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DRAGON'S LAIR*

Operators Manual With Illustrated Parts Lists

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DRAGON'S LAIR*

Operators Manual With Illustrated Parts Lists

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CHAPTER 1 SET UP

HOW TO USE THIS MANUAL

This manual, written for game operators and service technicians, describes your new ATARI game.

Chapter 1 contains a game overview, game specifications, inspection procedures, voltage plug and fuse information, switch locations, and option information.

Chapter 2 contains self-test procedures.

Chapter 3 contains troubleshooting procedures.

Chapter 4 contains maintenance and repair procedures.

Chapter 5 contains illustrated parts lists. Notes in this chapter refer you to other places in the manual for more detailed information.

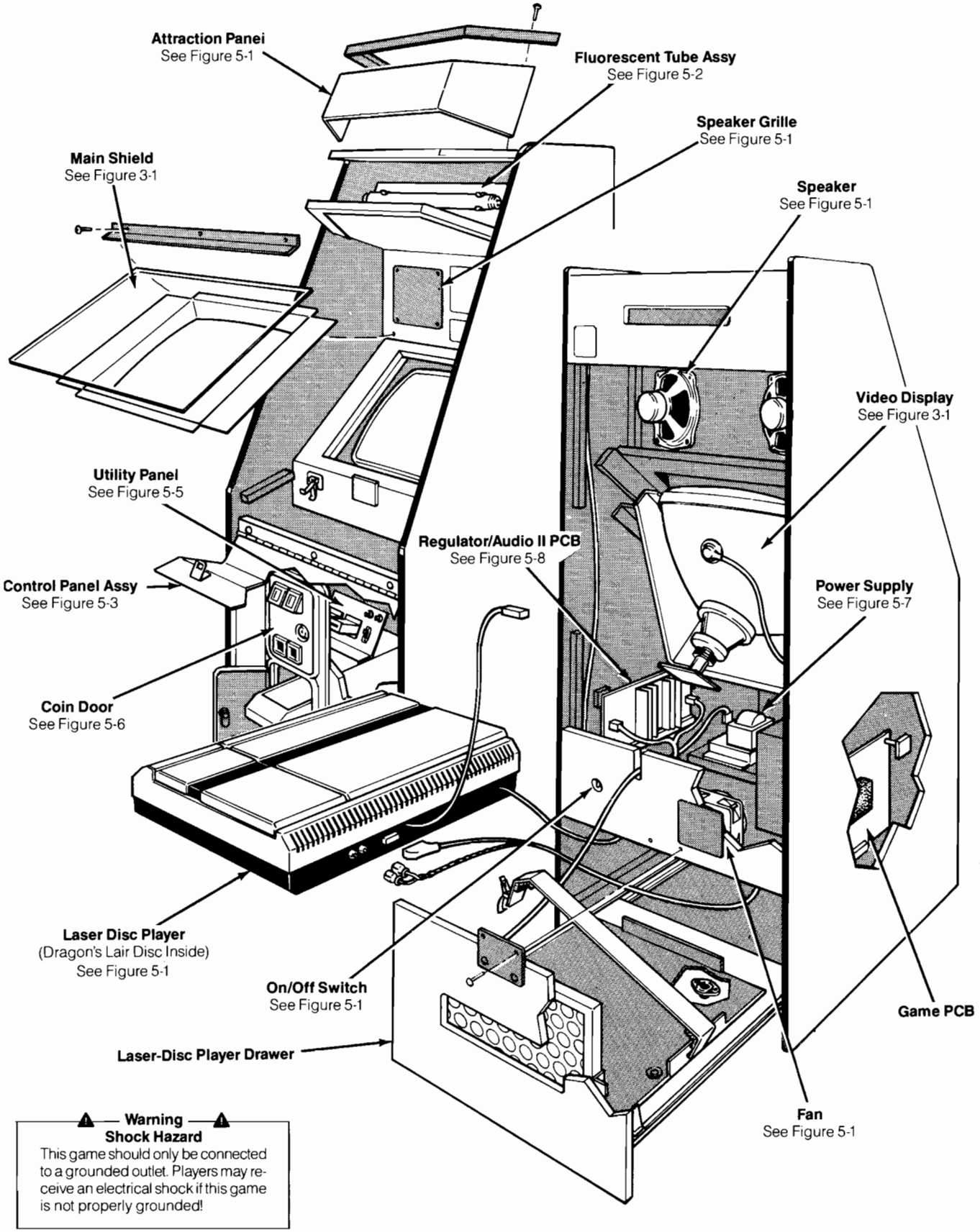
Schematic diagrams of the game circuitry are included as a supplement to this manual.

WARNING

Shock Hazard

To avoid electrical shock, do not plug in the game until it has been inspected and properly set up for the line voltage in your area.

Do not touch internal parts of the display with your hands or metal objects!



⚠ Warning ⚠
Shock Hazard
This game should only be connected to a grounded outlet. Players may receive an electrical shock if this game is not properly grounded!

Figure 1-1 Game Overview

GAME OVERVIEW

WARNING

Shock Hazard

This game should only be connected to a grounded outlet. Players may receive an electrical shock if this game is not properly grounded!

Dragon's Lair is new! It's THE original laser disc video game--the video and sound sequences for the game are stored on a LASER DISC. This unprecedented game lets a player participate in an animated AND INTERACTIVE motion-picture experience!

As Dirk the Daring, a player's goal is to rescue the princess. The adventures along the way are horrible and terrifying, but, a skilled and brave knight, like honor and truth, can prevail.

Dragon's Lair can be a one-or two-player game. If two play, two twin knights engage in mortal combat with the same demons until they both die (use up their lives), or until one rescues the fair princess from the dragon's lair.

Major Assemblies of the Dragon's Lair game are shown in Figure 1-1.

SETTING UP THE GAME

WARNING

The ambient temperature for proper operation of the laser-disc player must be 5°C (37°F) or more.

When the game is unpacked in cold conditions it should be allowed to reach room ambient temperature before power is applied.

Follow the guidelines below to set up the game.

Inspecting the Game

1. Examine the exterior of the game cabinet for dents, chips, or broken parts.

2. Remove the screws from the rear access panel. Unlock and remove this panel. Inspect the interior of the game as follows:

   a. Ensure that all plug-in connectors (on the game harnesses) are firmly plugged in. Replug any unplugged connectors. Do not force connectors together. The connectors are keyed so they only fit in the proper orientation.

   b. Ensure that all plug-in integrated circuits on the PCB are firmly plugged into their sockets.

   c. Remove the tie-wrap that secures the coiled power cord inside the cabinet. Inspect the power cord for any cuts or dents in the insulation. Repair or replace it as required. Attach a plug to the power cord--BE SURE THAT IT IS THE CORRECT PLUG FOR THE LINE VOLTAGE IN YOUR LOCATION! Place the square strain-relief plate in the wood slot at the bottom of the rear-panel opening.

   d. Inspect the power supply. Make sure the fuse block cover is mounted in place. Check that the green/yellow ground wire is connected.

   e. Inspect other major subassemblies, such as the control panel, video display, and each PCB. Make sure they are mounted securely and that the green ground wires are connected.

Setting Up the Disc Player

The disc player is installed in the drawer/player assembly of the cabinet before the game is shipped, and the Dragon's Lair video disc is already installed in the player. Therefore, the disc player should require no special set up. If you have trouble with the disc player, see Chapter 3 for instructions on how and where to send it for service.

CAUTION

Disconnect the disc controller interface cable from connector J2 on the Main PCB and connect the static prevention plug (attached to the end of the interface cable) to the player interface cable connector. This will prevent damaging the static-sensitive devices in the player.

Voltage-Plug Selection and Fuses

The power supply in your game contains six fuses. When you replace a fuse, use the identical type fuse with the same electrical rating (see Figure 1-2).

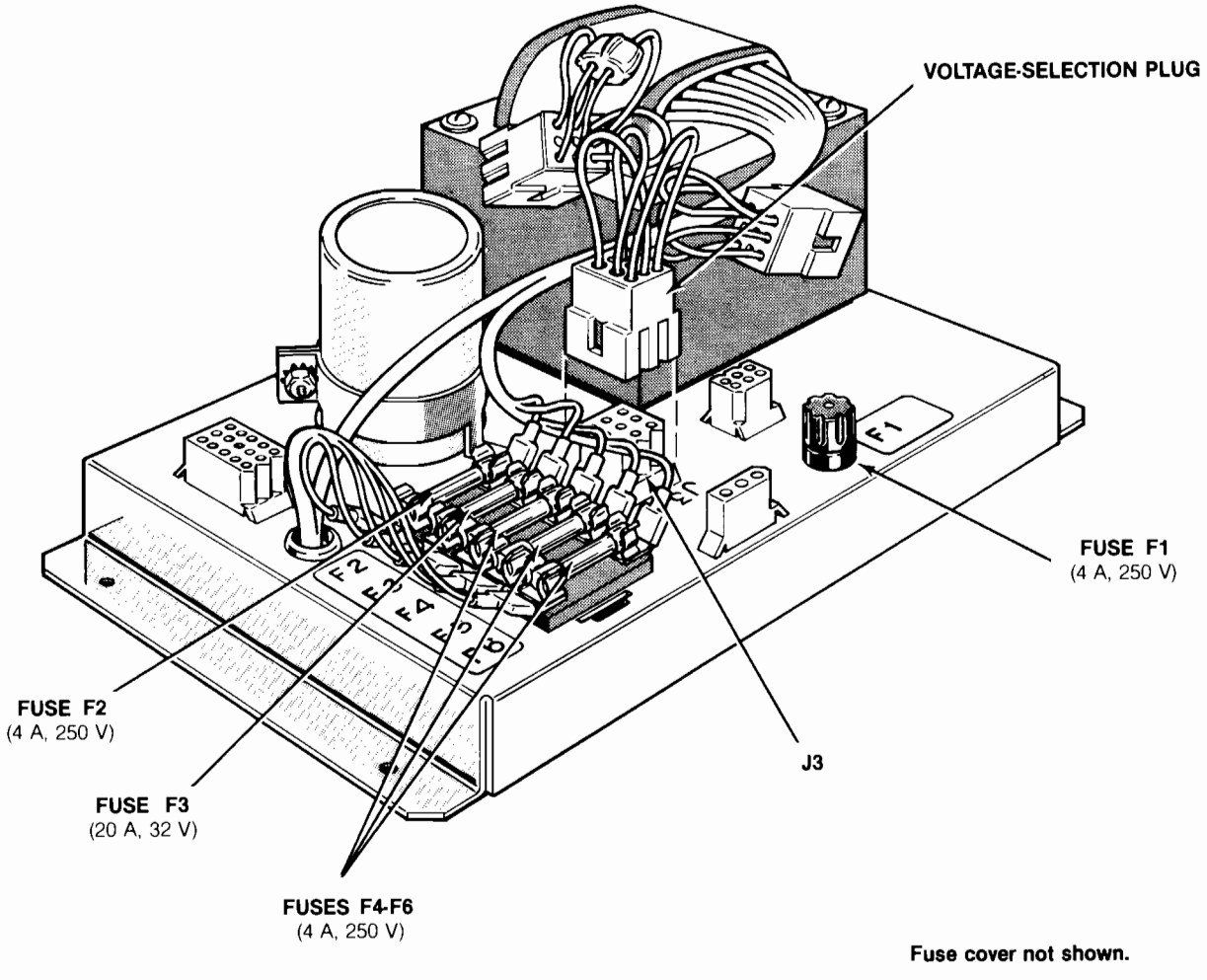


Figure 1-2 Voltage-Selection Plug and Fuse Locations

This power supply operates on the line voltage of many countries. The power supply comes with either one, two, or three voltage-selection plugs. Plug voltages and wire colors are 100 VAC (violet wire color), 120 VAC (yellow wire color), 220 VAC (blue wire color), and 240 VAC (brown wire color).

See Figure 1-2 for placement of the voltage-selection plug. Before plugging in your game, check your line voltage. Next, check the wire color on the voltage-selection plug. Make sure the voltage-selection plug is correct for the line voltage of your location.

Now plug the game into a grounded outlet.

> **NOTE**
>
> When you turn the game on, the self-test program will automatically run. See Chapter 2 for more information about self test.

SWITCH INFORMATION

Power On/Off Switch

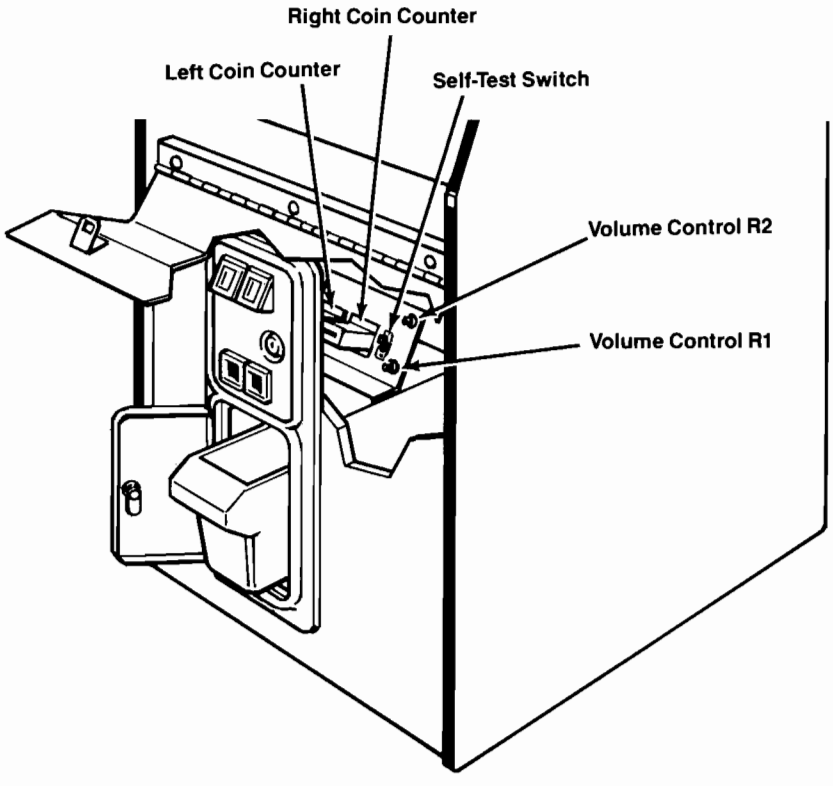
The power on/off switch is located on the back of the cabinet on the lower left side (see Figure 1-1).

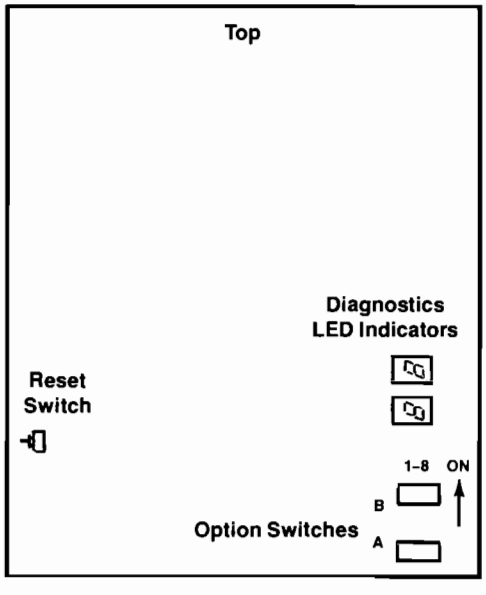
Utility Panel Switches

The utility panel is located inside the upper coin door (see Figure 1-1). Two coin counters, a self-test switch, and two volume controls are located on the utility panel. See Figures 1-1, 1-3, and 5-5 for details of these switches.

Each coin counter records the number of coins entered into the game. The self-test switch starts the self-test diagnostic program. Each volume control adjusts the level of sound produced by one channel of the game.

> **NOTE**
>
> The laser disc contains two sound channels. Control R1 adjusts sound from Channel A to one speaker; Control R2 adjusts sound from Channel B and computer-generated sounds to the other speaker.





Game PCB

Figure 1-3 Switch Locations

Disc Player Switches

The disc player has two rectangular silver pushbuttons. One is marked "ON", and the other is marked "OPEN".

CAUTION

Make sure the retaining strap is removed from the player before you press the "OPEN" button.

Option Switches

Two dual-inline-package (DIP) switches are located on the game PCB at locations SWA and SWB (see Figure 1-3). Each of these DIP switches consist of eight switches. Use these switches to select different game play and pricing options.

Possible game and pricing options are listed in Tables 1-1 and 1-2.

