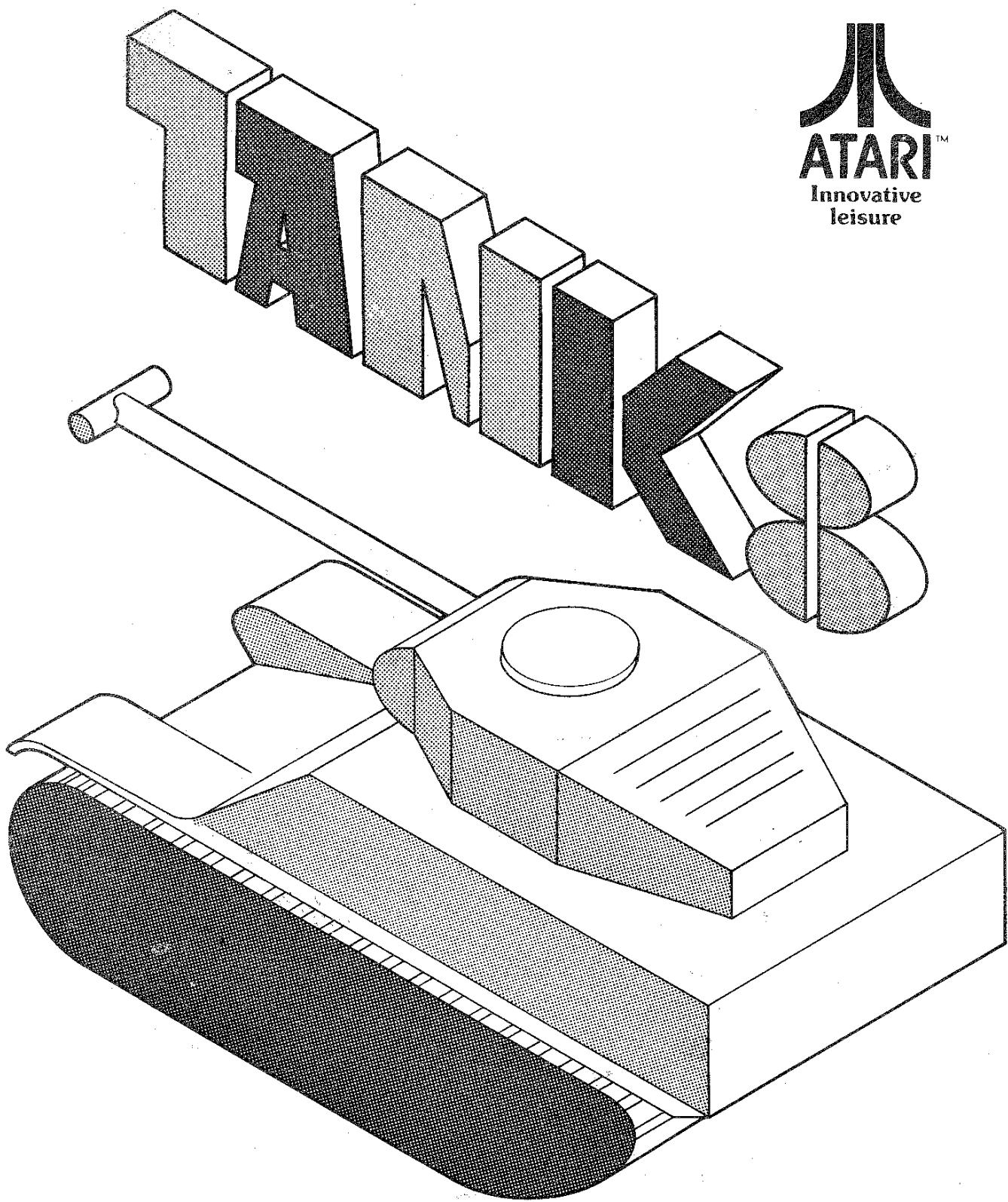


Operation · Maintenance · Service Manual



ATARI INC. 14600 WINCHESTER BLVD., LOS GATOS, CA 95030 • 408/374-2440 • TELEX 357-488
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I. INTRODUCTION

1.1 PHYSICAL DESCRIPTION OF GAME

Atari's TANK 8 is a tank battle game designed for two, three or as many as eight players. The video action takes place on the screen of a color television monitor mounted in the center of the game cabinet. The TV monitor is positioned with its screen facing up, and players stand around the cabinet, as many as two on each side. The tanks appear in various colors; for individual play each tank is a different color and in team play four tanks are red and four are dark blue.

Each player station has a full set of controls for one tank. These controls consist of two levers or joysticks plus a push button switch mounted on the top of one lever. Each player station also has a coin mechanism located below the controls. All eight mechanisms accept quarters only, one coin per play sequence. As an extra-cost optional accessory, a dollar bill acceptor unit can be installed at one of the cabinet's side panels. The deposit of a dollar bill produces credit for one game sequence and the controls at *all eight* player stations are enabled simultaneously. The dollar bill stacker portion of the acceptor is positioned behind the cabinet panel.

Each game is provided with duplicate credit controls in the form of a remote control box designed for use by a game attendant. The box has a set of push button switches which the attendant can operate to enable any player station, and also to select a team play sequence. When not in use the box and its connecting cable can be stored inside the game cabinet.

Eight speakers are mounted inside the game cabinet, two on each side. During play they add to the game excitement by producing tank motor, gunshot and explosion sounds.

A canopy assembly is included with each game cabinet. When installed, the canopy rises approximately four feet above the player controls. It is supported by four legs that fit into receptacle holes provided in the top of the cabinet; the bottom of each leg bolts to the frame inside the cabinet. The canopy can shield the TV screen from direct overhead illumination, and in a large room can help to draw player attention from a distance. If the canopy is not installed, small plugs are provided to cover the four receptacle holes. Game operation remains the same, however, whether the canopy is installed or not.

The following drawings, included in Section VII of this manual, show external views of the game cabinet. Drawing number A005090 shows a side view, with the canopy installed. Drawing number A004551 shows a top view, without the canopy.

1.2 BRIEF DESCRIPTION OF PLAY

In the TANK 8 game players try to shoot the opponent tanks, while at the same time maneuvering their own tanks to avoid shells being fired at them. Players also have to contend with various stationary obstacles dispersed about the battlefield. These obstacles include wall barriers, mines and derelict "broken" tanks. A hit made on an opponent tank adds one point to a player's score. Each player's accumulated score is displayed continuously on the TV screen, and the highest score flashes continuously.

Upon deposit of a coin, the game responds by producing a bugle call and showing the words "TEN SECONDS TO GAME TIME." Other players can then join in by depositing their coins and, if desired, team play can also be selected at this time. Play begins ten seconds after start of the bugle call. Tank controls at the participating player stations are enabled and those tanks can move, each starting out from its own "home" position. Each player's left lever controls movement of that tank's left tread and the right lever controls movement of the right tread. Tanks can be made to go backwards, forwards or to turn, but there is only one speed. Engine sounds are produced whenever tanks move. The player's push button controls firing of shells from that tank. Shells always travel in straight lines, and explode whenever they hit an object or else explode by themselves after having traveled a specified distance without hitting anything. A gunshot sound is produced whenever a shell is fired, and a more pronounced explosion sound is produced whenever a shell explodes. An explosion sound is also produced whenever a tank runs over a mine.

Play ends when the game time has run out. The bugle sounds "taps" ten seconds before the end. After the ten seconds elapse, the speakers cease producing sound, and the player controls are disabled, signalling the change to the attract mode. For approximately five seconds, player scores from the previous play continue to be displayed and all motion freezes.

Now the game's internal circuitry takes control of tank and shell motion. If the previous game was played in two teams, then the attract mode changes all tanks back to their eight individual colors. All scores revert back to 00. (The internal circuitry also takes control just after AC power is first applied to the game.) Realistic tank battles between all eight tanks are then displayed on the TV screen. Each battle continues for approximately four minutes, after which the TV picture is refreshed and a new 4-minute battle begins.

Although no sounds are produced in the attract mode during these mock battles, the video action on the TV screen serves to attract the attention of potential players. And anytime that money is deposited in the game, control or tank and shell motion is given back to the players for the duration of one game.

II. SPECIFICATIONS

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2.1 GENERAL

Cabinet Dimensions:	Height 84 inches with canopy in place, and 40½ inches without canopy; Width and Depth both 44½ inches. When disassembled, narrowest dimension of cabinet frame is 28 inches.
TV Monitor:	General Electric Model 25MB color monitor with tuner, IF, and audio modules removed, and with chroma module replaced by Atari unit.
Coin Mechanisms:	8 identical mechanisms; accept quarters only.
Cash Boxes:	Removable, one for every two coin mechanisms. Boxes are located behind access doors to respective coin assemblies.
Power Cord:	About 13 ft. long, protrudes from one corner of cabinet and has grounded three-prong plug for conventional wall outlet.
Remote Control Box:	Connects to cabinet via a 14-ft. cable. Can be used by a game attendant to give player credit and to select team play, or can be stowed inside cabinet when not in use.

2.2 ELECTRICAL

Power Requirement:	Uses conventional wall outlet providing 60 cycle AC (60 Hz, single phase) at 110 volts; power consumption rated at about 330 watts.
Fusing:	All fuses located inside cabinet; TV monitor has two fuses, a ½-amp and a 2.5-amp slow-blow, and remainder of game is protected by a 5-amp slow-blow fuse.
Power Interrupt Switches:	These are four safety switches mounted inside the cabinet, one switch behind each of the four side panels. Whenever a panel is opened, that panel's switch interrupts AC power to the game.

2.3 ENVIRONMENTAL

Operating and Storage Temperature Range:	from 32°F to 120°F (ambient temperature)
Relative Humidity:	from 0% to 80% <u>without</u> condensation.

2.4 OWNER/OPERATOR OPTION FOR STRUCTURING OF PLAY

Adjustable Game Time:	Settings on internal switch assembly can provide 16 choices of game time, from approximately 60 seconds to 210 seconds (in 10-second steps).
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2.5 ACCESSORIES AVAILABLE ON SEPARATE ORDER

Video Probe:	order from ATARI, Inc.
Universal Text Fixture:	order from ATARI, catalog no. TF101
Dollar Bill Acceptor:	Unit can be installed prior to shipment of game from factory, or can be supplied in kit form for field installation. Each dollar bill accepted causes game to enable controls at all eight player stations for one play.

2.6 FEATURE AVAILABLE ON SEPARATE ORDER

Overlay Message Produced on TV Screen:	Unless specified otherwise, the game's internal circuitry will be programmed to continuously display a standard message (such as "ATARI MAKES GREAT GAMES"), on the TV screen along with the tanks and other objects. In place of the standard message, any other message up to two lines long (with a 23-character maximum in the first line and 17-character maximum in the second line) can be ordered.
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III. THEORY OF OPERATION

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3.1 FUNCTIONAL DESCRIPTION OF GAME

The block diagram in Figure 3-1 shows the major functional parts of the TANK 8 game and how they are interconnected. Note that the game printed circuit board (PCB) sends video signals to the TV monitor and separate audio signals to the sound PCB. Also note the four diode matrix PCB's. Each diode matrix performs a "multiplexing" function by combining signals produced at two player stations. This design feature significantly reduces the number of wires needed in the harness leading to the game PCB.

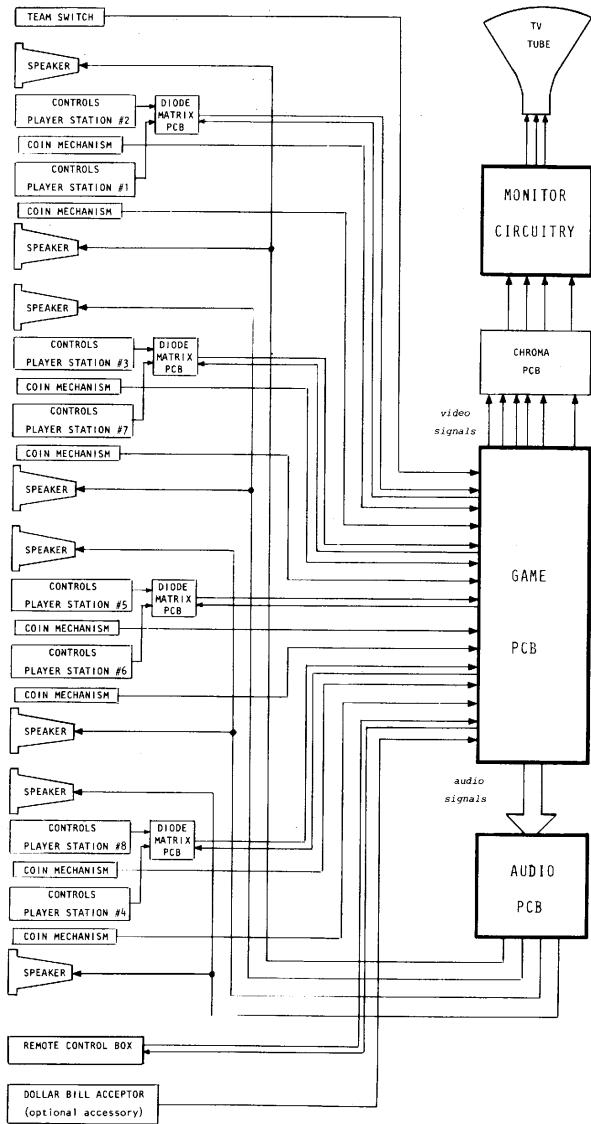


Fig. 3-1
Functional Block Diagram of TANK 8 Game

3.2 GENERAL INFORMATION

The general information about the TANK 8 game given here provides a background for understanding the Installation Instructions in Section IV of this manual, and the description of game operation in paragraphs 3.3 and 3.4.

3.2.1 ENERGIZING THE GAME: The TANK 8 game does not have an external "power on" switch. Instead the game is energized as soon as the power cord is plugged into an active AC wall outlet. This outlet must provide the AC power listed in the Specifications (Section II of this manual).

