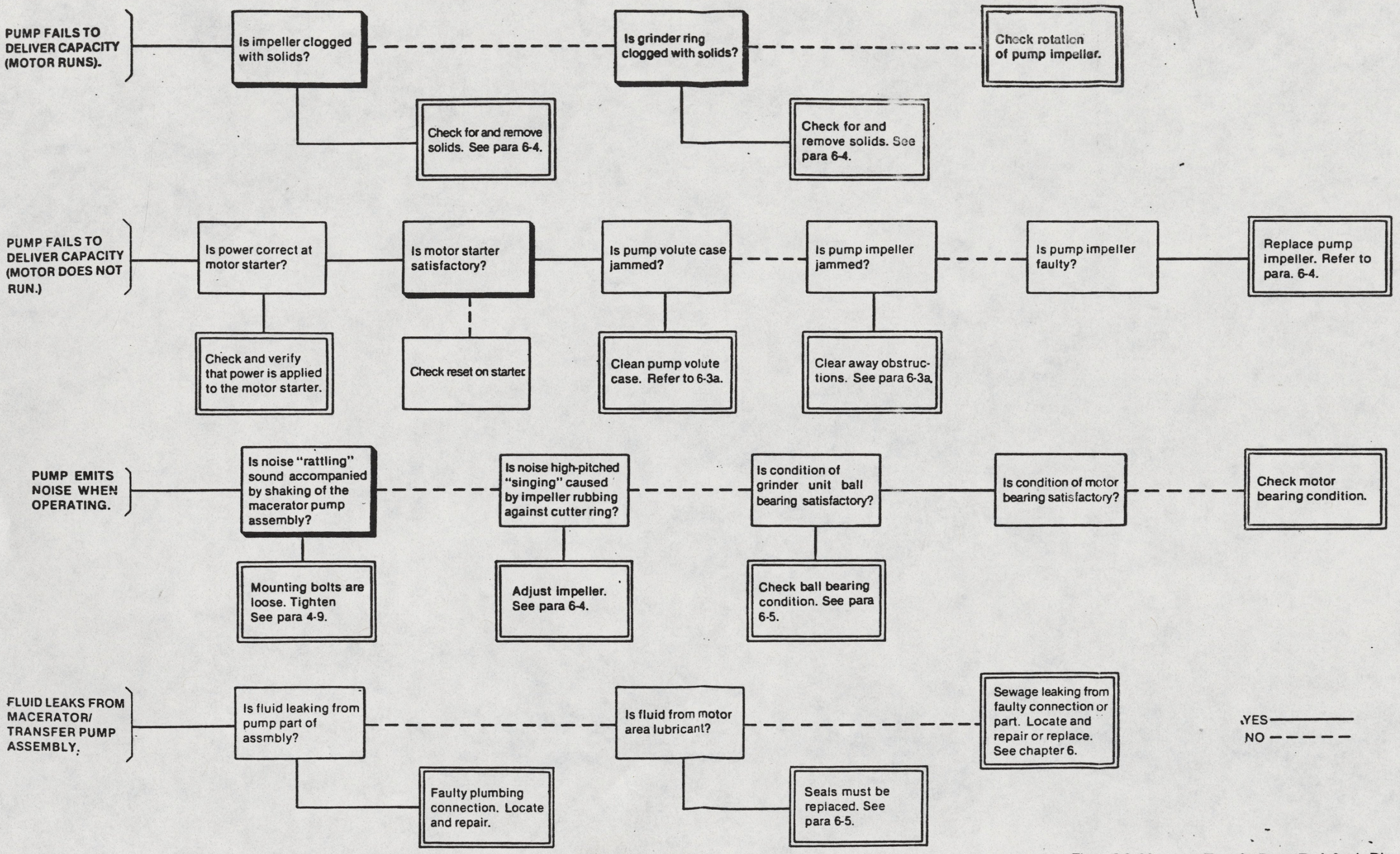



Figure 5-3. Macerator/Transfer Pump Fault Logic Diagram

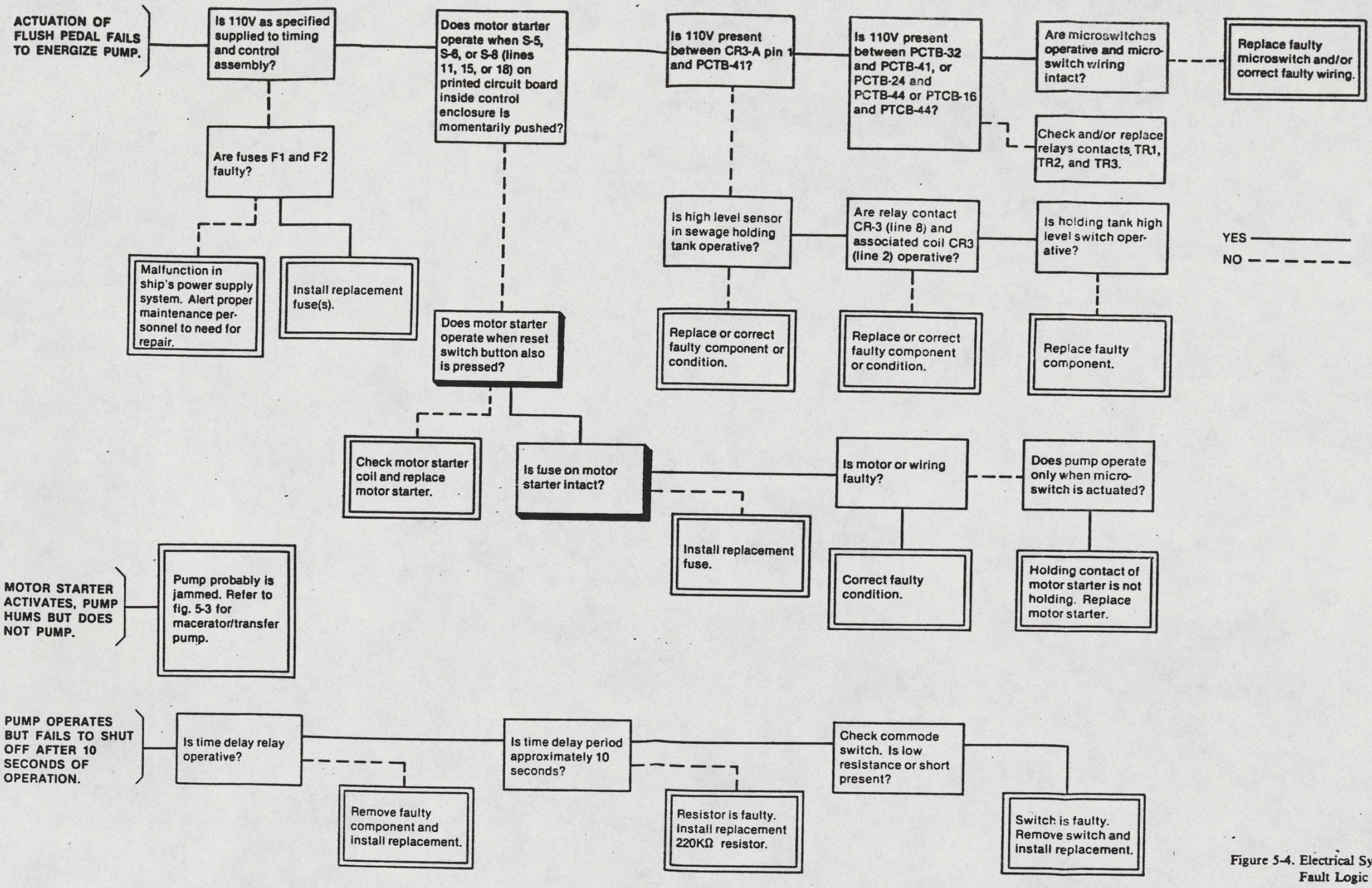



Figure 5-4. Electrical System Fault Logic Diagram

# CHAPTER 6
# CORRECTIVE MAINTENANCE

## 6-1. INTRODUCTION.

This chapter contains procedures recommended for repairing the MSD-MK II. For efficiency, this material is presented with the system broken down into its major components: a commode assembly, urinal assembly and macerator/transfer pump assembly.

## Section I ADJUSTMENT AND ALIGNMENT

## 6-2. GENERAL.

No electrical adjustments are required for the system. The length of time the macerator/transfer pump operates when activated is determined by the value of the resistor connected across the associated time delay relay. This is normally set for about 10 seconds using a 220K resistor.

Mechanical alignment of the cutter blades in the macerator/transfer pump is described in the repair procedures for the pump paragraph 6-8. Procedures for adjusting the flush valve flush volume are described in the repair procedures for the commode, paragraph 6-5. The adjustment procedure for the flush valve cable asembly is described in paragraph 8-11 of the Installation Section.

## Section II REPAIR

**6-4. COMMODE.** The replacement of parts on the commode is obvious upon inspection and requires no special instructions. Refer to the illustration in the parts list section for identification of replacement parts.

**6-5. FLUSH VALVE** If a decrease in commode assembly flush valve output is noticed, it may be necessary to clean the inside of the flush valve. To accomplish this, follow these steps:

1. Remove the cover as shown in figure 6-1.
2. Remove the piston, and use water to rinse all parts that are dirty.
3. Check that the flush volume is adequate after cleaning.
4. Readjust flush volume, if necessary, by turning the adjusting screw clockwise to reduce the volume of flush water or turning the same screw counterclockwise to increase volume.

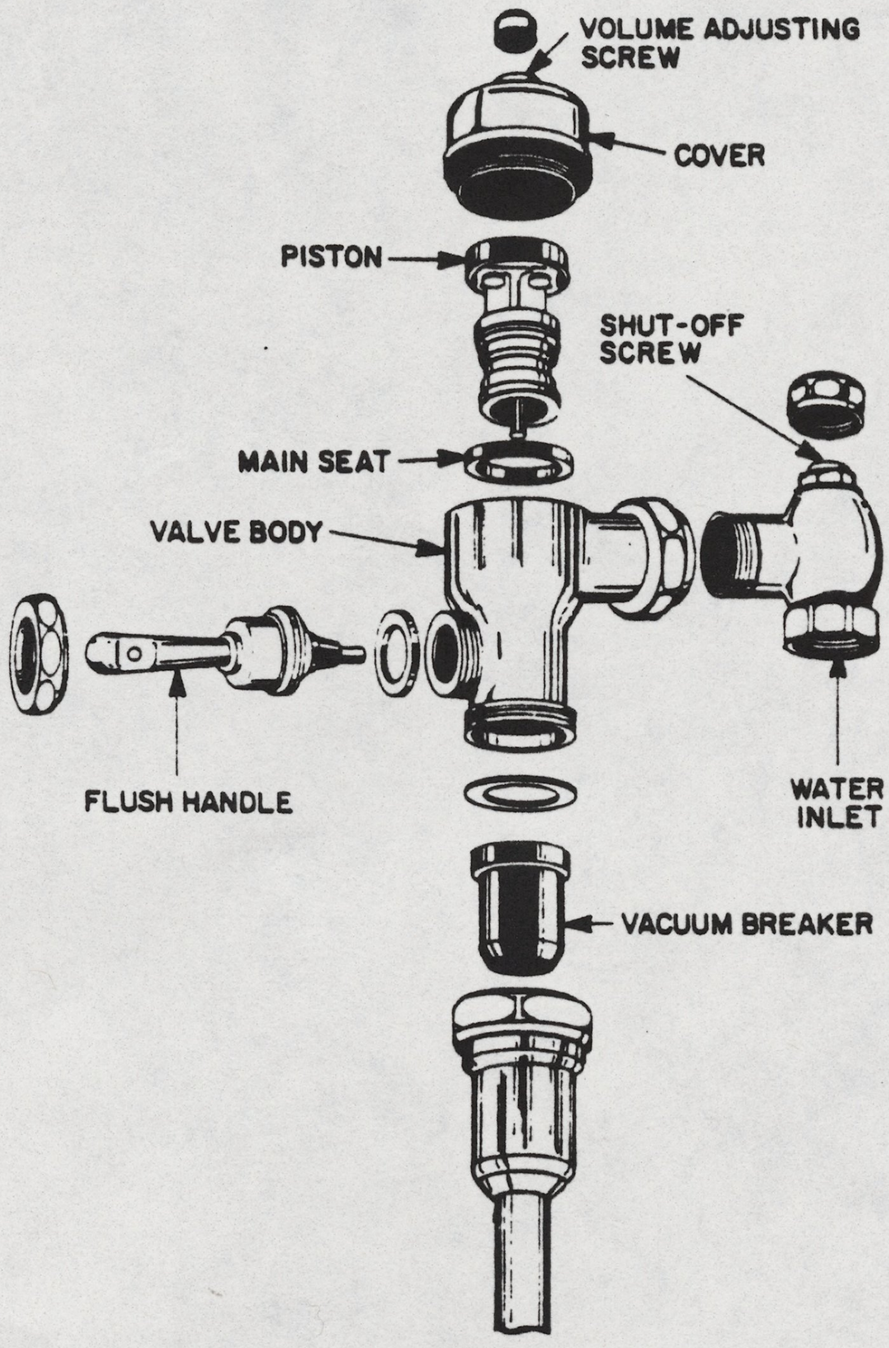



Figure 6-1. Commode and Urinal Flush Valve

## 6-6. URINAL ASSEMBLY

The urinal assembly flush valve in the same as the commode. Refer to paragraph 6-5.

## 6-7. MACERATOR/TRANSFER PUMP ASSEMBLY SERVICING PROCEDURE.

Refer to Figure 6-2 for identification of parts listed in the following procedures.

## 6-8. CLEANING VOLUTE CASE AND/OR REPLACING GRINDER PARTS.

**WARNING**

Never work on pump or control panel with power on. Tag "OUT OF SERVICE."

1. Remove power cable for pump from timing and control enclosure assembly.
2. Remove pump from soil line.
3. Unscrew screws (38) and remove inlet flange and suction castings (1).
4. Unscrew screws (31) and remove pump volute case (2). Cutter ring (6) can now be removed from case (2). Keep shims (21) for reassembly.

**NOTE**

Lower radial cutter (4) and upper axial cutter (5) are now exposed. If checking for clogging, these parts can now be cleaned without removing from shaft.

5. If necessary to replace lower radial cutter, remove screw (32) and unscrew cutter (4) from shaft (thread is right hand).
6. Bump cutter (4) with plastic hammer if necessary to loosen. Cutter (5) lifts off of shaft and is held from rotating by pin (19). Be sure pin (19) is in place when reassembling.
7. If necessary to replace pump impeller (3), unscrew from shaft. Thread is right hand.
8. If new impeller (3) is used, face clearance may have to be adjusted from top bearing.
9. Replace impeller (3), cutter (5), and cutter (4) and replace case (2) but do not replace stationary cutter (6) at this point.
10. Release screws (40) on top bearing cap and tighten screws (29) until pump impeller (3) just drags on volute case (2).
11. Now back off on screws (29) 1/8 turn and tighten on screws (40) to lift impeller (3) for proper face clearance.
12. Now replace cutter (6) and inlet flange (1).
13. Turn cutter (4) with fingers; it must run free. If it is not free and some rubbing exists, remove cutter (6) and add extra shims (21). These are stainless steel shims and must be obtained from the factory. It may be necessary to loosen screws (31) in volute case (2) and tap with hammer to get proper clearance on O.D. of cutter (4).
14. Reconnect power and operate pump. Run pump for a few seconds only to be sure parts are not rubbing.
15. Be sure all parts are thoroughly clean before any replacement operations are begun.

## 6-9. REPLACING SEALS.

1. Remove plugs (13) from motor and from seal chamber and drain out all oil.
2. Remove cutter and pump parts as described in previous procedure.
3. Remove screws (33) in seal plate (10) and use two of the screws in the tapped back off holes to force plate (10) from bearing frame (7). Pushing this plate (10) off will also force seal (18) from shaft.
4. Remove retaining ring (39) and pull ball bearing (16) from shaft.
5. Remove locknut (15).
6. Remove oil seal (25).

**CAUTION**

Do not use any old seal parts. Replace all parts with new parts combining old with new seal parts during repair can cause immediate seal failure.

7. Thoroughly clean all parts before replacing, checking to be sure ball bearing or shaft is not worn. Be sure all O rings are in good condition without cuts or nicks. Replace if defective.
8. After all parts are replaced and before final assembly of pump and grinder parts refill seal chamber and motor chamber with oil. Lay pump on side to fill seal chamber. Do not fill completely, allow about 1/2 inch below fill plug so that there will be an air space for expansion. Set pump upright to fill motor chamber. Again fill so that oil level is just over the top of winding to allow air space for expansion.
9. Use only Hydr-O-Matic submersible oil in motor chamber and seal chamber. A high grade transformer oil can be used in the motor chamber and No. 20 non-detergent automobile oil can be used in the seal chamber.