Table 1-1 Switch Settings for Option Switch SWA

1	2	3	4	5	6	7	8	Option
								Left Slot Coins
Off	Off	Off						Freeplay
On	Off	Off						1 coin
Off	On	Off						2 coins *
On	On	Off						3 coins
Off	Off	On						4 coins
On	Off	On						5 coins
Off	On	On						6 coins
On	On	On						7 coins
								Left Slot Credits
			Off	Off				Slot disabled
			On	Off				1 credit *
			Off	On				2 credits
			On	On				3 credits
								Attract Mode Audio
					Off			Silent *
					On			Sound
								Difficulty Level
						Off	Off	Easy *
						On	Off	Intermediate
						Off	On	Hard
						On	On	Very Hard

*Manufacturer's recommended settings

Table 1-2 Switch Settings for Options Switch SWB

1	2	3	4	5	6	7	8	Option
								Right Slot Coins
Off	Off	Off						Freeplay
On	Off	Off						1 coin
Off	On	Off						2 coins *
On	On	Off						3 coins
Off	Off	On						4 coins
On	Off	On						5 coins
Off	On	On						6 coins
On	On	On						7 coins
								Right Slot Credits
			Off	Off	Off			Slot disabled
			On	Off	Off			1 credit *
			Off	On	Off			2 credits
			On	On	Off			3 credits
			Off	Off	On			4 credits
			On	Off	On			5 credits
			Off	On	On			6 credits
			On	On	On			7 credits
								Lives per Game
						Off		3 *
						On		5
								Watchdog Timer
							On	Enable *
							Off	Disabled

*Manufacturer's recommended settings

GAME PLAY

Dragon's Lair is the first game born to the new generation of video games! This unprecedented game is the first motion-picture type fairy tale you interact with! As Dirk the Daring, your goal is to rescue the princess. Your adventures will be horrible and terrifying, but, brave knight errant that you are, you can do it!

The images for the game are stored on a laser disc, a new type of storage device that can compress information so densely that an entire encyclopedia can be contained on just one!

Dragon's Lair uses a laser-disc player made by Philips (model 22VP 932/00) and a Z80 microprocessor to generate the images and action required for game play. You control the knight with a 4-position joystick and a SWORD button. This game can accommodate a right- or left-handed knight.

Dragon's Lair has four operational modes--Attract, Play, High-Score, and Self-Test.

Attract Mode

The attract mode plays when the game has no credits registered or after a high-score mode has ended. It is designed to lure customers to play the game by introducing the characters and showing scenes from game play. The attract mode can be displayed with or without sound (see Table 1-1 for sound options in the attract mode).

The player's goal for Dragon's Lair is described by the announcer during the attract mode--to slay the dragon and rescue the Princess. "Dragon's Lair...the fantasy adventure...." is recited by the narrator while DRAGON'S LAIR and © 1983 STARCOM appear on the screen. Then the cast of characters is introduced--DIRK The DARING, The PRINCESS DAPHNE, The GIDDY GOONS, The LIZARD KING, The CRYPT CREEPS, and The SMITHEE. These are just a few of the motley monsters that Dirk meets on his adventures through the castle.

Play Mode

Game play starts when enough coins have been inserted to register a credit (see Tables 1-1 and 1-2 for coinage information). "PUSH ONE PLAYER OR TWO PLAYER BUTTON" and the number of credits will appear on the screen.

A player has a choice of 5 moves at any given time (4 positions on the joystick plus the SWORD button). A complete game of Dragon's Lair requires more than 200 correct moves. Timing is critical! Dirk can be too hesitant or too eager to make a move. Only experience and a good memory enable Dirk to complete his mission.

The game opens with the dark visage of a foreboding castle looming in the distance. Why, the next thing you know, YOU are DIRK, running across the castle drawbridge! The gate clangs shut behind you, and your quest to kill the dragon and save Princess Daphne has begun!

More than 40 possible episodes will be presented to you. Some require many fast repeated moves; others will require fewer, more calculated moves.

NOTE

Operators! We recommend you learn how to play Dragon's Lair so that you can help your customers if they get frustrated. Read Hints for Game Play for specific pointers.

Hints for Game Play

1. React! Often the player will be given a visual cue as to which direction to move. These cues are often presented as a flashing light, flashing tunnel, flashing rope, or flashing door. In general, the player should move toward a flashing object.

2. Remember, even though the player may know the direction to move, the timing of his move is critical.

3. The player must react to fire--it is his enemy. He should not linger too long near fire, and in general, he should move away from blazing fires.

At the beginning of the game, if the player makes a wrong move and loses a life, a new scene will appear at random. Later in the game, a scene that is not completed properly is repeated until it is mastered. Also, when a player loses a life, the scene stops, the screen turns blue, and "PLAYER ONE" or "PLAYER TWO" is displayed on the screen, along with that player's number of remaining lives.

As you play the game you may find that some scenes are repeated, but the image is reversed on the screen. (The scene is reversed on the disc, not by the hardware.)

Princess Daphne appears during the game, in distress and crying for help. She is unattainable until the end. Her voice is very high-pitched. If it is annoying, remember that the audio is stereo, and you can soften her voice with one of the two volume controls on the utility panel.

Most of the sounds you hear during game play originate from the disc.

High-Score Mode

After Dirk loses his last life, game play ends. The screen turns blue, and score information appears. The "HIGH SCORE" and the "LAST SCORE" earned are displayed at the same time. (Dragon's Lair does not have a table of high scores.)

Self-Test Mode

For complete self-test information, see Chapter 2.

CHAPTER 2 SELF TEST

SELF-TEST PROCEDURE

The self-test diagnostic program provides data to show if the game's circuitry and controls are operating properly. Data is provided on the LED display, DS1, located on the game PCB near the option switches (see Figure 1-3). No additional equipment is necessary.

> **NOTE**
>
> Open the coin door or remove the rear access panel to see the LED readout at DS1.

The self-test runs automatically when power is applied to the game, or after system reset. (The reset switch is the red switch on the game PCB at S1.) This program can also be started manually by setting the self-test switch on the utility panel to the on position.

If all the tests pass, a "P" is displayed on DS1. If a test fails, a number from 1 to 5 will appear on DS1. Table 2-1 lists possible DS1 readouts and their meanings.

Table 2-1 Self-Test Error Messages

DS1 Readout	Meaning
P	All tests pass
1	CPU Test Failure
2	ROM Test Failure
3	RAM Test Failure
4	Display Memory Test Failure
5	CTC Test Failure

CAUTION

If this game needs servicing, repair should only be performed by a qualified electronic technician.

CHAPTER 3 MAINTENANCE

The maintenance procedures provided in this chapter are for those items which are subject to the most severe use (refer to the following NOTE regarding laser-disc player maintenance). To assure the maximum trouble-free operation from this game, Atari recommends that periodic routine maintenance be performed on the game components described in the following procedures. How often routine maintenance is performed depends upon the game environment and frequency of play.

Refer to the illustrated parts lists in Chapter 5 of this manual to aid in locating the parts of this game that are mentioned in this chapter.

WARNING

To avoid possible electrical shock, unplug the game prior to performing the following maintenance procedures.

NOTE

Only routine cleaning procedures for the dust filter, laser disc, and objective lens of the laser-disc player are provided in this chapter. Atari recommends that the laser-disc player in this game be returned to your distributor for major maintenance or repair. Observe the Removing the Disc Player and Packing the Disc Player for Shipment instructions in this chapter for removing the player from the game cabinet and shipping the player to your distributor.

CLEANING REQUIREMENTS

The dust filter at the rear of the player drawer, the laser disc itself, and the objective lens in the laser-disc player should be cleaned at least twice a month to ensure optimum player quality and reliability. Clean the dust filter, the laser disc, and the objective lens as follows:

1. Open the laser disc player drawer as described in the first four steps under Removing the Disc Player.

2. Remove the dust filter at the rear of the player drawer.

3. Shake the dust from the filter and reinstall the filter in the drawer.

4. Release the draw latch on the player retaining strap.

5. Push the player drawer partially in and remove the player retaining strap.

6. Apply power to the game.

7. Press the OPEN pushbutton on the front of the player. Wait about 10 seconds and the lid will open automatically to allow access to the laser disc.

8. Remove power from the game.

> **CAUTION**
>
> Do not touch the playing surface of the laser disc. Handle the laser disc only by its edges or between the center hole and one edge.

9. Carefully remove the laser disc from the player.

10. Remove the dust from the objective lens and the video disc with a clean, lint-free, 100% cotton cloth. If necessary, dampen the cloth slightly with water.

> **CAUTION**
>
> Do not use any form of abrasive cleaner, alcohol, or solvent to clean the laser disc or objective lens. Permanent damage to the disc playing surface or lens may result.

11. With the playing surface of the disc facing downward, reinstall the disc in the player and press it gently onto the center spindle.

12. Close the lid on the player.

13. Replace the retaining strap.

14. Gently close and secure the player drawer.

15. Apply power to the game.

The game cabinet and display shield may be cleaned with any non-abrasive household cleaner. The coin mechanism should be cleaned periodically with hot or boiling water and a mild detergent. A toothbrush may be used to remove any stubborn build-up of residue in the coin path. After cleaning the coin mechanism, flush thoroughly with hot or boiling water and blow out all the water with compressed air. Compressed air is also recommended for cleaning dust from the interior of the cabinet. No lubrication is required for any of the moving parts in this game.

REMOVING THE DISC PLAYER

1. Remove power from the game.
2. Remove the rear access panel from the game cabinet.
3. Use an 8 mm socket to remove the two wing nuts and washers from the inside of the drawer security plate. Save the hardware for reassembly.
4. Gently slide the player drawer open.
5. Release the draw latch on the player retaining strap and remove the strap.
6. Apply power to the game.
7. Press the OPEN pushbutton on the front of the player. Wait about 10 seconds and the lid will open automatically.
8. Remove power from the game.

> **CAUTION**
>
> Handle the laser disc only by its edges or between the center hole and one edge. Do not touch the playing surface of the disc.

9. Carefully remove the laser disc from the player and place it in the envelope provided with the game. Store the disc in a cool, dark place.
10. Close the lid on the player.
11. Disconnect the coaxial video connector and the two audio connectors from the back of the player.
12. Disconnect the disc controller interface cable from connector J2 on the Main PCB and connect the static prevention plug (attached to the end of the interface cable) to the player interface cable connector.

13. Disconnect the player power cord from the yellow three-pin connector J4A on the power supply. Carefully cut the cable ties that retain the power cord.

14. Remove the player drawer by gently lifting and sliding the drawer out of the track.

15. Gently lift the laser-disc player from its mounting plate and out of the drawer.

Reinstall the laser-disc player in the game cabinet in the reverse order of removal. Make certain that the disc controller interface cable is free from any obstructions as the player is placed in the drawer. Replace the power cord cable ties.

PACKING THE DISC PLAYER FOR SHIPMENT

Check the window in the laser-disc player lid to make certain the laser disc has been removed before packing the player for shipment. If the laser disc is inside the laser-disc player, apply power to the player from connector J4A on the game power supply. Then, press the OPEN pushbutton and wait for the lid to open. Refer to the Removing the Disc Player procedure for detailed laser disc removal instructions.

Seal the laser-disc player in a plastic (or an equivalent material) bag to provide moisture and dust protection during transit. Pack the sealed laser-disc player in a sturdy shipping container large enough to allow at least three inches of space around the top, bottom, and all sides of the player. Pack at least three inches of loose or rigid foam (or an equivalent shock-absorbent material) on the bottom of the container. Place the laser-disc player in the container and pack all sides tightly with packing material. Then place enough packing material on the top of the player to hold the player firmly in place when the container lid is closed. Seal the shipping container with an appropriate adhesive tape.

NOTE

If the laser-disc player is to be shipped by common carrier, we suggest you insure the player against loss or damage for the replacement cost.

OPENING THE CONTROL PANEL

1. Unlock and open the coin door. Reach up through the opening to the top of the control panel and release the two spring-draw latches.

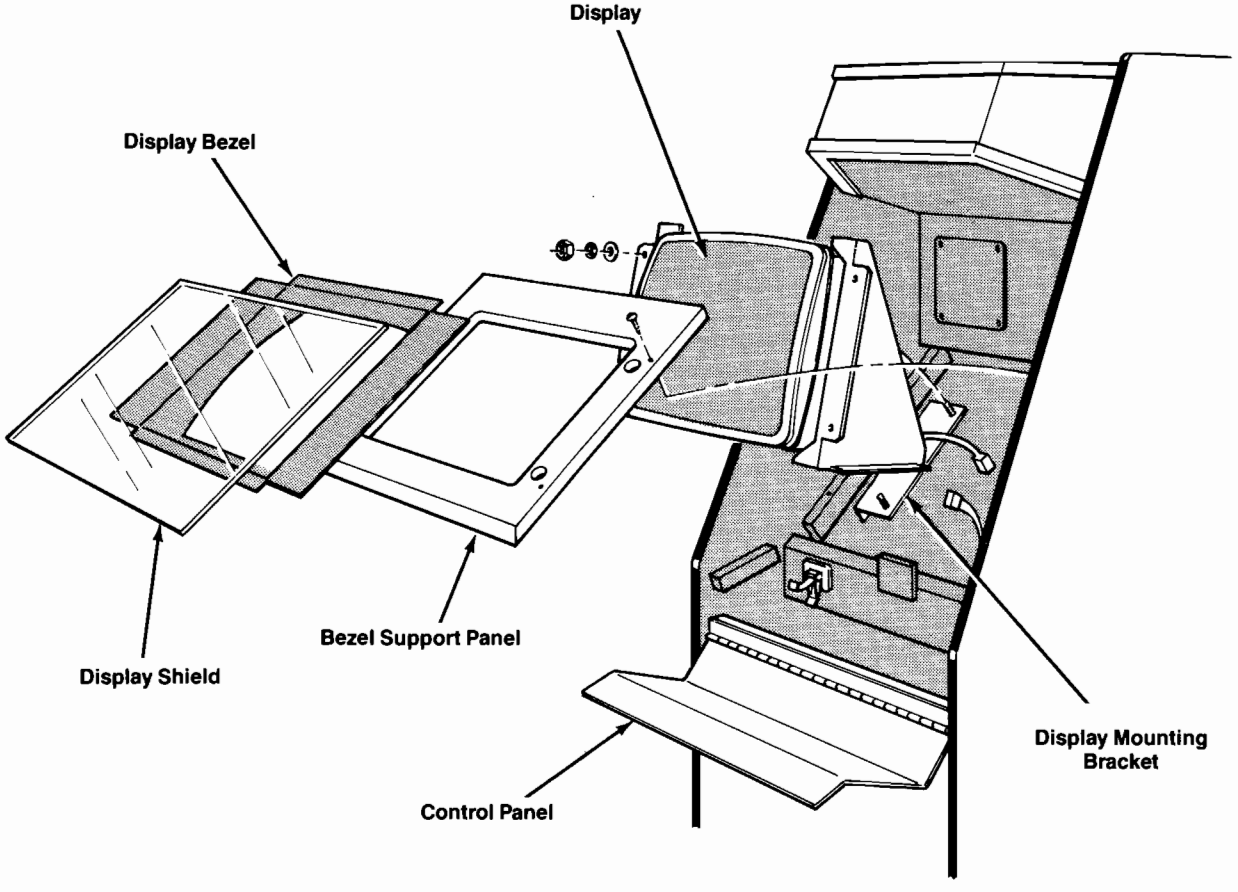


Figure 3-1 Removing the Display

2. Close the coin door.

3. Lift the control panel at the top edge and tilt it toward you.

REMOVING THE DISPLAY

This procedure is illustrated in Figure 3-1.

1. Unplug the game.

2. Remove the rear access panel from the game cabinet.

3. Disconnect the power lead (two-pin connector) and the video input lead (five-pin connector J5) from the CRT assembly.

4. Open the control panel as previously described.

5. Carefully remove the display shield and bezel.

6. Remove the four screws that secure the display support panel to the cabinet.

7. Lift the front edge of the bezel support panel and slide it out from the front of the game.

8. Use an 11 mm socket to remove the four bolts, nuts, and washers from the front of the display mounting brackets.

9. Carefully lift the CRT assembly out from the front of the game cabinet.

Reinstall the CRT assembly in the reverse order of removal.

SERVICING THE JOYSTICK LEAF SWITCHES

1. Open the control panel as previously described.

2. To replace the joystick leaf switches, you do not need to disassemble the joystick. Using your thumbs, pry apart the plastic flanges on the switch holder. With your index finger, lift the switch up so that it will clear the plastic tab located on the outside end of the switch holder.

3. Slide the leaf switch out of its holder. Replace the switch in reverse order.

4. Make sure that each leaf switch is firmly seated in its holder. There is a small gray plastic tab on the outside end of the switch

holder. The black plastic part of each leaf switch must be in front of this tab.

5. Check that all four leaf switches can be activated by watching the switch blades as you move the joystick handle up, down, left, and right.

6. Adjust each switch contact for a narrow gap using the following procedure:

   a. Push the joystick handle away from the switch for easier servicing.

   b. Use a pair of needlenose pliers or a switch adjustment tool to bend each double set of blades in toward the center. Make the bend where the double set of blades protrude from the black plastic part of the switch.