3.2.2 TV MONITOR: The game's TV monitor is based upon a General Electric Model 25 MB color monitor. The Model 25 MB tuner, IF and audio modules have been removed, and the chroma module has been replaced by an Atari unit. The monitor is self-contained in its own chassis and is used as a video amplifier. Because the signals sent to the monitor by the game circuitry are not equivalent to the signals derived from commercial color TV broadcasts, the picture appearing on the screen is not like that of a home TV set and the monitor itself does not produce any sound. The game's sounds are produced by speakers that are driven directly by the game circuitry; the "audio" connections shown in Figure 3-1 point this out.

3.2.3 PICTURE ON THE TV SCREEN: The playfield background is black and objects appearing on it are either white or one of eight solid colors. For example, in individual play each player's tank (and that tank's score numerals) is one of the following colors (moving counterclockwise around the TV screen): red, yellow, light blue, purple, peach, pink, green and dark blue. In *team play* the yellow, light blue and purple tanks (and score numerals) change to red, and the peach, pink and green tanks (and score numerals) change to dark blue. The shells fired by a tank and its score numerals are the same color as that tank. The colors of characters (letters, numerals, and symbols) in messages and in the game name identification are determined by the position on the screen. Specifically, the screen can be divided up into four quadrants with character colors as follows: dark blue in the quadrant having the dark blue tank, red in the quadrant having the red tank, purple in the quadrant having the purple tank, and peach in the quadrant having the peach tank. The message and the game identification are each written on the screen twice.

Figure 3-2 shows a corner of the TV screen and identifies typical objects appearing there. The boundary along the edge of the TV screen that completely encloses the playfield, thick walls, thin walls, mines and derelict "broken" tanks are always white. The boundary and thick walls are permanent obstacles — they continue to appear throughout game play. However, by firing shells into the *other* white objects, players can cause these to disappear for the remaining portion of one play sequence. If a shell happens to explode under a message or game identification character, that character will also disappear.

In Figure 3-2 the tank next to the score numerals is shown in its "home" position; it has just fired a shell. The exploding shell shown in Figure 3-2 has been fired by some other tank, because no tank can fire a shell until its previously fired shell has exploded. "Live" tanks, shells, message and game identification characters, and score numerals are never allowed to be white. The game identification characters spell out ATARI (in two diagonally-opposed corners of the screen) and TANK 8 (in the other two diagonally opposed corners).

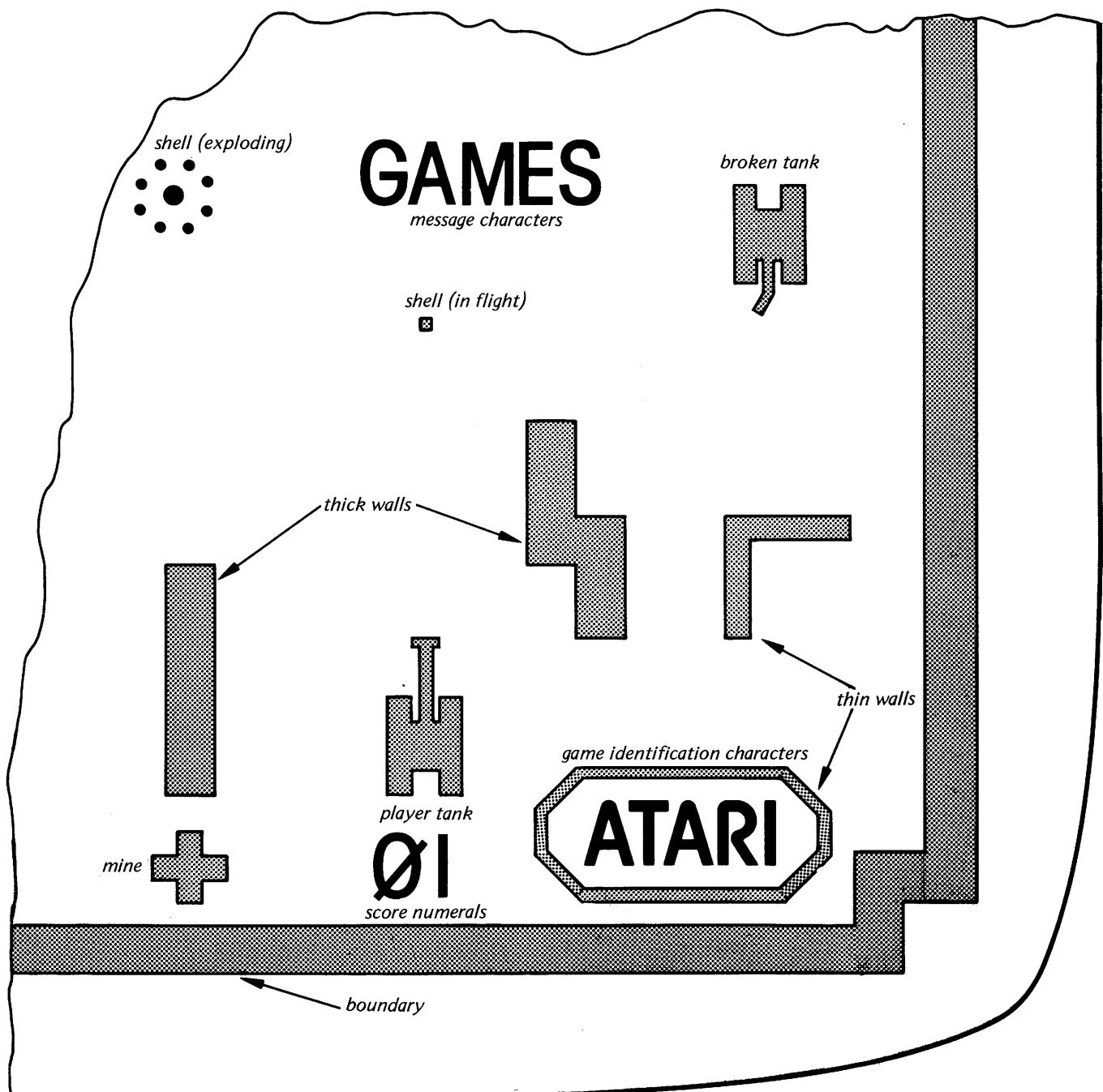


Figure 3-2 Typical Picture on Portion of TV Screen
(not drawn to scale)

3.3 GAME SEQUENCE

3.3.1 OPERATING MODES: During use the TANK 8 game can be described as operating in either of two modes, attract or play. Plugging the power cord into an active AC outlet energizes the game and it starts out in the attract mode. The game remains in attract until a player deposits money; then it changes over to the play mode. Two variations of the game sequence are possible in the latter mode – individual play and team play.

The game remains in the play mode until the game time runs out, at which time it reverts back to the attract mode. The following subparagraphs contain additional game sequence details to supplement the descriptions given in Section I and in paragraph 3.2.

3.3.2 ATTRACT MODE: In the attract mode each tank is a different color and all eight tanks move continually, each firing shells one after another. A tank explodes when hit by a shell or when it runs over a mine. After the explosion a white broken tank appears and remains at that spot on the screen, and the colored tank reappears at its home position. Tanks are only allowed to travel directly ahead, along straight-line paths. If a tank runs into some object other than a mine, it rapidly spins for a few moments and then sets out again along some new straight-line path. Neither tanks nor shells interact with score numerals, game identification or message characters.

Shells are not allowed to collide in flight. Each time a tank fires a shell into another tank, one point is added to that tank's score. Numerals in the highest score will blink; if two or more tanks are tied for the highest score, the score numerals of all the highest scores will blink.

In the attract mode no sounds are produced and all player controls are disabled. Every four minutes the picture on the screen is refreshed and a new tank battle begins.

3.3.3 INDIVIDUAL PLAY MODE: A player depositing a coin causes the game to change over to the play mode. By depositing their coins, other players can join in also. On game cabinets having a dollar bill acceptor, a player inserting a dollar bill also initiates a play mode, with all eight player stations enabled. If no one depresses the "TEAM" push button, the game sequence will be individual play (each tank appearing in a different color).

After the game starts, a player can operate his control levers to produce tank motion on the playfield, as summarized in the instruction panels on the game. The push-button switch mounted on top of the control lever serves as a "trigger" for firing shells from that tank. Only one shell can be fired at a time, and the previous shell must explode – either by hitting an opponent tank or some obstacle, or else by itself after having travelled a fixed distance – before a new shell can be fired. Shells always travel in straight lines and at speeds faster than the tank speeds.

Players have the choice of depressing and releasing the

push button each time they want to fire a shell, or of holding down the push button steadily so that a new shell will be fired automatically as soon as the previous one has exploded. However, players have more control over time of firing if they release the trigger every time. There is no limit to the number of shells that a player can fire during a game. Shells fired into non-participating player tanks have no effect.

The speakers produce the various game sounds during the play mode. However, the speaker pairs mounted on each side of the cabinet produce their sounds independently. This means, for example, that speakers #1 and #2 produce only those sounds associated with tanks #1 and #2; they do not produce any sounds for tanks #3 through #8. Whenever a tank runs into the boundary, a wall, a broken tank, or a player tank, a sound identical to the gunshot sound is produced by that tank's speaker pair. Also the tank "bounces" straight back a short distance when it collides with one of these objects. A tank also "recoils" straight back a short distance each time it fires a shell.

When a tank reappears at its home position (after running over a mine or being hit by a shell), the game's circuitry provides a few seconds of "protection time." During this time interval shells fired into that tank produce no effect. This feature allows a player to maneuver the tank away from home, thus preventing other tanks from earning easy score points by merely waiting in front of some tank's home position. If a broken tank is blocking off a tank's home position, the reappearing tank "jumps" over it and on to the playfield.

The game has a "lock-out" coil mounted at each coin mechanism. A stud on the armature of the coil blocks the coin path whenever the coil is not energized. This means that the coin path is blocked if AC power is not being applied to the game. Also the coil is de-energized as soon as credit is given to the player station, so that the coin mechanism will not accept a second coin during any one play sequence.

Subparagraph 3.3.6 describes game operation when the remote control box is being used.

3.3.4 TEAM PLAY MODE: Team play is selected by depressing the "TEAM" push button during the first ten seconds after money is deposited in the game. An individual play sequence will follow if the "TEAM" push button is not depressed during this ten-second interval. If the "TEAM" button is depressed at any other time, there is no response from the game. Only one "TEAM" push button is mounted on the cabinet.

The differences between individual and team play sequences are as follows. In individual play each tank is a different color, while in team play four tanks are red and the other four are dark blue. In individual play each participating player's score is shown independently, while in team play the score for all four red tanks is the same and the score for all four dark blue tanks is the same. In team play the score numerals never blink. In team play if a tank

runs over a mine, one point is added to the opponent team's score. If a player happens to fire a shell into another tank of that same team, one point is added to the opponent team's score also.

Subparagraph 3.3.6 describes game operation when the remote control box is being used.

3.3.5 OWNER/OPERATOR OPTION: The TANK 8 game features an owner/operator option that allows adjustment of game time. Sixteen choices are possible, in 10-second steps from a minimum of 60 seconds to a maximum of 210 seconds. Game time can be changed by performing a simple manual adjustment on a miniature switch assembly mounted on the game printed circuit board. Paragraph 4.3 in Section IV of this manual gives instructions for making this adjustment.

3.3.6 OPERATION WITH REMOTE CONTROL BOX: The remote control box is a separate unit that connects to the game cabinet via a 14-ft. cable. The box, supplied with each game, is intended for use by a game attendant. When not being used, it has a connector that must be disconnected from a mating connector inside the cabinet. Then both the box and its cable can be stored inside the cabinet.

Ten push-button switches are mounted on top of the box. (These are shown on drawing number A004606 included in Section VII of this manual.) Eight of these push buttons are labeled "RC1" through "RC8," and each one is associated with a player station. By depressing one of them, the attendant can enable the controls at that player station for one game sequence. For example, depressing "RC1" enables controls at player station #1. However, even when the box is connected, players can still get credit by depositing a coin at their player station's coin mechanism (provided that the attendant has not already depressed that push button).

The box also has a push button switch labeled "REMOTE START" and one labeled "REMOTE TEAM." When the box is connected, no play sequence can begin until the attendant has depressed "REMOTE START." And when this is done, the game sequence starts immediately — no bugle sound is produced and the words "TEN SECONDS TO GAME TIME" do not appear on the TV screen. The "REMOTE TEAM" switch functions in the same way as the "TEAM" push button switch mounted on game cabinet.

3.4 DETAILED TECHNICAL DESCRIPTION OF OPERATION

3.4.1 GENERAL COMMENTS: The game's electronic circuitry is contained on printed circuit boards, as follows: Game PCB, sound (audio) PCB, four diode matrix PCBs (one PCB at each pair of player stations), chroma PCB (mounted in the chassis of the TV monitor), TV monitor, remote control box, and a dollar bill acceptor, if installed. Other components that connect to this circuitry include:

8 speakers, 8 coin mechanisms, eight sets of player controls, four interlock safety switches, the "TEAM" push button switch, and components on an electronics tray assembly.

In this part of the manual brief technical descriptions are given for those portions of the control circuitry regarded as field-repairable. Correction of trouble causes traced to certain portions of the circuitry on the game PCB may require replacement of the entire board. The drawings included in Section VII of this manual supplement the text given here.

On the game PCB and on its schematic, each integrated circuit device location is identified by a column letter designation (A through P) and a row number designation (1 through 9). A similar method of identification is used on the sound PCB.

On both the game and audio schematics the symbol "P" (which appears at various inputs to logic gates and other integrated circuits) indicates a connection to +5 volts through a pull-up resistor.

3.4.2 DIODE MATRIX PCB: Each diode matrix PCB performs a multiplexing function. The game PCB sends out eight "distribution" signals to the diode matrix boards, two signals to each board. The timing of the distribution signals is such that only one signal is present at any one time (see timing diagram in Figure 3-3). As inputs from the diode matrix boards the game PCB receives the five "switch" signals SW2, SW3, SW4, SW5 and SW8. However, the respective switch signals are common for all four boards. In other words, the SW2 signal from all four diode matrix boards is a common line, and so forth for all five switch signals. The connections shown in the simplified block diagram in Figure 3-4 illustrate this arrangement.