## 6-10. ADJUSTMENT OF CUTTER MECHANISM

1. Lay pump on side so that pump inlet is exposed and can easily be reached by hand.
2. Using thumb and forefinger, turn radial cutter (4) to be sure shaft turns freely.

**NOTE**

Remember that the allen screws raise the shaft while the hex screws push the shaft downward.

3. Loosen jam nuts (35) on allen screws (40) located on top bearing cap.

**CAUTION**

The cap screws mentioned herein, both hex (29) and allen (40) varieties, must be tightened and/or loosened approximately the same amount.

4. Using proper size allen wrench, loosen allen screws (40).
5. Using proper size wrench, tighten hex screws (29) until axial cutter (5) just drags on cutter ring.
6. Back off hex screws (29) 1/8 turn.
7. Tighten allen screws (40) to lift impeller for proper clearance.
8. Tighten jam nuts (35) on allen screws (40).
9. Again turn radial cutter (4) with thumb and forefinger to determine if shaft has any drag.
10. If there is still some drag, repeat above steps and back off hex screws (29) further.

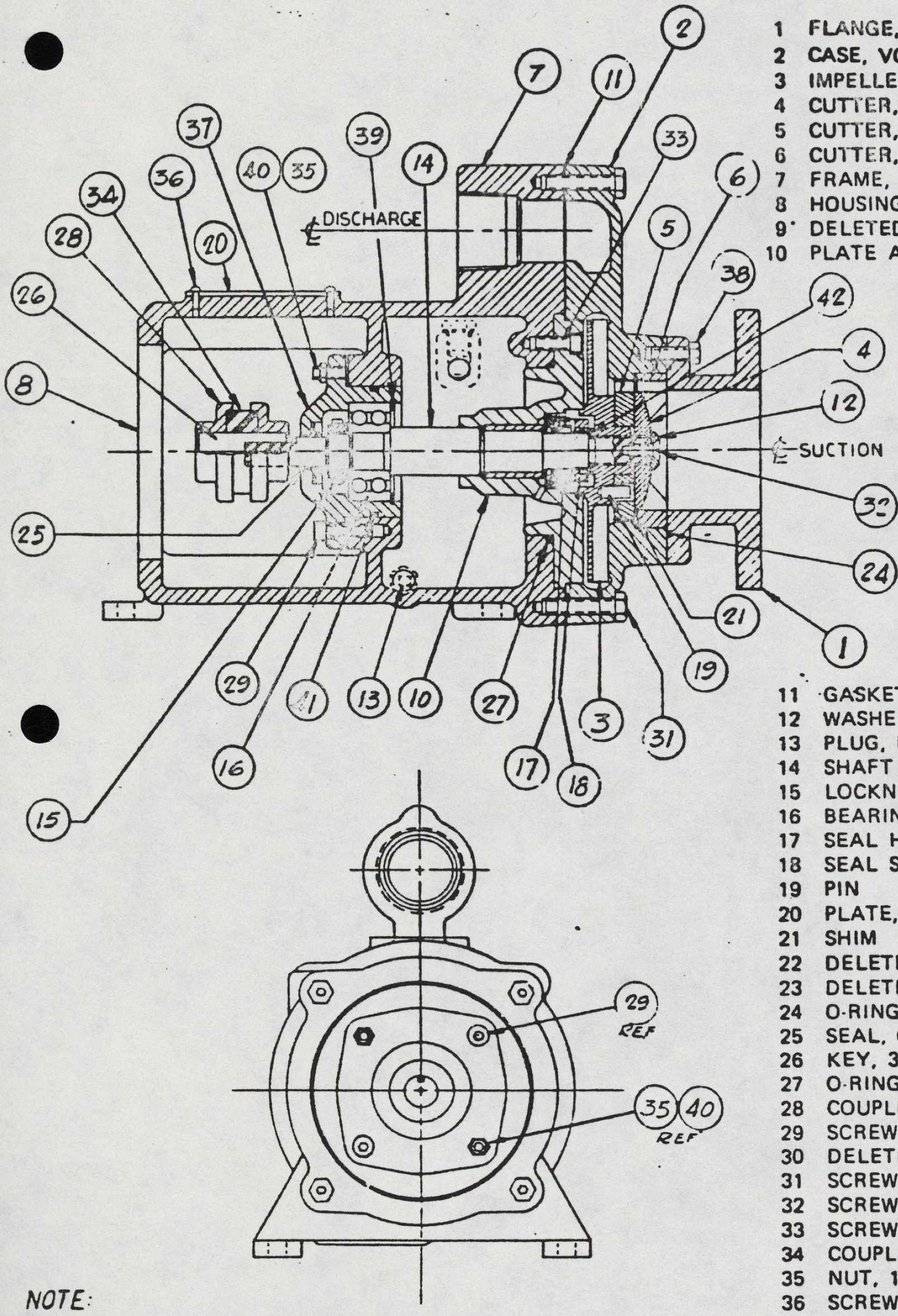
## 6-11. ELECTRICAL CONTROLS SERVICING PROCEDURE.

Refer to Fold-out 5-4, Electrical Controls Troubleshooting, for aid in pinpointing malfunctions. Proceed as follows when replacing the faulty components.

**WARNING**

Electrical circuits can be hazardous. Use extreme care when working on the electrical controls system of a Marine Sanitation Device.

1. Check that circuits to be serviced have been de-energized.
2. Label all wires that are to be disconnected during removal of a faulty component to aid in reassembly.
3. Remove faulty component(s).
4. Install a replacement part(s) with the same part number(s) or equivalent(s) in its place (refer to Chapter 7, Parts List).




1 FLANGE, THREE-INCH, INLET
2 CASE, VOLUTE
3 IMPELLER, PUMP
4 CUTTER, RADIAL, LOWER,
5 CUTTER, AXIAL, UPPER
6 CUTTER, STATIONARY
7 FRAME, BEARING
8 HOUSING CAVITY
9* DELETED
10 PLATE AND BUSHING, SEAL
11 GASKET (PERMATEX)
12 WASHER
13 PLUG, PIPE
14 SHAFT
15 LOCKNUT
16 BEARING, BALL
17 SEAL HEAD
18 SEAL SEAT
19 PIN
20 PLATE, NAME, DESCRIPTIVE
21 SHIM
22 DELETED
23 DELETED
24 O-RING
25 SEAL, OIL
26 KEY, 3/16 X 3/16 X 7/8 IN.
27 O-RING
28 COUPLING, SHAFT
29 SCREW, CAP, 1/4 X 1 IN.
30 DELETED
31 SCREW, CAP, 5/16 X 1-1/2 IN.
32 SCREW, MACHINE, 1/4 X 5/8 IN.
33 SCREW, CAP, 1/4 X 5/8 IN.
34 COUPLING, SLEEVE
35 NUT, 1/4
36 SCREW, DRIVE
37 CAP, BEARING
38 SCREW, CAP, 5/16 X 1
39 RING, RETAINING
40 SET SCREW, 1/4 X 3/4
41 O-RING
42 WASHER

NOTE:
ITEMS 9, 22, 23 AND 30 DELETED.

Figure 6-2. Macerator/Transfer Pump

# CHAPTER 7
# PARTS LIST

## 7-1. INTRODUCTION

This chapter contains parts location illustrations and identifies the parts used for each component listed in paragraph 7-2. The original manufacturer and part number are provided.

## 7-2. LIST OF MAJOR COMPONENTS.

The following table lists the major components covered in the following parts lists. The quantity is for one shipset.

**Table 7-1. List of Major Components**


| QUANTITY | NAME OR NOMENCLATURE | PAGE NO |
|---|---|---|
| 3 | Figure 7-1. Timing and Control Enclosure Assembly | 7-2 |
| 3 | Figure 7-2. Timing and Control Panel Assembly | 7-3 |
| 3 | Figure 7-3. Printed Circuit Board Assembly | 7-4 |
| 8 | Figure 7-4. Macerator/Transfer Pump Assembly | 7-5 |
| 8 | Figure 7-5. Macerator Transfer Pump | 7-6 |
| 13 | Figure 7-6. Commode Assembly (Sheet 1 of 2) | 7-8 |
| 13 | Figure 7-6. Commode Assembly (Sheet 2 of 2) | 7-9 |
| 13 | Figure 7-7. Remote Control Lever | 7-11 |
| 13 | Figure 7-8. Spring Bracket Assembly | 7-12 |
| 13 | Figure 7-9. Flush Valve Cable Assembly | 7-13 |
| 13 | Figure 7-10. Hopper Stopper Assembly | 7-13 |
| 5 | Figure 7-11. Urinal Assembly | 7-14 |


## 7-3. PARTS LIST.

The parts list identifies all the parts used in the components. These parts are crossreferenced to an illustration to identify the exact location of the part. All new military parts are identified by the FSCM number and manufacturers part numbers. The parts list is divided into the following columns.

## 7-4. FIGURE AND INDEX NUMBER.

This column contains the figure number and index number, thus locating the part on the corresponding illustration.

## 7-5. NAME AND DESCRIPTION.

This column contains the designated names of the parts with brief descriptions indicating their use. Following the description of military part in the military identification number.

## 7-6. QUANTITY.

This column identifies the quantity of parts used in a component.

## 7-7. FEDERAL SUPPLY CODE.

This column lists the government assigned federal manufacturer code identification number for the parts.

## 7-8. MANUFACTURERS PART NUMBER.

This column lists the acutal manufacturers part number.

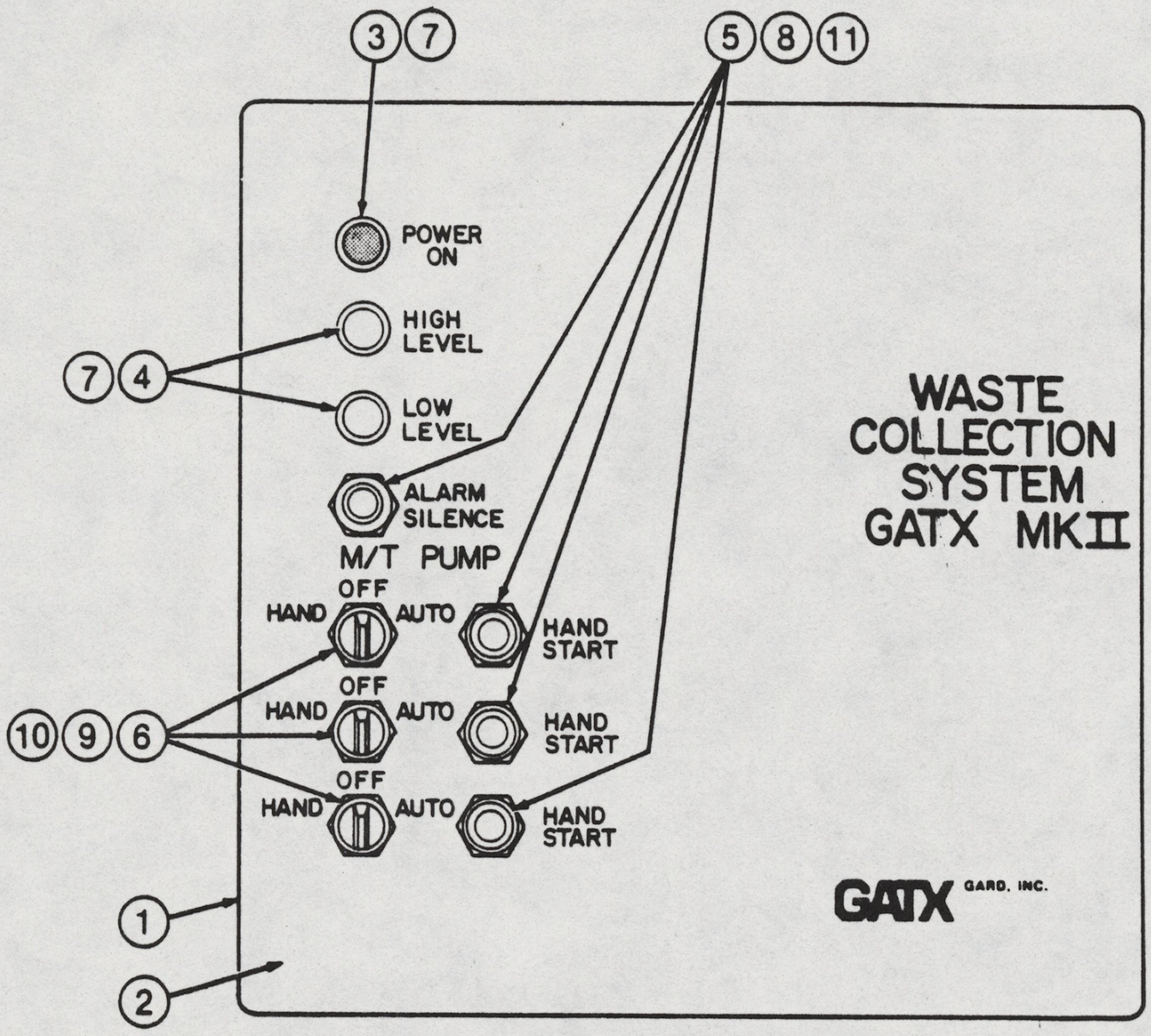



**Figure 7-1. Timing and Control Enclosure Assembly**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-1 | TIMING AND CONTROL ENCLOSURE ASSMEBLY: | 1 | 19190 | 2-22-16771 |
| 7-1-1 | ENCLOSURE, MODIFIED: | 1 | 19190 | 2-22-16770 |
| 7-1-2 | PANEL ASSEMBLY: (See Figure 7-2 for Breakdown) | 1 | 19190 | 2-22-16769 |
| 7-1-3 | LAMP ASSEMBLY: Green | 1 | 13812 | 104-3227-0212-403 |
| 7-1-4 | LAMP ASSEMBLY: Amber | 2 | 13812 | 104-3227-0213-403 |
| 7-1-5 | SWITCH, PUSHBUTTON: | 4 | 90211 | KR-3U |
| 7-1-6 | SWITCH, ROTARY: 3-position | 3 | 90211 | KS-43B |
| 7-1-7 | LAMP: | 3 | 08806 | 10C7/5 DC |
| 7-1-8 | CONTACT BLOCK: | 4 | 90211 | KA-2 |
| 7-1-9 | CONTACT BLOCK: | 6 | 90211 | KA-1 |
| 7-1-10 | LEGEND PLATE: | 3 | 90211 | KN-360 |
| 7-1-11 | LEGEND PLATE: | 3 | 90211 | KN-301 |