7. Inspect the switch action. The switches must move independently for right, left, up, and down motion of the joystick.

DISASSEMBLING THE JOYSTICK ASSEMBLY

1. Open the control panel as previously described.

2. Remove the entire joystick assembly from the control panel.

3. Remove the four screws in the plastic joystick frame.

4. Remove the retaining ring from the bottom of the shaft. The assembly will now come apart.

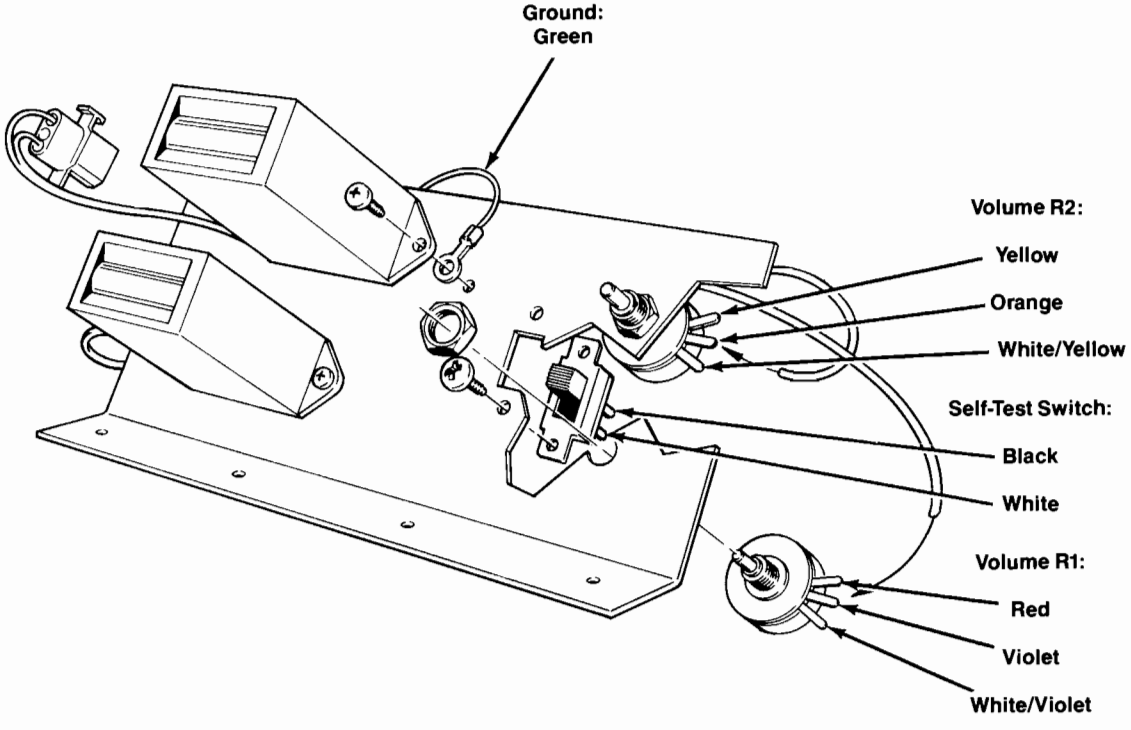
5. To replace the bellows, pry the bellows up and out of the plastic frame. Note that the inner raised ring on the bellows is longer on one side. This longer side goes on top of the assembly (toward the control knob).

Reassemble the joystick in reverse order.

SERVICING THE PUSHBUTTON LEAF SWITCHES

1. Open the control panel as previously described.

2. Adjust the leaf switch contacts for a narrow gap. When a pushbutton is pressed, the resulting wiping action of the cross-bar contacts provides a self-cleaning feature. Don't burnish the contacts. To clean them, use electrical contact cleaner.



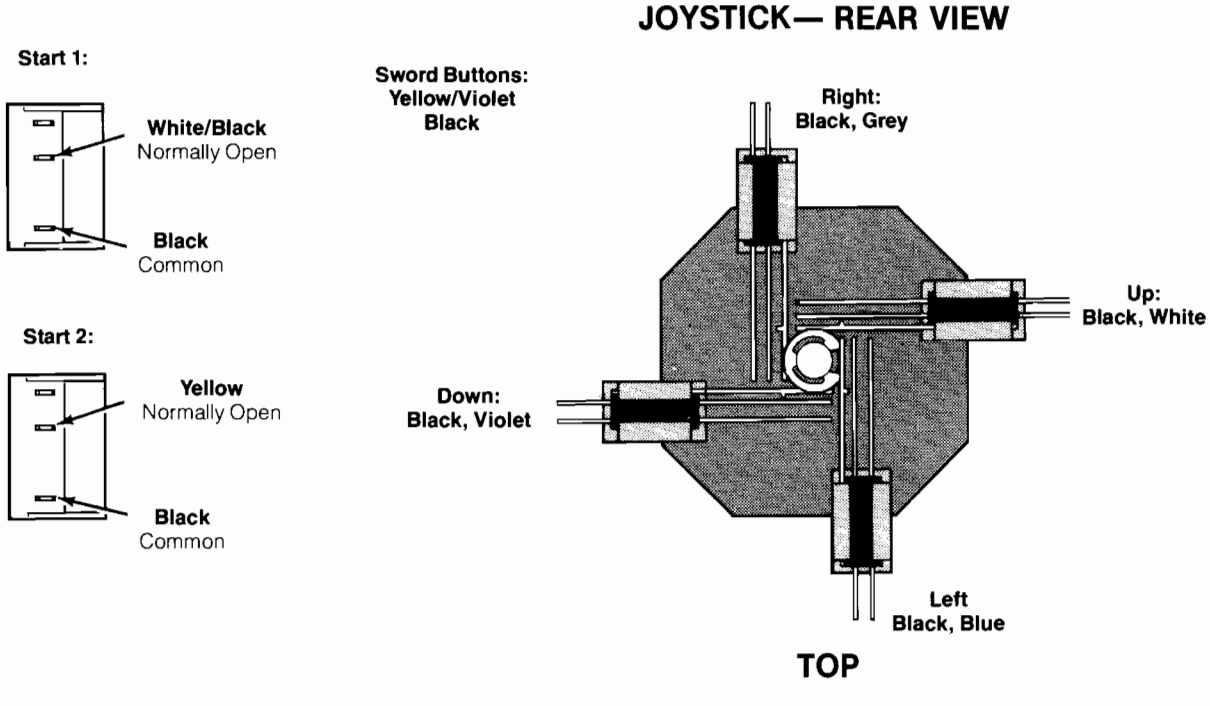


Figure 3-2 Wire Colors

3. To replace a leaf switch, remove the stamped nut and replace the molded switch body.

4. To replace the switch pushbutton, turn the stamped nut with a wrench in a counterclockwise direction, as seen from the inside of the control panel. The ring on the outside of the control panel should not spin.

5. Reinstall the pushbutton switch. Reconnect the harness wires to the switch terminals (see Figure 3-2).

SERVICING THE START SWITCHES

1. Open the control panel as previously described.

> **NOTE**
>
> Start switches can be checked for proper operation with an ohmmeter. Disconnect the wires from the switch terminals and connect an ohmmeter between the normally open and common contacts (see Figure 3-2). Press and release the pushbutton and check for zero and infinite resistance. If the switch is not operating properly, perform the following procedure.

2. Turn the switch counterclockwise while firmly holding the black cone-shaped bushing on the outside of the control panel.

3. Install a new switch using the reverse procedure.

4. Reconnect the harness wires as shown in Figure 3-2. Make certain the right colors go to the right tabs on the switch.

WIRING THE CONTROLS

When you replace a switch or conrol, refer to Figure 3-2 for the proper wire connections.

CHAPTER 4 TROUBLESHOOTING

TROUBLESHOOTING AIDS

> **NOTE**
>
> Atari recommends that the laser-disc player be returned to your distributor for maintenance or repair. Refer to the Disc Player Removal procedures and the Disc Player Packing for Shipment instructions in Chapter 3 before shipping the player to your distributor.

Troubleshooting aids are provided throughout this manual and the Schematic Package supplement. The following information is intended to acquaint the service technician with the portions of these documents that contain useful troubleshooting and repair information.

Assembly and Component Locations

The parts lists in Chapter 5 illustrate the locations of assemblies and components. Printed-circuit board (PCB) illustrations aid in rapidly locating components shown on the corresponding schematic diagram(s).

Diagrams

The Schematic Package supplement included with this game contains the following:

- Schematic diagrams with component locations, active component type numbers, and electrical values.
- Memory map(s) with address and data information.

Troubleshooting Procedures

This game will test itself and provide data to aid in localizing troubles to a major circuit. Self-test procedures are provided in Chapter 2. Refer to the following section on Troubleshooting Techniques for a suggested troubleshooting sequence that uses the self-test procedures.

Detailed theory of operation information to aid in locating defective components is provided inside the Schematic Package supplement.

TROUBLESHOOTING TECHNIQUES

> **WARNING**
>
> To avoid electrical shock, turn off the game power before attempting to troubleshoot this game.

The following troubleshooting steps are arranged in a sequence recommended for locating a defective component. The procedure begins with a check of the simple trouble possibilities and progresses to more extensive procedures for localizing the trouble to an assembly or major circuit, and then to a defective component.

Check Switch Settings

Incorrect switch settings can sometimes indicate a problem that does not exist. Refer to Chapter 1 to verify that the game has been installed properly and that the switches are set to their correct positions. Check for proper operation in all game-play modes.

Check Fuses

Check for open fuses. Refer to the Power Supply Assembly Parts List in Chapter 5 and to the Display Manual for the location and rating of each fuse used in this game. Make sure that replacement fuses are the proper type and rating.

Check Power-Supply Voltages

Improper operation of all circuits usually indicates a power supply problem. Check that the proper line voltage is available to the power supply.

Localize Trouble

Determine the trouble symptom. Use the wiring diagrams in the Schematic Package supplement to determine which assemblies or major circuits could cause the trouble. Perform the self-test procedure provided in Chapter 2.

Visual Check

Visually check for obvious problems in the portion of the game where the trouble is suspected. For example, check for loose or defective solder connections, integrated circuits loose in their sockets, loose cable connections, broken wires, and damaged printed-circuit boards or components.

Check Voltages

Check for correct voltages.

Check Individual Components

Check soldered-in passive components (e.g., resistors, capacitors, diodes) by disconnecting one end to isolate the measurement from the effects of the surrounding circuitry. Often, direct substitution is the most practical way to determine if a component is faulty. However, eliminate the possibility of some other circuit problem existing that could damage the substitute component.

Repair the Assembly

CAUTION

Soldered-in transistors and integrated circuits are difficult to remove without damaging the printed-circuit board or component. Refer to the information in this chapter pertaining to soldering and replacing integrated circuits and transistors.

Repair or replace the defective part. Refer to Chapter 3 for special removal and replacement procedures. Check for proper operation of the repaired circuit. Refer to the Schematic Package supplement for applicable adjustment procedures.

SOLDERING TECHNIQUES

Observe the following recommendations when removing or replacing components soldered to a printed-circuit board (PCB) in this game. Poor soldering practices can damage a PCB or heat-sensitive electrical components.

Choosing the proper soldering iron is essential before attempting to remove or replace soldered-in components. Excessive heat is a common cause of damage to a component or PCB. However, transient voltages from solder guns or improperly grounded soldering irons can also damage certain voltage-sensitive semiconductor devices. Refer to Troubleshooting Discrete Field-Effect Transistors for more specific information.

A 15- to 27-watt pencil-tip soldering iron is recommended to avoid separating the etched circuit wiring from the board material and to avoid damaging active components. A temperature-controlled soldering station rated at 700°F with a fine cone or a very fine chisel tip can also be used.

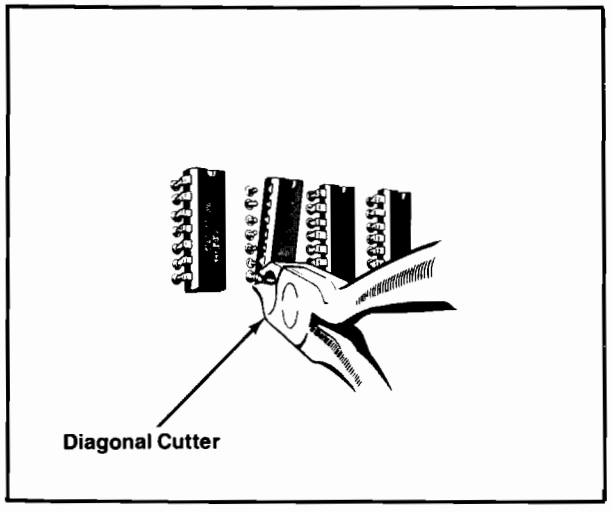


Figure 4-1 Removing ICs (Cut Pin Method)

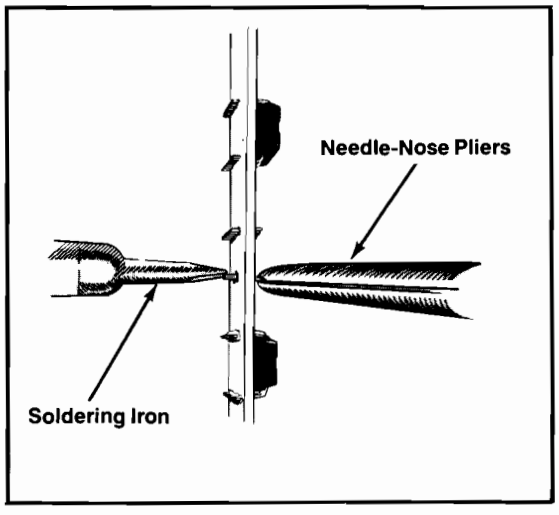


Figure 4-2 Removing IC Pins

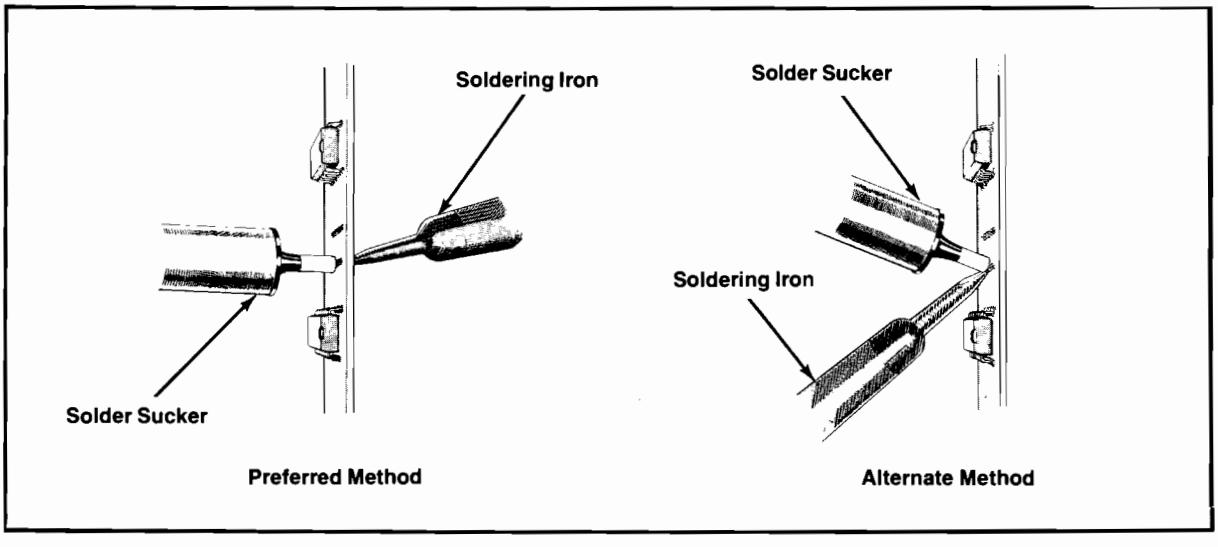


Figure 4-3 Removing Solder from Plated-Through Holes

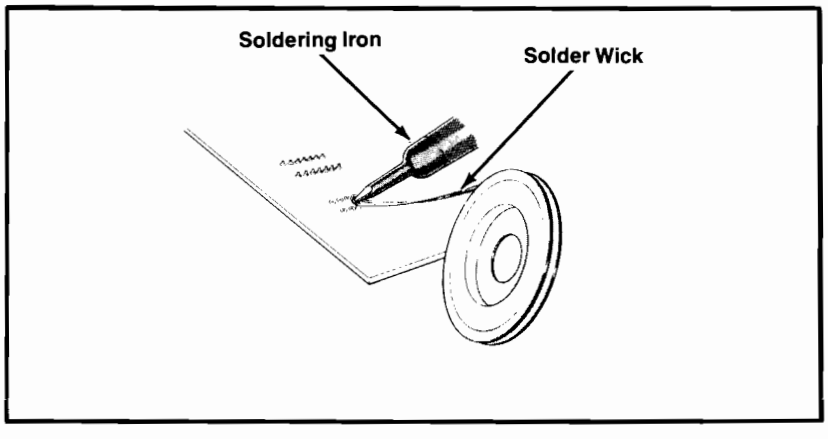


Figure 4-4 Removing Solder from Lead Connection Pads

CAUTION

Solder guns are not recommended for removing or replacing soldered-in components on a PCB. The added possibility for overheating and the large transient voltage induced by the solder gun could cause damage to heat- or voltage-sensitive devices.