The internal circuitry on the game PCB looks at the "switch" inputs once during every distribution signal time. The manner in which the game PCB interprets the "switch" inputs is summarized in the table shown on sheet 3 of the game PCB schematic.

3.4.3 GAME PCB: The circuitry shown on sheet 1 of the schematic, in zones D5 through D8, generates the synchronization timing signals for the TV monitor and also various other timing signals used on the board. The basic CLOCK signal is generated in an 11.055 MHz crystal-controlled oscillator circuit. The CLOCK signal is then divided down by binary counters to produce the horizontal signals (H SYNC and H BLANK) and the vertical signals (V SYNC and V BLANK).

The circuitry shown in zone D2 through D4 provides the COMP VIDEO and VIDEO GND signals. These are not used within the game, however, and no harness wires are connected to pins 2 and 37 of the game PCB edge connector. During final testing at the factory, and when the board is plugged into the Atari Test Fixture, these signals can be used as inputs to a test black-&-white TV monitor (separate from the game's color monitor).

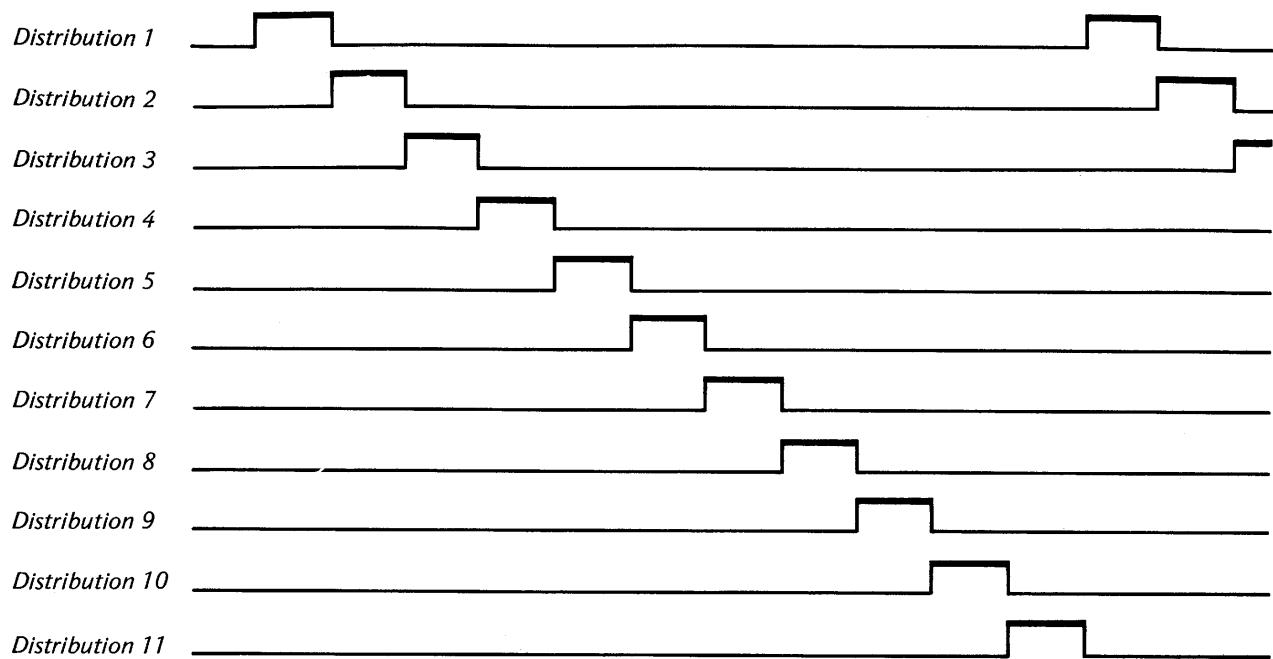


Figure 3-3 Timing Diagram for Distribution Signals

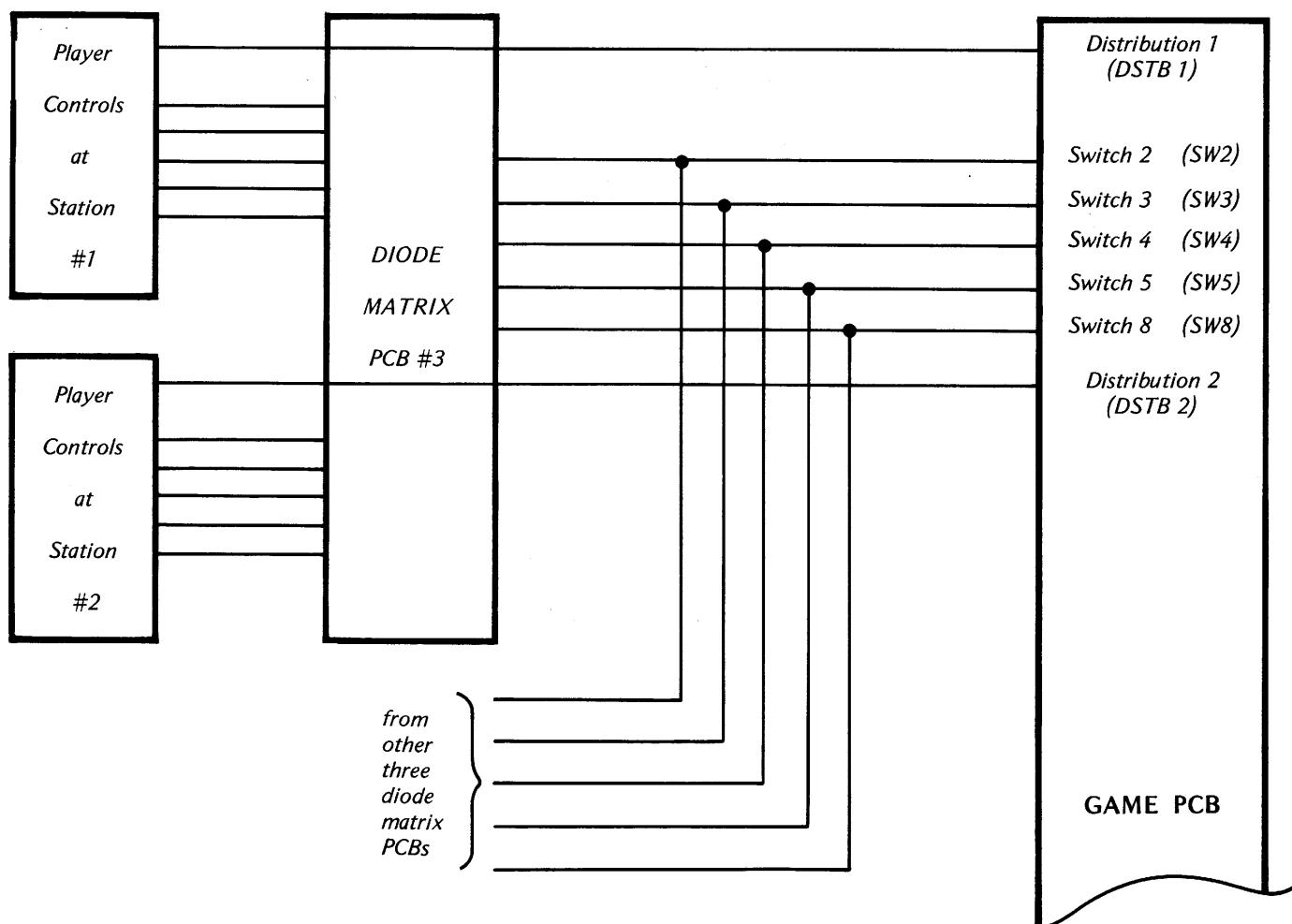


Figure 3-4 Simplified Block Diagram

The circuitry in zone B1 and B2 is provided as the interface between the game PCB and a dollar bill acceptor. Either a Rowe or an ARDAC unit can be installed on the game cabinet. The output from this portion of the game PCB circuitry is the \$ signal.

On sheet 2 of the schematic, the type-9316 counter circuit configuration in zone C3 produces the bugle contribution to the game sounds. The 1V and 2V are timing signals derived from the CLOCK signal generated by the crystal-controlled oscillator. The BUG 1 and BUG 2 signals provide timing sequences for producing tones that play the bugle call at the start of the game sequence, and the "taps" melody at the end of the game.

The ROM device in location N6 stores the pictures of objects (except tanks) that will appear on the TV screen. The two type-9322 devices in locations K5 and L5 provide character rotation signals. The IC devices in locations H5 and J5 produce the tank movement. The type-9316 device in location J3 produces shell movement. The collisions of tanks and shells with various objects are detected in the circuit configuration that includes the type-74153 device in location B2.

The type-9322 device in location B3 produces the signals that go to the chroma PCB mounted in the color TV monitor chassis.

3.4.4 CHROMA PCB: The four signals COLOR CODE 0, COLOR CODE 1, COLOR CODE 2 and COLOR CODE 3 coming from the game PCB are decoded by a type-74145 device to produce eight individual outputs, one for each color of tank. Each output is coupled through a resistor weighted network to the \bar{B} , \bar{R} and \bar{G} inputs to 2N3643 transistors. The \bar{B} (blue), \bar{R} (red) and \bar{G} (green) signals at the collectors of these transistors are sent to the TV monitor circuitry. The COMP SYNC signal from the game PCB is coupled through a resistor and also sent on to the TV monitor.

3.4.5 SOUND PCB: On sheet 1 of the schematic the eight identical tank motor sound generator circuits are shown in zones A through D, 6 and 7. They are driven by a type-9334 device that decodes the BBA0 through BBA2, BBD0 and MOTOR signals coming from the game PCB. The tank motor, crash & explosion and bugle sound contributions are mixed at eight type-LM324 amplifier stages to produce four output signals. These four signals serve as inputs to four type-LM380 amplifiers used as speaker drivers. Potentiometers R133 through R136 provide the adjustments described in subparagraph 5.3 in Section V of this manual. During the attract mode, the ATTRACT signal, which comes from the game PCB, will disable the speaker drivers so that no sound can be produced.

On sheet 2 the BBA0 through BBA2, BBD0 and LOCK signals are decoded by a type-9334 device that drives eight darlington-connected transistor pairs. The eight collector outputs from these transistors connect in series to the lock-out coils mounted in the coin mechanisms. There is one coil in each coin mechanism. When the lock-out coil is energized, the path for the coin is clear; when not energized, the path is blocked.

The two type-74164 serial-to-parallel shift registers form a noise generator circuit that is driven by the 2V timing signal generated in the sync countdown portion of the game PCB circuitry. The output of the noise circuit, at the collector of transistor Q20, is combined in an LM324 amplifier circuit with the EXPLOSION and CRASH signals coming from the game PCB. The CRASH signal is produced either when a tank runs into an object or when a tank gun fires. The EXPLOSION signal is produced when a shell explodes by itself or else hits an object, or when a tank runs over a mine. The signal resulting from the last amplifier of the combining circuit is named CRASH & EXPLOSION. Potentiometer R132 in this stage provides the adjustment described in subparagraph 5.3.

IV. INSTALLATION INSTRUCTIONS

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4.1 UNPACKING INSTRUCTIONS

4.1.1 EXAMINATION FOR SHIPPING DAMAGE: Before shipment from the factory, components and sub-assemblies of each game are carefully checked for proper operation. However, during shipment some adjustments may have changed or parts may have been damaged. Upon initial removal of the game from the shipping container, first examine the exterior of the cabinet. Then remove all four side panels and also examine the interior. Any shipping damage such as a dented, cracked or broken cabinet, sub-assemblies broken loose, etc., should be reported immediately to the shipper and to Atari, Inc.

4.1.2 MECHANICAL INSPECTION: After determining that the game has been received in good condition, carefully inspect the interior parts and verify the following:

- (a) All slip-on and plug-in connectors are firmly seated (particularly the PCB edge connectors)
- (b) The fuses are all seated in their holders
- (c) No loose foreign objects are present (especially metal objects which could cause electrical short circuits)
- (d) No harness wires have become disconnected or pulled loose.

Be sure *all* major assemblies have been checked: game PCB, sound PCB electronics tray, speakers, coin mechanisms, player controls and TV monitor chassis.

Do not go on to the remaining paragraphs in this section until the above mechanical inspection has been thoroughly performed.

4.1.3 ASSEMBLY OF CABINET AT GAME SITE: At the factory the game cabinet is partially disassembled at the time of placement into the shipping container. After the game has been received, inspected and moved to the game site, the cabinet has to be reassembled. Drawing number A005090 in Section VII of this manual gives assembly instructions. The owner/operator has the choice of installing the canopy or not, because the game will operate either way.

4.2 ENERGIZING THE GAME

4.2.1 APPLICATION OF AC POWER: Close and lock the side panels, making sure each is completely shut at the bottom and at the top. Plug the power cord into an AC outlet providing the AC power listed in the Specifications (Section II of this manual). The wall outlet must accept a three-prong plug and the receptacle must be connected to a good earth ground.

After the power cord has been plugged in, the proper response from the game is that images appear on the TV screen. If there is no response at all from the game, unplug the power cord and check the AC wall outlet. A simple, safe way to check for presence of AC power at the wall outlet is to plug in an appliance known to be working properly — such as a table lamp, radio, or an electric clock. If the wall outlet passes the check, then presume that the

trouble is with the game and refer to Section VI of this manual.

CAUTION: No troubleshooting steps should be attempted inside the cabinet by anyone not familiar with safety measures and repair procedures on electrical equipment.

Do not go on to the remaining paragraphs in this section until the proper response described above has been observed.

4.2.2 CHECK ON OPERATION OF INTERLOCK SWITCHES: The interlock switches are four safety switches mounted inside the cabinet, near the top edge of each side panel. At the factory each switch is mechanically adjusted so that it will automatically transfer to its "off" position (switch contacts open) whenever the side panel is opened. When the interlock switch is in its "off" position, the AC power leading to the game's power supply is interrupted. When the side panel is closed, the interrupt switch is adjusted to be in the "on" position (switch contacts "closed") and AC power is allowed to reach the game's power supply, meaning that the game can operate.