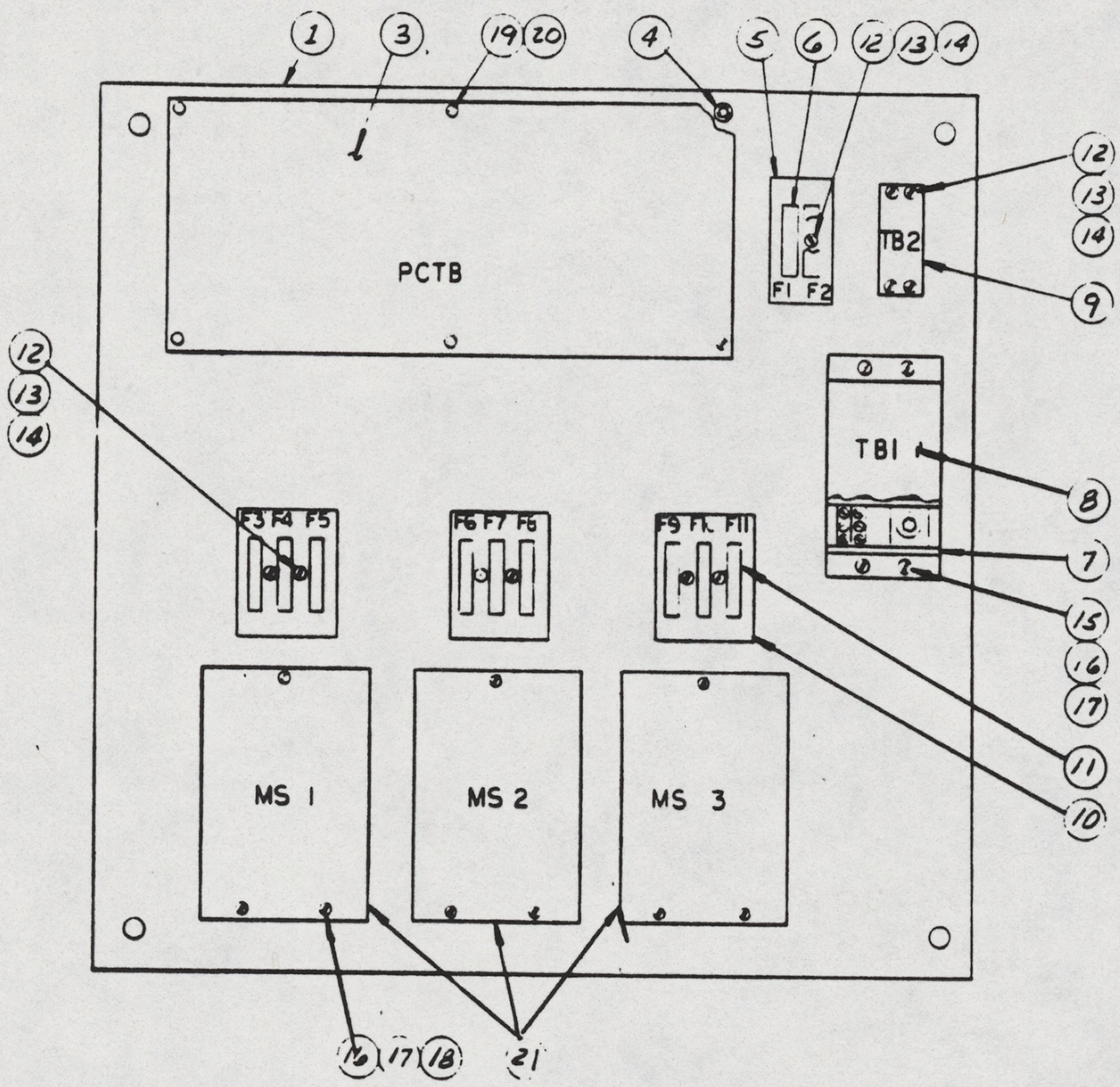



**Figure 7-2. Timing and Control Panel Assembly**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-2 | PANEL ASSEMBLY: Timing and Control | 1 | 19190 | 2-22-16769 |
| 7-2-1 | PANEL: | 1 | 19190 | 2-22-16764 |
| 7-2-2 | STARTER, MOTOR: | 3 | 23826 | 14CF32AA |
| 7-2-3 | PRINTED CIRCUIT BOARD: (See Figure 7-3 for Breakdown) | 1 | 19190 | 2-17-16763 |
| 7-2-4 | STANDOFF: 6-32 x 3/4 in. | 6 | | 8517-8-0632 |
| 7-2-5 | FUSE BLOCK: 2-pole | 1 | 03614 | 2808 |
| 7-2-6 | FUSE: 3 Ampere | 2 | 03614 | KTK-3 |
| 7-2-7 | TERMINAL BLOCK: 3-pole | 1 | 11873 | 16021-3 |
| 7-2-8 | COVER: Power Terminal Block | 1 | 19190 | 2-22-16026 |
| 7-2-9 | TERMINAL BLOCK: 3-Pole | 1 | 71785 | 3-140 |
| 7-2-10 | FUSE BLOCK: 3-Pole | 3 | 03614 | 2809 |
| 7-2-11 | FUSE: 5-Ampere | 9 | 03614 | KTK-5 |
| 7-2-12 | SCREW, RD. HD: 8-32 x 3/4 in. | 12 | 19190 | 1-26-12235 |
| 7-2-13 | NUT, HEX: 8-32 | 12 | 19190 | 1-26-10862 |
| 7-2-14 | WASHER, LOCK: #8 | 12 | 19190 | 1-26-10858 |
| 7-2-15 | SCREW, RD. HD: 10-32 x 1 in. | 4 | 19190 | 1-26-12291 |
| 7-2-16 | NUT, HEX: 10-32 | 13 | 19190 | 1-26-10860 |
| 7-2-17 | WASHER, LOCK: #10 | 13 | 19190 | 1-26-10497 |
| 7-2-18 | SCREW, RD. HD: 10-32 x 1/2 in. | 9 | 19190 | 1-26-15915 |
| 7-2-19 | SCREW, RD. HD: 6-32 x 3/8 in. | 6 | 19190 | 1-26-11037 |
| 7-2-20 | WASHER, LOCK: #6 | 6 | 19190 | 1-26-11454 |
| 7-2-21 | HEATER: Overload | 9 | 23826 | 1-19-16780 |

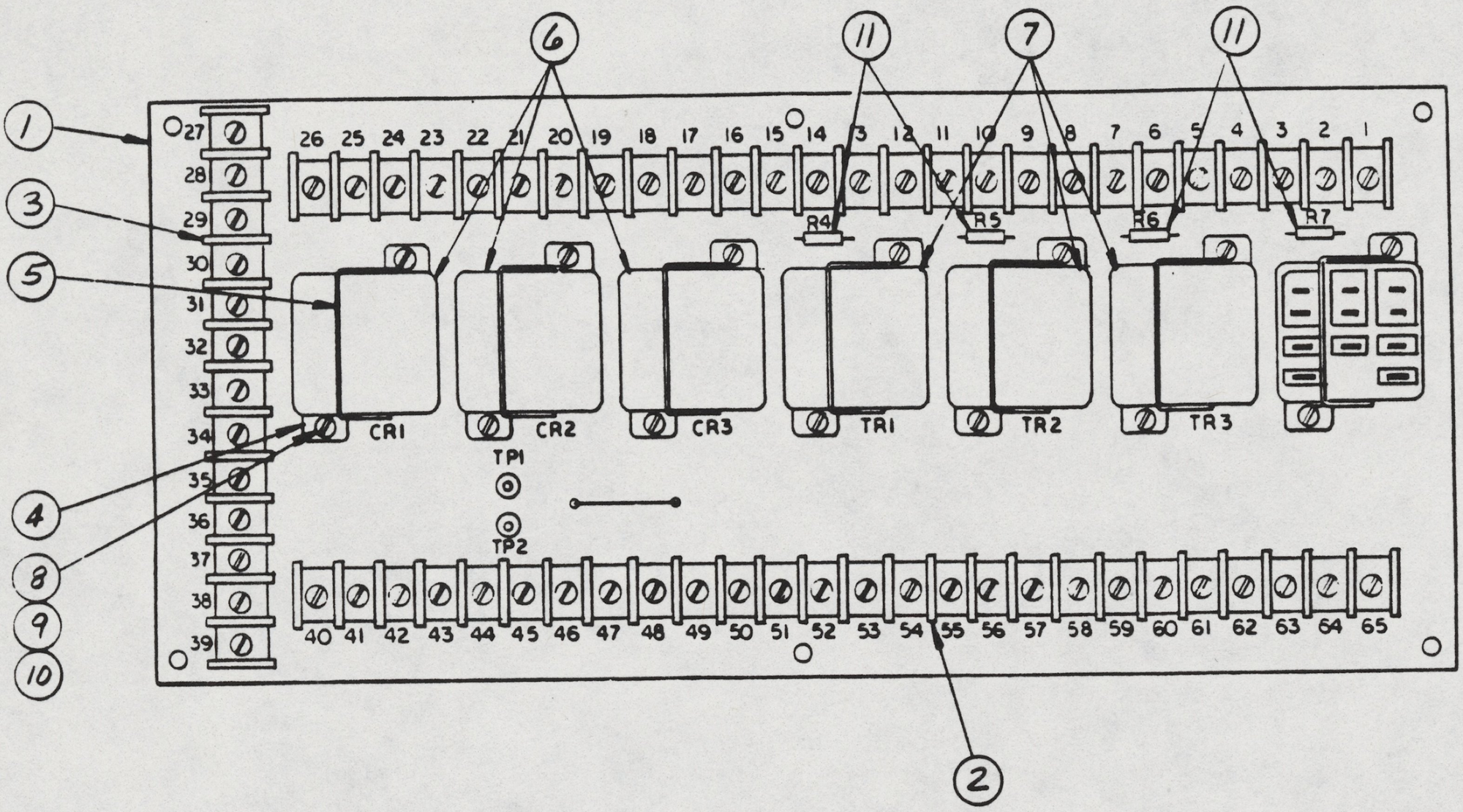



**Figure 7-3. Printed Circuit Board Assembly**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-3 | PRINTED CIRCUIT BOARD ASSEMBLY | 1 | 19190 | 2-17-16763 |
| 7-3-1 | PRINTED CIRCUIT BOARD: | 1 | 19190 | 2-23-15937 |
| 7-3-2 | TERMINAL BLOCK: 26 Terminals | 2 | 73631 | GBPC-26 |
| 7-3-3 | TERMINAL BLOCK: 13 Terminals | 1 | 73631 | GBPC-13 |
| 7-3-4 | SOCKET, RELAY: | 7 | 81265 | 27E046 |
| 7-3-5 | CLIP: Relay Holddown | 7 | 81265 | 20C228 |
| 7-3-6 | RELAY: 110 Vac | 3 | 81265 | KUP11A15 |
| 7-3-7 | RELAY: Time Delay, 110 Vac | 3 | 81265 | CUF41-70120 |
| 7-3-8 | SCREW, RD. HD: 6-32 x 1/2 in. | 14 | 19190 | 1-26-10234 |
| 7-3-9 | NUT, HEX: 6-32 | 14 | 19190 | 1-26-10773 |
| 7-3-10 | WASHER, LOCK: #6 | 14 | 19190 | 1-26-11454 |
| 7-3-11 | RESISTOR, FIXED COMPOSITION: 220K, 1/2W | 4 | 81349 | RCR20GF221J |

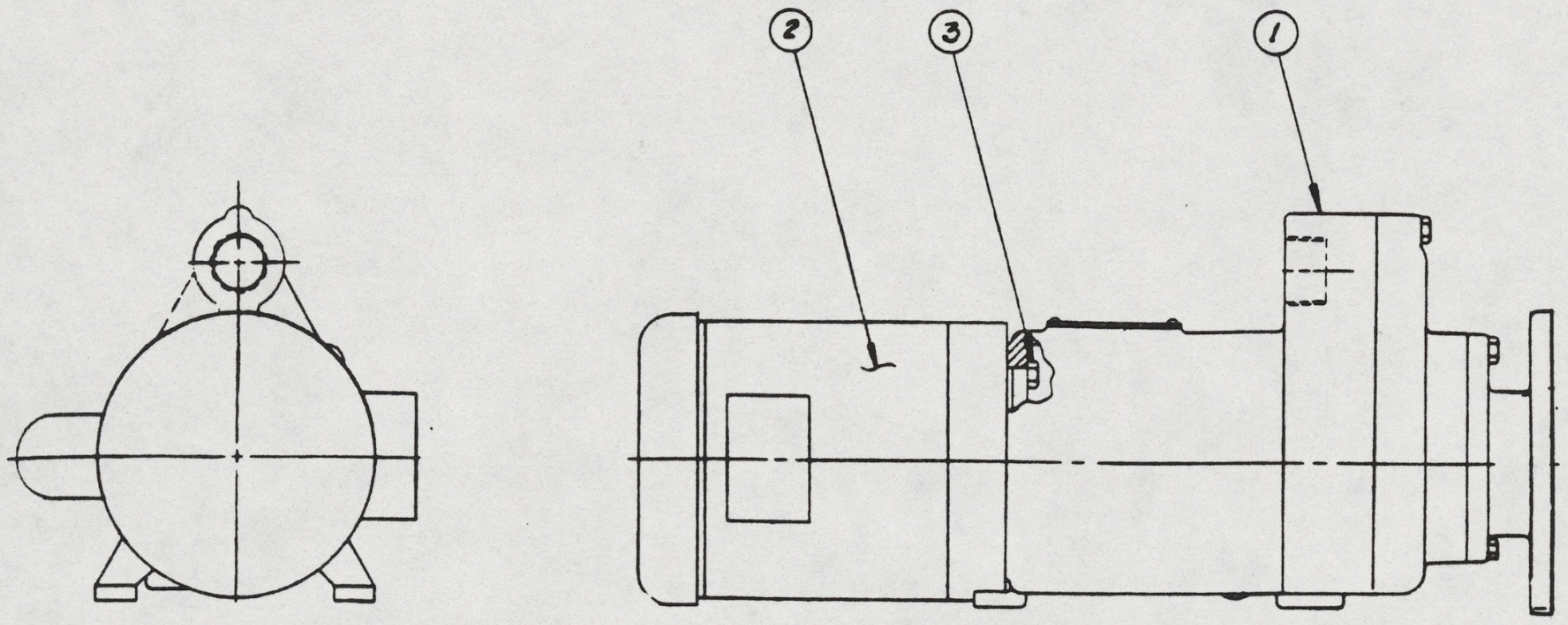
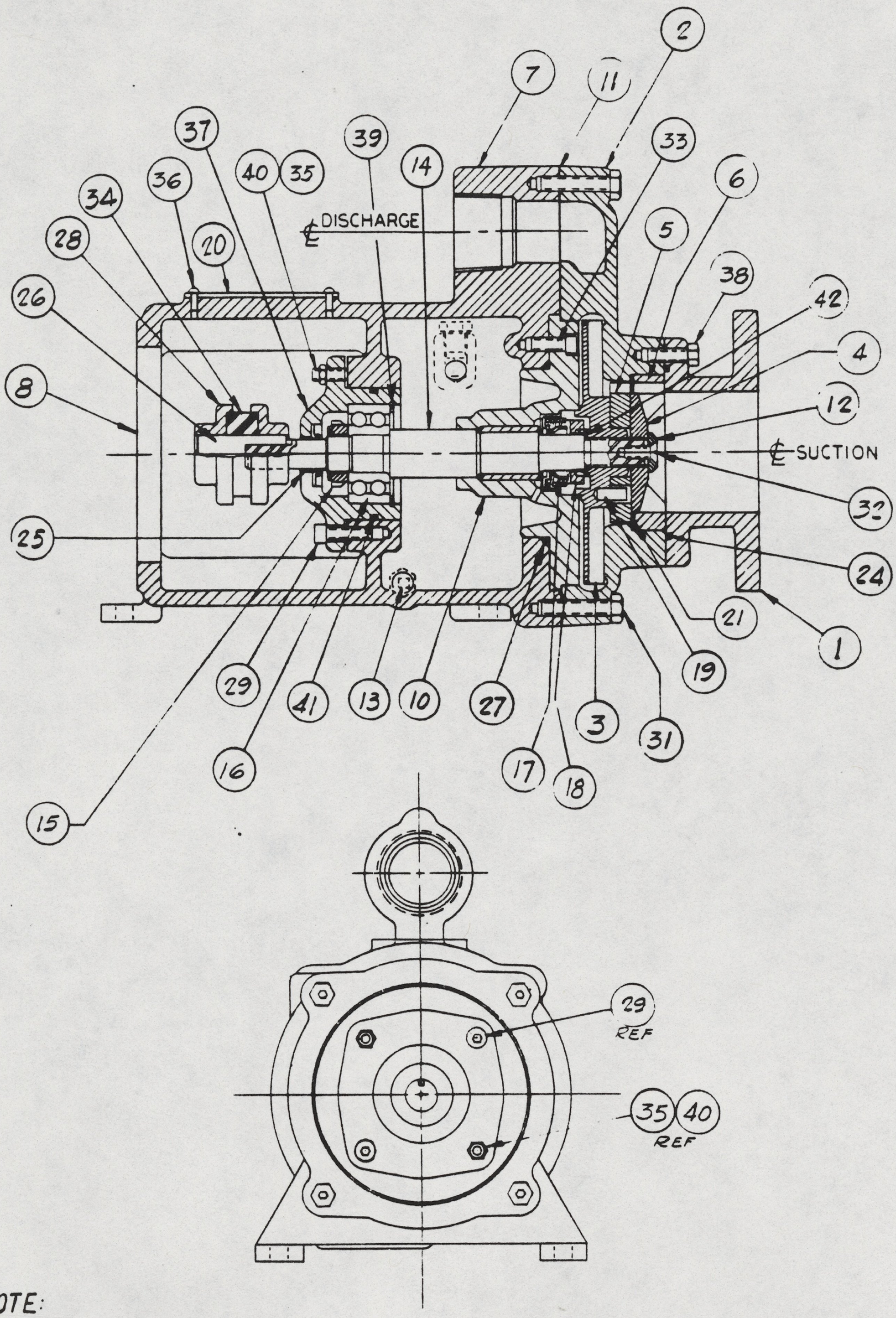



**Figure 7-4. Macerator/Transfer Pump Assembly**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-4 | MACERATOR/TRANSFER PUMP ASSEMBLY: | 1 | 19190 | 2-28-16776 |
| 7-4-1 | PUMP ASSEMBLY: (See figure 7-4 for Breakdown) | 1 | 31015 | NPG-200M |
| 7-4-2 | MOTOR, AC: 2 HP, 440 V, 30 | 1 | 05472 | 356731X454 |
| 7-4-3 | SCREW, HEX HEAD: 3/8-16 x 1 in. | 4 | 19190 | 1-26-15909 |




NOTE:
ITEMS 9, 22, 23 AND 30
DELETED.