The following additional equipment is recommended for removing and replacing soldered-in components:

- Solder Sucker--Hand-operated vacuum tool used to remove liquified solder from the PCB. Top-of-the-line Soldapullt® brand is recommended.
- Solder Wick--Resin-soaked copper braid used for removing excess solder from the lead connections on the PCB. See Removing Integrated Circuits for precautions relating to the use of a solder wick on a multi-layer PCB with plated-through holes.
- Flux Remover--Non-corrosive chemical used to clean foreign material from the PCB before soldering and to remove any flux residue where components have been replaced. Also used to clean any foreign material from the PCB during preventive maintenance. Isopropyl alcohol is recommended.
- Acid Brush--Small stiff-bristled paint or tooth brush used with flux remover to clean flux and other foreign material from the PCB.

REMOVING INTEGRATED CIRCUITS

The easiest and safest method for removing soldered-in integrated circuits (IC) from a printed-circuit board (PCB) is to cut off each pin as close to the IC case as possible with a tip dyke or diagonal cutter as shown in Figure 4-1.

Use the proper soldering iron as described under Soldering Techniques. Then, to avoid excessive heat buildup in one area of the PCB, apply heat directly to each pin in a random order. Remove the loosened pin with the tip of the soldering iron or a needle-nose pliers as shown in Figure 4-2. Allow a moment for the PCB to cool before proceeding to the next pin. Apply just enough heat to remove any stubborn pins.

For a multi-layer PCB with plated-through holes, use a solder sucker to remove the remaining solder from inside each hole as shown in Figure 4-3. If possible, suck the solder from the opposite side of the PCB from where the heat is applied.

Use a solder wick to remove excess solder from around the lead connection pads on the top and/or bottom surface of the PCB as shown in Figure 4-4.

CAUTION

Do not use a solder wick to remove solder from inside plated-through holes. The heat required for the solder wick to remove the solder from inside the hole could damage the PCB.

TROUBLESHOOTING STATIC-SENSITIVE DEVICES

Certain precautions must be taken when working with static-sensitive devices,e.g., microprocessors, field-effect transistors (FET), complementary metal-oxide semiconductors (CMOS), and other large-scale integration (LSI) devices that use metal-oxide semiconductor (MOS) technology. Static charge buildup in a person's body or leakage from an improperly grounded soldering iron can cause static-sensitive device failure.

Before handling a static-sensitive device or a PCB with such devices attached to it, ground any static voltage that may have accumulated in your body by touching an object that has been earth grounded. A bare wire wrapped around your wrist and attached to an earth ground is effective when working extensively with static-sensitive devices. When soldering on a static-sensitive device, use a soldering iron with a properly grounded three-wire cord. (Refer to Soldering Techniques for a discussion of recommended soldering irons and procedures.)

A static-sensitive device may appear defective due to leakage on a PCB. Observe the precautions for grounding static voltages described in the preceding paragraph and clean both sides of the PCB with flux remover or an eraser before replacing what may be a good static-sensitive device. For discrete FETs, clean thoroughly between the gate, drain, and source leads.

Static-sensitive devices may be packaged in conductive foam or have a protective shorting wire attached to the pins. Remove the conductive foam just prior to inserting the device in its socket or soldering to a PCB. Remove the shorting wire only after the device is inserted in its socket or after all the leads are soldered in place.

CHAPTER 5 ILLUSTRATED PARTS LISTS

This chapter provides information you need to order parts for your game. Common hardware (screws, nuts, washers, etc.) has been deleted from most of the parts lists. However, a parts list is included for the hardware to mount the printed-circuit boards (PCBs) to the cabinet.

The PCB parts lists are arranged in alphabetical order by component. Each component subsection is arranged alphanumerically by reference designator.

Other parts lists are arranged alphanumerically by Atari part number. In these parts lists, all A-prefix numbers come first. Following these are numbers in sequence evaluated up to the hyphen, namely 00- through 99-, then 000598- through approximately 201000-.

When ordering parts, please give the part number, part name, number of this manual, and serial number of your game. This will aid in filling your order rapidly and correctly. We hope the results will be less downtime and more profit from your game.

Atari Customer Service numbers are listed on the inside front cover of this manual.

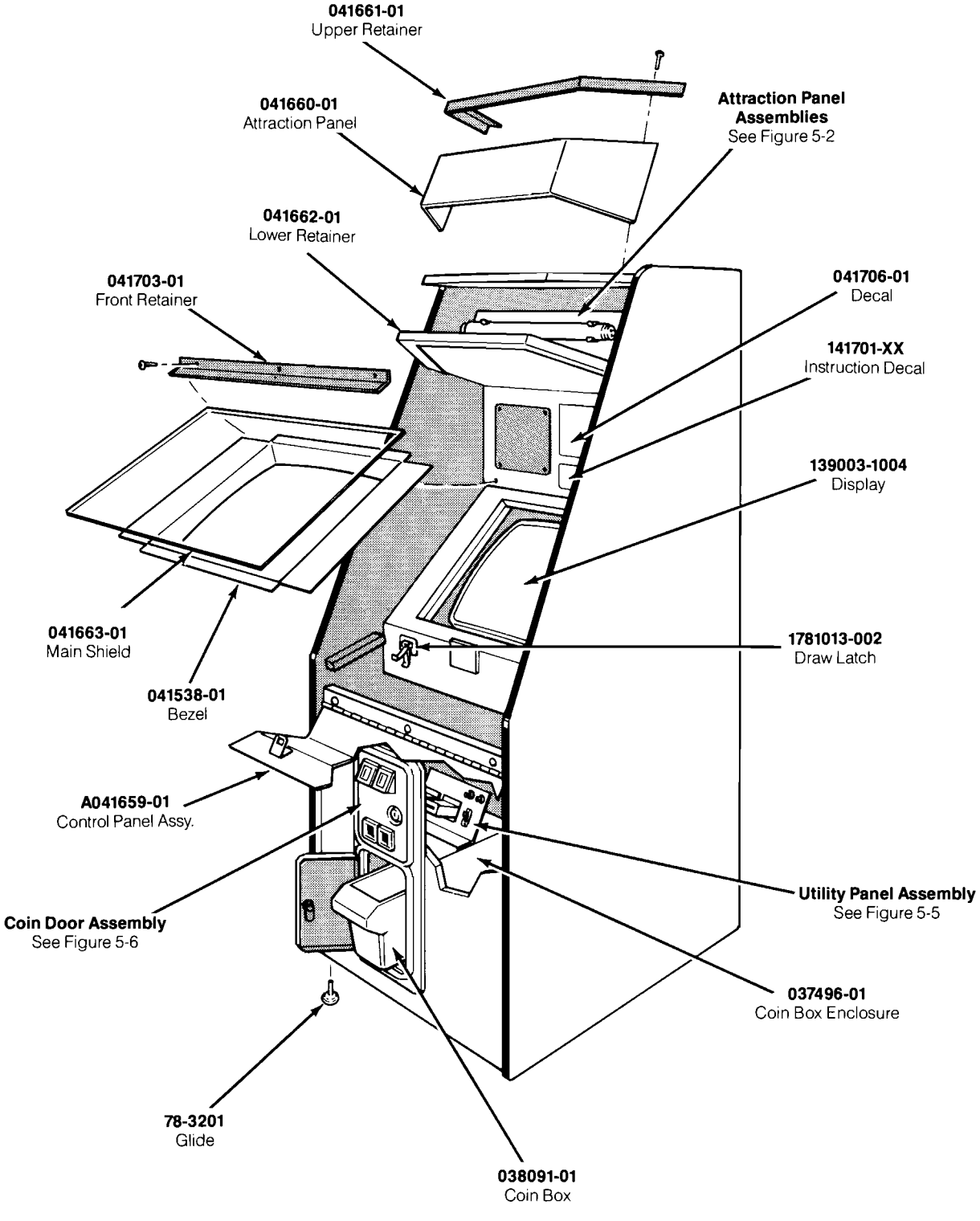


Figure 5-1 Cabinet-Mounted Assemblies
A041650-01 A

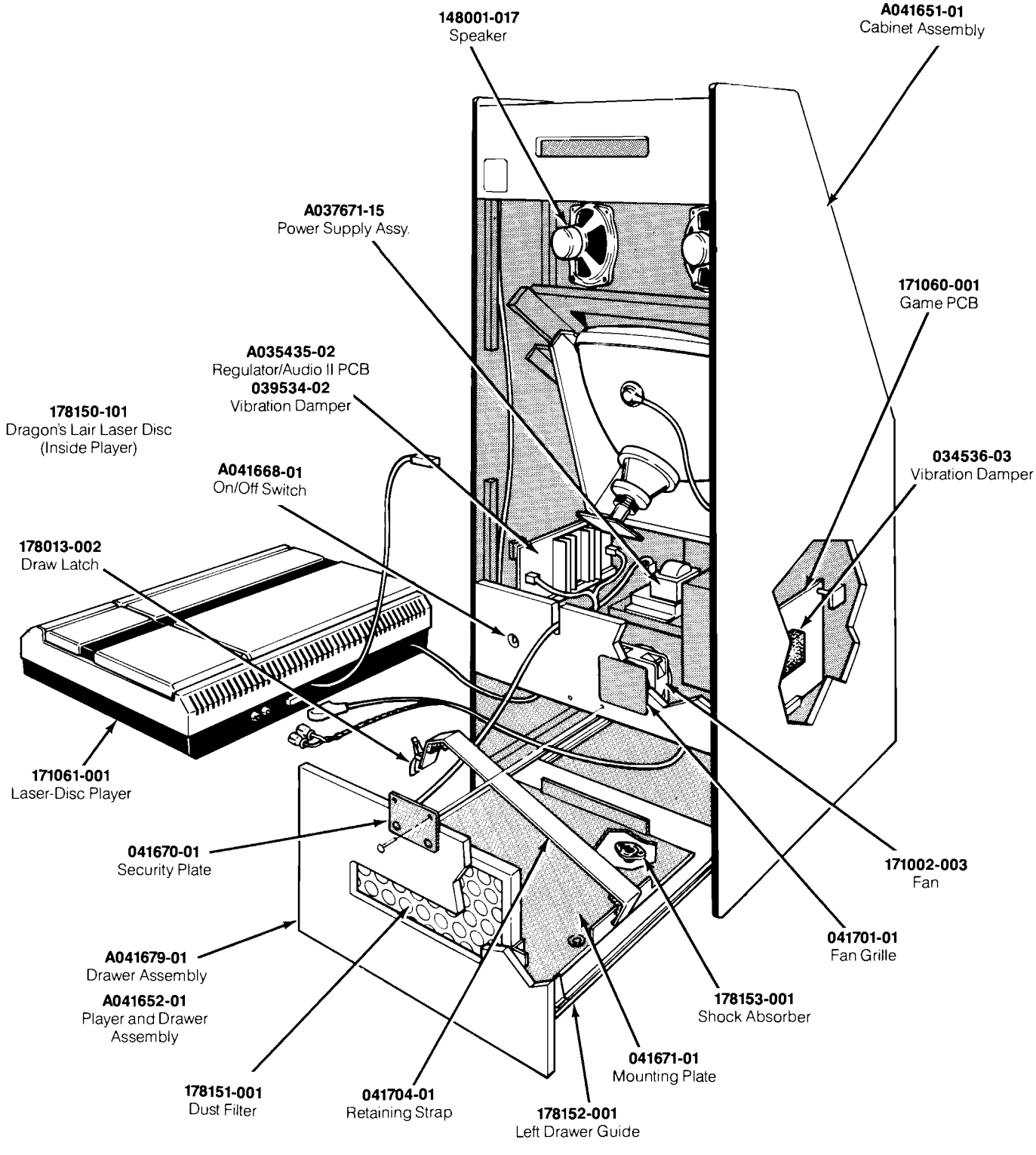


Figure 5-1 Cabinet-Mounted Assemblies, continued
A041650-01 A

Cabinet Mounted Assemblies
A041650-01 A

Part No.	Description
A041651-01	Cabinet Assembly
A041652-01	Player and Drawer Assembly--includes:
A041679-01	Drawer Assembly
178152-001	Left Sliding Drawer Guide
178152-002	Right Sliding Drawer Guide (not shown)
041671-01	Player Mounting Plate
041704-01	Disc Player Retaining Strap
171061-101	Video Disc Player--22VP932/00 (includes video cable)
178013-002	Draw Latch
178150-001	Dragon's Lair Laser Disc
178151-001	Dust Filter
178153-001	Shock Absorber (three required -- acceptable substitute is part no. 178153-002)
A041655-01	Main Harness (not shown)
A041666-01	On/Off Harness (not shown)
A041667-01	Strain Relief Power Cord Assembly (not shown)
A041668-01	On/Off Switch
A041669-01	Rear Door Assembly (not shown)
A041700-01	Display Video Harness (not shown)
78-6900402	1/4-Inch by 1/8-Inch Foam Tape (not shown)
009992-01	On/Off Switch Cover (not shown)
034536-03	Foam Vibration Damper
037496-01	Coin Box Enclosure
038091-01	Coin Box
039534-02	1/2-Inch Thick Foam Vibration Damper
041538-01	Cardboard Bezel
041660-01	Upper Attraction Panel
041661-01	Upper Retainer
041662-01	Lower Retainer
041663-01	Main Shield
041670-01	Drawer Security Plate
041671-01	Mounting Plate
041672-01	Display Bracket (not shown)
041673-01	Power Base Support Bracket (not shown)
041674-01	Filter Retainer Bracket (not shown)
041693-01	Display Panel (not shown)
041694-01	Support Cleat (not shown)

Cabinet Mounted Assemblies
A041650-01 A

Part No.	Description
041695-01	Side Panel Decal (not shown)
041701-01	Fan Grille
041702-01	Disc Player Spacer (not shown)
041703-01	Front Retainer
041704-01	Disc Player Retaining Strap
041706-01	Credit Line Decal
139003-1004	19-Inch Color Raster Display (Matsushita)
148001-017	Speaker
171002-003	Fan
178003-001	Fan Finger Guard (not shown)

The following are technical information supplements to this game:

TM-256	Dragon's Lair Operators Manual
TM-220	19-Inch Color Raster Display Manual (Matsushita)
SP-256	Dragon's Lair Schematic Package
041709-01	Disc Player Manual (English) (not shown)
041709-02	Disc Player Manual (German) (not shown)

Fluorescent Tube Assembly
Parts List

Part No.	Description
A005493-01	Tube and Speaker Harness Assembly
70-304	18-Inch, 15 W, Cool White Fluorescent Tube
99-11002	1 1/8-Inch Fluorescent Tube Clamp
99-11003	Fluorescent Tube Starter
99-11008	50 Hz, 118 V, Ballast Transformer
99-11009	Starter Socket
035835-01	12-Inch Y-Lead Connector
041660-01	Upper Attraction Panel (not shown)
041661-01	Upper Retainer (not shown)
041662-01	Lower Retainer (not shown)
041689-01	Tube Board