After application of AC power per paragraph 4.2.1 above, correct operation of each interlock switch can be checked as follows: unlock the side panel and slowly open it. The correct response is that by the time the edge of the panel has moved about 2 to 3 inches away from the cabinet, the TV screen should go dark, verifying that the interlock switch has automatically transferred to "off." While opening the panel, do not insert fingers inside the cabinet, and do not allow foreign objects to fall inside. If the TV screen continues to be lighted up even after the panel has been opened, immediately close and lock the panel, and unplug the power cord from the wall outlet. Then refer to Section VI of this manual to replace and/or adjust the interlock switch.

Do not go on to the remaining paragraphs in this section until the operation of each interlock switch has been checked and found to be correct.

4.3 GAME STRUCTURING

Before putting the game into operation at the game site, the game structuring should be defined by the owner/operator. The term "game structuring" for TANK 8 refers to the length of the game time per play sequence, as described in subparagraph 3.3.5 in Section III of this manual.

Game time is determined by the settings of four off/on slide switches in a miniature switch assembly mounted on the game PCB. The game times resulting from each of the 16 possible combinations of switch settings are listed in Table 4-1. In order to change switch settings, the game PCB has to be removed from its metal enclosure, and then the studs on top of the switches have to be moved by hand.

The game PCB is located above the sound PCB, near the top at one corner of the game cabinet. Refer to drawing

Total Game Time	Switch Positions				Remarks
	SW 1	SW 2	SW 3	SW 4	
60 sec.	off	off	off	off	minimum time
70 sec.	off	off	off	on	
80 sec.	off	off	on	off	
90 sec.	off	off	on	on	
100 sec.	off	on	off	off	
110 sec.	off	on	off	on	
120 sec.	off	on	on	off	
130 sec.	off	on	on	on	
140 sec.	on	off	off	off	
150 sec.	on	off	off	on	
160 sec.	on	off	on	off	
170 sec.	on	off	on	on	
180 sec.	on	on	off	off	
190 sec.	on	on	off	on	
200 sec.	on	on	on	off	
210 sec.	on	on	on	on	maximum time

Table 4-1 Settings on Game Time Switch Assembly

number 005301 for an internal view of the cabinet.

Before performing this adjustment, the game should be de-energized or not operating. Further, it is also recommended that the power cord be unplugged beforehand.

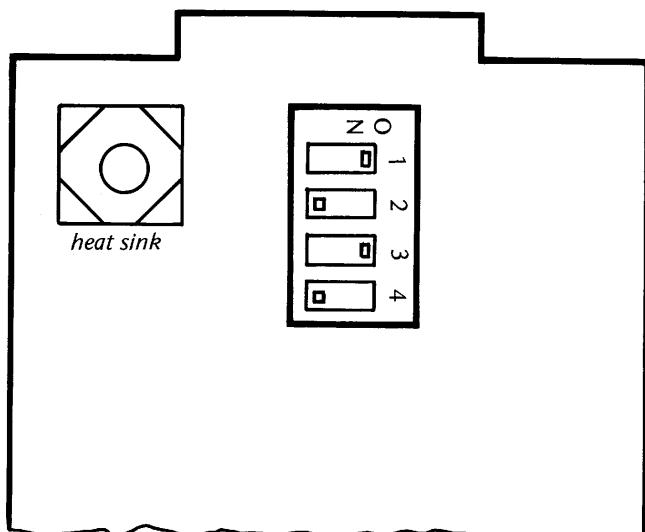
Unlock and open the side panel; doing this should cause the interlock switch to de-energize the game, as described in subparagraph 4.2.2. If the switch fails to de-energize the game, immediately close and lock the panel, unplug the power cord, and refer to Section VI of this manual to adjust and/or replace the switch.

While being careful to avoid touching any parts of the body against the TV chassis components or other wiring connections inside the cabinet, find the metal enclosure and unplug the edge connector to the RF board. Carefully now how the connector plugs in. (It must be reconnected *in exactly* the same way after the switch settings have been changed.) Remove the screws holding the RF board onto the front of the metal enclosure and unplug the RF board from the game board.

Now the game PCB has been freed so that it can be slid out of the enclosure far enough to provide access to the miniature switch assembly. Figure 4-1 shows its approximate location near the edge connector end of the board. (For the exact location, see the item labeled "SW 1" on drawing number A005067.) On close examination, an arrow and the word "ON" can be seen engraved on the body of the switch assembly. Using Table 4-1 as a reference, slide the studs on the four individual switches so that their positions match those listed in the table for the desired Game Time.

After doing this, slide the game PCB back into its enclosure and plug the RF board back on to the game PCB. Replace the RF board on the front of the enclosure and secure it in place. Then replug the edge connector back onto the RF board, *making sure* that it is reconnected in the way originally found.

After performing this adjustment, close and lock the side panel, and energize the game.



NOTE: Component side shown; not drawn to scale

Figure 4-1 Approximate Location of Game Time Adjustment on Game PCB

4.4 FUNCTIONAL CHECK OF GAME OPERATION

The following procedure provides a simple check that can be quickly performed at the game site and that does not require external test equipment. If at any point during this procedure the game's response is observed to be other than the response called for herein, assume the game is not operating correctly and refer to Section VI of this manual. If all the responses are as described here, then all major parts of the game can be assumed to be functioning correctly.

After performing the adjustments described in paragraph 4.3, Game Structuring, and in paragraph 4.2, Energizing the Game, the game should be operating in the

attract mode, as per paragraph 3.3.2. The speakers should not be producing any sound. Observe the TV screen.

4.4.1 CHECK OF ATTRACT MODE:

All eight tanks should be moving about the playfield, engaged in a mock battle, as described in subparagraph 3.2.2.

NOTE: Sometimes upon initial application of power (or, more rarely, later on during play), a "scrambled" picture may appear on the TV screen. The game's internal circuitry not having initialized itself can produce this irregularity. Although normally taken care of automatically, it is possible that severe noise spikes on the AC power line could upset the self-initialization. This condition can generally be corrected by de-energizing the game and then re-energizing it, one or more times. Do this by unplugging the power plug from the wall outlet and reconnecting it, or else by opening and closing a cabinet side panel so that an interlock safety switch is exercised.

Occasionally, upon close examination of objects appearing on the TV screen, certain peculiarities may be observed. These would not appear continuously in every game sequence, and do not interfere with the game's operation. For example, due to certain closely-spaced timing situations the game's internal circuitry may sometimes cause an exploding shell to be left "frozen" somewhere on the screen. Or a moving tank and/or shell may sometimes penetrate the boundary around the edge of the playfield and then spin off the edge of the screen. These kinds of random and infrequent occurrences do not mean that the game's operation is defective.

During the attract mode all player controls should be disabled, and the picture on the screen should be refreshed approximately every four minutes.

4.4.2 CHECK OF INDIVIDUAL PLAY MODE:

After correct game operation in the attract mode has been verified, next the controls at each player station should be checked for the responses described in subparagraph 3.3.3 for individual play mode.

Deposit a coin in the coin mechanism at one of the player stations. As soon as the coin has been accepted, the bugle call sound should be produced and the words "TEN SECONDS TO GAME TIME" should appear on the TV screen. At this time certain of the score numerals may be changing very rapidly, but this does not indicate incorrect game operation and the numerals should all go to "00" after the ten seconds elapse. Now deposit a coin in the coin mechanism of the player station to the right, and confirm that this coin also has been accepted.

Return to the previous player station and try to deposit a second coin. This time the coin slot should not accept the coin.

Next operate the control levers and depress the push button on and off, and also hold it down continuously for

a few seconds. The responses of the tank and its shells should be as described in subparagraph 3.3.3. Be sure to also fire a shell into the participating tank from the player station to the right.

After controls of that player station have been checked, perform the above checks at each of the other seven player stations, one at a time.

4.4.3 CHECK OF TEAM PLAY MODE:

After correct operation in the attract and individual play modes have been verified, the following steps will check the features of a team play mode.

Deposit a coin in the coin mechanism at a player station at one corner of the cabinet (say at player station #1, or #3, or #7 or #5) and then, within the next ten seconds, depress the "TEAM" push button and deposit coins in two diagonally-opposite player stations (#2, #4, #8, #6). Doing all this within ten seconds should set up a team play sequence, with one tank on the first team and two tanks on the second team.

Next check for the responses described in subparagraph 3.3.4. Be sure to drive a tank over a mine and confirm that one point is added to the score of the opposing team. Also, on the two-tank team, fire a shell from one tank into its teammate. Confirm again that one point is added to the score of the opposing team. Remember that the score numerals do not blink in team play.

4.4.4 CHECK OF REMOTE CONTROL BOX:

Before the remote control box can be used, the connector on the end of its cable inside the game cabinet has to be mated with the game's harness. (The mating connector wired to the harness is shown as item 22 on drawing number 005301 in Section VII of this manual.) Make sure that the remote control box is connected to the game before performing this check.

The game should be energized and operating in the attract mode, per subparagraph 3.3.2. Depress the "START" push button on the box. The game should respond by immediately changing over to individual play mode, *without* the bugle call or the words "TEN SECONDS TO GAME TIME" appearing on the TV screen. Then depress each of the eight "player credit" push buttons. Doing this should set up an individual play mode per subparagraph 3.3.3. Go to each player station, one at a time, and confirm that the player controls are all enabled. Also confirm that no coin mechanism will accept a coin. After doing this, let the game time run out, at which time the game should change over to the attract mode.

Deposit a coin in each of the eight coin mechanisms. With the remote control box connected, the mechanisms should accept one coin each but the game should remain in the attract mode. Confirm that no coin mechanism will accept a second coin. Then go over to the remote control box and depress the "START" push button. Doing this should cause the game to change over to individual play mode, again without the bugle call or the message on the screen. Let the game time run out.

On the remote control box depress both the "START" and the "TEAM" push buttons, and then each of the eight "player credit" push buttons. Doing this should cause the game to change over to team play mode, again without the bugle call or the message on the screen. Confirm that the picture on the screen is correct — four red tanks on one half of the screen and four dark blue tanks on the other half.

This completes the check on the remote control box. Disconnect the remote control box mating connectors inside the game cabinet if the game is presently being used without the box.

4.4.5 CHECK OF DOLLAR BILL ACCEPTOR: Perform the following check if a dollar bill acceptor unit has been installed in the game. First the game should be energized and operating in the attract mode per subparagraph 3.3.2. Following the instructions printed on the front of the unit, insert a dollar bill into the acceptor.

The acceptor's motor should respond by causing the bill to be pulled inside. Then the game should respond by producing the bugle call sound and showing the "TEN SECONDS TO GAME TIME" message on the TV screen. After ten seconds have elapsed the game should change over to individual play mode.

Next go over to each of the eight player stations, one at a time, and confirm that no coin mechanism will now accept a coin and that all the player controls are enabled. Let the time run out, at which time the game should change over to the attract mode again.

Next deposit a coin in one coin mechanism. The mechanism should accept the coin, and the game should respond by producing the bugle call, showing the message, and going through another individual play mode sequence. Let the game time run out. This completes the check.

V. MAINTENANCE AND ADJUSTMENTS

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5.1 ROUTINE MAINTENANCE

Due to its solid-state electronic circuitry, this Atari game should require very little maintenance and only occasional adjustment.

5.1.1 CLEANING: Game cabinets and glass may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners which leave no residue can be obtained from distributors.

5.1.2 LUBRICATION: About once every three months lightly spray the rejector linkage portion of the coin acceptor inside each coin mechanism. Use WD-40® or similar lubricant, and *avoid* spraying the entire coin acceptor. Potentiometer shafts must *never* be lubricated in any way.

5.2 ADJUSTMENTS ON TV MONITOR

The TV monitor need be adjusted only when the picture is distorted, or if color balance is incorrect.

NOTE: The TV monitor is accessible only from inside the game cabinet and these adjustments have to be made while the game is energized. Therefore only persons familiar with safety measures and repair procedures on electrical equipment should perform these adjustments.

For specific procedures for performing color and other service adjustments on the TV monitor, refer to Atari manual TM-066, "G. E. #25MB COLOR MONITOR TROUBLESHOOTING MANUAL for TANK 8 and similar games."

5.3 ADJUSTMENT OF EXPLOSION SOUND AND SPEAKER VOLUMES

The electronic drive circuit for each pair of speakers

includes a potentiometer whose setting determines volume of the sounds produced by those two speakers. The four potentiometers are independent of one another and each can be adjusted manually. The circuit that generates the CRASH & EXPLOSION signal also includes a potentiometer. Its setting determines how pronounced these sounds will be with respect to the tank motor sounds. This potentiometer can also be adjusted manually. To adjust these potentiometers, proceed as follows.

The sound printed circuit board is inside the game cabinet, just beneath the metal box that encloses the game PCB (refer to drawing number 005301 for an internal view of the cabinet). Unlock and open the side panel; doing this should cause the interlock switch to de-energize the game, as described in subparagraph 4.2.2. If the switch fails to de-energize the game, immediately close and lock the door, unplug the power cord, and refer to Section VI of this manual to adjust and/or replace the switch.

While being careful to avoid touching any parts of the body against the various mechanical components and wiring connections inside the cabinet, find the sound PCB and examine its surface. All five potentiometers are found near the edge-connector end of the board, on the component side. Their approximate locations are shown in Figure 5-1, and their exact locations are shown as R132 through R136 on drawing number A005069 in Section VII of this manual.

To cause a speaker pair to produce louder sounds, move the stud on top of the respective potentiometer in the direction shown by the "louder" arrow in Figure 5-1. For quieter sounds move it in the opposite direction. To make explosion sounds more pronounced with respect to the tank motor sounds, move the stud on that potentiometer in the direction shown by that arrow.

After performing adjustments, close and lock the side panel, and energize the game.