**Figure 7-5. Macerator/Transfer Pump**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-5 | MACERATOR/TRANSFER PUMP: | 1 | 31015 | NPG-200M |
| 7-5-1 | FLANGE: 3 inch inlet | 1 | 31015 | 10152-010-2 |
| 7-5-2 | CASE, VOLUTE: | 1 | 31015 | 5402-010-2 |
| 7-5-3 | IMPELLER: | 1 | 31015 | 7033-002-2 |
| 7-5-4 | CUTTER, RADIAL, Lower | 1 | 31015 | 5405-002-2 |
| 7-5-5 | CUTTER, AXIAL, Upper | 1 | 31015 | 5506-001-2 |
| 7-5-6 | CUTTER, STATIONARY: | 1 | 31015 | 5407-001-2 |
| 7-5-7 | FRAME, BEARING: | 1 | 31015 | 9803-000-2 |
| 7-5-8 | HOUSING, CAVITY: | 1 | 31015 | 5409-012-2 |
| 7-5-9 | Not Used | — | — | — |
| 7-5-10 | PLATE AND BUSHING, SEAL: | 1 | 31015 | 5404-010-5 |
| 7-5-11 | GASKET: (Permatex No Gasket) | 1 | 31015 | 5413-001-1 |
| 7-5-12 | WASHER, BEVEL: | 1 | 31015 | 5570-001-3 |
| 7-5-13 | PLUG, PIPE: | 1 | 31015 | 119-002-1 |
| 7-5-14 | SHAFT: | 1 | 31015 | 9802-001-3 |
| 7-5-15 | NUT, LOCKS: | 1 | 31015 | 9855-001-1 |
| 7-5-16 | BEARING, BALL: | 1 | 31015 | 7167-001-1 |
| 7-5-17 | SEAL HEAD: | 1 | 31015 | 4917-000-1 |
| 7-5-18 | SEAL SEAT: | 1 | 31015 | 4918-000-1 |
| 7-5-19 | PIN: | 1 | 31015 | 5419-001-1 |
| 7-5-20 | PLATE, NAME: Descriptive | 1 | 31015 | 7173-000-1 |
| 7-5-21 | SHIM: | A/R | 31015 | 628-013-1-1 |
| 7-5-22 | Not Used | — | — | — |
| 7-5-23 | Not Used | — | — | — |
| 7-5-24 | O-RING: | 1 | 31015 | 150-013-1 |
| 7-5-25 | SEAL, OIL: | 1 | 31015 | 1090-007-1 |
| 7-5-26 | KEY: 3/16 x 3/16 x 7/8 in. | 2 | 31015 | 9831-001-1 |
| 7-5-27 | O-RING: | 1 | 31015 | 150-029-1 |
| 7-5-28 | COUPLING, SHAFT: | 1 | 31015 | 8349-025-1 |
| 7-5-29 | SCREW, CAP: 1/4 x 1 in. | 2 | 31015 | 517-007-1 |
| 7-5-30 | Not Used | — | — | — |
| 7-5-31 | SCREW, CAP: 5/16 x 1-1/2 in. | 5 | 31015 | 101-010-1 |
| 7-5-32 | SCREW, MACHINE: 1/4 x 5/8 in. | 1 | 31015 | 1130-001-1 |
| 7-5-33 | SCREW, CAP: 1/4 x 5/8 in. | 3 | 31015 | 517-004-1 |
| 7-5-34 | COUPLING, SLEEVE: | 1 | 31015 | 8348-007-1 |
| 7-5-35 | NUT: 1/4 | 2 | 31015 | 112-008-1 |
| 7-5-36 | SCREW, DRIVE: | 2 | 31015 | 4580-001-1 |
| 7-5-37 | CAP, BEARING: | 1 | 31015 | 9801-000-2 |
| 7-5-38 | SCREW, CAP: 5/16 x 1 | 4 | 31015 | 101-007-1 |
| 7-5-39 | RING RETAINING: | 1 | 31015 | 974-008-1 |
| 7-5-40 | SET SCREW: 1/4 x 3/4 | 2 | 31015 | 11-009-1 |
| 7-5-41 | O-RING: | 1 | 31015 | 834-018-1 |
| 7-5-42 | WASHER: | 1 | 31015 | 156-025-1 |

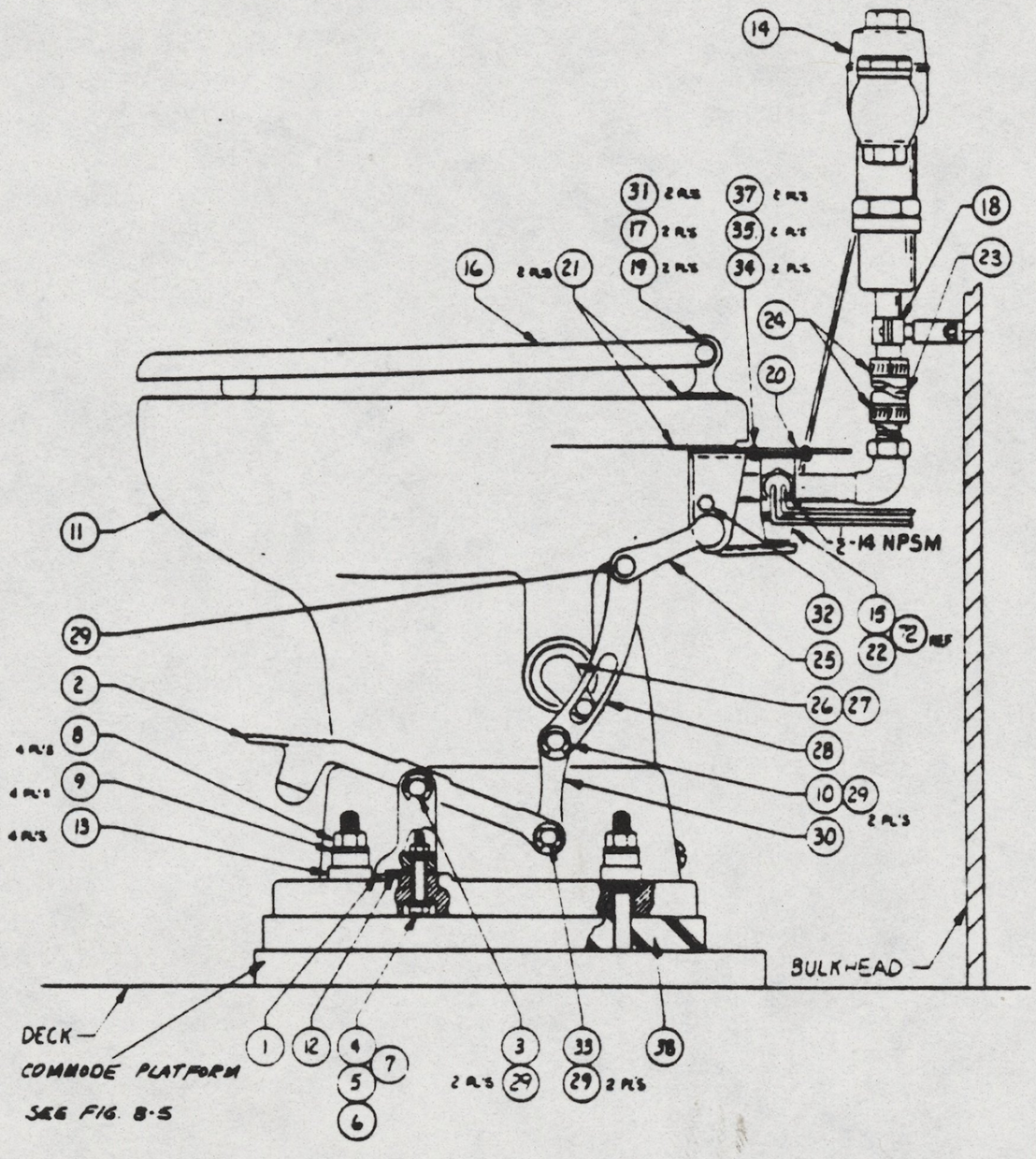



**Figure 7-6. Commode Assembly (Sheet 1 of 2)**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-6 | COMMODE ASSEMBLY: | 1 | 19190 | 2-28-14679 |
| 7-6-1 | BRACKET: Manual Control Lever Mounting | 1 | 19190 | 2-23-10551 |
| 7-6-2 | LEVER: Manual Control | 1 | 19190 | 2-23-10550 |
| 7-6-3 | PIN, GROOVED: Straight, 1-19/32 in. lg., 1/2 in. dia. | 1 | 19190 | 2-26-10597 |
| 7-6-4 | SCREW, CAP, HEX: | 1 | 96906 | MS35307-343 |
| 7-6-5 | NUT, SELF-LOCKING, HEXAGON: | 1 | 72962 | 79NE058 |
| 7-6-6 | WASHER, FLAT: | 1 | 88044 | AN960C516 |
| 7-6-7 | WASHER: Neoprene, 3/8 I.D., 3/4 O.D. by 1/8 in. Thk. | 1 | 19190 | 1-39-10729 |
| 7-6-8 | NUT, PLAIN, HEXAGON: | 4 | 96906 | MS519171-5 |
| 7-6-9 | WASHER, FLAT: | 4 | 96906 | MS5795-819 |
| 7-6-10 | PIN, GROOVED: Straight, 29/32 in. Lg., 1/2 in. dia. | 1 | 19190 | MS15795-819 |
| 7-6-11 | BOWL, PORCELAIN, COMMODE: White | 1 | 19190 | 2-39-10557 |
| 7-6-12 | PAD: Rubber, 1/16 in. Thk. 1-9/16 in. by 15/16 in. | 1 | 19190 | 2-36-13957 |
| 7-6-13 | CUSHION: Rubber, Mounting | 4 | 75543 | 2577 |
| 7-6-14 | FLUSH VALVE ASSY: | 1 | 78330 | 3942604 |
| 7-6-15 | GASKET: Oil-Paper, 0.15 Thk. 2.12 by 1.75 in. | 1 | 19190 | 2-31-14089 |
| 7-6-16 | SEAT, COMMODE: | 1 | 90772 | 150RBS |
| 7-6-17 | SCREW, CAP, HEXAGON HEAD: | 2 | 96906 | MS35307-368 |
| 7-6-18 | BRACKET, MOUNTING, VALVE: | 1 | 25733 | J312A3-41N |

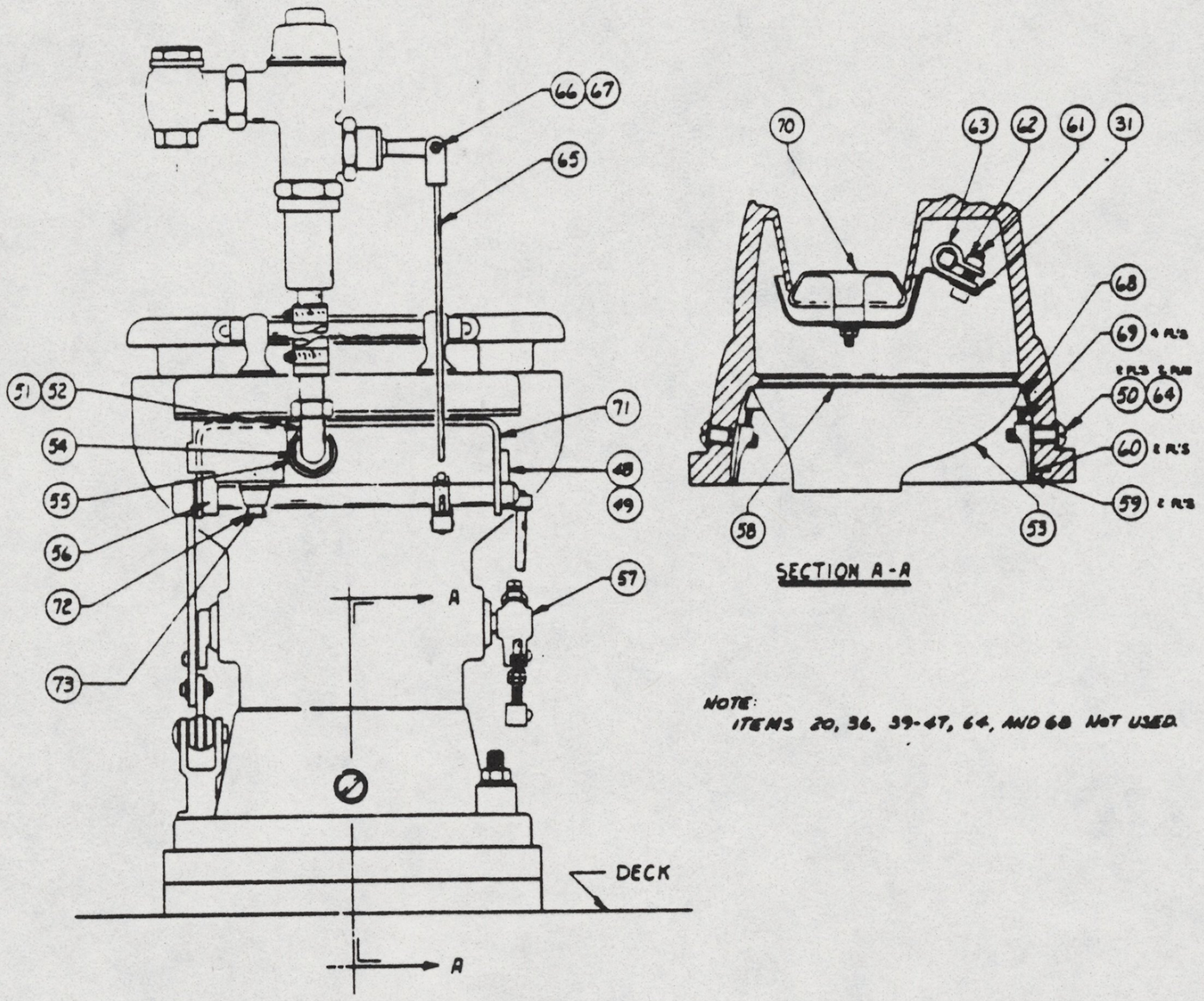



**Figure 7-6. Commode Assembly (Sheet 2 of 2)**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-6-19 | POST, HINGE, SEAT ASSY: | 2 | 19190 | 2-39-10600 |
| 7-6-20 | NOT USED | — | — | — |
| 7-6-21 | WASHER: Rubber, 3/32 in. Thk., 1-1/4 in. O.D., 7/16 I.D. | 4 | 19190 | 2-36-13474 |
| 7-6-22 | SWITCH PUSH: Enclosed, SPDT, Flange Mount | 1 | 91929 | BZV6-2RN |
| 7-6-23 | HOSE: Rubber 15 in. lg. | 1 | 09505 | A112 3-4 IN |
| 7-6-24 | CLAMP, HOSE: Screw-Type | 2 | 81646 | 6316 |
| 7-6-25 | LEVER, REMOTE CONTROL: (See Figure 7-6 for Breakdown | 1 | 19190 | 2-23-10558 |
| 7-6-26 | CRANKSHAFT, COMMODE: Brass | 1 | 19190 | 2-23-16080 |
| 7-6-27 | SLEEVE: Brass, Tubular, 1-3/4 In. Lg., 19/32 In. I.D., 47/64 In. O.D. | 1 | 19190 | 2-26-10543 |
| 7-6-28 | LINK, HOPPER CONNECTING: Curved, Slotted and Drilled | 1 | 19190 | 2-23-13320 |
| 7-6-29 | RING, RETAINING: | 7 | 79136 | 5133-50 |
| 7-6-30 | LINK, CONNECTING: Rigid, 1/4 in. Thk., 3-3/4 in. Lg., Drilled, 507 In., 2-3/4 In. Centers | 1 | 19190 | 2-23-13321 |
| 7-6-31 | WASHER, FLAT: 3/8 I.D. x 1 O.D. x 1/16 In. Thk. | 3 | 19190 | 1-26-14086 |
| 7-6-32 | SCREW, CAP HEX HEAD: | 1 | 96906 | MS35307-308 |
| 7-6-33 | PIN, GROOVED: 1/2 In. Dia., 1-3/32 In Lg. | 1 | 19190 | 2-26-13475 |
| 7-6-34 | SCREW, MACHINE: | 2 | 96906 | MS51957-30 |
| 7-6-35 | WASHER, FLAT: | 2 | 96906 | MS-15795-806 |
| 7-6-36 | NOT USED | — | — | — |