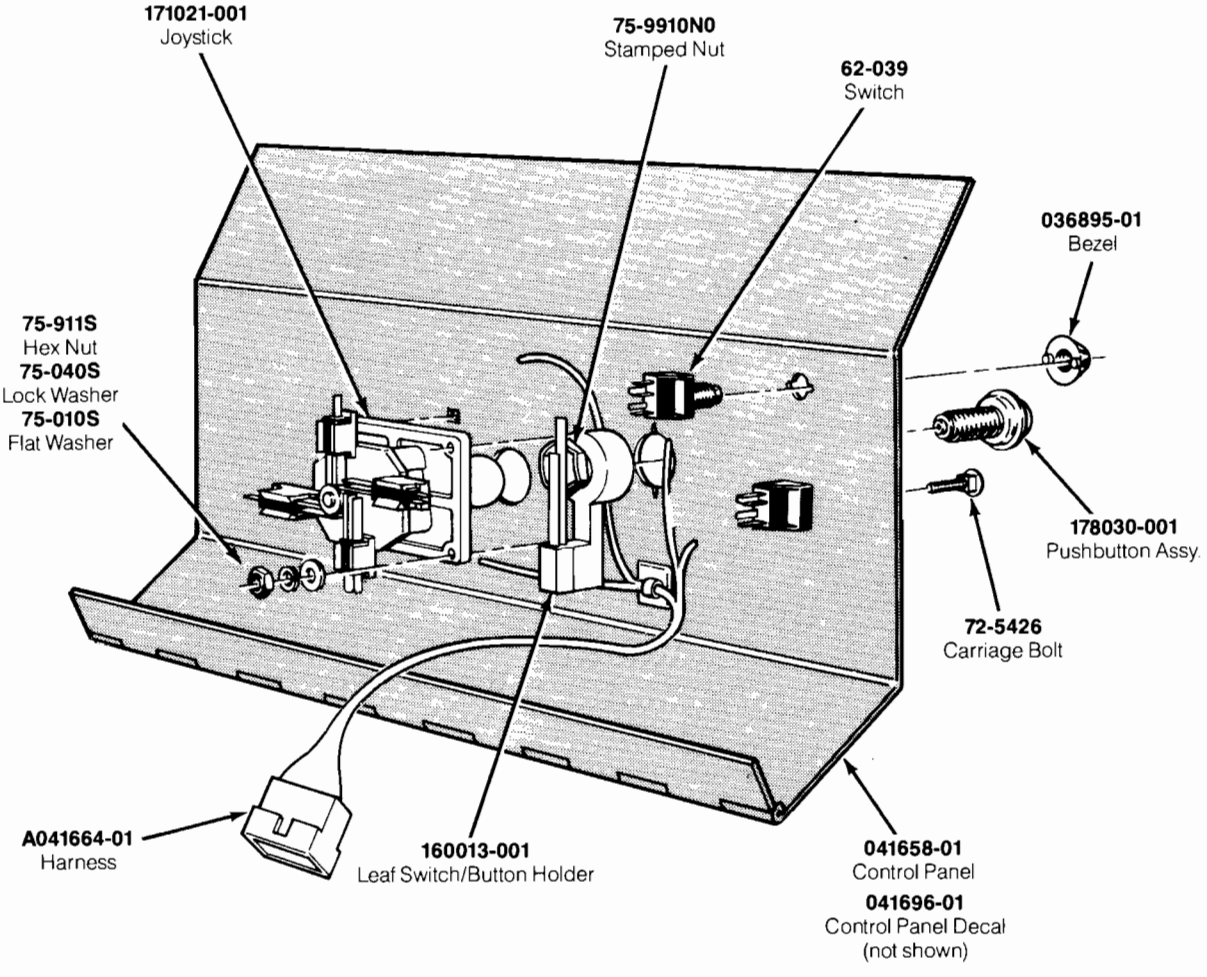


Figure 5-3 Control Panel Assembly
A041656-01 A

Control Panel Assembly
Parts List

Part No.	Description
A041657-01	Control Panel and Graphics Assembly--includes:
041658-01	Control Panel
041696-01	Control Panel Decal
A041664-01	Control Harness
62-039	Switch
72-5426	#10 x 3/4-Inch Carriage Bolt
75-9910N0	Stamped Nut
036895-01	Bezel
160013-001	Switch
171021-001	Joystick
178030-001	White Pushbutton Assembly

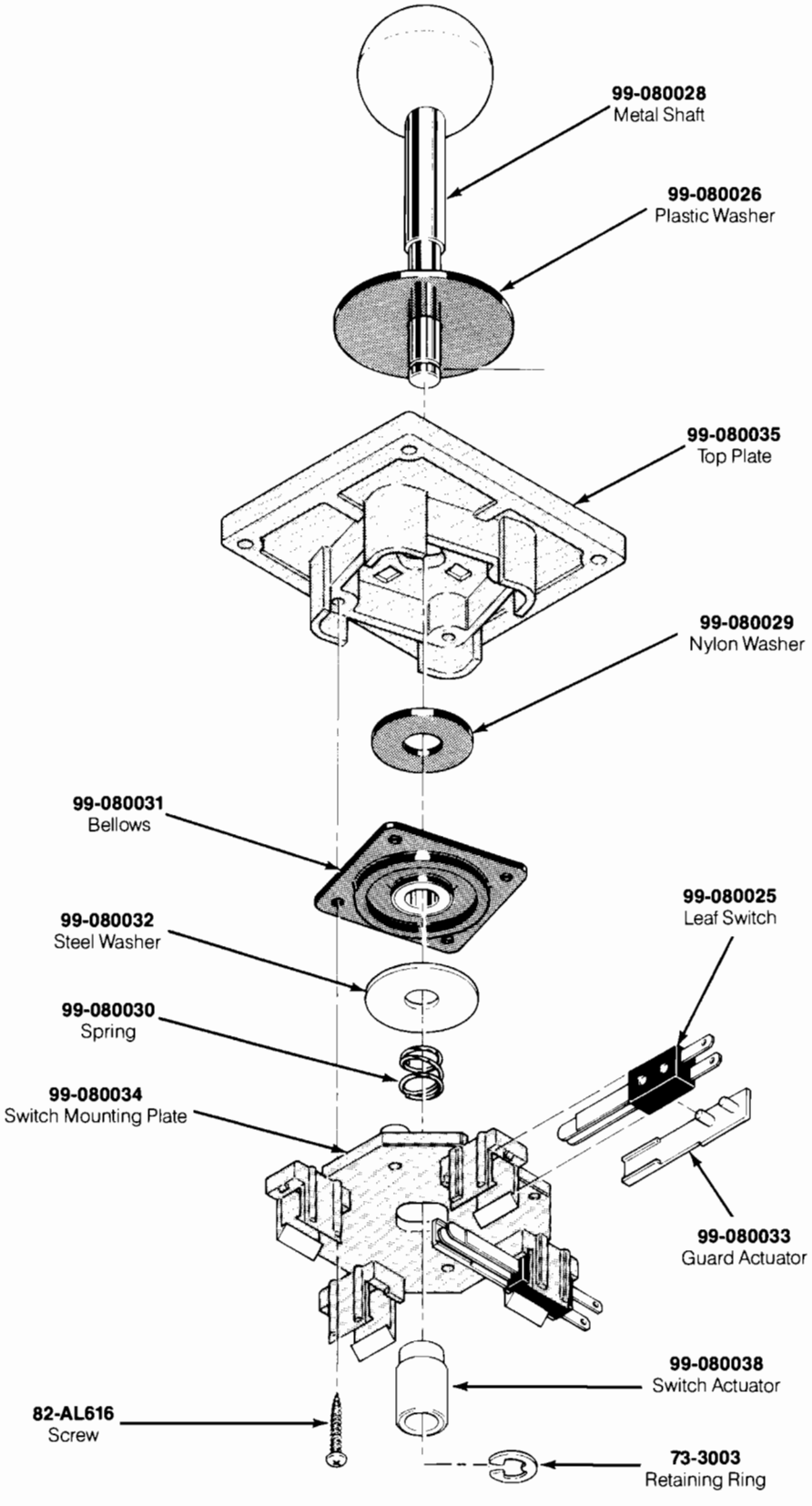


Figure 5-4 4-Position Joystick Assembly 171021-001

4-Position Joystick Assembly
Parts List

Part No.	Description
73-3003	Retaining Ring
82-AL616	#6 x 1-Inch Cross-Recessed Pan-Head Type BT Tapping Steel Screw
99-080025	Leaf Switch
99-080026	2-Inch Black Plastic Washer
99-080028	Metal Shaft
99-080029	Nylon Washer
99-080030	Spring
99-080031	Bellows
99-080032	Flat Steel Washer
99-080033	Plastic Guard/Actuator
99-080035	Top Plate
99-080034	Switch Mounting Plate
99-080038	Nylon Switch Actuator

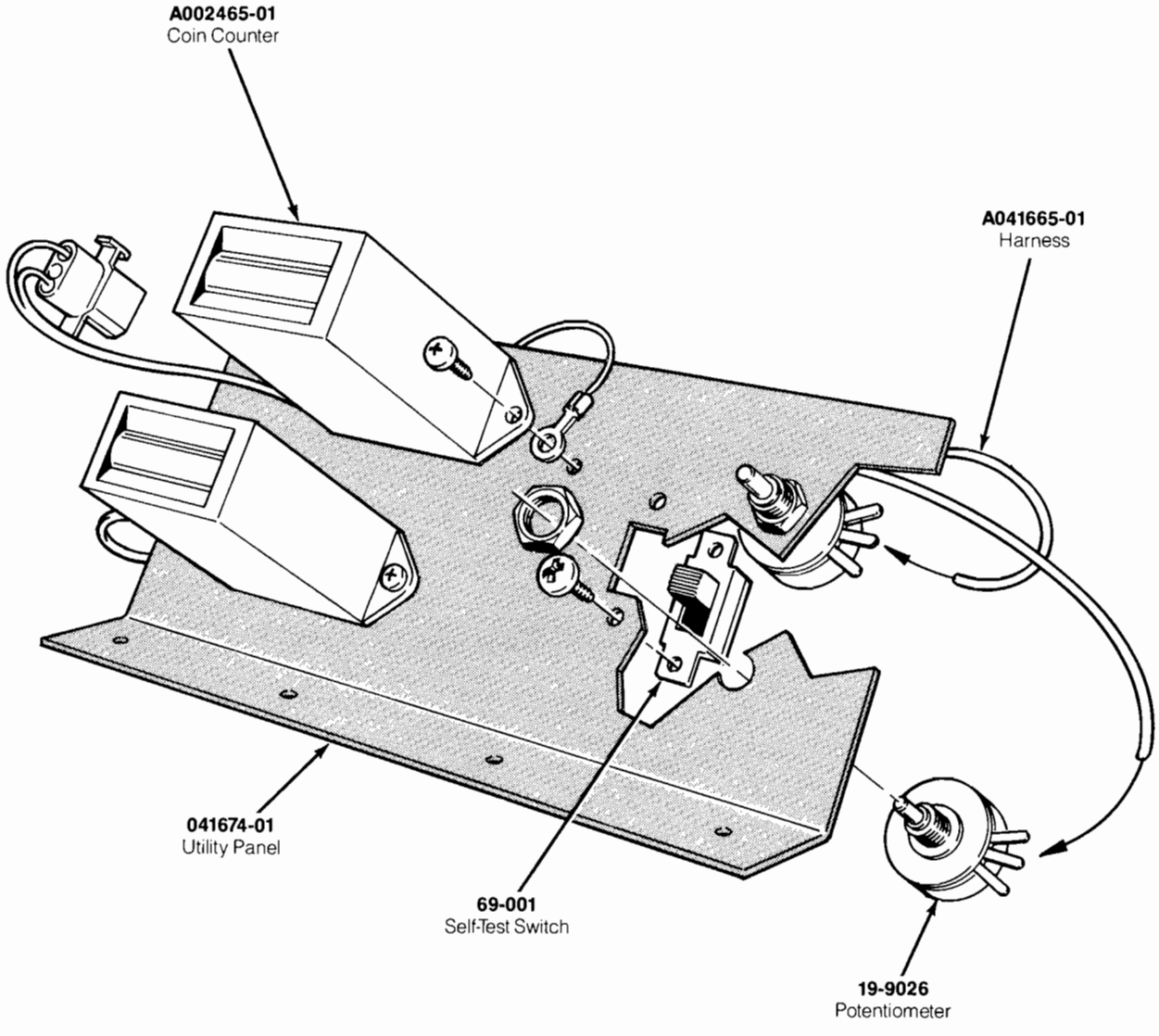


Figure 5-5 Utility Panel Assembly
A041653-01 A

Utility Panel Assembly
Parts List

Part No.	Description
A002465-01	10 V Coin Counter
A041665-01	Utility Panel Harness
19-9026	5 KΩ Potentiometer with Hex Nut and Locking Washer (Volume Control) Acceptable substitute is part no. 19-9022
69-001	Self-Test Switch
041674-01	Utility Panel