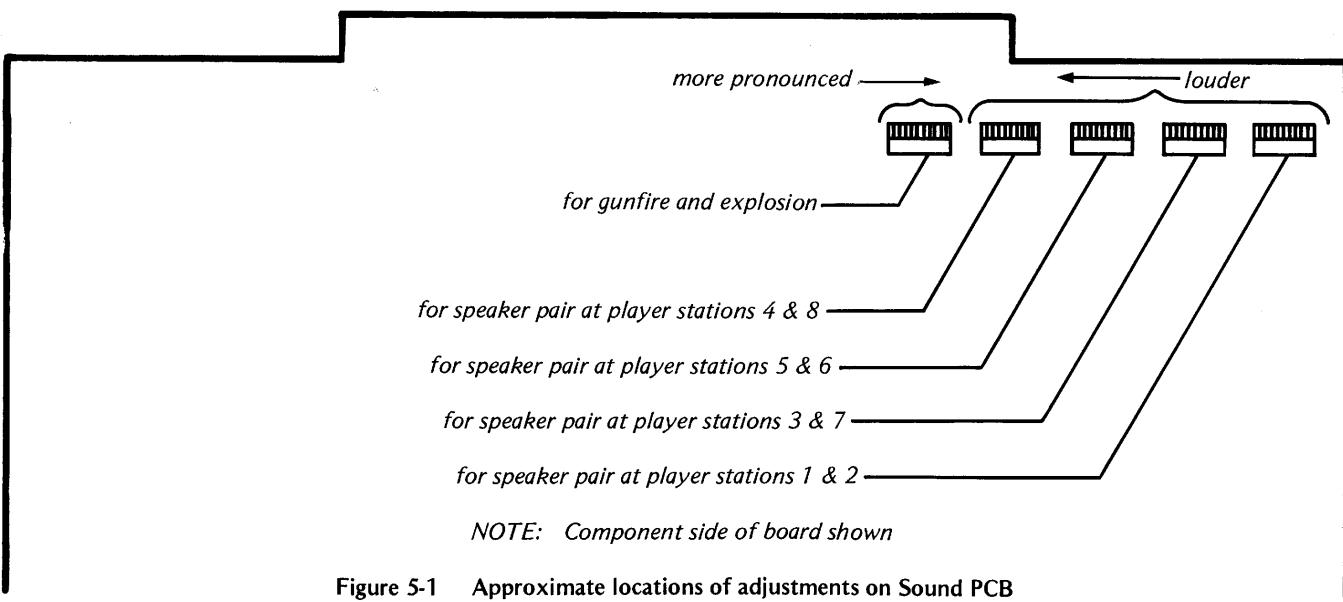


Figure 5-1 Approximate locations of adjustments on Sound PCB

VI. TROUBLESHOOTING AND REPAIR

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6.1 GENERAL PROCEDURE

NOTE: This section describes troubleshooting procedures in detail sufficient for a person with moderate technical ability to understand. However, for those interested in gaining more information on video game technology, especially the electronics, we recommend reading the Video Game Operator's Handbook, manual no. TM-043. This book is available from Atari, Inc., attn. Customer Service Dept., 2175 Martin Avenue, Santa Clara, CA 95050 for \$5.00 each, or from your distributor.

6.6.1 IDENTIFYING THE TROUBLE AREA: The first troubleshooting step should be to note all observable trouble symptoms. Examples of symptoms are: depositing a coin produces no game response, no sound coming out of the speaker at any time, no picture on the TV screen. At the same time also note the game features that still work. A systematic way of checking game operation is to perform the functional check given in Section IV of this manual. Carefully train your eye to pick up all clues; by doing this an experienced troubleshooter can often spot the cause of a trouble even before he opens the cabinet.

Keeping these observations in mind, use the understanding of game operation gained from the theory of operation (Section III) and the schematic drawings (Section VII). Next narrow down the suspected cause of the trouble to a specific area or areas of the game: coin mechanism, TV monitor, harness and front panel components (switches and control lever), remote box, electronics tray, printed circuit board, and power cord. Be careful not to overlook possible trouble areas that may seem too obvious: a power cord plug that has worked loose from the wall outlet and is no longer fully seated in the receptacle, or a side panel access door that is not fully closed (thus causing the interrupt switch to block the AC power path to the game).

6.1.2 LOCATING THE TROUBLE CAUSE: Once a problem has been narrowed down to one or more areas, the next step is to perform various tests and measurements to isolate a specific cause of the trouble. Remember that sometimes a very complicated problem, such as erratic game operation, can be traced to a simple cause — the printed circuit board not being fully seated in its edge connector. Start with the most suspect area and trace backwards from the point where the trouble is first observable, using a process of elimination to eventually locate the faulty component, connection, etc. For example, if no sound is audible during game play, first check for a signal at the speaker leads. If no signal is present there, go back through the wiring harness connections to the printed circuit board. If there is still no signal, then systematically check back through the various components of the sound generation circuit.

Substitution of parts is a legitimate and easy way to isolate the cause. For instance, if the PCB is the suspected trouble area, remove it and substitute a known-to-be-good PCB. Then check for correct game operation. Similarly, to

check the TV monitor, connect the game to a known-to-be good monitor. The harness can often be checked by substitution also. Substitute both a known-to-be-good PCB and TV monitor. If the trouble still persists, the harness must be at fault.

While locating the trouble cause, use the technical descriptions in Section III as guides for correct circuit-level operation, and the schematic drawings of Section VII as roadmaps for tracing signal flow paths.

The test equipment for use in troubleshooting is discussed in paragraph 6.2.

6.1.3 CORRECTING THE TROUBLE CAUSE: In practice, the steps required to correct troubles can range from simple adjustments (fully seating the PCB in its edge connector, changing the setting on a potentiometer, adjusting the picture controls on the TV monitor) to repair of loose connections and replacement of defective parts. Extreme care should be exercised when removing integrated circuit devices and discrete components. Use a 40-watt soldering iron with a small tip designed especially for IC work. To remove an IC device, follow this procedure:

Clip all leads and lift the IC package out, leaving two rows of leads. Then remove leads individually with a soldering iron and needle-nose pliers. Finally, evacuate the hoies with a solder sucker. Afterwards clean the area thoroughly, using an approved PCB cleaning solution to remove any traces of flux and dirt. Alcohol will do in a pinch, if necessary.

Insert the new IC device using an IC insertion tool, making sure that the reference notch is oriented correctly and that the device's leads are not bent during insertion into the board. Afterwards, be sure to solder each lead on *both* sides of the PCB, using as little solder as possible. After soldering, clean the area thoroughly to remove the flux.

Observe the same removal and insertion procedures when replacing discrete components. Trim the leads as close as possible and be sure to orient diodes and capacitors correctly.

6.1.4 VERIFYING CORRECT GAME OPERATION: After locating and correcting the cause of a trouble, re-energize the game and perform a final check on correct game operation. Doing this will verify that your troubleshooting was correct. If the game operation is still not correct, go back and double-check your work. Make sure that any replaced components were installed correctly. If this was done properly, then start the troubleshooting steps over again. Keep in mind that there may be more than one trouble at a time, and that correcting one trouble can sometimes bring previously undetectable troubles to light.

This verification is especially important when the original trouble had been intermittent, that is, was not happening all the time.

6.2 TEST EQUIPMENT

Electronic troubleshooting of a video game essentially consists of checking for the presence of various signals and of examining their condition. A signal can be thought of as acting like a "messenger" that carries instructions from one unit or circuit to another. Many different types of signals are produced in a video game, and for this reason several unusual and perhaps unfamiliar types of test instruments are used during troubleshooting. Each instrument has its own set of advantages and disadvantages for examining a given type of signal, and both the depth of the intended troubleshooting capability and budget will determine what instruments will be needed. Some instruments are basic and essential, no matter what size of service facility, while other optional instruments are desirable because they make troubleshooting easier and quicker.

6.2.1 BASIC TEST EQUIPMENT:

(a) *The Video Probe.* This is a simple but invaluable instrument having two leads — a test-clip lead and a test-probe lead. During troubleshooting of video signals the test-clip lead is left connected to the game side of the video coupling capacitor. On the Outlaw game this point is the junction of resistors R15, R17 and R18 on the PCB. When the test-probe lead is then connected to any video developmental signal, that signal will be coupled to the video signal going to the TV monitor and a video probe picture will appear on the TV screen. The shape and other characteristics of this picture will give information about the signal being probed. The video probe is suited for troubleshooting synchronization and image signals, but will not be useful for extremely fast signals (such as the clock) or for very slow analog or digital signals.

A video probe can be constructed in a few minutes from these common electrical components: a length of 20 AWG (American Wire Gauge) rubber-coated wire, a 4.7K-ohm, 1/4-watt carbon resistor, and two test leads. For the leads, use a single Mouser test clip (Mouser #131C 301 or 302) attached to one end of the wire, and a test prod containing the resistor on the other.

To assemble the video probe, proceed as follows: Remove the cap from the test clip and strip 3/16 inch off each end of the wire. Solder one end to the post in the test clip, thread the other end through the hole in the cap, and snap on the cap. Next unscrew the plastic body of the test prod from the point and trim both leads of the resistor to a 3/16-inch length. Solder one resistor lead to the inside of the point. Thread the other end of the wire through the hole in the body and solder it to the other resistor lead; screw the body back onto the point.

(b) *The Logic Probe.* This is a test instrument designed for fast verification of digital IC outputs. It is small, convenient to carry, easy to read, and relatively inexpensive. The logic probe derives its power from the system under test; it has two power leads, one for connection to ground and the other to +5 volts DC. When the logic probe's tip is held against a digital signal point, three colored lamps in the tip will indicate the signal's condition or state, as follows:

- The red lamp lit indicates a high or logic level 1 (for TTL components, this is +2.4 to +5 volts)
- The white lamp lit indicates a low or logic level 0 (for TTL components, this is 0 to +0.8 volt)
- The blue lamp lit indicates that the signal is changing states
- No lamps lit indicate the grey region between 0 and 1 (for TTL this is between +0.8 and +2.4 volts)

A circuit shorted to ground will illuminate the white lamp and an open circuit will illuminate the red lamp.

The logic probe is readily available from electronic supply sources; a commercial model found satisfactory is the Kurz-Kasch model LP 520.

(c) *The Logic Pulser.* This test instrument is similar in size and shape to the logic probe, and it also derives its power from the system under test. When the logic pulser's tip is held against a digital signal point, the source and sink capabilities of the pulser override any IC output and the point is driven to the opposite logic level. If the point that the logic pulser is held against is low, pressing the switch on the side of the pulser will introduce a high pulse. Conversely, pulsing a high line will pull that line low momentarily.

During troubleshooting the logic pulser allows stimulation of in-circuit ICs with a shaped digital pulse. For example, a certain feature of the game may not be working and you suspect that a circuit is not receiving the necessary signal. Use the pulser to imitate that signal: if the circuit begins working, you have proved that the signal was in fact missing and you can begin tracking it down. This technique is very similar to jumping coils in electromechanical games such as pinball machines.

In addition to the regular "pulse" button, there is another switch mounted on the logic pulser. When this switch is set in the "rep" mode, the instrument pulses the digital signal point at a 5-Hz rate or 5 times per second. This extremely low rate is slow enough to allow watching events initiated by the pulser. Counter outputs, for example, are more easily observed when the counter is pulsed or clocked at this rate.

The logic pulser is also readily available from electronic supply sources; a commercial model found satisfactory is the Kurz-Kasch model HL 583.

(d) *Oscilloscope.* The most versatile test instrument, and also the most expensive, is the oscilloscope. The high-speed TTL integrated circuits used in video games produce fast-rise-time signals. The oscilloscope should have a 50-MHz bandwidth, dual trace and dual time base capability. These latter features allow examination of both input and output signals simultaneously, so that precise timing relationships can be checked. The oscilloscope should also have provision for internal or external sync.

Of the newer, solid-state oscilloscopes, a satisfactory model is the Tektronix 465.

(e) *VOM or Volt-Ohmmeter.* This common measuring instrument is extremely useful in video game troubleshooting. It can be used to check line voltage, transformer secondary windings, continuity, resistance, power supply voltages, and to some extent used for measurements in the analog circuitry.

One commercial model found satisfactory is the Simpson 260.

6.2.2 OPTIONAL TEST EQUIPMENT:

(a) *The Logic Comparator.* This test instrument's main benefit is that it can be used to check the functioning of an integrated circuit device while the device is still in place on the printed circuit board. The logic comparator performs the check by comparing the suspect ICs functioning with that of an identical-type reference IC mounted in the instrument itself. Suppose that the functioning of a type-74193 device on the PCB is suspected to be defective. First insert a program card with a known-to-be-good 74193 into the logic comparator, and then clip the comparator test leads onto the leads of the suspect device. If there are any logic state differences between the reference IC and the suspect IC under test, then an LED on the logic comparator will light up to indicate which output is not functioning correctly. Once a defective IC has been located, it should be replaced.

Logic comparators are readily available from electronic supply sources.

(b) *Atari Universal Test Fixture.* In situations where a large number of video games are being serviced, investment in the Universal Test Fixture will be justified. This item of test equipment forms a test station for troubleshooting printed circuit boards after they have been removed from the game cabinet. The Universal Test Fixture has a full set of controls for operating the game and also has its own TV monitor. The game's PCB is plugged into an edge connector mounted on the side of the Fixture; with this arrangement the PCB is positioned in a convenient way for connecting probes and other test instruments.

A program card inserted into a receptacle in the top of Fixture takes the place of the game's interconnect wires. The program card thus sets up the Fixture for each particular game; the game's name is clearly printed on the program card itself.

With the Universal Test Fixture the method of troubleshooting via substitution of known-to-be-good parts is made fast and convenient. For example, suppose that the TV picture in a game is completely broken up and you want to determine whether the game or monitor is causing the problem. Remove the PCB and plug it into the Fixture's edge connector, and also insert the correct program card for that game. If the picture on the Fixture's monitor is correct, then you know that the problem lies in the game's monitor.

6.3 SPECIFIC TROUBLESHOOTING INFORMATION

The following subparagraphs give additional troubleshooting information about certain areas of the Outlaw game.

6.3.1 COIN MECHANISM: If a player inserts a coin and the game does not respond, first check the coin mechanism. If pressing the coin rejector button forces the rejector mechanism to return the coin, then examine the coin to make sure that it is genuine. If it is, then use a set of your own test coins (which should include both very new and very old, worn coins) to determine whether or not the player's coin is undersize or underweight. If your test coins are also returned, this indicates that servicing of the coin acceptor portion of the coin mechanism is called for. Generally the cause of this particular problem is an improperly adjusted magnet gate.