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-6-37 | NUT, SELF-LOCKING, HEXAGON: | 2 | 72962 | 79NM62 |
| 7-6-38 | PAD: Rubber, Rectangular | 1 | 19190 | 2-31-13351 |
| 7-6-39 | NOT USED | — | — | — |
| 7-6-40 | NOT USED | — | — | — |
| 7-6-41 | NOT USED | — | — | — |
| 7-6-42 | NOT USED | — | — | — |
| 7-6-43 | NOT USED | — | — | — |
| 7-6-44 | NOT USED | — | — | — |
| 7-6-45 | NOT USED | — | — | — |
| 7-6-46 | NOT USED | — | — | — |
| 7-6-47 | NOT USED | — | — | — |
| 7-6-48 | BRACKET: Brass | 1 | 19190 | 2-23-16050 |
| 7-6-49 | SCREW, FLAT HEAD: 1/4-20 x 1/2 In. SST. | 2 | 19190 | 2-26-16052 |
| 7-6-50 | SCREW, FILLISTER HEAD: | 2 | 96906 | MS35276-311 |
| 7-6-51 | PIPE, FLUSH: Bent Steel | 1 | 19190 | 2-23-10555 |
| 7-6-52 | WASHER, FLAT: 1/8 In. Thk. Karropak, 1-7/8 In. by 2 In. | 1 | 19190 | 2-31-10599 |
| 7-6-53 | INSERT, COMMODE, BOWL: Abf, .100 In. | 1 | 19190 | 2-41-14091 |
| 7-6-54 | JAM NUT, HEX: Brass, 3/4 In. NPSC | 1 | 19190 | 2-26-10590 |
| 7-6-55 | WASHER: Rubber, 3/16 In. Thk., 1 In. I.D. 1-7/8 In. O.D. | 1 | 19190 | 2-31-10601 |
| 7-6-56 | COLLAR: Remote Control Lever, Brass | 1 | 19190 | 2-23-13322 |
| 7-6-57 | SPRING/BRACKET ASSEMBLY: (See Figure 7-7 for Breakdown) | 1 | 19190 | 2-28-14090 |
| 7-6-58 | GASKET: 1/8 Thk. Asphalted Paper | 1 | 19190 | 2-31-10733 |
| 7-6-59 | LUG, INSERT RETAINING: Brass, Drilled and Tapped | 2 | 19190 | 2-39-10592 |
| 7-6-60 | PAD: Karropak, 1/32 In. Thk., Drilled 1/2 In. Dia. | 2 | 19190 | 2-31-10593 |
| 7-6-61 | SCREW, CAP, SOCKET HEAD: | 1 | 96906 | MS16995-81 |
| 7-6-62 | NUT, PLAIN: Square | 1 | 19190 | 1-26-11007 |
| 7-6-63 | CLAMP, LOOP: | 1 | 19190 | 2-22-10658 |
| 7-6-64 | NOT USED | — | — | — |
| 7-6-65 | CABLE ASSEMBLY: Flush Valve (See Figure 7-8 for Breakdown) | 1 | 19190 | 2-28-13517 |
| 7-6-66 | NUT, SELF-LOCKING, HEX: | 1 | 72962 | 79NM02 |
| 7-6-67 | SCREW, CAP, SOCKET HEAD: | 1 | 96906 | MS16996-9 |
| 7-6-68 | NOT USED | — | — | — |
| 7-6-69 | SCREW, CAP, SOCKET HEAD: | 4 | 96906 | MS16995-55 |
| 7-6-70 | STOPPER ASSEMBLY, HOPPER: (See Figure 7-9 for Breakdown) | 1 | 19190 | 2-28-13338 |
| 7-6-71 | BRACKET, MOUNTING, SHAFT: | 1 | 19190 | 2-24-16076 |
| 7-6-72 | COLLAR, ACTUATOR: | 1 | 19190 | 2-24-16077 |
| 7-6-73 | SCREW, SQAURE HEAD: 5/16-18 x 1/2 SST | 1 | 19190 | 1-26-16079 |

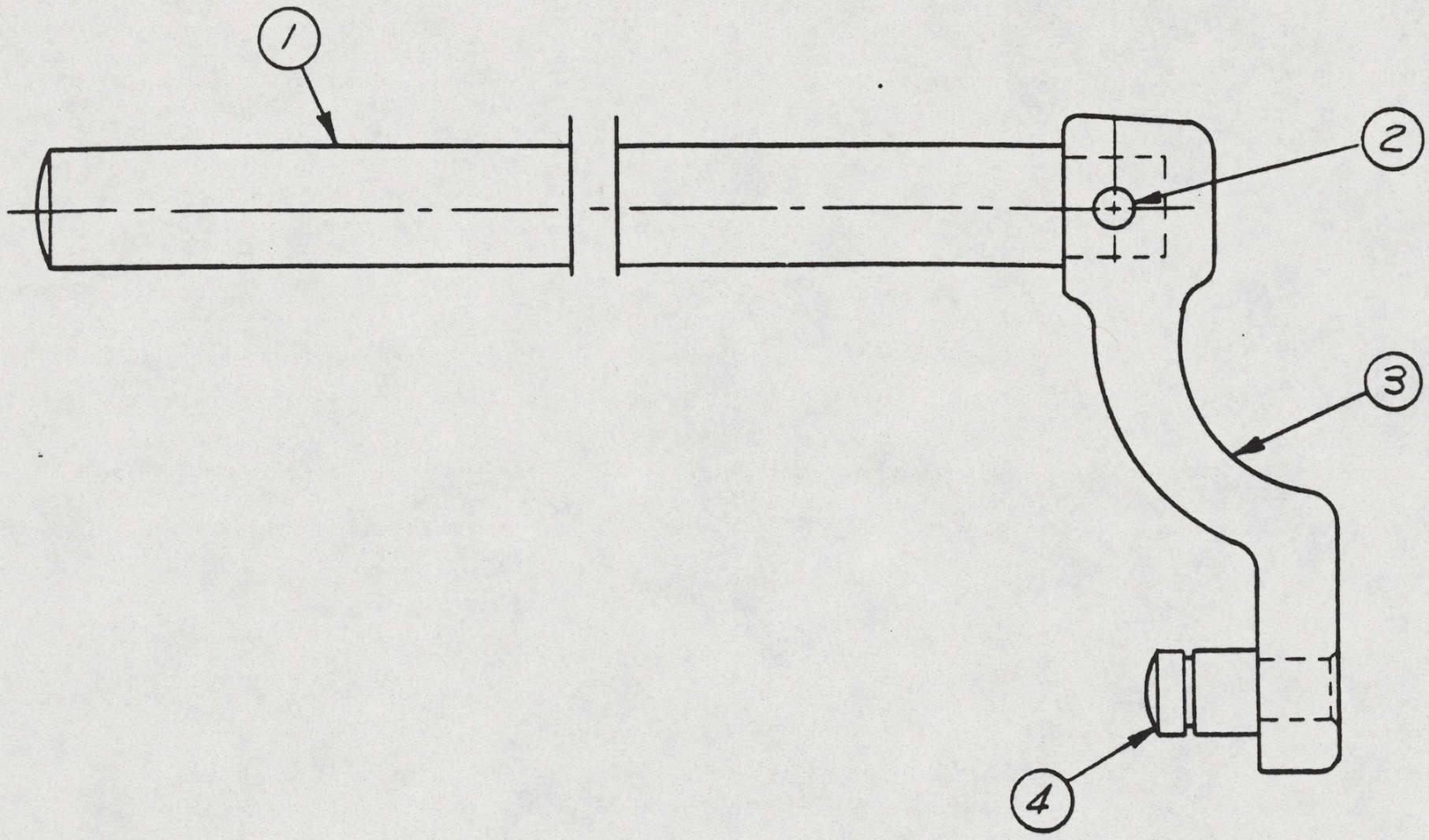



**Figure 7-7. Remote Control Lever**

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-7 | LEVER, REMOTE CONTROL: | 1 | 19190 | 2-23-10558 |
| 7-7-1 | ROD: 10-7/8 in. lg. x 0.628 in. minor dia., | 1 | 19190 | 2-23-16055 |
| 7-7-2 | PIN, RETAINING: | 1 | 19190 | 2-23-16058 |
| 7-7-3 | ARM: | 1 | 19190 | 2-23-16056 |
| 7-7-4 | PIN, GROOVED: Brass | 1 | 19190 | 2-23-16057 |

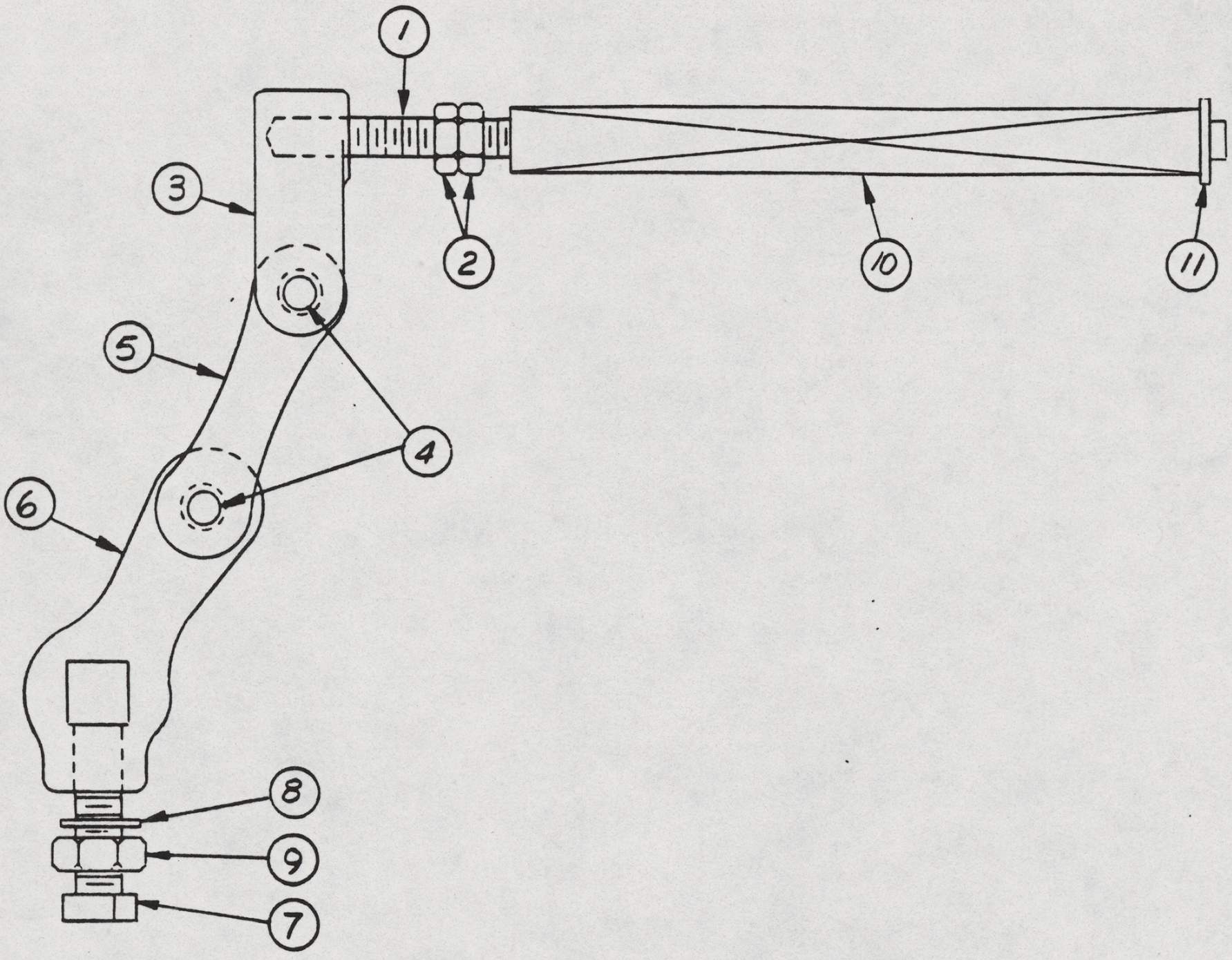



Figure 7-8. Spring/Bracket Assembly

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-8 | SPRING/BRACKET ASSEMBLY: | 1 | 19190 | 2-28-14090 |
| 7-8-1 | ROD: Brass, 5/16 in. dia., 5/16-24 thk. | 1 | 19190 | 2-28-16042 |
| 7-8-2 | NUT, JAM HEX: Brass, 5/16-24 | 2 | 19190 | 1-26-16044 |
| 7-8-3 | YOKE, ANGLE: | 1 | 19190 | 2-23-16043 |
| 7-8-4 | RIVET: Solid, 1/4 in. x 3/4 in., 2 in. plate | 2 | 19190 | 1-26-16040 |
| 7-8-5 | LINK: 1/4 in. thk., 2-1/2 in. lg., drilled 0.257 in., 1-3/4 in. centers | 1 | 19190 | 2-23-16045 |
| 7-8-6 | ARM, PIVOT: Brass | 1 | 19190 | 2-23-16041 |
| 7-8-7 | SCREW, SET: 3/8-16 x 1, Socket head Screw SST | 1 | 19190 | 1-26-16048 |
| 7-8-8 | LOCKWASHER, INTERNAL TOOTH: SST, 3/8 in. | 1 | 19190 | 1-26-16047 |
| 7-8-9 | NUT, JAM HEX: SST, 3/8-16 | 1 | 19190 | 1-26-16046 |
| 7-8-10 | SPRING: 43 Coil, RH, SST, 0.58 in., 6-9/16 in. | 1 | 19190 | 2-39-16049 |
| 7-8-11 | WASHER, FLAT: SST | 1 | 19190 | 1-26-13312 |

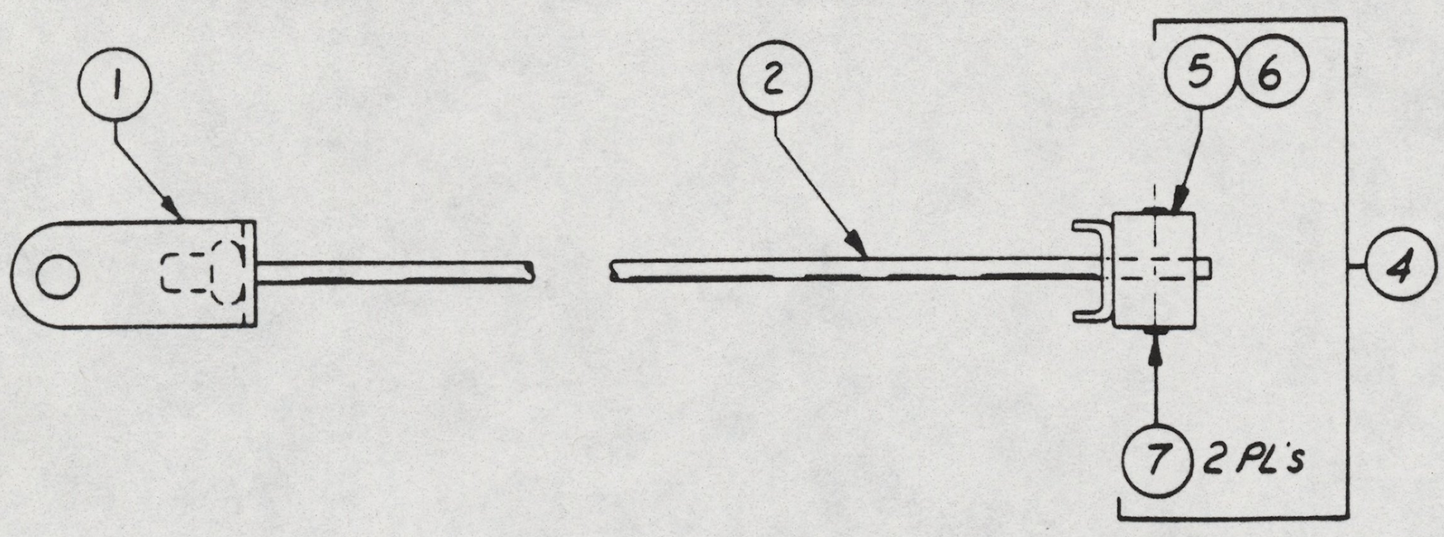



Figure 7-9. Flush Valve Cable Assembly

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-9 | CABLE ASSEMBLY, FLUSH VALVE: | 1 | 19190 | 2-28-13517 |
| 7-9-1 | CLEVIS, ROD END: | 1 | 19190 | 2-22-13516 |
| 7-9-2 | ROPE ASSEMBLY: Wire, 36 in. lg. | 1 | 19190 | 2-18-13521 |
| 7-9-3 | NOT USED | — | — | — |
| 7-9-4 | RETAINER ASSEMBLY, RETAINER: | 1 | 19190 | 2-28-13515 |
| 7-9-5 | TUBE, COPPER ALLOY: | 1 | 19190 | 1-21-13514 |
| 7-9-6 | COLLAR, SHAFT: 0.50 in. dia. by 0.66 in. lg. | 1 | 19190 | 2-23-13513 |
| 7-9-7 | SETSCREW: | 2 | 96906 | MS51021 |