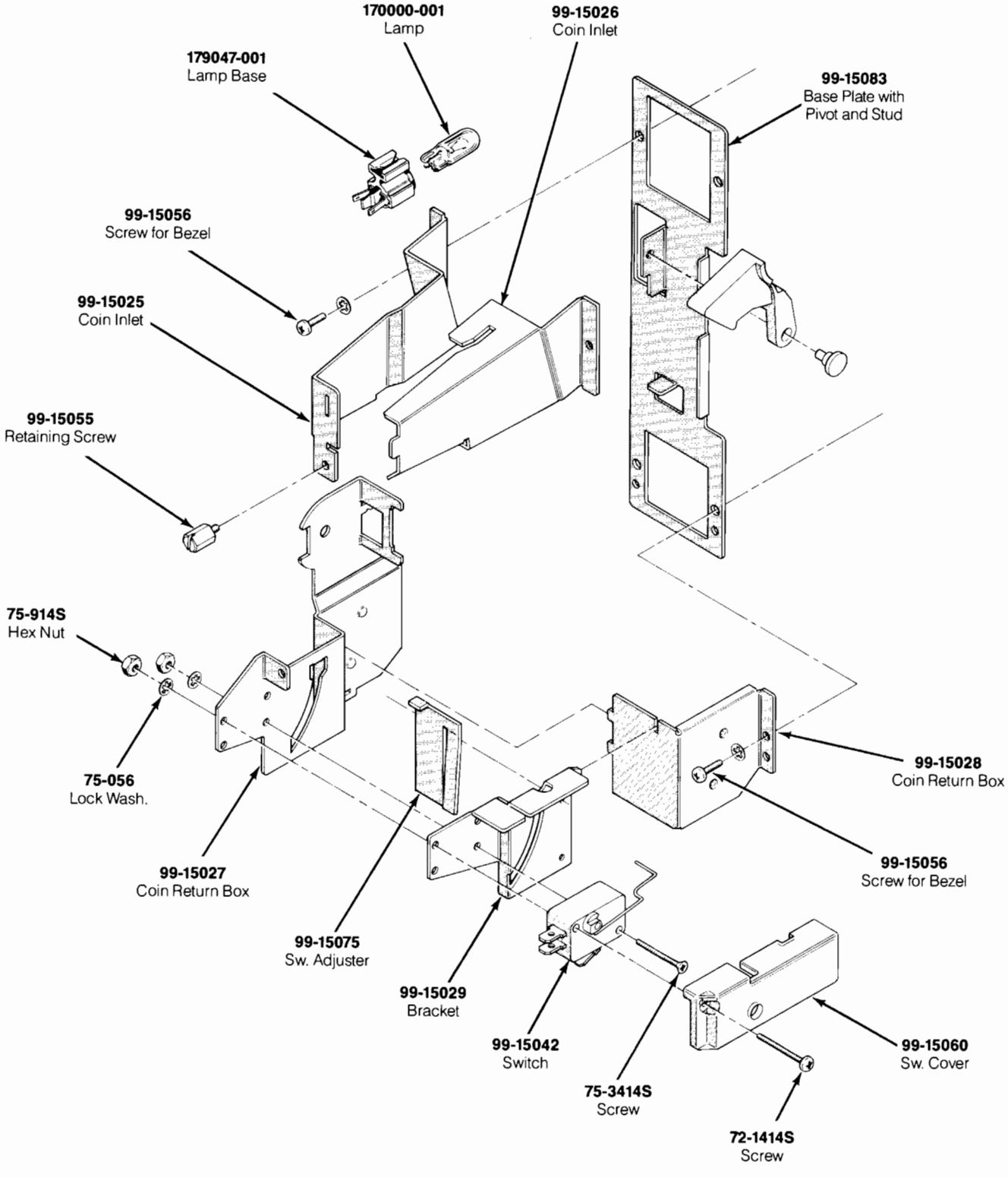


Figure 5-6 Coin Controls Coin Door
171034-xxx A

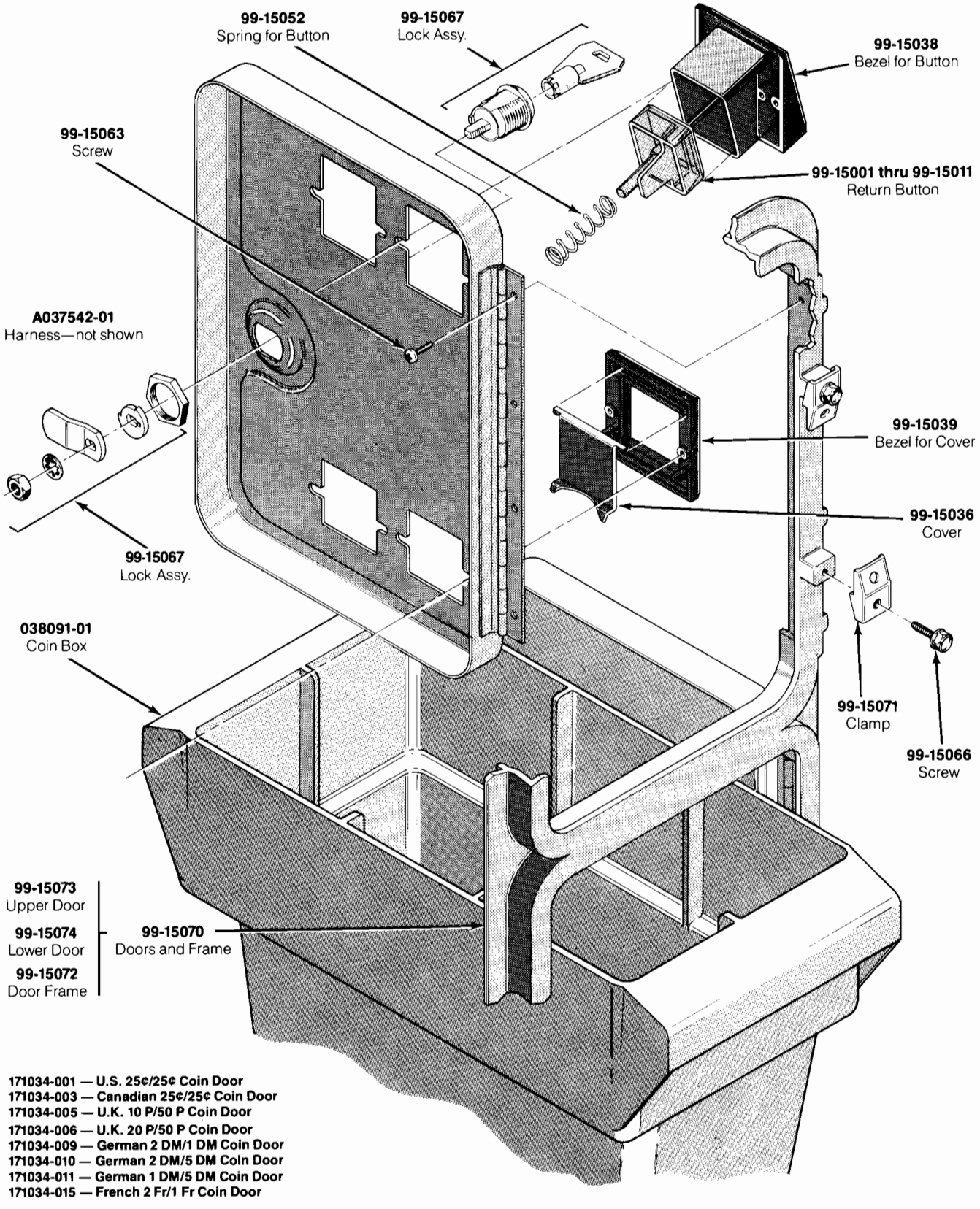


Figure 5-6 Coin Controls Coin Door, continued
171034-xxx A

Coin Controls Coin Door Assembly
Parts List

Part No.	Description
A036597-01	Harness Assembly (Ireland-Built cabinet only)
A037542-01	Harness Assembly
72-1414S	#4-40 x 7/8-Inch Cross-Recessed Pan-Head Steel Machine Screw
75-056	#6 Internal-Tooth Zinc-Plated Steel Lock Washer
75-914S	#4-40 Steel Machine Hex Nut
75-3414S	#4-40 x 7/8-Inch 82° Cross-Recessed Flat-Head Steel Machine Screw
99-15003	Coin Return Button with German 1 DM Price Plate
99-15004	Coin Return Button with German 2 DM Price Plate
99-15005	Coin Return Button with German 5 DM Price Plate
99-15006	Coin Return Button with Belgian 5 Fr Price Plate
99-15007	Coin Return Button with French 1 Fr Price Plate
99-15008	Coin Return Button with Japanese 100 Yen Price Plate
99-15009	Coin Return Button with British 10 Pence Price Plate
99-15010	Coin Return Button with Australian 20-cent Price Plate
99-15011	Coin Return Button with Italian 100 Lire Price Plate
99-15025	Left Half of Coin Inlet
99-15026	Right Half of Coin Inlet
99-15027	Side Plate of Coin Return Box
99-15028	Base Plate of Coin Return Box
99-15029	Switch Bracket
99-15036	Metal Coin Return Cover
99-15038	Bezel for Coin Return Button
99-15039	Metal Bezel for Coin Return Button
99-15052	Spring for Coin Return Button
99-15055	Retaining Screw

Coin Controls Coin Door Assembly, continued
Parts List

Part No.	Description
99-15056	#4-40 x 5/16-Inch Cross-Recessed Pan-Head Steel Machine Screw
99-15060	Switch Cover
99-15063	Screw for Hinge
99-15066	Screw for Clamp
99-15067	Lock Assembly
99-15070	Doors and Frame
99-15071	Clamp for Frame
99-15072	Door Frame
99-15073	Upper Door
99-15074	Lower Door
99-15075	Switch Adjuster
99-15083	Base Plate--includes:
99-15040	Lever
99-15054	Pivot for Lever
99-15023	Base Plate
038091-01	Coin Box--not included in assembly (Acceptable substitute is part no. A037491-01)
170000-001	6.3 V Miniature Wedge-Base Incandescent Lamp
171006-037	Metal Coin Mechanism for German 1 DM
171006-038	Metal Coin Mechanism for German 2 DM
171006-039	Metal Coin Mechanism for German 5 DM
171006-005	Metal Coin Mechanism for Belgian 5 Fr
171006-010	Metal Coin Mechanism for French 1 Fr
171006-018	Metal Coin Mechanism for Japanese 100 Y
171006-030	Metal Coin Mechanism for British 10 P
171006-002	Metal Coin Mechanism for Australian $.20
171006-015	Metal Coin Mechanism for Italian 100 L
179047-001	Lamp Base

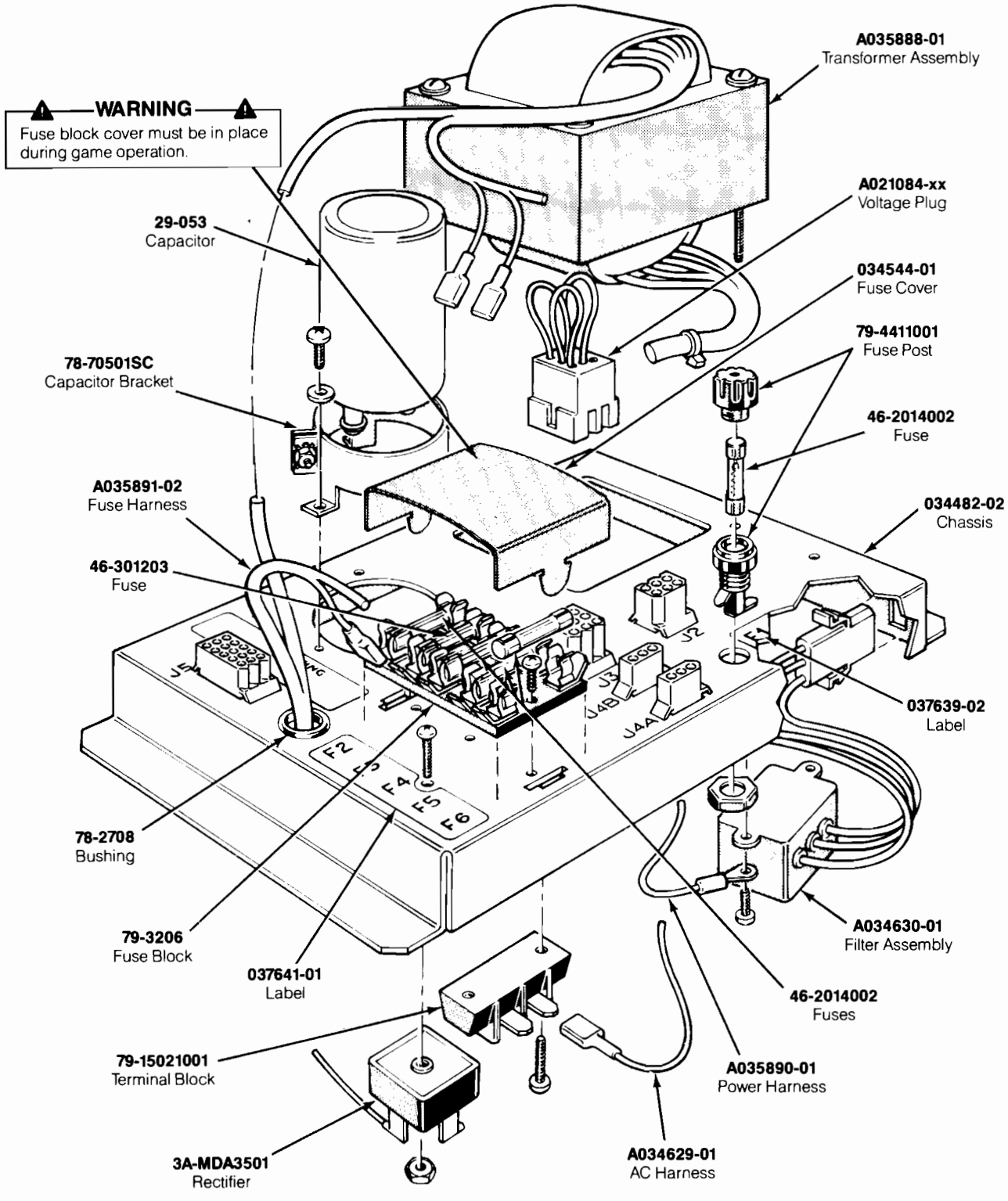


Figure 5-7 Power Supply Assembly
A037671-15 A

Power Supply Assembly
Parts List

Designator	Description	Part No.
J3	Voltage Block Assembly for 220 V (200--240 VAC) (blue wire color)	A021084-04
J3	Voltage Block Assembly for 220 V (200--240 VAC) (brown wire color)	A021084-05
F1, F2, F4-F6	4 A, 250 V Slow-Blow Glass Cartridge-Type Fuse (Acceptable substitute is part no. 46-2014001)	46-2014002
F2 -F6	Label for Fuse Values	037641-01
F1	Label for Fuse Value	037639-02
C1	27,000 µF, 15 VDC Electrolytic Capacitor	29-053
C1	2-Inch Diameter Capacitor Mounting Bracket	78-70501SC
CR1	Type-MDA 3501 Bridge Rectifier	3A-MDA3501
F1	Panel-Mounting Non-Indicating 3AG Cartridge-Type Fuse Post	79-4411001
F2 -F6	5-Position 3AG Fuse Block with 1/4-Inch Quick-Disconnect Terminals	79-3206
F2 -F6	Fuse Block Cover	034544-01
F3	20 A, 32 V, 3AG Slow-Blow Glass Cartridge-Type Fuse	46-301203
F4	2-Circuit Single-Row Terminal Block	79-15021001
FL1	RFI Filter Assembly (designation not marked)	A034630-01
J2	Power Harness	A035890-01
J4A	AC Harness	A034629-01
T1	Transformer Assembly (Acceptable substitute is part no. A035888-02)	A035888-01
	Power Supply Chassis Base	034482-02
	Fuse Harness	A035891-02
	Nylon Type 6/6 Hole Bushing with 5/8-Inch Inside Diameter x 55/64-Inch Outside Diameter x 1/4-Inch Thick	78-2708

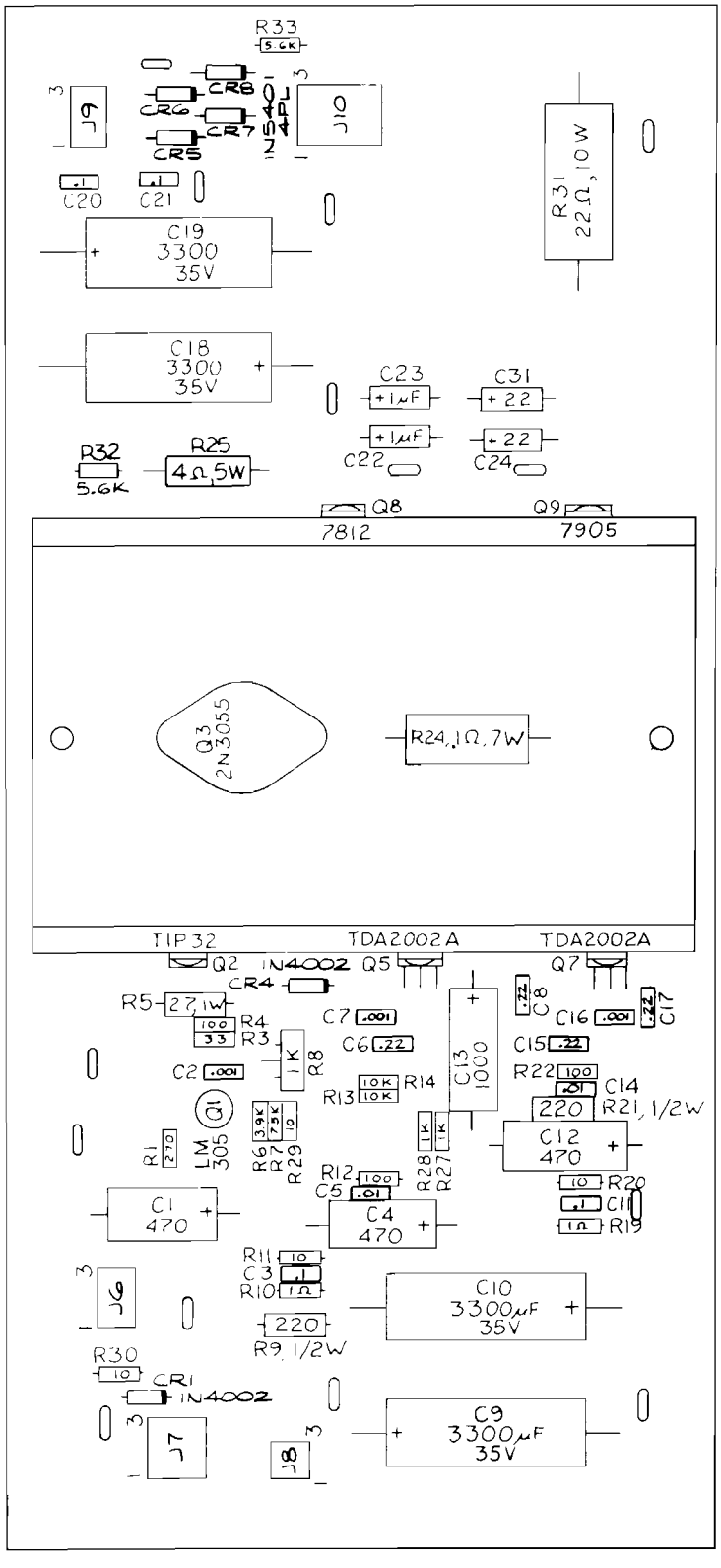


Figure 5-8 Regulator/Audio II PCB Assembly A035435-02 H

Regulator/Audio II PCB Assembly
Parts List

Designator	Description	Part No.
	Capacitors	
C1	470 µF, 25 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-250477
C2	0.001 µF, 50 V, Ceramic-Disc Axial-Lead Capacitor	122002-102
C3	0.1 µF, 50 V, Ceramic-Disc Axial-Lead Capacitor (Acceptable substitute is part no. 122002-104)	29-088
C4	470 µF, 25 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-250477
C5	0.01 µF, 25 V Minimum, Ceramic-Disc Axial-Lead Capacitor (Acceptable substitute is part no. 122005-103)	100015-103
C6	0.22 µF, 25 V, Ceramic-Disc Axial-Lead Capacitor	122004-224
C7	0.001 µF, 50 V, Ceramic-Disc Axial-Lead Capacitor	122002-102
C8	0.22 µF, 25 V, Ceramic-Disc Axial-Lead Capacitor	122004-224
C9, C10	3300 µF, 35 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-350338
C11	0.1 µF, 50 V, Ceramic-Disc Axial-Lead Capacitor (Acceptable substitute is part no. 122002-104)	29-088
C12	470 µF, 25 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-250477
C13	1000 µF, 25 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-250108
C14	0.01 µF, 25 V Minimum, Ceramic-Disc Axial-Lead Capacitor (Acceptable substitute is part no. 122005-103)	100015-103
C15	0.22 µF, 25 V, Ceramic-Disc Axial-Lead Capacitor	122004-224
C16	0.001 µF, 50 V, Ceramic-Disc Axial-Lead Capacitor	122002-102
C17	0.22 µF, 25 V, Ceramic-Disc Axial-Lead Capacitor	122004-224
C18, C19	3300 µF, 35 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-350338
C20, C21	0.1 µF, 50 V, Ceramic-Disc Axial-Lead Capacitor (Acceptable substitute is part no. 122002-104)	29-088
C22, C23	1 µF, 50 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-500105
C24	22 µF, 35 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-350226
C31	22 µF, 35 V, Aluminum Electrolytic Fixed Axial-Lead Capacitor	24-350226