Inside the coin mechanism a magnet is used to test the metallic composition of the coin. Highly magnetic coins, such as those made of steel or iron, will be retained by the magnet and can be returned by actuating the wiper operating lever. Coins having comparatively high magnetic properties will be slowed down by the magnet, and will drop off the end of the rail short of the "accept" entrance and be returned. Coins having little or no magnetic properties, such as brass or zinc coins, will pass through the magnetic field so fast that they will overshoot the "accept" entrance and be returned.

A magnetic gate adjusted with too large a gap may pass both genuine and counterfeit coins. An adjustment with too small a gap can lead to rejection of some or even all coins. Over a period of time, the screw that adjusts the magnet gate has a tendency to work loose, resulting in a gradual narrowing of the gate. At first, only the thickest (i.e., newest) coins are rejected. As time passes, more and more coins are rejected until finally player complaints lead to the calling of the game repairman.

If pressing the coin rejector button does not cause the coin to be returned, and if the game still does not respond, then check the coin mechanism to see if the coin is jammed inside.

If you are certain that the coin is genuine, and that the coin passes through the coin mechanism and into the cash box, then the lack of game response is probably due to some kind of electrical trouble. Check for signals at the electrical contacts of the coin mechanism before moving on to the harness and other parts of the circuitry.

6.3.2 TV MONITOR: The TV monitor is a self-contained unit housed in its own chassis and mounted inside the game cabinet. To narrow down a trouble's cause to the monitor use either the substitution method (where the suspect monitor is temporarily replaced by a known-to-be-good monitor), or else verify both the presence of AC power to

the monitor power supply and the presence of the *correct* video signals coming from the game PCB. The entire monitor can then be removed from the game cabinet. Doing this facilitates troubleshooting, because all monitor components will then be accessible.

After disconnecting and removing the monitor from the game, standard TV troubleshooting techniques are adequate for locating the cause or causes of trouble. The monitor in this game is a General Electric 25 MB chassis that is used as a video amplifier. The tuner, IF, audio, and chroma modules have been removed. Information from the game PCB is fed directly, via an Atari chroma PCB that replaces the original chroma module, to the RGB module. All remaining modules and circuits remain as original, and are approached as are all other 25 MB chassis.

Refer to Atari manual TM-066, "G. E. #25 MB COLOR MONITOR TROUBLESHOOTING MANUAL for TANK 8 and similar games," for a block diagram of the monitor, circuit schematics, and service adjustments and troubleshooting information. Additional servicing information is available from the manufacturer (General Electric Corp.).

6.3.3 ANTENNA STATIC MODIFICATION: This subparagraph gives a procedure for modifying the antenna wire connected to pin v of the game printed circuit board's edge connector. The antenna is part of the credit portion of the

game circuitry. This static modification feature is included so that it will not be possible for a player to obtain bonus games (that is, game plays without having deposited money into the game) by inducing a static charge in the coin entrance plate or any other metal part of the game — provided that the antenna has been cut to optimum length.

The antenna is a wire approximately one foot long, with one end intentionally left not connected. When a static discharge occurs, an electric current is induced in this wire and an impulse is transmitted to the credit circuitry on the game PCB. This impulse resets the circuitry, turning off game credit and switching the game over to the attract mode.

To test the static modification feature, touch the end of the antenna wire with your finger; the body usually has enough capacitance to trigger the circuitry. Sensitivity of the static modification feature may be adjusted by changing the length of the antenna wire. Lengthening the wire increases sensitivity, so that a lesser charge will turn off game credit. Cutting the wire shorter decreases sensitivity, so that a larger charge is required for triggering the circuit.

If there are problems with static charges accidentally shutting off the game, try cutting the wire shorter, in increments of $\frac{1}{2}$ inch at a time. Be aware, however, that if the antenna wire is cut too short, players may be able to obtain free game credit (bonus games) by inducing a static charge in the game.

VII. SCHEMATICS, DRAWINGS & PARTS LISTS

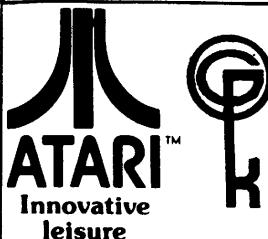
Number

Title

21

A005090	Parts List and Drawing Top Assembly and Assembly Instructions
A004551	Parts List and Drawing Cabinet Top Assembly
A005087	Parts List and Drawing Cabinet Lower Assembly (with acceptor)
A002303	Parts Lists and Drawing Joystick Assembly
005301	Harness Installation
A005158	Harness Schematic
A005163	Parts List and Drawing Electronics Tray Assembly
A004606	Schematic, Parts List and Assembly Remote Control PCB
A004608	Schematic, Parts List and Assembly Matrix PCB
A005069	Schematic, Parts List and Assembly Audio or Sound PCB
A005067	Schematic, Parts List and Assembly Main PCB
	Schematic Chroma PCB (for G. E. color monitor)

TANK 8



ASSEMBLY TITLE / TOP ASSEMBLY & ASSY INSTRUCTIONS P/L A005090

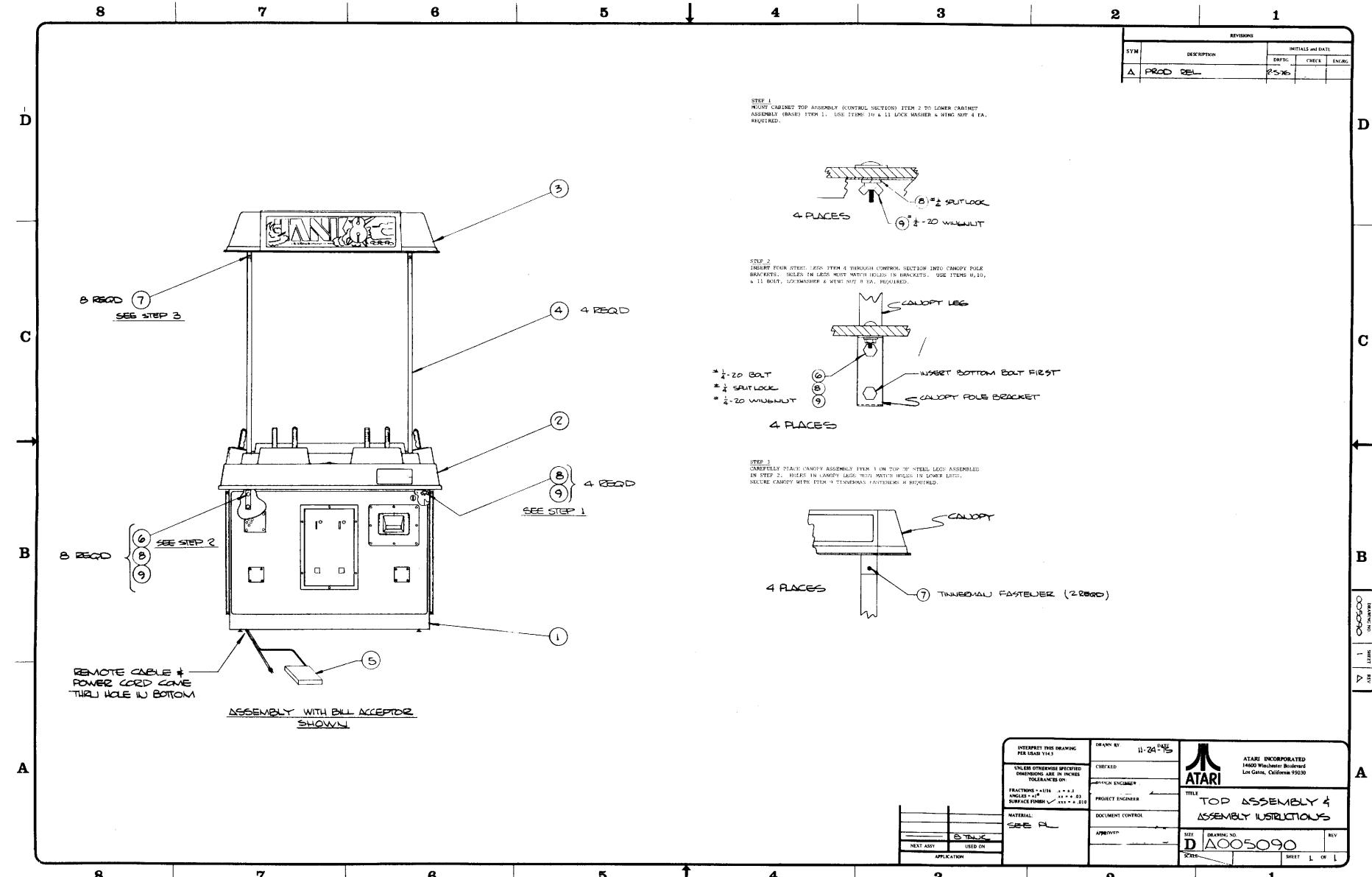
PARTS LIST SPECIFICATION

Page 1 of 1

Drawn Cook	
Checked	Mech. Eng.
Proj. Eng.	Elec. Eng
	REV. A

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REL	3/17/76					

Item	Part Number	Qty.	DESCRIPTION
1	A005087	1	Lower Cabinet Assembly
2	A004551	1	Top Cabinet Assembly
3	A005269	1	Canopy Assembly
4	A004098	4	Lower Legs
5	A005096	1	Remote Box Assembly
6	72-5532	8	Bolt, Hex Hd, # $\frac{1}{4}$ -20 x 2" Lg
7	81-4001	8	Fastener, Tinnerman, Mfg P/N C60184AA-020-805 (Black)
8	75-045	12	Washer, Split Lock, $\frac{1}{4}$
9	75-535	12	Wing Nut, # $\frac{1}{4}$ -20



8 TANK



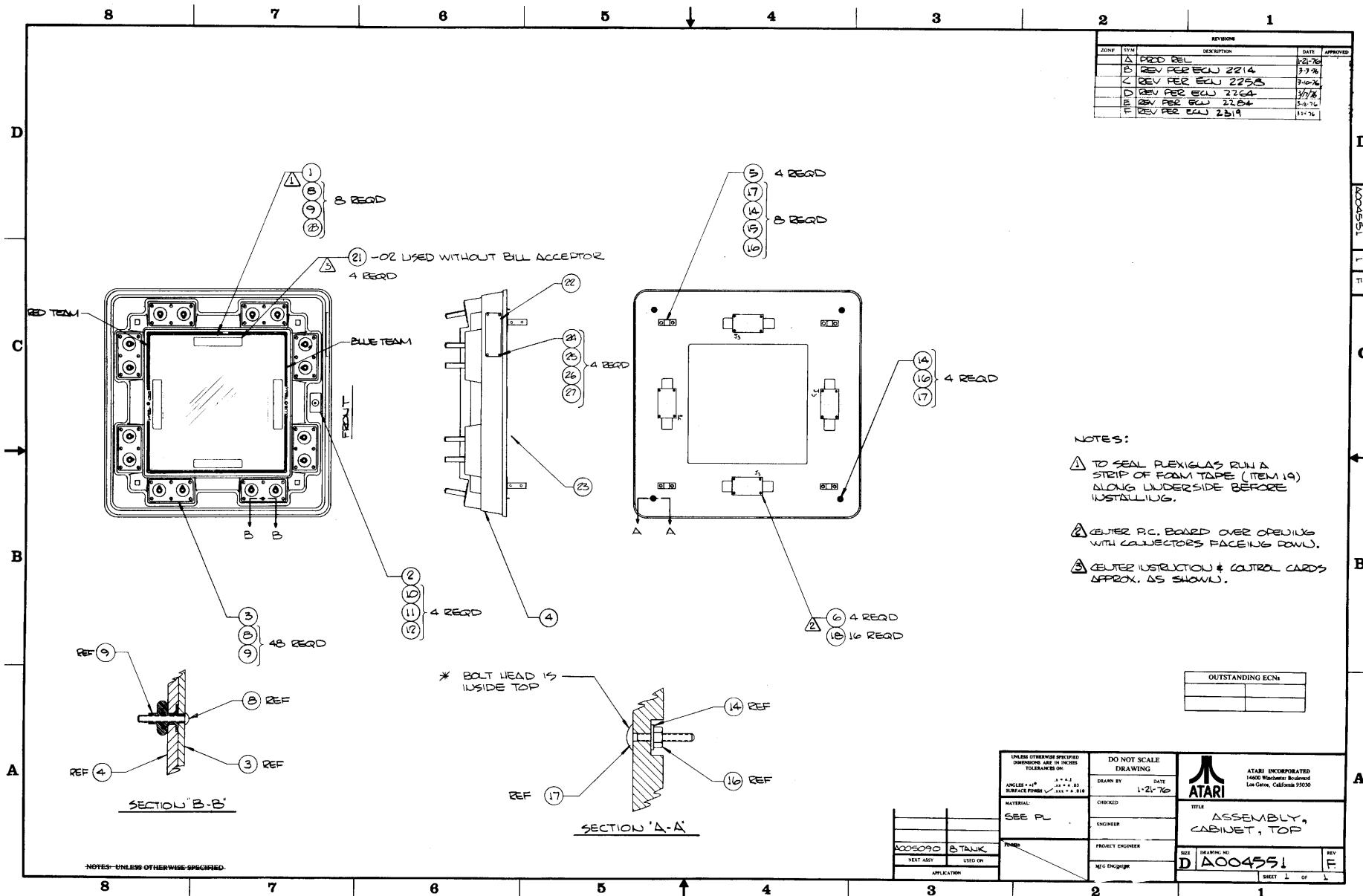
ASSEMBLY TITLE	ASSEMBLY, CABINET, TOP	P/L 004551
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PARTS LIST SPECIFICATION		Page 1 of 1
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Drawn		
Checked	Mech. Eng.	
Proj. Eng.	Elec. Eng	REV.
		F

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REL	1-20-76					
B	Rev per ECN 2214	3-3-76					
C	Rev per ECN 2258	3-10-76					
D	Rev per ECN 2264	3-15-76					
E	Rev per ECN 2284	3-18-76					
F	Rev per ECN 2319	3-24-76					