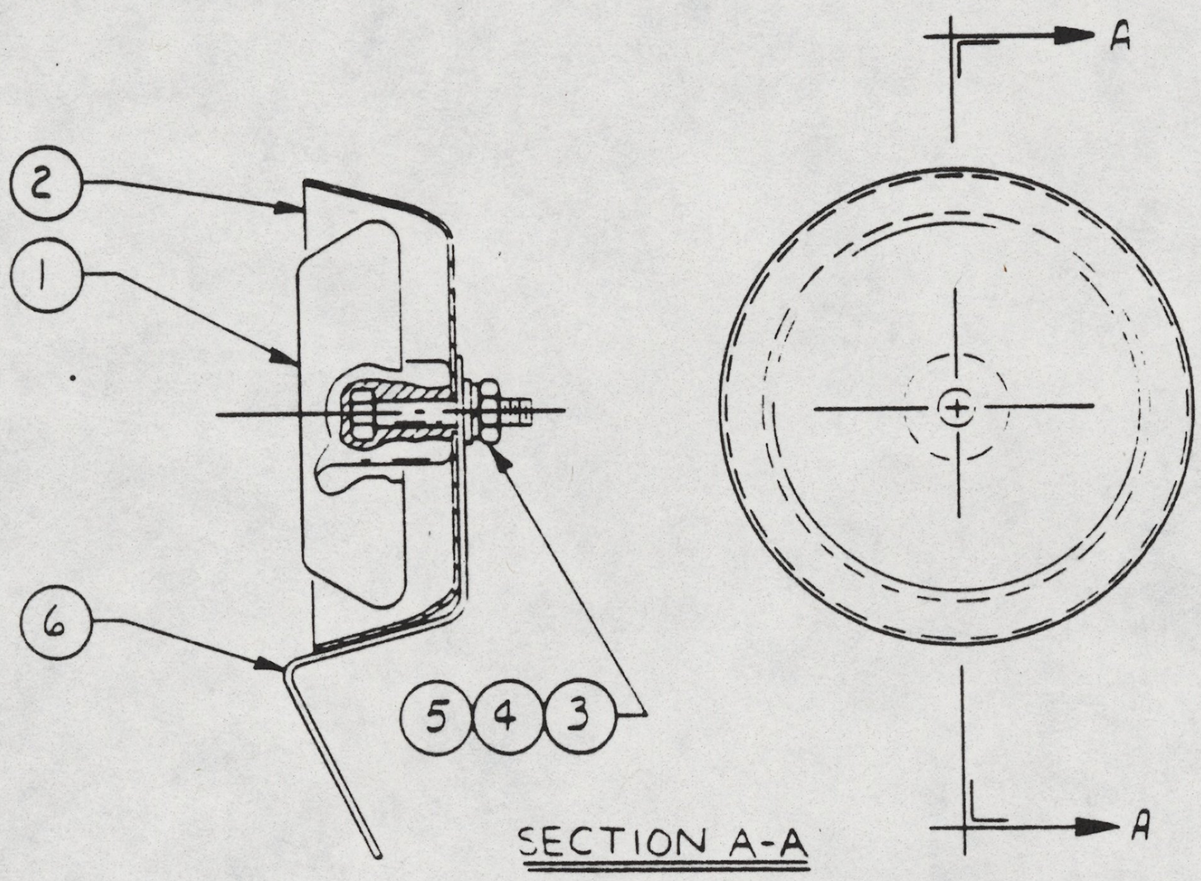



Figure 7-10. Hopper Stopper Assembly

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-10 | STOPPER ASSEMBLY HOPPER: | 1 | 19190 | 2-28-13338 |
| 7-10-1 | STOPPER, HOPPER: Neoprene | 1 | 19190 | 2-33-10648 |
| 7-10-2 | CUP, STOPPER: | 1 | 19190 | 2-33-10649 |
| 7-10-3 | WASHER, FLAT: | 1 | 88044 | AN960C416 |
| 7-10-4 | WASHER, LOCK: | 1 | 96906 | MS35339-139 |
| 7-10-5 | NUT, PLAIN HEX: | 1 | 96906 | MS35649-2254 |
| 7-10-6 | BRACKET, MOUNTING, STOPPER: SST, 1/8 in. thk. | 1 | 19190 | 2-22-13337 |

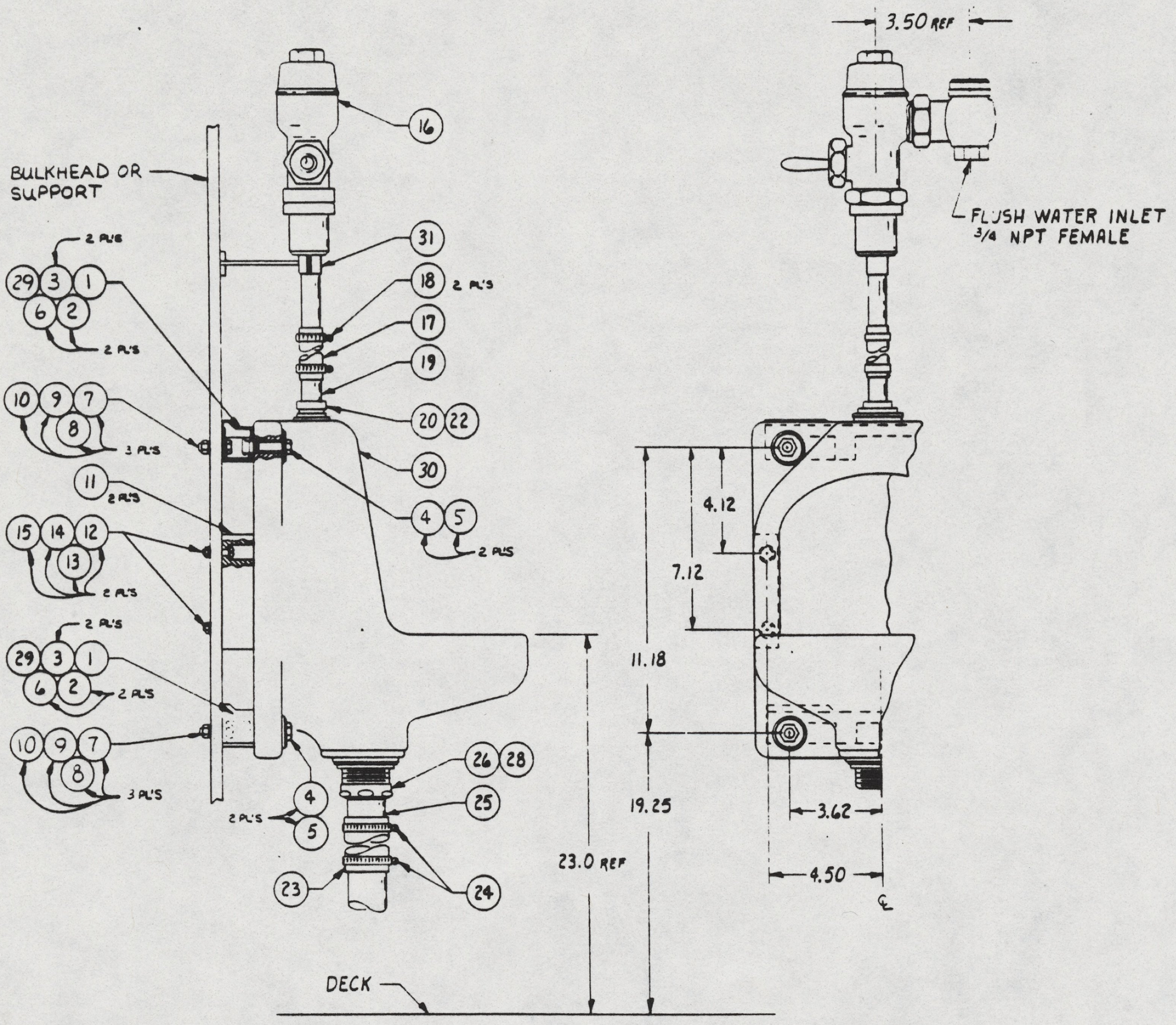



Figure 7-11. Urinal Assembly

| FIGURE AND INDEX NO. | NAME AND DESCRIPTION | QTY | FEDERAL SUPPLY CODE | MFR PART NO. |
|---|---|---|---|---|
| 7-11 | URINAL ASSEMBLY: | 1 | 19190 | 10168200300 |
| 7-11-1 | MOUNT, RESILIENT: | 2 | 89814 | PA2403 |
| 7-11-2 | SPACER, SLEEVE: | 4 | 89814 | PB16321 |
| 7-11-3 | INSULATOR, WASHER: | 4 | 89814 | PB16320 |
| 7-11-4 | SCREW, CAP, HEXAGON HEAD: | 4 | 89814 | PB16323 |
| 7-11-5 | WASHER, FLAT: | 4 | 89814 | PB18414 |
| 7-11-6 | NUT, SLEEVE: | 4 | 89814 | PB16327 |
| 7-11-7 | SCREW, CAP, HEXAGON HEAD: | 6 | 96906 | MS35307-309 |
| 7-11-8 | WASHER, FLAT: | 6 | 19190 | 1-26-10100 |
| 7-11-9 | NUT, PLAIN, HEXAGON: | 6 | 96906 | MS51971-1 |
| 7-11-10 | WASHER, LOCK: | 6 | 96906 | MS35338-139 |
| 7-11-11 | MOUNT, RESILIENT: | 2 | 89814 | PB16511 |
| 7-11-12 | SCREW, MACHINE: | 4 | 96906 | MS51957-67 |
| 7-11-13 | WASHER, FLAT: | 4 | 96906 | MS15795-842 |
| 7-11-14 | NUT, PLAIN, HEXAGON: | 4 | 96906 | MS35649-204 |
| 7-11-15 | WASHER, LOCK: | 4 | 96906 | MS35338-138 |
| 7-11-16 | VALVE ASSEMBLY, FLUSH: | 1 | 78330 | 185 |
| 7-11-17 | HOSE: Rubber 7 in. lg. | 1 | 89814 | 16350 |
| 7-11-18 | CLAMP, HOSE: | 2 | 08484 | QS200M12S |
| 7-11-19 | TAILPIECE, UNION: | 1 | 89814 | PB18386 |
| 7-11-20 | NUT, UNION: | 1 | 89814 | B21358 |
| 7-11-21 | NOT USED | — | — | — |
| 7-11-22 | GASKET: | 1 | 89814 | PB18389 |
| 7-11-23 | HOSE: Rubber | 1 | 89814 | PB16348 |
| 7-11-24 | CLAMP, HOSE: | 2 | 08484 | QS200M24S |
| 7-11-25 | TAILPIECE, WASTE DRAIN: | 1 | 89814 | PB16346 |
| 7-11-26 | NUT, UNION: | 1 | 89814 | PB8880 |
| 7-11-27 | NOT USED | — | — | — |
| 7-11-28 | GASKET: | 1 | 89814 | PB6821 |
| 7-11-29 | RUBBER STRIP: | 2 | 89814 | PB18211 |
| 7-11-30 | URINAL, STATIONARY: | 1 | 89814 | PB1904 |
| 7-11-31 | BRACKET, MOUNTING, VALVE: | 1 | 25733 | J312A3-4IN |

# CHAPTER 8
# INSTALLATION

## Section I. REQUIREMENTS

**8-1. SITE INFORMATION.**
The components of the Marine Sanitation Device all have special requirements that must be considered during the selection of suitable mounting sites. These include the water, water pressure, electric power and space needs as follows.

**8-2. CONTROLLED VOLUME FLUSH WATER CLOSETS.** The CVF water closets supplied are vitreous china bowl units equipped with foot pedal operated waste flapper valves and controlled volume flush water valves. Refer to Commode Piping Detail (figure 8-2). The units are designed to be shock mounted on the deck surface and to interface with a standard 4-inch soil line. The soil pipe (or sump pipe) is brought through the deck water closet mounting plate so that the upper end of the soil pipe protrudes approximately 1/4-inch above the deck plate surface. Seating between the soil pipe and the water closet outlet is normally accomplished by using a standard wax seal ring available at plumbing supply houses. Mechanical anchoring of the commode assembly requires four bolts or studs welded to the deck plate for hold down.

**8-3. Flush Valve Assembly.** The controlled volume flush valve is provided with a manual valve handle actuated by a cable attached between the valve handle and the collar extension on the water closet. The valve unit is preassembled and calibrated to provide the proper volume of water at each flush. The deatils for mechanical mounting of the valve and valve bracket and interfacing of the valve with the ship's flush water line and the water closet are left to the discretion of the ship's outfitters. However, it is recommended that the valve handle be located high enough (approximately 24 inches) and in a line to permit a favorable angle for the valve actuating cable connected between the valve handle and the collar assembly on the water closet.

**8-4. Electrical Connection of the Water Closet.** The water closet is provided with a switch assembly mounted on a plate at the rear of the water closet. This switch is interconnected with the control system, as shown on the Cable Diagram (figure 8-6).

**8-5. CONTROLLED VOLUME FLUSH URINAL.** The CVF urinal supplied with the system is a vitreous china unit equipped with a controlled volume flush water valve. The unit is designed to be shock mounted on a bulkhead; typical mounting height to the bottom of the urinal is 20 inches. Plumbing interface consists of a flush water line from the ship's service line to the valve input and a soil line from the urinal tailpiece to the soil line.

**8-6. MACERATOR/TRANSFER PUMP ASSEMBLY.** The macerator/transfer pump assembly needs gravity's assistance for utmost efficiency and so should be located below and as close as possible to the bottoms of the commodes they serve. If at all possible, avoid horizontal runs greater than 4 feet and never exceed horizontal runs of 6 feet. Also, to ease future maintenance, the location should provide access for unhindered removal of the macerator/transfer pump assembly from the soil line.

**8-7. Electrical Connection of Macerator/Transfer Pump.** Electrical power to operate the pump is provided by the ship's service (440 VAC, 3-phase, 60 Hz) through the fused disconnect and magnetic starter; the starter relay is controlled by 115 VAC, 1-phase, 60 Hz power.

**8-8. ELECTRICAL CONTROLS.** The electrical control box is designed for bulkhead mounting utilizing the four mounting legs located at the top and bottom of the box. The control box should be located in a reasonably accessible area.

**8-9. TOOLS AND MATERIALS REQUIRED.**
Installation of the Marine Sanitation Device requires the use of welding, plumbing, electrical wiring and mechanical assembly tools and equipment. The operation, however, can be accomplished without any need for specially-designed material.

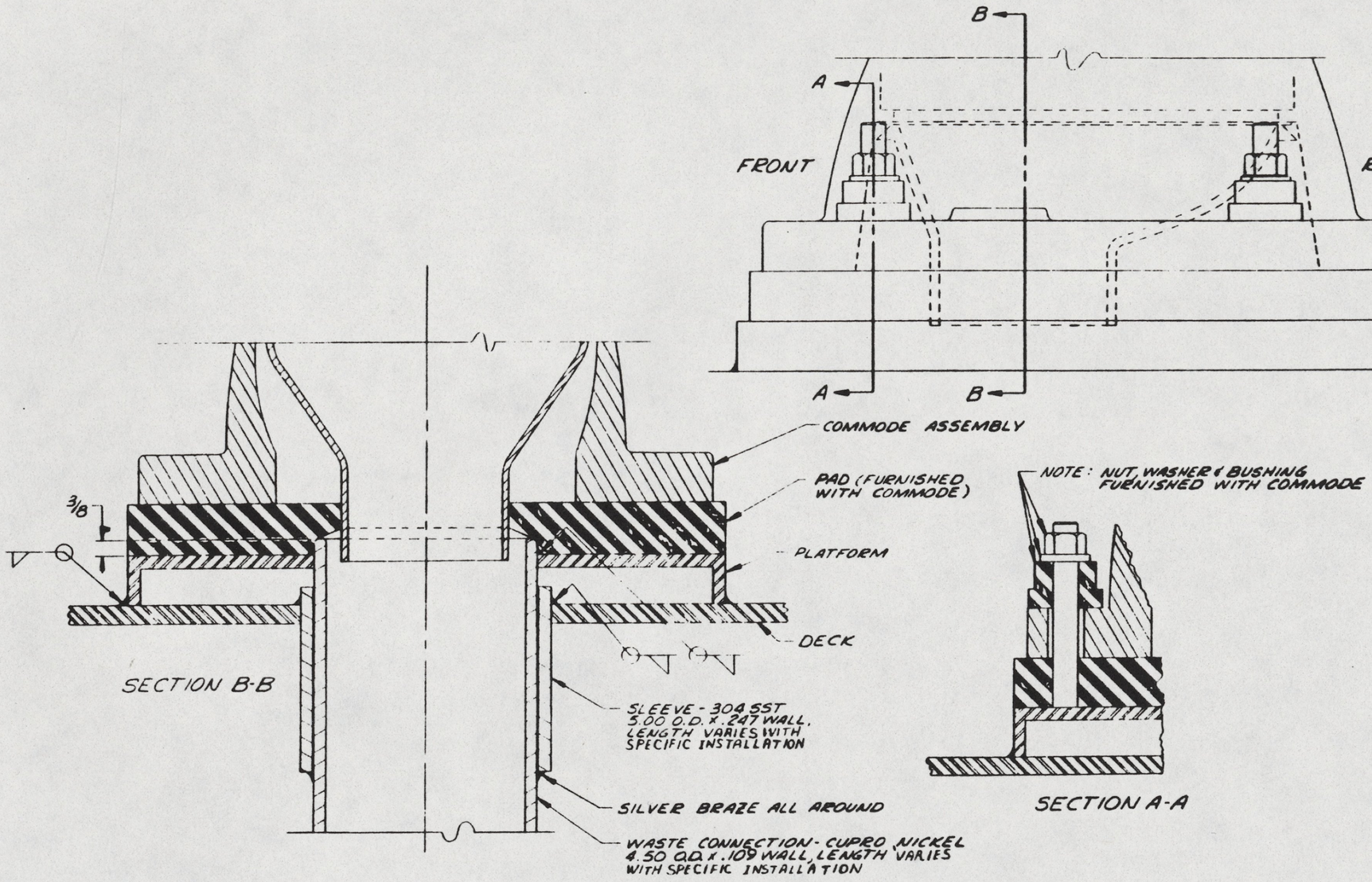



**Figure 8-1. Commode Installation Detail**

## 8-10. INPUT REQUIREMENTS.

Installation of the Marine Sanitation Device requires inputs of water at 30 psig and 110 VAC 60 Hz and 440 VAC, 60 Hz electrical power.