Regulator/Audio II PCB Assembly
Parts List, continued

Designator	Description	Part No.
	Diodes	
CR1	Type-1N4002, 1 A, 100 V Silicon Rectifier Diode	31-1N4002
CR4	Type-1N4002, 1 A, 100 V Silicon Rectifier Diode	31-1N4002
CR5--CR8	Type-1N5401, 3 A, 100 V Silicon Rectifier Diode	31-1N5401
	Resistors	
R1	270 Ω, ±5%, 1/4 W Resistor	110000-271
R3	33 Ω, ±5%, 1/4 W Resistor	110000-330
R4	100 Ω, ±5%, 1/4 W Resistor	110000-101
R5	2.7 Ω, ±5%, 1 W Resistor	110009-027
R6	3.9 kΩ, ±5%, 1/4 W Resistor	110000-392
R7	7.5 kΩ, ±5%, 1/4 W Resistor	110000-752
R8	1 kΩ Vertical PCB-Mounting Cermet Potentiometer	119002-102
R9	220 Ω, ±5%, 1/2 W Resistor	110001-221
R10	1 Ω, ±5%, 1/4 W Resistor	110000-010
R11	10 Ω, ±5%, 1/4 W Resistor	110000-100
R12	100 Ω, ±5%, 1/4 W Resistor	110000-101
R13, R14	10 kΩ, ±5%, 1/4 W Resistor	110000-103
R19	1 Ω, ±5%, 1/4 W Resistor	110000-010
R20	10 Ω, ±5%, 1/4 W Resistor	110000-100
R21	220 Ω, ±5%, 1/2 W Resistor	110001-221
R22	100 Ω, ±5%, 1/4 W Resistor	110000-101
R24	0.1 Ω, ±3%, 7 W Wirewound Resistor	19-100P1015
R25	4 Ω, ±5%, 5 W Wirewound Resistor	116001-040
R27, R28	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R29, R30	10 Ω, ±5%, 1/4 W Resistor	110000-100
R31	22 Ω, ±5%, 10 W Wirewound Resistor	116000-220
R32, R33	5.6 kΩ, ±5%, 1/4 W Resistor	110000-562
	Transistors	
Q2	Type-TIP32 PNP Power Transistor	33-TIP32
Q3	Type-2N3055 NPN Silicon Transistor	34-2N3055
	Miscellaneous	
J6	6-Position Connector Receptacle	79-58306
J7	9-Position Connector Receptacle	79-58308
J8	4-Position Connector Receptacle	79-58354
J9	6-Position Connector Receptacle	79-58306

Regulator/Audio II PCB Assembly
Parts List, continued

Designator	Description	Part No.
J10	12-Position Connector Receptacle	79-58346
Q1	Type-LM305, 5 V, Linear Voltage Regulator	37-LM305
Q2, Q9	Thermally Conductive Silicon Insulator	78-16014
Q3	Thermally Conductive Silicon Insulator	78-16008
Q5	Type-TDA2002A Linear Audio Amplifier	137151-002
Q7	Type-TDA2002A Linear Audio Amplifier	137151-002
Q8	Type-7812, +12 V, Voltage Regulator	37-7812
Q9	Type-7905, -5 V, Voltage Regulator	37-7905
	Heat Sink	034531-01
	Test Point (Acceptable substitute is part no. 179051-001)	179051-002

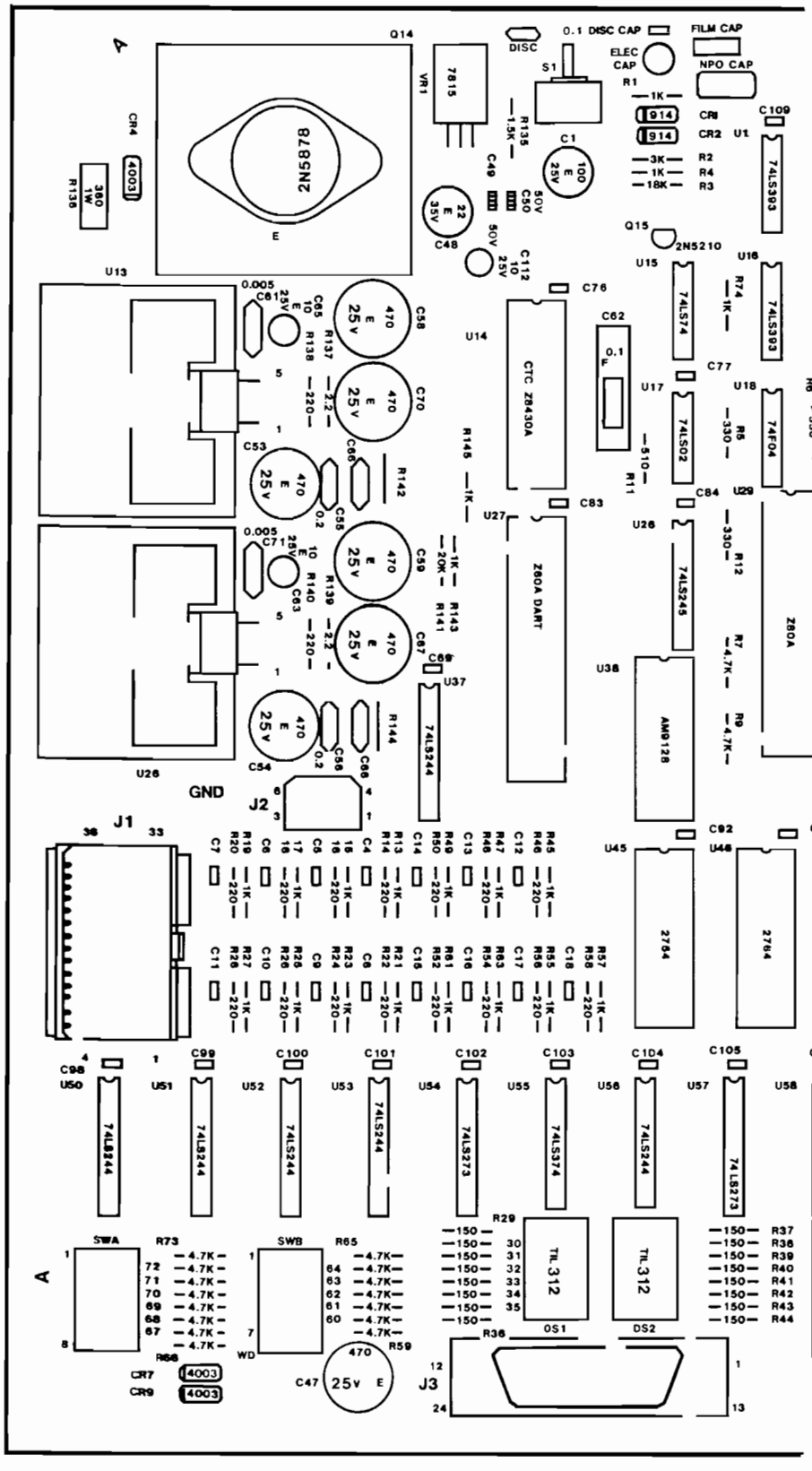


Figure 5-9 Game PCB Assembly

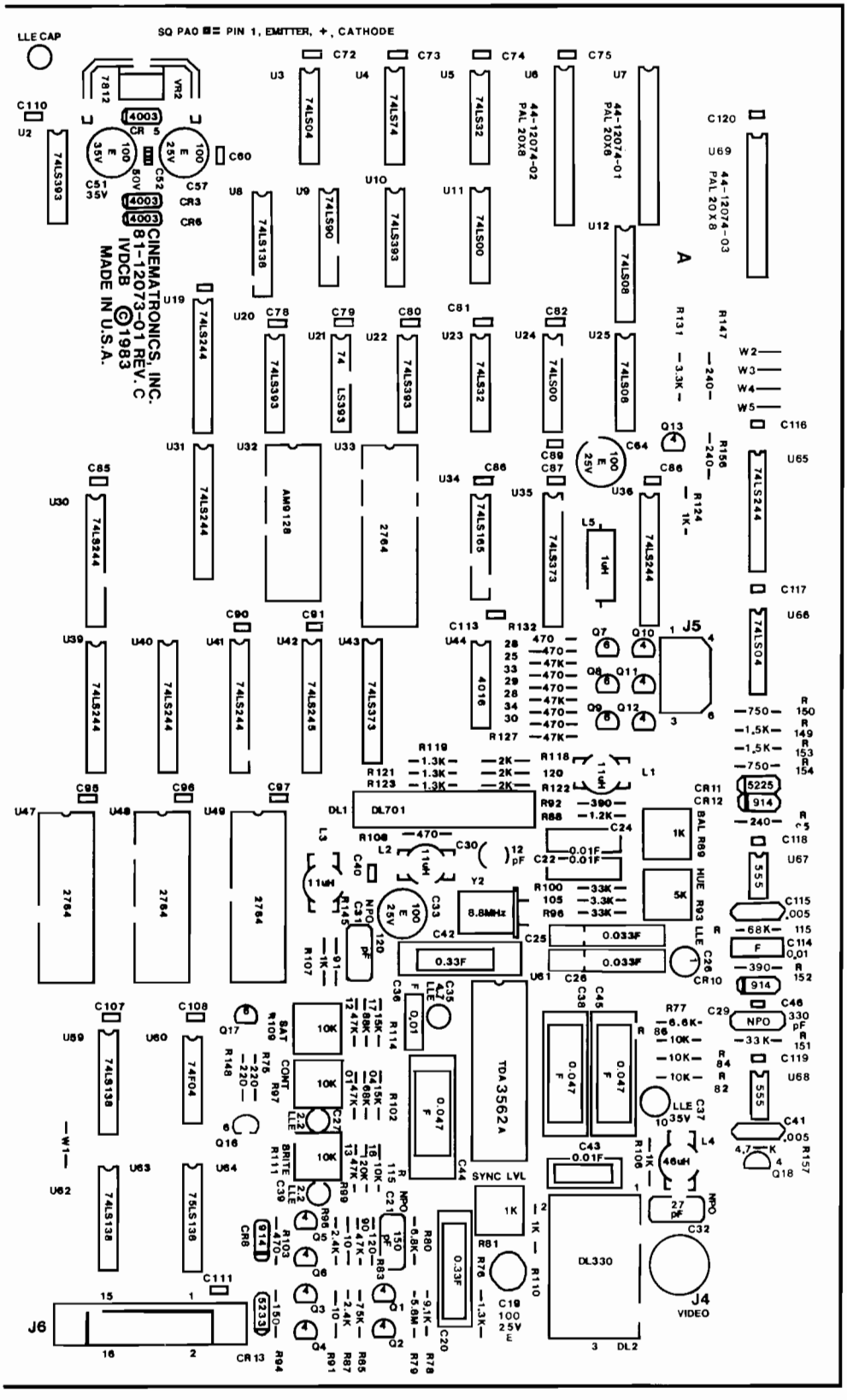


Figure 5-9 Game PCB Assembly, continued

Dragon's Lair PCB Assembly
171060-101 Rev A

Designator	Description	Part Number
	Capacitors	
C1	100 µF, 25 V Radial-Lead Electrolytic Capacitor	123003-107
C2	680 pF, ±20%, 50 V Ceramic Disk Capacitor	121020-681
C3	470 pF, ±20%, 50 V Ceramic Disc Capacitor	121020-471
C4-C18	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C19	100 µF, 16 V Radial-Lead Electrolytic Capacitor	123004-101
C20	0.33 µF, 100 V Film Capacitor	99-201004
C21	150 pF, ±5%, NPO Film Capacitor	122016-151
C22	0.01 µF, 100 V Film Capacitor	125000-103
C24	0.01 µF, 100 V Film Capacitor	125000-103
C25	0.033 µF, 250 V Film Capacitor	99-201005
C26	1 µF, 16 V Electrolytic Capacitor	123001-105
C27	2.2 µF, 50 V Electrolytic Capacitor	24-500225
C28	0.033 µF, 250 V Film Capacitor	99-201005
C29	330 pF, ±5% NPO Capacitor	122016-331
C30	12 pF, Ver. Adj. Capacitor	128002-120
C31	120 pF, ±5%, NPO Film Capacitor	122016-121
C32	27 pF, ±5%, NPO Film Capacitor	122016-270
C33	100 µF, 25 V Radial-Lead Electrolytic Capacitor	123003-107
C35	4.7 µF, 35 V Radial-Lead Electrolytic Capacitor	123000-475
C36	0.01 µF, 100 V Film Capacitor	125000-103
C37	10 µF, 35 V LLE Capacitor	24-350106
C38	0.047 µF, 100 V Film Capacitor	21-101473
C39	2.2 µF, 50 V Electrolytic Capacitor	24-500225
C40	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C41	0.005 µF, 50 V Capacitor	122015-472
C42	0.33 µF, 100 V Film Capacitor	99-201004
C43	0.01 µF, 100 V Film Capacitor	125000-103
C44, C45	0.047 µF, 100 V Film Capacitor	21-101473
C46	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C47	470 µF, 25 V Electrolytic Capacitor	24-250477
C48	22 µF, 35 V Electrolytic Capacitor	24-350226
C49	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C50	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C51	100 µF, 25 V Radial-Lead Electrolytic Capacitor	123003-107
C52	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C53, C54	470 µF, 25 V Electrolytic Capacitor	24-250477
C55	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C56	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104

C57	100 µF, 25 V Radial-Lead Electrolytic Capacitor	123003-107
C58, C59	470 µF, 25 V Electrolytic Capacitor	24-250477
C60	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C61	0.005 µF, 50 V Capacitor	122015-472
C62	0.1 µF, 100 V Film Capacitor	126000-104
C63	10 µF, 25 V Electrolytic Capacitor	24-250106
C64	100 µF, 25 V Radial-Lead Electrolytic Capacitor	123003-107
C65	10 µF, 25 V Electrolytic Capacitor	24-250106
C66	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C67	470 µF, 25 V Electrolytic Capacitor	24-250477
C68, C69	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C70	470 µF, 25 V Electrolytic Capacitor	24-250477
C71	0.005 µF, 50 V Capacitor	122015-472
C72-C93	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C95-C111	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104
C112	10 µF, 25 V Electrolytic Capacitor	24-250106
C114	0.01 µF, 100 V Film Capacitor	125000-103
C115	0.005 µF, 50 V Capacitor	122015-472
C116-C119	1 µF, ±20%, 50 V Ceramic Disc Capacitor	122002-104

Diodes

CR1, CR2	Type-1N914 Diode	31-1N914
CR3-CR7	Type-1N4003 ENCPL	99-201001
CR8	Type-1N914 Diode	31-1N914
CR9	Type-1N4003 ENCPL	99-201001
CR10	Type-1N914 Diode	31-1N914
CR11	Type-IN5225 Diode	99-201002
CR12	Type-1N914 Diode	31-1N914
CR13	Type-IN5233 6 V Diode	99-201003
DS1, DS2	Type-TIL312 Diode	38-MAN71A

Inductors

L1, L2	11 µH Adj. Choke	99-201008
L3	11 µH C.T. Bifalar Adj.	99-201010
L4	46 µH Adj. Choke	99-201006
L5	1 µH Choke	141006-09

Integrated Circuits

U1, U2	Type-74LS393 Integrated Circuit	37-74LS393
U3	Type-74LS04 Integrated Circuit	37-74LS04
U4	Type-74LS74 Integrated Circuit	37-LS74
U5	Type-74LS32 Integrated Circuit	37-74LS32

U6	20 x 8 PAL Integrated Circuit (Vertical)	99-201019
U7	20 x 8 PAL Integrated Circuit (Horizontal)	99-201018
U8	Type-74LS138 Integrated Circuit	137177-001
U9	Type-74LS90 Integrated Circuit	37-74LS90
U10	Type-74LS393 Integrated Circuit	37-74LS393
U11	Type-74LS00 Integrated Circuit	37-74LS00
U12	Type-74LS08 Integrated Circuit	37-74LS08
U13	Type-CA2002 Integrated Circuit	137151-002
U14	CTCZ8430A Integrated Circuit	99-201014
U15	Type-74LS74 Integrated Circuit	37-LS74
U16	Type-74LS393 Integrated Circuit	37-74LS393
U17	Type-74LS02 Integrated Circuit	37-74LS02
U18	Type-74F04 Integrated Circuit	99-201017
U19	Type-74LS244 Integrated Circuit	37-74LS244
U20-22	Type-74LS393 Integrated Circuit	37-74LS393
U23	Type-74LS32 Integrated Circuit	37-74LS32
U24	Type-74LS00 Integrated Circuit	37-74LS00
U25	Type-74LS08 Integrated Circuit	37-74LS08
U26	Type-CA2002 Integrated Circuit	137151-002
U27	Type-Z8470 DART Integrated Circuit	99-201016
U28	Type-74LS245 Integrated Circuit	37-74LS245
U29	Type-Z80A (4 MHz) Microprocessor	137194-001
U30, U31	Type-74LS244 Integrated Circuit	37-74LS244
U32	Type-AM9128 Integrated Circuit	137348-003
U33	Type-2764 Integrated Circuit	99-201021
U34	Type-74LS165 Integrated Circuit	37-74LS165
U35	Type-74LS373 Integrated Circuit	37-74LS373
U36, U37	Type-74LS244 Integrated Circuit	37-74LS244
U38	Type-AM9128 Integrated Circuit	137348-003
U39-U41	Type-74LS244 Integrated Circuit	37-74LS244
U42	Type-74LS245 Integrated Circuit	37-74LS245
U43	Type-74LS373 Integrated Circuit	37-74LS373
U44	MC14016B Integrated Circuit	37-4016
U45	Type-2764 Integrated Circuit	99-201022
U46	Type-2764 Integrated Circuit	99-201023
U47	Type-2764 Integrated Circuit	99-201024
U48	Type-2764 Integrated Circuit	99-201025
U49	Type-2764 Integrated Circuit	99-201026
U50-U53	Type-74LS244 Integrated Circuit	37-74LS244
U54	Type-74LS273 Integrated Circuit	37-74LS273
U57, U58	Type-74LS273 Integrated Circuit	37-74LS273
U59	Type-74LS138 Integrated Circuit	137177-001
U60	Type-74F04 Integrated Circuit	99-201017
U61	TDA3562A Integrated Circuit	99-201015