Item	Part Number	Qty.	DESCRIPTION
1	004544-01	1	Cover, Plexiglas
2	A004549	1	Assy, Plate, Switch
3	A004550	8	Assy, Joystick
4	004091	1	Top, Cabinet
5	004094	4	Bracket, Canopy Pole
6	A004608	4	Assy, Diode Board
7			
8	*82-8014B	56	Screw, Button Hd., Socket Cap. #10-32 x 7/8" Lg.
9	**75-99090006	56	Well-Nut Blind Hole Fastener #10-32
10	75-018S	4	Washer, Flat, Plain Pattern #8
11	75-048	4	Washer, Split-Lock #8
12	75-918S	4	Nut, Mach., Hex, STD Pattern
13			
14	75-015S	12	Washer, Flat, Plain Pattern, $\frac{1}{4}$
15	75-045	8	Washer, Split-Lock, $\frac{1}{4}$
16	75-915S	12	Nut, Mach., Hex, STD Pattern, $\frac{1}{4}$ -20
17	75-5520NX	12	Bolt, Carriage, Rd., Hd., Sq.Neck, $\frac{1}{4}$ -20 x $1\frac{1}{4}$ Lg.
18	72-6608	16	Screw, Sheet Metal, Self-Tapping, Steel
19	78-6900402	A/R	Tape, Foam, Adhesive
20			
21	004548-02	4	Instruction & Control Card (Without Acceptor)
22	005098-01	1	Plate, Instruction, No.2
23	005138-02	1	Bezel, 25" Monitor
24	75-5112B	4	Bolt, Carriage, #10-24 x 3/4" Lg.
25	75-010S	4	Washer, Flat #10
26	75-040	4	Washer, Split-Lock #10
27	75-911S	4	Nut, Hex, #10-24
28	75-07021	8	Washer, Flat, Nylon (Black)
			* Possible Supplier The Olander Comp. Sunnyvale, CA
			** Possible Supplier E.Wachtel Comp., INC. Mountain View, CA





8 TANK

ASSEMBLY TITLE		ASSEMBLY, CABINET, LOWER (WITH ACCEPTOR)		P/L A005087-01
PARTS LIST SPECIFICATION				Page 2 of 2
Item	Part Number	Qty.	DESCRIPTION	
33	*004548-01	4	Instruction & Control Card (with Acceptor)	
34	*005089-01	1	Plate Instruction No.1	
35	*005088	4	Hole Plug	
36	*75-5116B	4	Bolt, Carriage, #10-24 x 1" Lg	
37	*75-07002	4	Washer Flat Special .218 I.D. - 1.250 O.D.	
38	*75-040	4	Washer Split-Lock #10	
39	**75-931	4	Ash Tray MFG #14-0127-Wico	

* These Items to be shipped in Coin Box

** The Ash Trays are shipped with every Game (Mounting is Optional)

8 TANK



ASSEMBLY TITLE ASSEMBLY, CABINET, LOWER
(WITHOUT ACCEPTOR) P/L A005087-02

PARTS LIST SPECIFICATION

Page 1 of 2

Drawn		
Checked	Mech. Eng.	
Proj. Eng.	Elec. Eng.	REV. C

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REI	2-23-76					
B	Rev per ECN 228L 228Z	3-18-76					
C	Rev per ECN 228B, 233Z	3-25-76					

Item	Part Number	Qty.	DESCRIPTION
1	A004552	1	Assembly, Monitor Frame
2	004246	1	Frame Weldment
3	004086	1	Bar, Cross
4	A004553-02	1	Assembly, Panel, Front
5	A005085-	3	Assembly, Panel, Side
6	75-6608	3	Screw, Sht Met, #6 x $\frac{1}{2}$ " Lg
7	005301	Ref	Harness Installation
8	000869	1	Grill Speaker
9	A005163	1	Assembly, Electronics Tray
10	68-001	4	Switch, Interlock
11	78-3201	4	Glide, Adjustable
12	72-5108	14	Screw, Mach., Hex Hd, Steel, #10-24 x 1/2" Lg
13	72-5116	4	" " " " " " " " 1" Lg
14	75-020S	12	Washer, Flat, Reg. Pattern, #10
15	75-040	20	Washer, Split-Lock #10
16	75-911S	12	Nut, Hex, #10-24
17	73-77002	4	Pop Rivet
18	75-5112N	4	Bolt, Carriage, Rnd. Hd., #10-24 x 3/4" Lg
19	A004286-07	1	Assembly R.F. Shield Box
20	004541	1	P.C. Mount Board
21	A005069	1	Assembly, P.C. Audio
22	A005067	1	Assembly, P.C. Game
23	—	—	—
24	—	—	—
25	—	—	—
26	—	—	—
27	—	—	—
28	—	—	—
29	—	—	—
30	—	—	—
31	—	—	—
32	A005159	1	Assy, Main Harness
33	—	—	—
34	—	—	—
NOTE: Transformers needed for Voltage Conversion			
42-7120	A/R		Transformer (Step-Down) 95V, Triad N37MG
42-7118	A/R		Transformer (Step-Up) 220V, Triad N7MG
72-5108	A/R		Screw, Mach. Hex Hd Steel #10-24 x $\frac{1}{2}$ Lg (2 Per Assy)

ASSEMBLY TITLE ASSEMBLY, CABINET, LOWER
(WITHOUT ACCEPTOR) P/L A005087-02

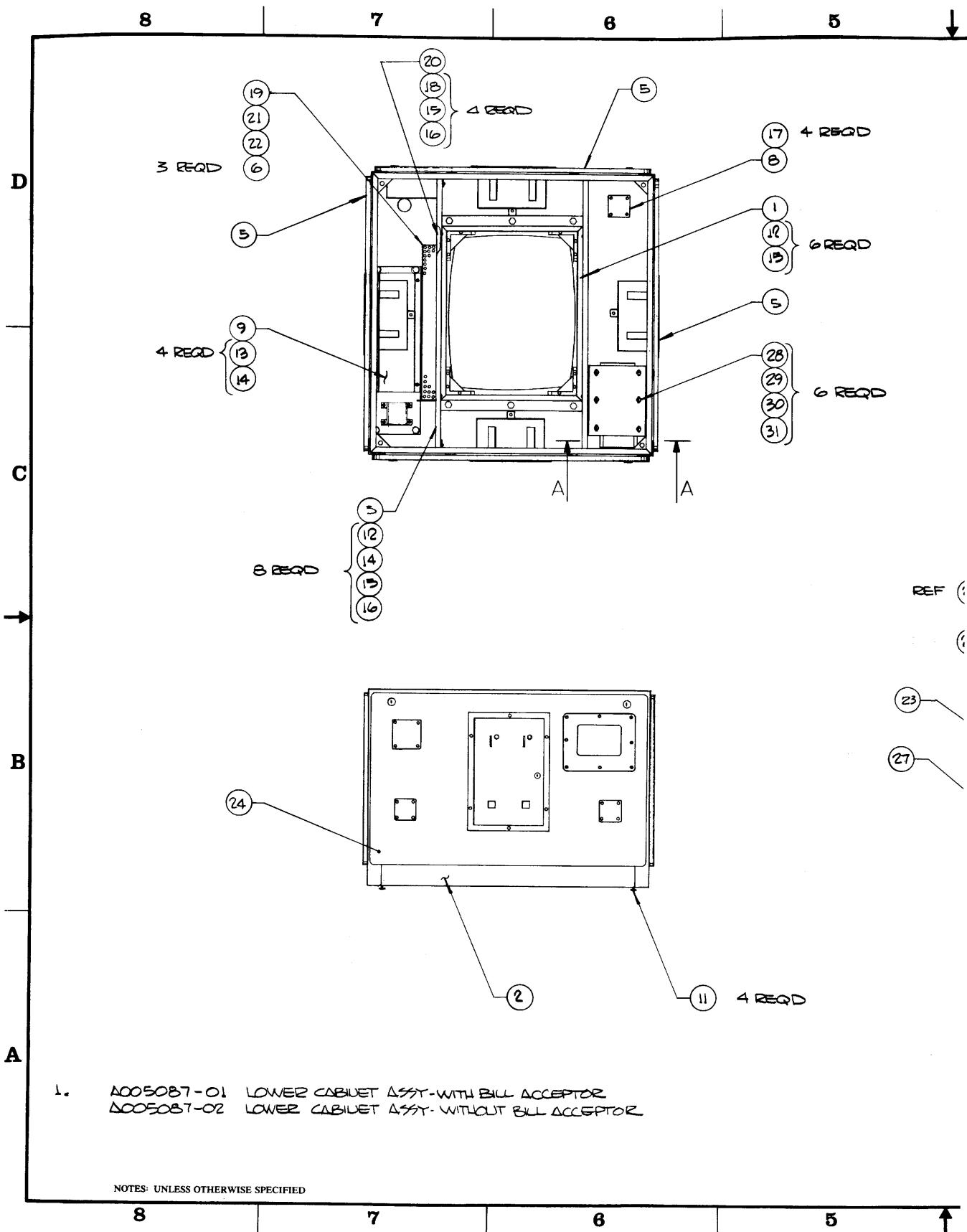
PARTS LIST SPECIFICATION

Page 2 of 2

Item	Part Number	Qty.	DESCRIPTION
35	*005088	4	Hole Plug
36	*75-5116B	4	Bolt, Carriage, #10-24 x 1" Lg
37	*75-07002	4	Washer Flat Special .218 I.D. - 1.250 O.D.
38	*75-040	4	Washer Split-Lock #10
39	**75-931	4	Ash Tray MFG #14-0127-Wico
40	*005272	1	Kit - Rowe Acceptor
41	*005273	1	Kit - Ardac Acceptor

* These Items to be shipped in Coin Box

** The Ash Trays are shipped with every Game (Mounting is Optional)



4	3	2	1																				
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="4">REVISIONS</th> </tr> <tr> <th>ZONE</th> <th>SYM</th> <th>DESCRIPTION</th> <th>DATE APPROVED</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>△</td> <td>PROD REL</td> <td>2-4-76</td> </tr> <tr> <td>B</td> <td></td> <td>REV PER ECU 2282</td> <td>3-23-76</td> </tr> <tr> <td>C</td> <td></td> <td>REV PER ECU 2288 & 2332</td> <td>7-24-76</td> </tr> </tbody> </table>				REVISIONS				ZONE	SYM	DESCRIPTION	DATE APPROVED	A	△	PROD REL	2-4-76	B		REV PER ECU 2282	3-23-76	C		REV PER ECU 2288 & 2332	7-24-76
REVISIONS																							
ZONE	SYM	DESCRIPTION	DATE APPROVED																				
A	△	PROD REL	2-4-76																				
B		REV PER ECU 2282	3-23-76																				
C		REV PER ECU 2288 & 2332	7-24-76																				
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<u>VIEW B-B</u>																							
<u>VIEW A-A</u>																							
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td colspan="2">OUTSTANDING ECNs</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </table>				OUTSTANDING ECNs																			
OUTSTANDING ECNs																							
<p><u>A005087-01 SHOWN</u></p>																							
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td colspan="2"> UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES ±4° X = ± .1 XX = ± .03 SURFACE FINISH ✓ XXX = ± .010 </td> <td colspan="2"> DO NOT SCALE DRAWING DRAWN BY DATE SEE PL 2-4-76 </td> </tr> <tr> <td colspan="2"> MATERIAL: SEE PL </td> <td colspan="2"> CHECKED ENGINEER </td> </tr> <tr> <td colspan="2"> FINISH APPLICATION </td> <td colspan="2"> PROJECT ENGINEER </td> </tr> <tr> <td colspan="2"> A005090 B-TANK NEXT ASSY USED ON </td> <td colspan="2"> SIZE DRAWING NO. D A005087-XX C. SHEET 1 OF 1 </td> </tr> </table>				UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES ±4° X = ± .1 XX = ± .03 SURFACE FINISH ✓ XXX = ± .010		DO NOT SCALE DRAWING DRAWN BY DATE SEE PL 2-4-76		MATERIAL: SEE PL		CHECKED ENGINEER		FINISH APPLICATION		PROJECT ENGINEER		A005090 B-TANK NEXT ASSY USED ON		SIZE DRAWING NO. D A005087-XX C. SHEET 1 OF 1					
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES ±4° X = ± .1 XX = ± .03 SURFACE FINISH ✓ XXX = ± .010		DO NOT SCALE DRAWING DRAWN BY DATE SEE PL 2-4-76																					
MATERIAL: SEE PL		CHECKED ENGINEER																					
FINISH APPLICATION		PROJECT ENGINEER																					
A005090 B-TANK NEXT ASSY USED ON		SIZE DRAWING NO. D A005087-XX C. SHEET 1 OF 1																					
A TITLE ASSEMBLY, CABINET, LOWER																							



ASSEMBLY TITLE / JOYSTICK ASSY (UP, DOWN & FIRE) P/LA 002303-01

PARTS LIST SPECIFICATION

Page 1 of 1

Drawn		
Checked	Mech. Eng.	
Proj. Eng.	Elec. Eng	REV. H

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REL	4-3-75		H	Rev per ECN 2318	3/25/76	
B	Rev per ECN 1285	4-3-75					
C	Rev per ECN 1333	4/21/75					
D	Rev per ECN 1470	6/6/75					
E	Rev per ECN 1503						
F	Rev per ECN 1809	12/4/75					
G	Rev per ECN 1876	1/7/76					

Item	Part Number	Qty.	DESCRIPTION
1	002299	1	Button
2			
3	002302	1	Spring Return
4			
5	002298	1	Rod
6	002294	1	Bushing
7	002296	2	Washer, Return
8	002293	1	Hub
9	002297	1	Spacer Ring
10	003207	1	Switch Plate 11
11	002301	1	Bracket, Switch
12	002300	1	Actuator
13	A003583-01	1	Handle Assy
14	75-2412S	2	Screw, Mach, Rd Hd, Phil #4-40x3/4
15	75-044	2	Washer, Split Lock, #4
16	75-914S	2	Nut, Hex #4-40
17	75-990512	1	Nut, Hex $\frac{1}{4}$ -28 Self Locking
18	75-019S	1	Washer, Flat, 5/16
19	75-06003	2	Washer, Belleville Spring
20	85-22F610	4	Screw, Self-Tapping, #6 x 5/8" Lg
21	85-22F612	4	Screw, Self-Tapping, #6 x 3/4" Lg
22	**65-081A	3	Micro Switch
23			
24	75-912S	2	Nut, Hex, #2-56
25	72-6608	1	Screw, Sht. Met., Self-Tapping, Xrec, #6 x $\frac{1}{2}$ Lg.
Notes:			
* Optional Handle Grip See DWG No. 003092			
** Acceptable Substitutes			
65-091A, 65-101A, 65-111A.			