## 8-11. UNPACKING AND REPACKING.

Each component is supplied ready for installation and connection to a ship's holding tank, piping, and discharge connections. No special unpacking and repacking procedures are required. Care must be exercised in handling the urinal and commode to prevent breakage since these components are made of vitreous china.

## 8-12. COMMODE ASSEMBLY INSTALLATION.

**8-13. MOUNTING AND OUTLET CONNECTION.** The commodes are designed to interface with standard 4-inch soil line (4.5" OD) as shown in Figure 8-1, Commode Installation Detail and Figure 8-2, Piping Detail. The soil pipe should be brought through the commode mounting platform so that the upper end of the soil pipe protrudes approximately 3/8 inch above the surface of the platform. The platform normally is constructed by the shipyard installing the sanitary system. Overall dimensions are shown in Figure 8-3, Platform-Commode Shock Mount. The height of the platform should be such that its top surface is from 1/2 to 1 inch above the finished surface (title etc.) of the deck. Due to variations of the finished ceramic commode, the location of the mounting studs are not shown on the above referenced drawing. These dimensions should be taken from the supplied commodes. Both the base of the platforms and its studs should be fabricated from 300 series stainless steel.

1. The commode should be located at a sufficient distance from the rear bulkhead to afford easy access to flush valve plumbing and mounting. A distance of approximately 16 to 18 inches between the bulkhead and the center of the discharge soil pipe is recommended.
2. Install a 1-inch vent line directly beneath the 4-inch soil line that penetrates the deck as shown in figure 8-2. The purpose of this vent is to prevent air from forming a large bubble that would cause water to splash out of the commode during the flush operation.
3. Before the commode is put in place, insert a wax ring between the commode and the shock mount. The wax ring assures a leak-proof seal.
4. When the platform is not constructed during installation (i.e. the ship deck serves as the commode platform) then the commode mounting bolts should be welded to the deck as shown in figure 8-3.

**8-14. FLUSH VALVE.** Position and mount flush valve as follows.

1. Position the furnished flush valve bracket at least 25 inches above the deck.
2. Mount the flush valve to the bulkhead with the mounting bracket, making sure the flush valve handle is on the left and the water inlet on the right when facing the valve. The valve has a 3/4-inch NPT female thread at its inlet.

**NOTE**

A wire rope assembly (flush cable), connects the flush valve handle to the actuator collar on the remote control lever.

3. Adjust the actuator collar (figure 8-4), so it rests in a position roughly parallel to the deck by loosening the square head set screw, rotating the actuator collar into place and then tightening the set screw.
4. Feed the flush cable, unfinished end first, through the exposed hole of the rod end clevis and then through the hole in the lever portion of the actuator collar.
5. Attach the rod end clevis to the flush valve handle.
6. Feed the free end of the wire rope assembly through the shaft collar.
7. Slide the shaft collar up the wire rope assembly against the lever portion of the actuator collar and tighten the two set screws. Final adjustment should allow minimal free play in the cable without pulling on the flush valve handle. Excess cable may be cut off and discarded.

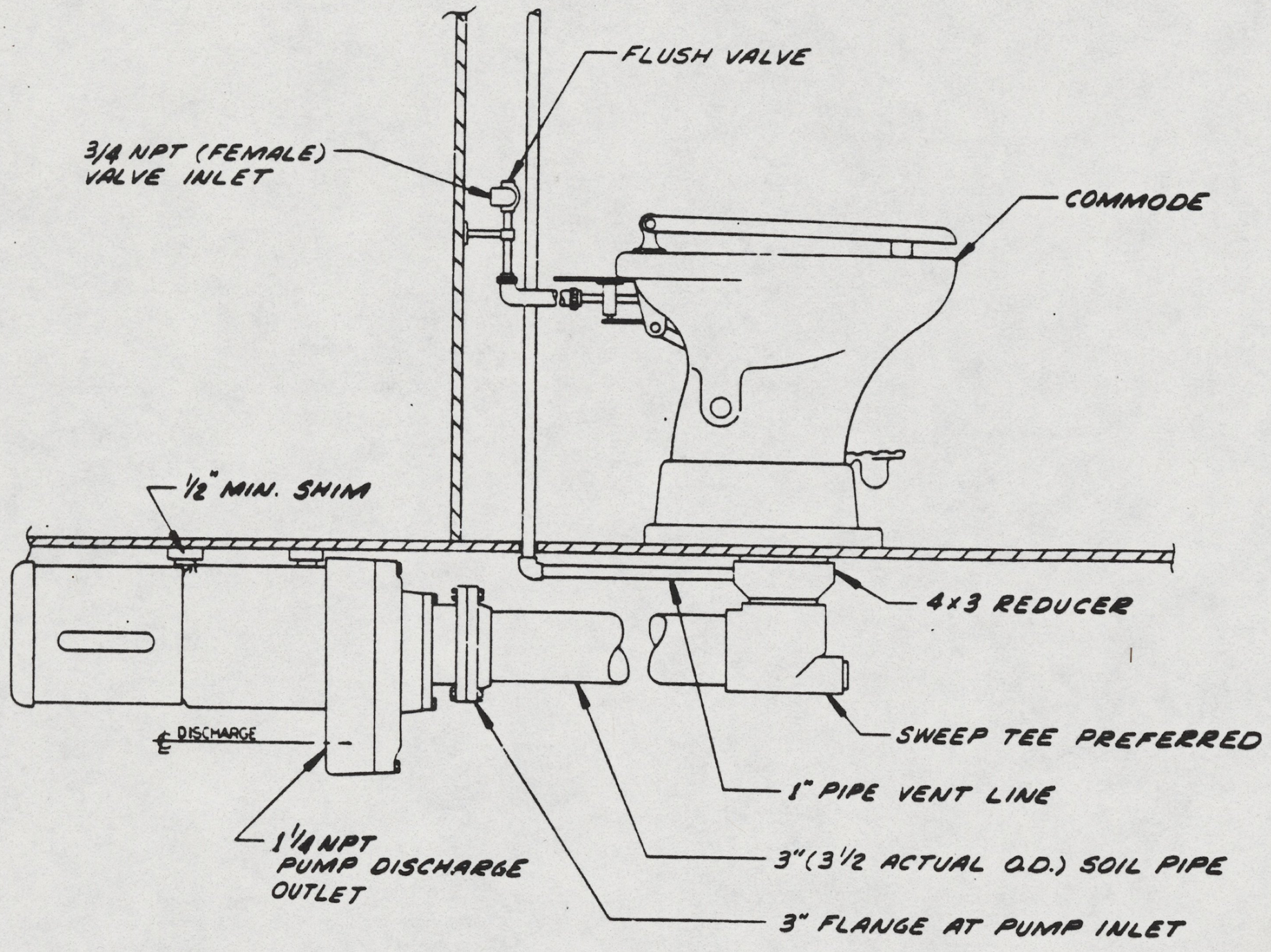



Figure 8-2. Piping Detail

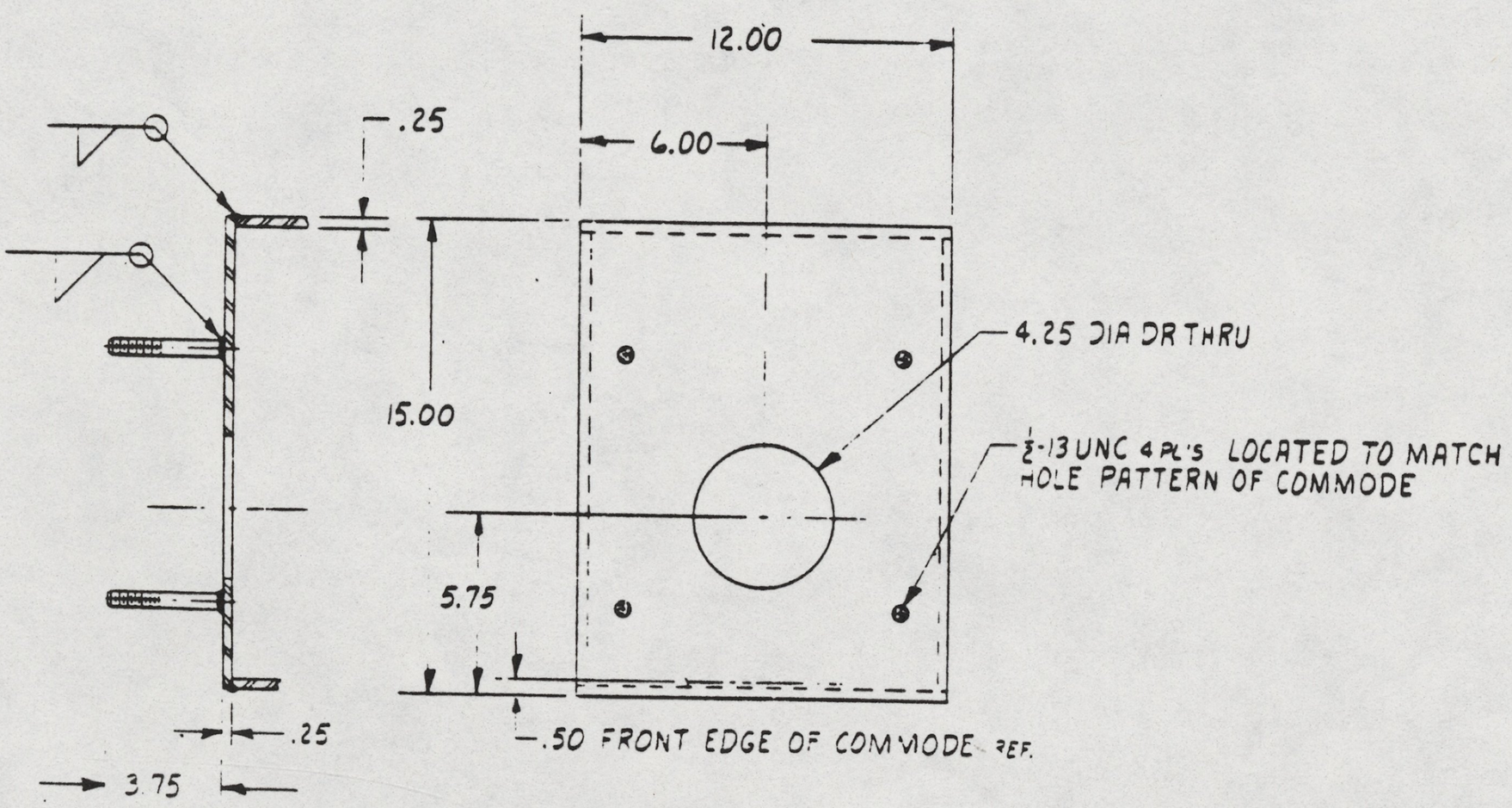



Figure 8-3. Platform-Commode Shock Mount

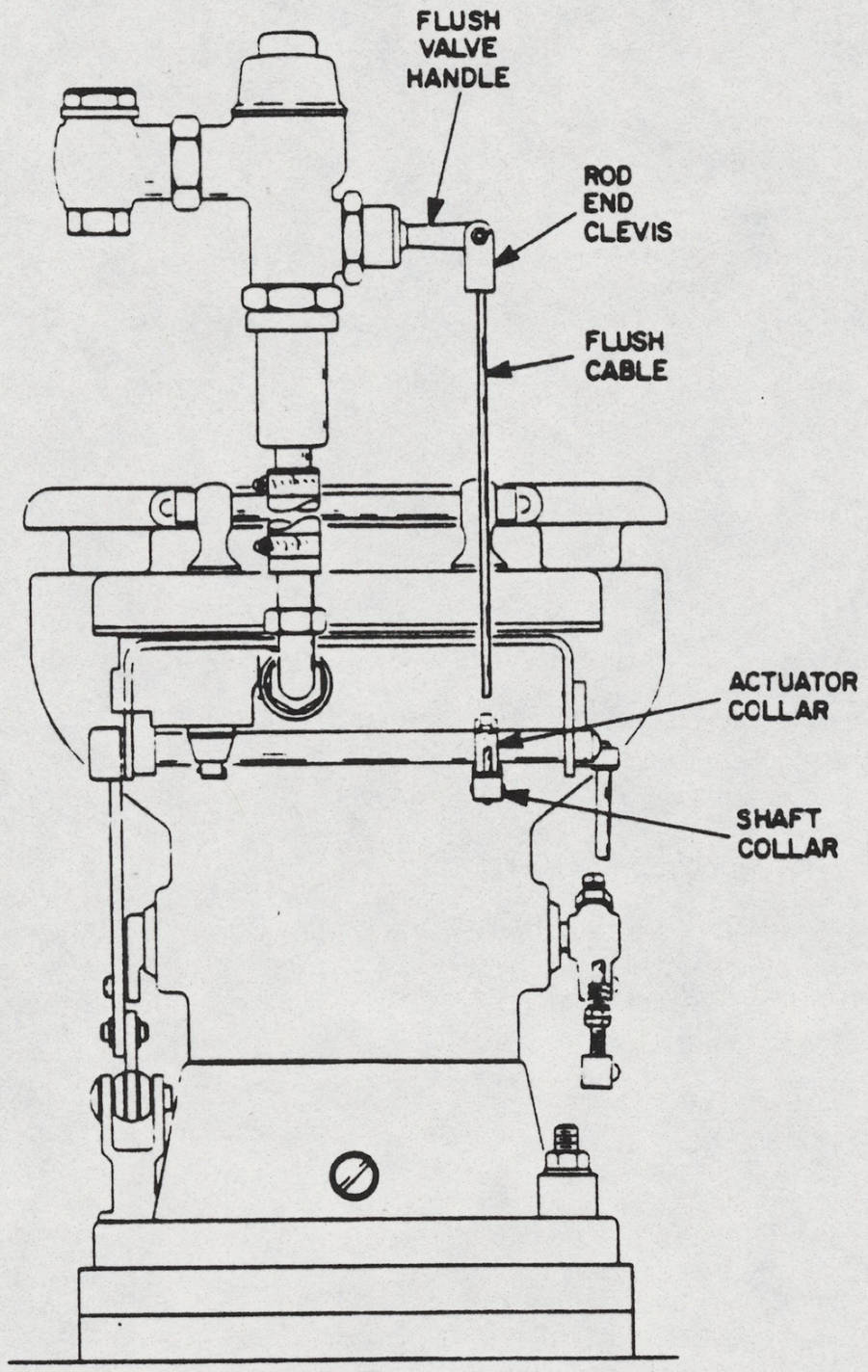



Figure 8-4. Flush Valve Cable Installation

**8-15. FLUSH WATER.** Connect flush water supply at 30 psig to the inlet of the flush valve.

**8-16. Electrical.** Check microswitch operation as follow.

1. Wires from the microswitch at the rear of the commode assembly will be connected later to terminals in the control enclosure.
2. Check that the remote control lever falls away from the microswitch sufficiently when the flush pedal is pressed to actuate the microswitch.

**8-17. MACERATOR/TRANSFER PUMP ASSEMBLY INSTALLATION.**

**8-18. IMPELLER ROTATION CHECK.** Prior to installation of the pumps, the rotation of the impellers must be checked. The impeller rotation must be counterclockwise when viewed from the suction (input) end of the pump or the unit will not function properly. Reversal of pump rotation can be attained by reversing any two of the three input power lines to the pump. It should be noted that pump rotation should not be determined by "feeling" the outward air flow from the pump since some air flow will be sensed irrespective of the direction of rotation.