U63, U64	Type-74LS138 Integrated Circuit	137177-001
U65	Type-74LS244 Integrated Circuit	37-74LS244
U66	Type-74LS04 Integrated Circuit	37-74LS04
U67, U68	Type-LM555 Integrated Circuit	37-555
U69	20 x 8 PAL Burst Gate Integrated Circuit	99-201020
VR1	Type-LM7815 Integrated Circuit	37-LM7815
VR2	Type-LM7812 Integrated Circuit	37-7812

Resistors

R1	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R2	3 kΩ, ±5%, 1/4 W Resistor	110000-302
R3	18 kΩ, ±5%, 1/4 W Resistor	110000-183
R4	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R5, R6	330 Ω, ±5%, 1/4 W Resistor	110000-331
R7-R10	4.7 kΩ, ±5%, 1/4 W Resistor	110000-472
R11	510 Ω, ±5%, 1/4 W Resistor	110000-511
R12	330 Ω, ±5%, 1/4 W Resistor	110000-331
R13	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R14	220 Ω, ±5%, 1/4 W Resistor	110000-221
R15	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R16	220 Ω, ±5%, 1/4 W Resistor	110000-221
R17	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R18	220 Ω, ±5%, 1/4 W Resistor	110000-221
R19	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R20	220 Ω, ±5%, 1/4 W Resistor	110000-221
R21	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R22	220 Ω, ±5%, 1/4 W Resistor	110000-221
R23	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R24	220 Ω, ±5%, 1/4 W Resistor	110000-221
R25	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R26	220 Ω, ±5%, 1/4 W Resistor	110000-221
R27	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R28	220 Ω, ±5%, 1/4 W Resistor	110000-221
R29-R44	150 Ω, ±5%, 1/4 W Resistor	110000-151
R45	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R46	220 Ω, ±5%, 1/4 W Resistor	110000-221
R47	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R48	220 Ω, ±5%, 1/4 W Resistor	110000-221
R49	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R50	220 Ω, ±5%, 1/4 W Resistor	110000-221
R51	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R52	220 Ω, ±5%, 1/4 W Resistor	110000-221
R53	1 kΩ, ±5%, 1/4 W Resistor	110000-102

R54	220 Ω, ±5%, 1/4 W Resistor	110000-221
R55	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R56	220 Ω, ±5%, 1/4 W Resistor	110000-221
R57	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R58	220 Ω, ±5%, 1/4 W Resistor	110000-221
R59-R73	4.7 kΩ, ±5%, 1/4 W Resistor	110000-472
R75	220 Ω, ±5%, 1/4 W Resistor	110000-221
R76	1.3 kΩ, ±5%, 1/4 W Resistor	110000-132
R77	6.8 kΩ, ±5%, 1/4 W Resistor	110000-682
R78	9.1 kΩ, ±5%, 1/4 W Resistor	110000-912
R79	5.6 MΩ, ±5%, 1/4 W Resistor	110000-565
R80	6.8 kΩ, ±5%, 1/4 W Resistor	110000-682
R81	1 kΩ Trimming Potentiometer	119002-102
R82	10 kΩ, ±5%, 1/4 W Resistor	110000-103
R83	120 Ω, ±5%, 1/4 W Resistor	110000-121
R84	10 kΩ, ±5%, 1/4 W Resistor	110000-103
R85	75 kΩ, ±5%, 1/4 W Resistor	110000-753
R86	10 kΩ, ±5%, 1/4 W Resistor	110000-103
R87	2.4 kΩ, ±5%, 1/4 W Resistor	110000-242
R88	1.2 kΩ, ±5%, 1/4 W Resistor	110000-122
R89	1 kΩ Trimming Potentiometer	119002-102
R90	47 kΩ, ±5%, 1/4 W Resistor	110000-473
R91	10 Ω, ±5%, 1/4 W Resistor	110000-100
R92	390 Ω, ±5%, 1/4 W Resistor	110000-391
R93	5 kΩ T.G. Potentiometer	119002-502
R94	150 Ω, ±5%, 1/4 W Resistor	110000-151
R95	240 Ω, ±5%, 1/4 W Resistor	110000-241
R96	2.4 kΩ, ±5%, 1/4 W Resistor	110000-242
R97	10 kΩ Trimming Potentiometer	119002-103
R98	33 kΩ, ±5%, 1/4 W Resistor	110000-333
R99	10 Ω, ±5%, 1/4 W Resistor	110000-100
R100	33 kΩ, ±5%, 1/4 W Resistor	110000-333
R101	47 kΩ, ±5%, 1/4 W Resistor	110000-473
R102	15 kΩ, ±5%, 1/4 W Resistor	110000-153
R103	470 Ω, ±5%, 1/4 W Resistor	110000-471
R104	68 kΩ, ±5%, 1/4 W Resistor	110000-683
R105	3.3 kΩ, ±5%, 1/4 W Resistor	110000-332
R106, R107	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R108	470 Ω, ±5%, 1/4 W Resistor	110000-471
R109	10 kΩ Trimming Potentiometer	119002-103
R110	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R111	10 kΩ Trimming Potentiometer	119002-103
R112, R113	47 kΩ, ±5%, 1/4 W Resistor	110000-473

R114	15 kΩ, ±5%, 1/4 W Resistor	110000-153
R115	10 kΩ, ±5%, 1/4 W Resistor	110000-103
R116	120 kΩ, ±5%, 1/4 W Resistor	110000-124
R117	68 kΩ, ±5%, 1/4 W Resistor	110000-683
R118	2 kΩ, ±5%, 1/4 W Resistor	110000-202
R119	1.3 kΩ, ±5%, 1/4 W Resistor	110000-132
R120	2 kΩ, ±5%, 1/4 W Resistor	110000-202
R121	1.3 kΩ, ±5%, 1/4 W Resistor	110000-132
R122	2 kΩ, ±5%, 1/4 W Resistor	110000-202
R123	1.3 kΩ, ±5%, 1/4 W Resistor	110000-132
R124	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R125-R127	47 kΩ, ±5%, 1/4 W Resistor	110000-473
R128-R130	470 Ω, ±5%, 1/4 W Resistor	110000-471
R131	3.3 kΩ, ±5%, 1/4 W Resistor	110000-332
R132-R134	470 Ω, ±5%, 1/4 W Resistor	110000-471
R135	1.5 kΩ, ±5%, 1/4 W Resistor	110000-152
R136	360 Ω, ±5%, 1/4 W Resistor	110000-361
R137	2.2 Ω, ±5%, 1/4 W Resistor	110000-022
R138	220 Ω, ±5%, 1/4 W Resistor	110000-221
R139	2.2 Ω, ±5%, 1/4 W Resistor	110000-022
R140	220 Ω, ±5%, 1/4 W Resistor	110000-221
R141	20 kΩ, ±5%, 1/4 W Resistor	110000-203
R143	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R145	91 Ω, ±5%, 1/4 W Resistor	110000-910
R146	1 kΩ, ±5%, 1/4 W Resistor	110000-102
R147	240 Ω, ±5%, 1/4 W Resistor	110000-241
R148	220 Ω, ±5%, 1/4 W Resistor	110000-221
R149	1.5 kΩ, ±5%, 1/4 W Resistor	110000-152
R150	750 Ω, ±5%, 1/4 W Resistor	110000-751
R151	33 kΩ, ±5%, 1/4 W Resistor	110000-333
R152	390 Ω, ±5%, 1/4 W Resistor	110000-391
R153	1.5 kΩ, ±5%, 1/4 W Resistor	110000-152
R154	750 Ω, ±5%, 1/4 W Resistor	110000-751
R155	68 kΩ, ±5%, 1/4 W Resistor	110000-683
R156	240 Ω, ±5%, 1/4 W Resistor	110000-241
R157	4.7 kΩ, ±5%, 1/4 W Resistor	110000-472

Switches

SWA, SWB	8-Position Dual-Inline-Package Switch	66-119P1T

Transistors

Q1-Q6	Type-2N3904, 350 mW, 60 V, NPN	34-2N3904
Q7-Q9	Type-2N3906, PNP Transistor	34-2N3906
Q10-Q13	Type-2N3904, 350 mW, 60 V, NPN	34-2N3904
Q14	Type-2N5878 NPN Transistor	99-201012
Q15	Type-2N5210 NPN Transistor	99-201011
Q16, Q17	Type-2N3906, PNP Transistor	34-2N3906
Q18	Type-2N3904, 350 mW, 60 V, NPN	34-2N3904

Miscellaneous

Y1	14.31818 MHz Crystal	90-101
Y2	8.8672375 MHz Crystal	99-201013
DL1	Type-DL701 Delay Line	99-201007
DL2	Type-DL330 Delay Line	99-201006

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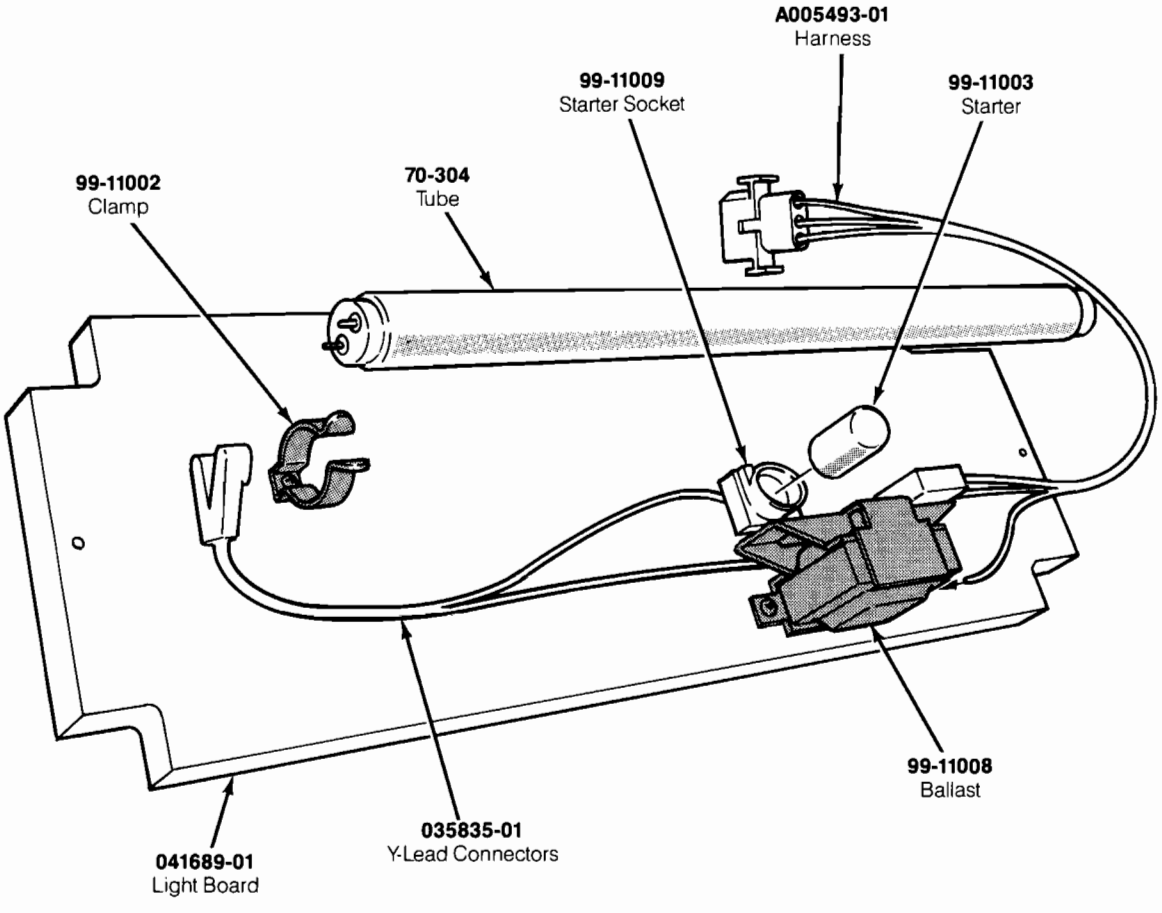

Figure 5-2 Fluorescent Tube Assembly A041659-01 A

First Fold

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If the products described in this manual fail to conform to this warranty, Seller's sole liability shall be, at its option, to repair, replace, or credit Buyer's account for such products which are returned to Seller during said warranty period, provided:

(a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;

(b) Such products are returned prepaid to Seller's plant; and

(c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by accident, misuse, neglect, alteration, improper repair, installation, or improper testing.

In no event shall Seller be liable for loss of profits, loss of use, incidental or consequential damages.

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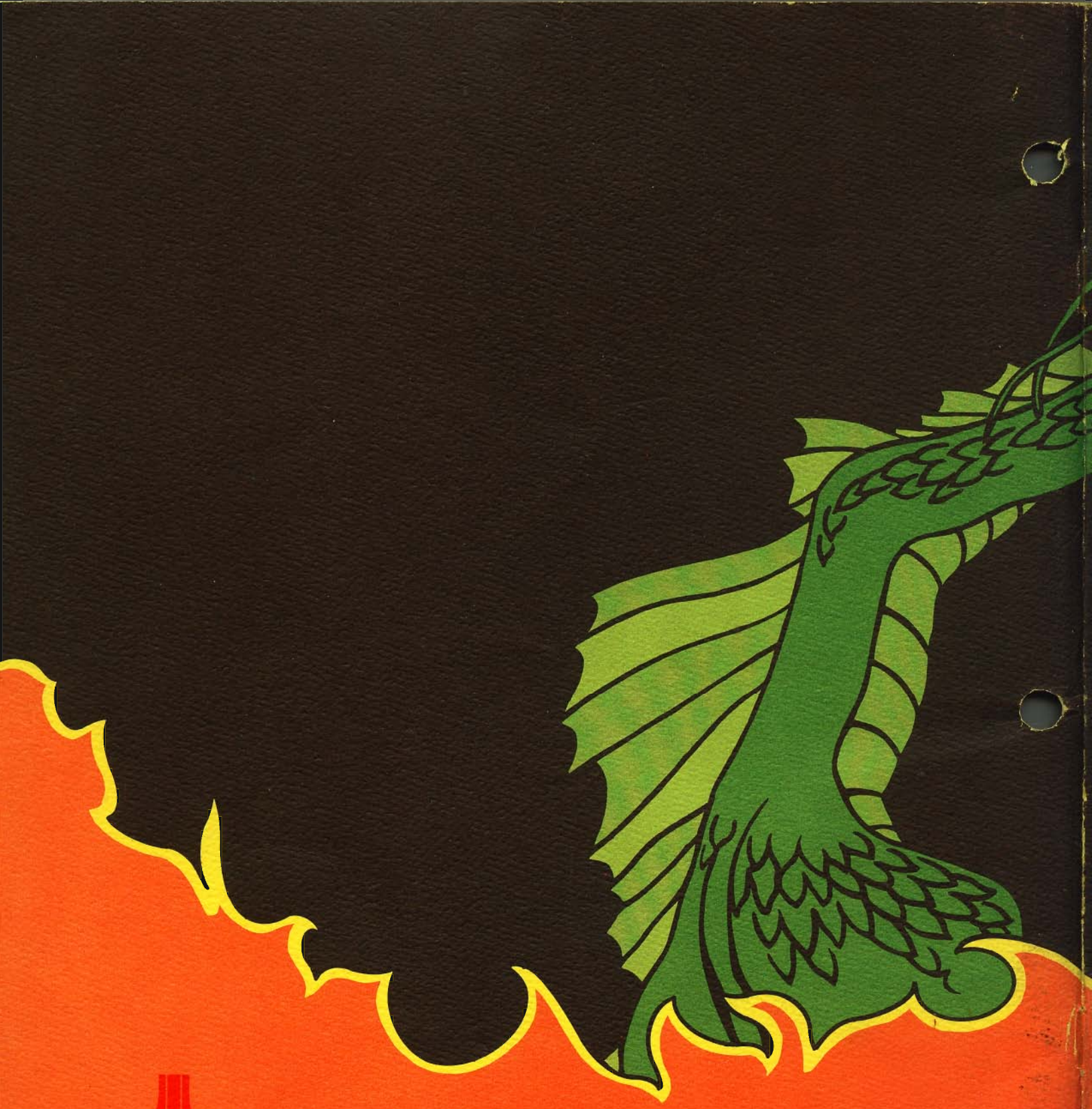

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