**8-19. MOUNTING.** In laying out the plumbing system, it is important that the suction end of the pump be located below and as close as possible to the bottom of the water closets it serves; distances greater than 6 feet should be avoided. Urinal location is not critical since urinal wastes are entirely liquid and their flow to the pump will be adequate as long as the urinal outlet is reasonably above the pump level. Mount the macerator/transfer

pump assembly to a convenient ceiling, hull, bulkhead, deckplate, or other permanent structural member with the mounting feet provided, as shown in figure 8-2. Mounting dimensions are shown in figure 8-5.

**8-20. INTERFACE.** Connect pump to soil line as follows.

1. Connect the 3-inch pump inlet flange to the soil pipe as shown in figure 8-4, in order to allow the pump to be readily removed for cleaning or servicing.
2. Install a check valve at the 1-1/4-inch female connector of the pump outlet to prevent backflow from the pump.

**8-21. ELECTRICAL CONNECTION OF MACERATOR/TRANSFER PUMP ASSEMBLY.** Refer to the wiring diagram figure 8-6 for pump connections to the control enclosure.

**NOTE**

Electrical power from the ship's service to operate the pump motor must be connected through the magnetic starter.

**8-22. ELECTRICAL CONTROLS INSTALLATION.**

**8-23. COMPONENT LOCATION.** Installation of controls consists of mounting the control enclosure and providing prime power from the ships's source. 115 VAC single phase is used for control circuitry and 440 VAC three phase is used to operate the pumps.

**8-24. CABLING.** In installations in which more than one commode flows to a single macerator/transfer pump assembly, all connects microswitches are wired in parallel. Typical system configuration, wiring diagram, and electrical schematics are shown in figures 8-6 and 3-2 respectively. Table 8-1 identifies all the terminals that may be used in conjunction with commode wiring and macerator/transfer pump assembly operation.

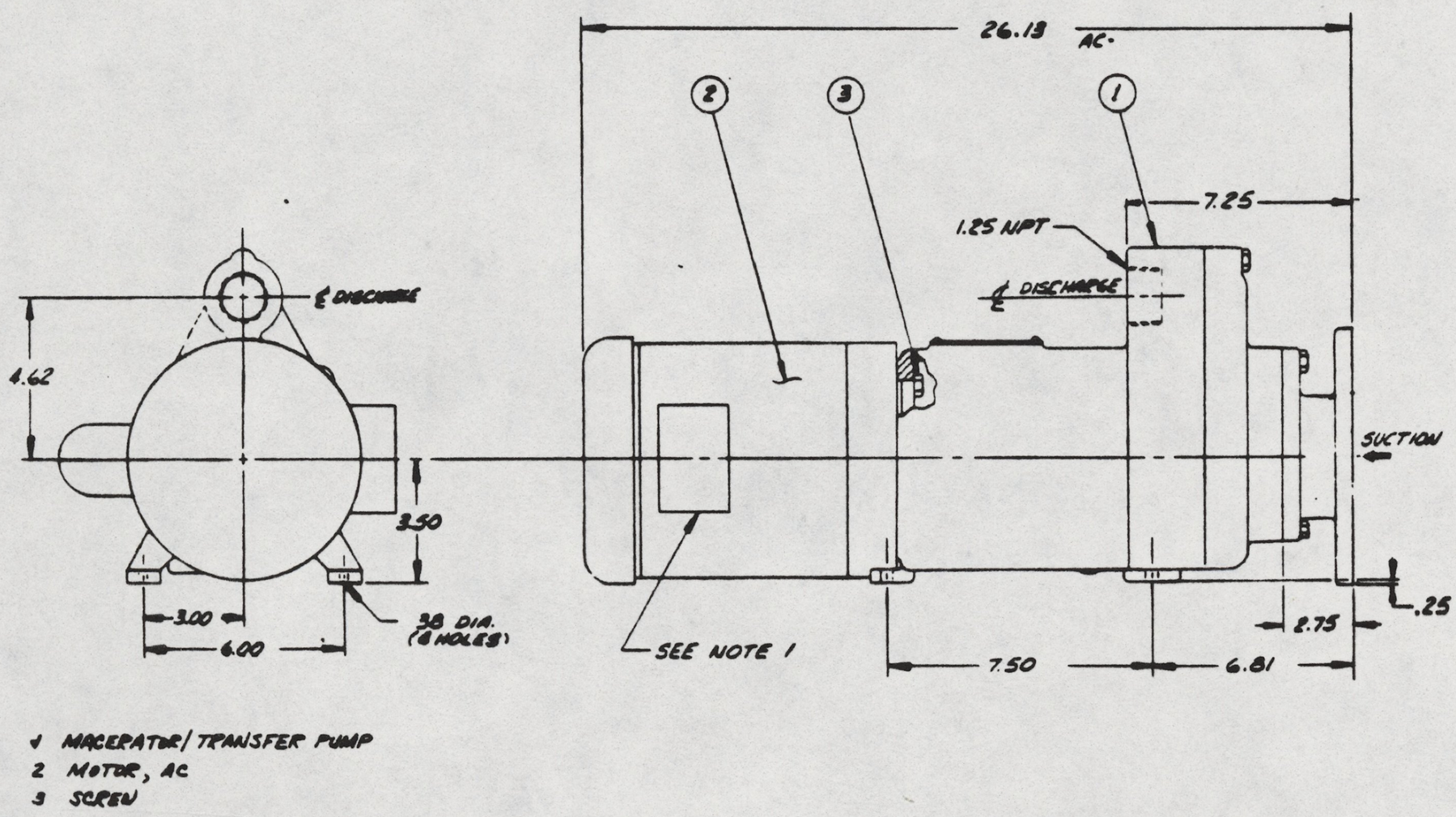



Figure 8-5. Macerator/Transfer Pump, Outline Drawing

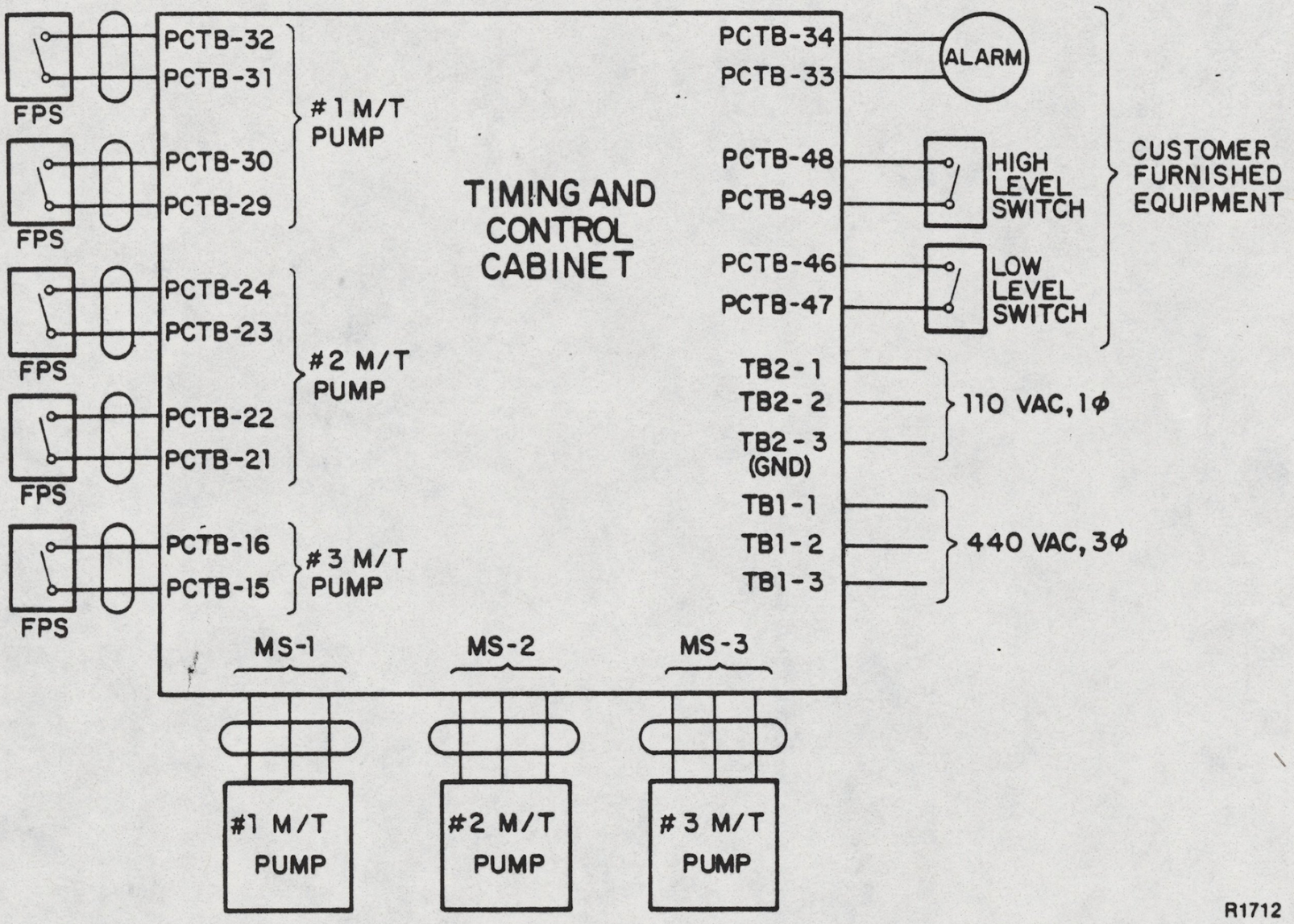



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Figure 8-6. Wiring Diagram

**Table 8-1. Commode Macerator/Transfer Pump Assembly Wiring**

| Commode | Macerator/Transfer Pump Assembly | Terminals* |
|---|---|---|
| 1 | 1 | PTCB 32 & 31 |
| 2 | | 30 & 29 |
| 1 | 2 | PTCB 24 & 23 |
| 2 | | 22 & 21 |
| 1 | 3 | PTCB 16 & 15 |

*These terminals are on the terminal strip on the printed circuit board, figure 8-7, inside the timing and control enclosure assembly.

**8-25. INSTALLATION CHECKOUT.**

**8-26. PREENERGIZING PROCEDURE.**

1. Set all control valves for normal operation of the Marine Sanitation System.
2. Check that water and drain line for possible leaks.
3. Check that all electrical connections have been completed.

**8-27. INITIAL TURN-ON.**

1. Place HAND-OFF-AUTO switches (total 3) in OFF position.
2. Apply ships power to system.
3. Place all three HAND-OFF-AUTO switches in AUTO position.

**8-28. COMMODE INSTALLATION VERIFICATION.** After the commode and flush valve are installed the following check should be made:

**8-29. Switch Adjustment.** Push the flush pedal and observe that (1) the flush cable pulls the flush valve handle and operates the flush valve, (2) the microswitch (foot pedal switch) lever pulls away from the switch and starts the macerator/transfer pump or if the pump is not connected, a "click" can be heard within the switch each time the foot-pedal is pressed and released.

**8-30. Output.** Check the volumetric output of the flush valve by adding 1 pint (16 fluid ounces) of water to an empty commode. Mark the level of water in the commode with a crayon or suitable marker. Empty the water by pressing the flush pedal and holding it down until the flush valve has completed its operation. Release the flush pedal and add a single flush from the flush valve by pushing the handle once. The amount of water added to the bowl should be approximately the same as when one pint was added to the bowl. Refer to pargraph 6-2 if an adjustment is necessary.

**8-31. Stopper Disc Assembly.** The operation of the commode stopper disc assembly should be checked by pushing the foot pedal all the way to its stop. This action should cause the stopper disc assembly to swing open until it is almost in a vertical position.

**8-32. Stopper Disc Seal.** The stopper disc seal should be checked by adding 1 or 2 pints of water to the bowl with the flush valve. The water level should be marked and no noticeable decrease in water level should occur within a 15-minute period of time.

**8-33. MACERATOR/TRANSFER PUMP ASSEMBLY INSTALLATION VERIFICATION.** To check that the factory-sealed macerator/transfer pump assembly is installed and functioning correctly, follow these steps:

1. Check that the assembly is securely attached to the mounting surface.
2. Check that the motor on each unit runs smoothly with no unusual noises.
3. Check that no leaks are present at any pipe junction.

**8-34. ELECTRICAL CONTROLS INSTALLATION VERIFICATION.** Installation checkout for the electrical controls should include the following steps:

1. Place all three HAND-OFF-AUTO switches in HAND position. Press each of the three START push buttons and check that macerator/transfer pumps operate.
2. Place all three HAND-OFF-AUTO switch in AUTO position. Flush each commode using the foot pedal and check that macerator/transfer pumps operate. Allow pump to stop before flushing next commode.
3. Place all three HAND-OFF-AUTO switch in OFF position. Verify that macerator/transfer pump does not operate either from pushbutton or by flushing commode with foot pedal.

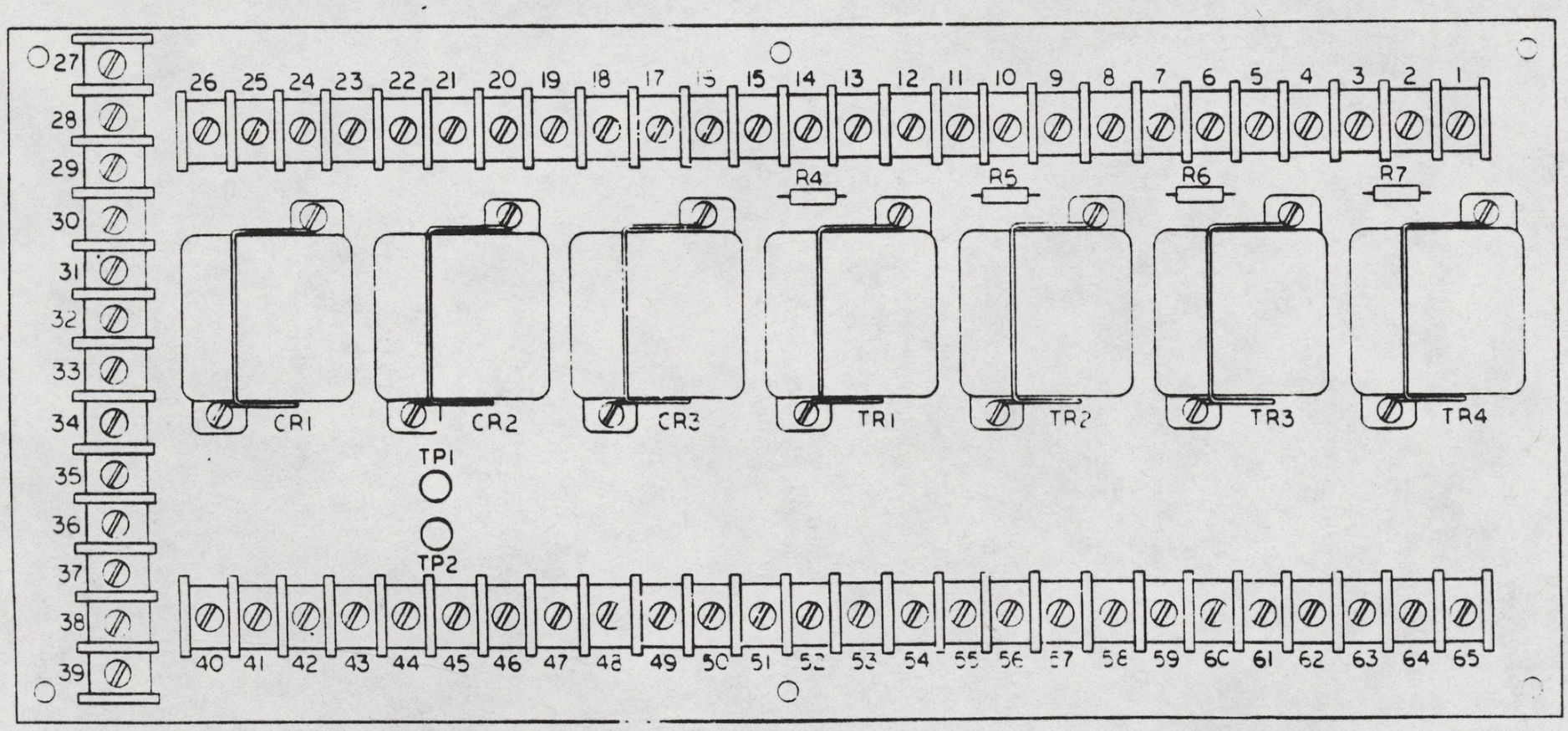


Figure 8-7. Printed Circuit Board Assembly