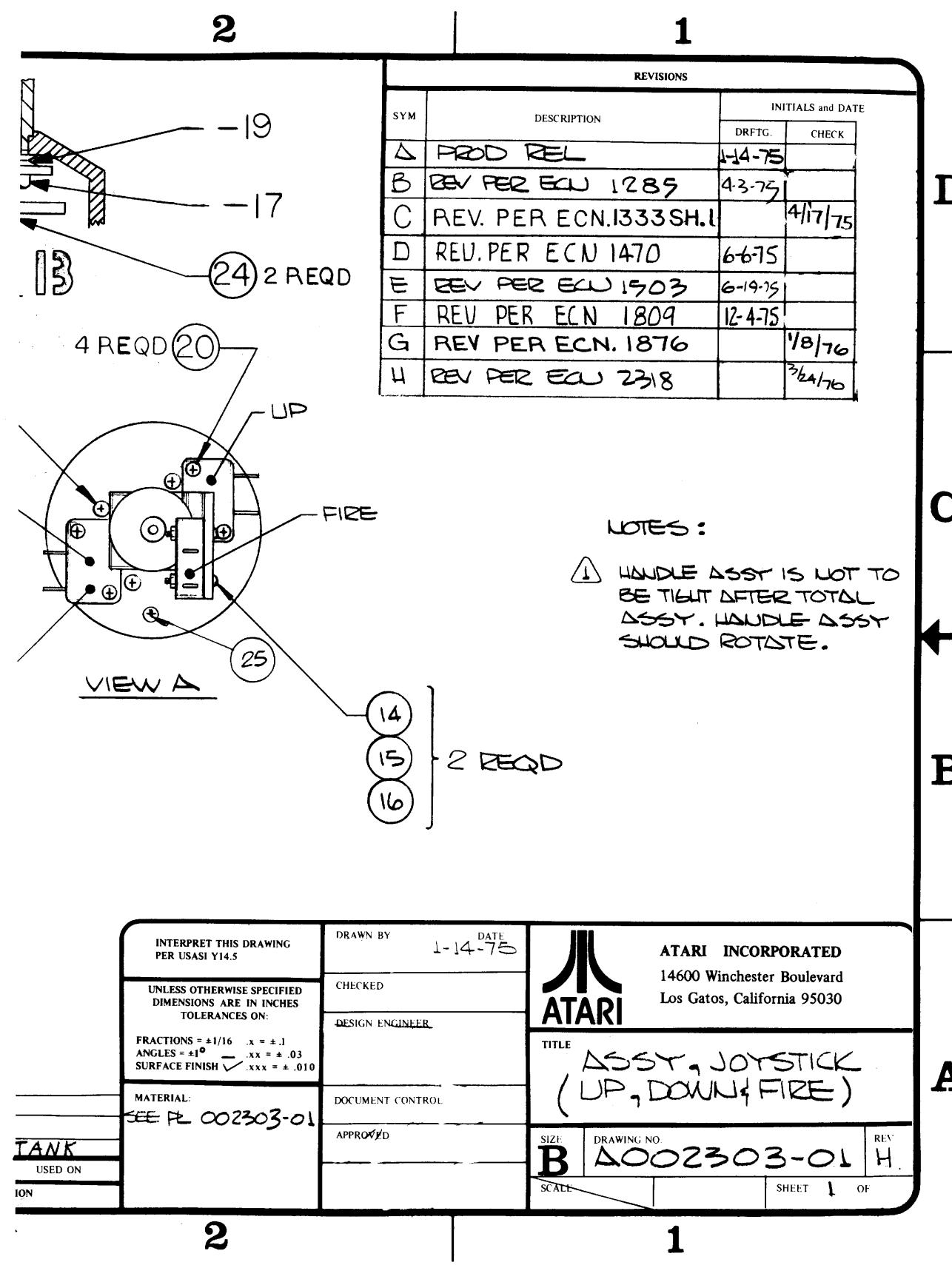
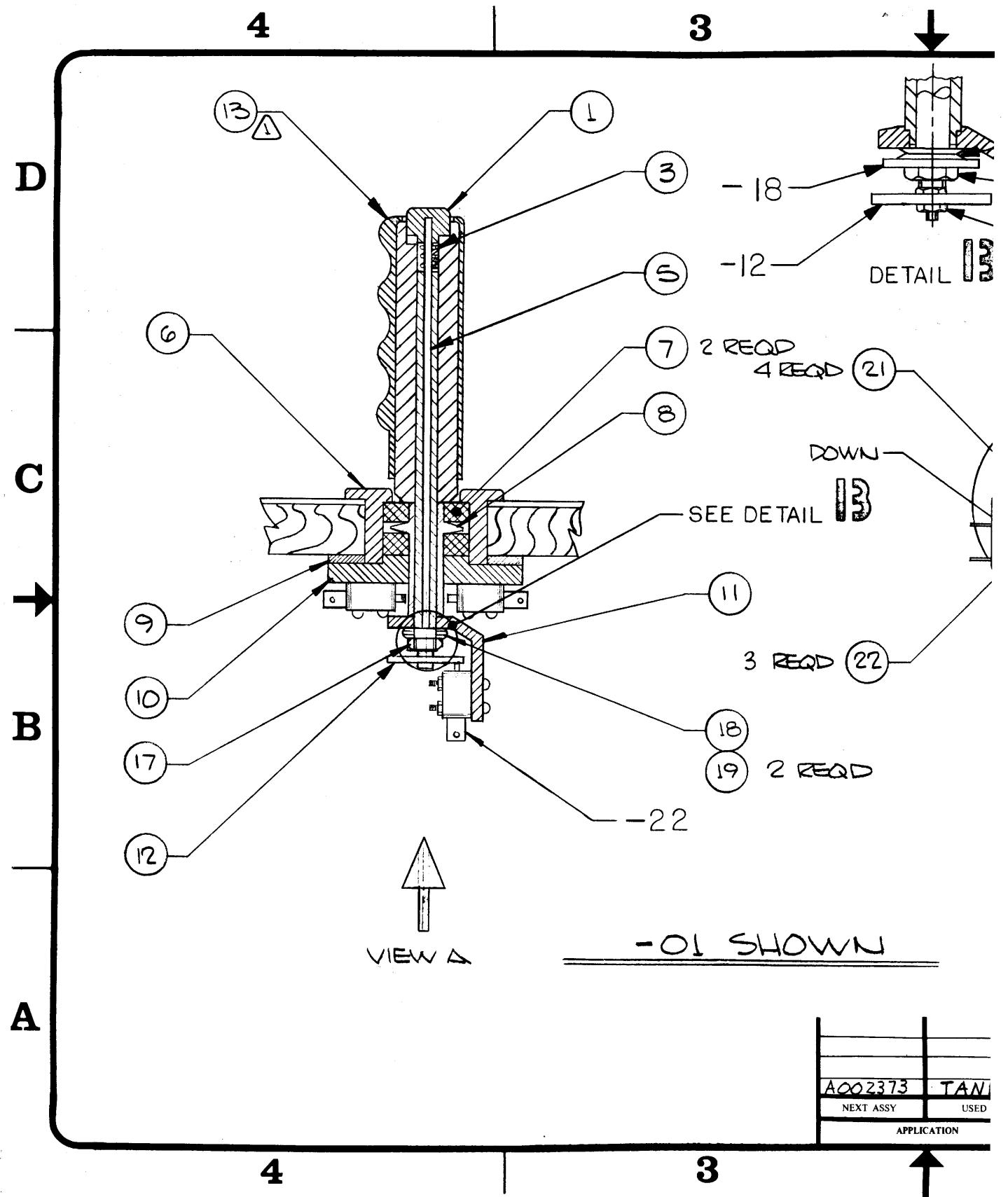


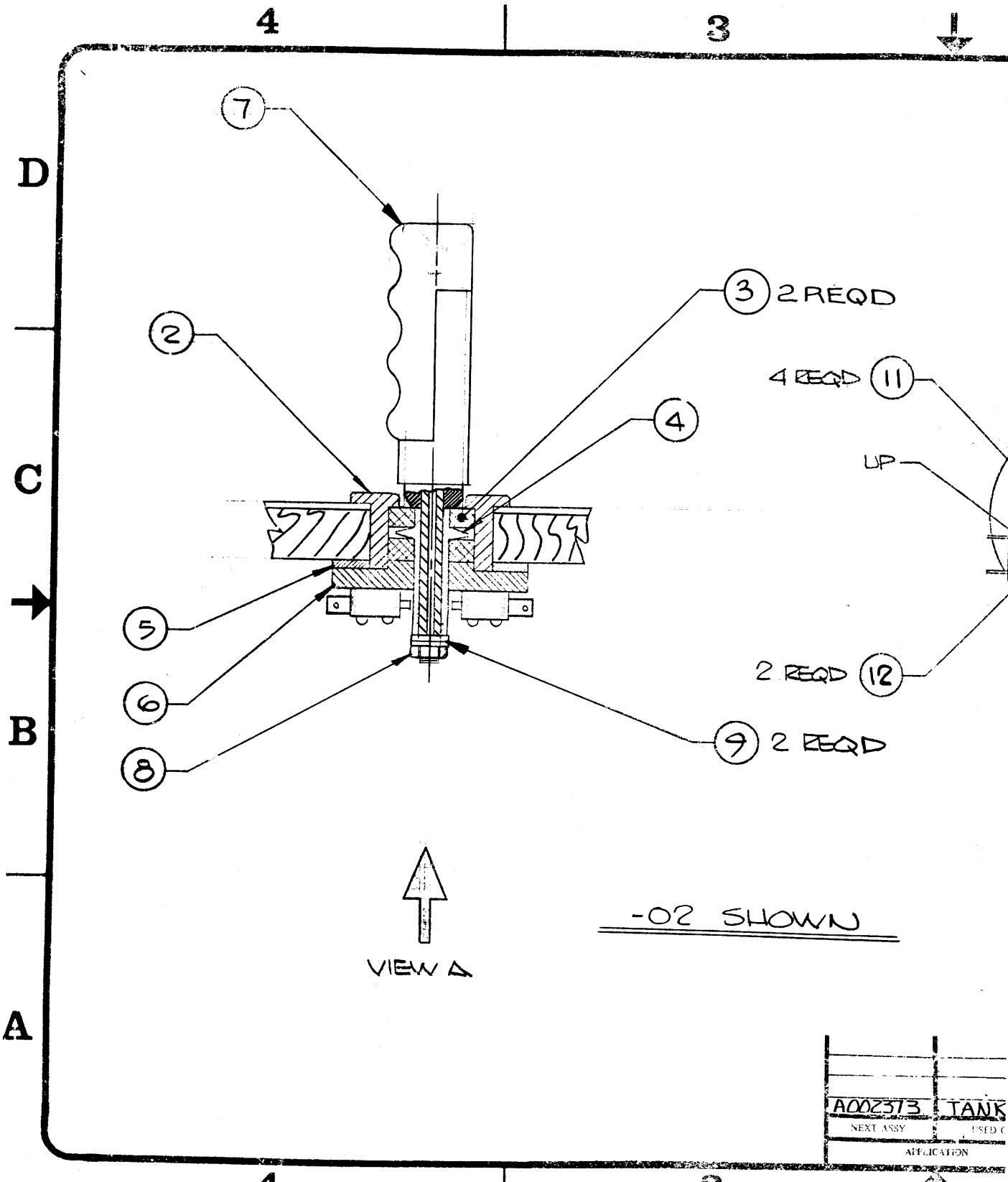
ASSEMBLY TITLE		JOYSTICK ASSY (DUMMY BUTTON)		P/L A002303-02
PARTS LIST SPECIFICATION				Page 1 of 1
Drawn				
Checked		Mech. Eng.		
Proj. Eng.		Elec. Eng		REV. H

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
B	Prod Rel/ECN 1285	4-3-75					
C	Rev per ECN 1333	4/21/75					
D	Rev per ECN 1470	6/6/75					
E	Rev per ECN 1503						
F	Rev per ECN 1810	12/4/75					
G	Rev per ECN 1876	1/7/76					
H	Rev per ECN 2318	3/25/76					

Item	Part Number	Qty.	DESCRIPTION
1		1	Bushing
2	002294	2	Washer, Return
3	002296	1	Hub
4	002293	1	Spacer Ring
5	002297	1	Switch Plate 11
6	003207	1	Handle Assy
7	A003583-02	1	Nut, Hex, $\frac{1}{4}$ -28 Self Locking
8	75-990512	2	Washer, Flat, 5/16
9	75-019S	4	Screw, Self-Tapping, #6 x 5/8" Lg
10	85-22F610	4	Screw, Self-Tapping, #6 x 3/4" Lg
11	85-22F612	2	Switch
12	**65-081A	1	Screw, Self-Tapping, #6 x $\frac{1}{2}$ Lg
13	72-6608		

Notes:
 * Optional Handle Grip See DWG No. 003082
 ** Acceptable Substitutes
 65-091A
 65-110A
 65-111A





REVISIONS		
SYM	DESCRIPTION	INITIALS and DATE
		DRFTG. CHECK ENG'D.
B	SEE SUT 1	- - -
C	REV. PER ECN.1333 SH.2	
D	REV. PER ECN 1470	6-6-75
E	REV. PER ECN 1503	6-19-75
F	REV. PER ECN 1810	12-4-75
G	REV. PER ECN 1876	
H	REV. PER ECN 2318	

NOTES:

① HANDLE ASSY IS NOT TO BE TIGHT AFTER TOTAL ASSY. HANDLE ASSY SHOULD ROTATE.

Technical drawing of a joystick assembly (View A) showing a circular cross-section of the handle assembly. Labels include (10) 4 REQD, (11) UP, (12) DOWN, and (13) VIEW A. A note at the bottom left states "-02 SHOWN".

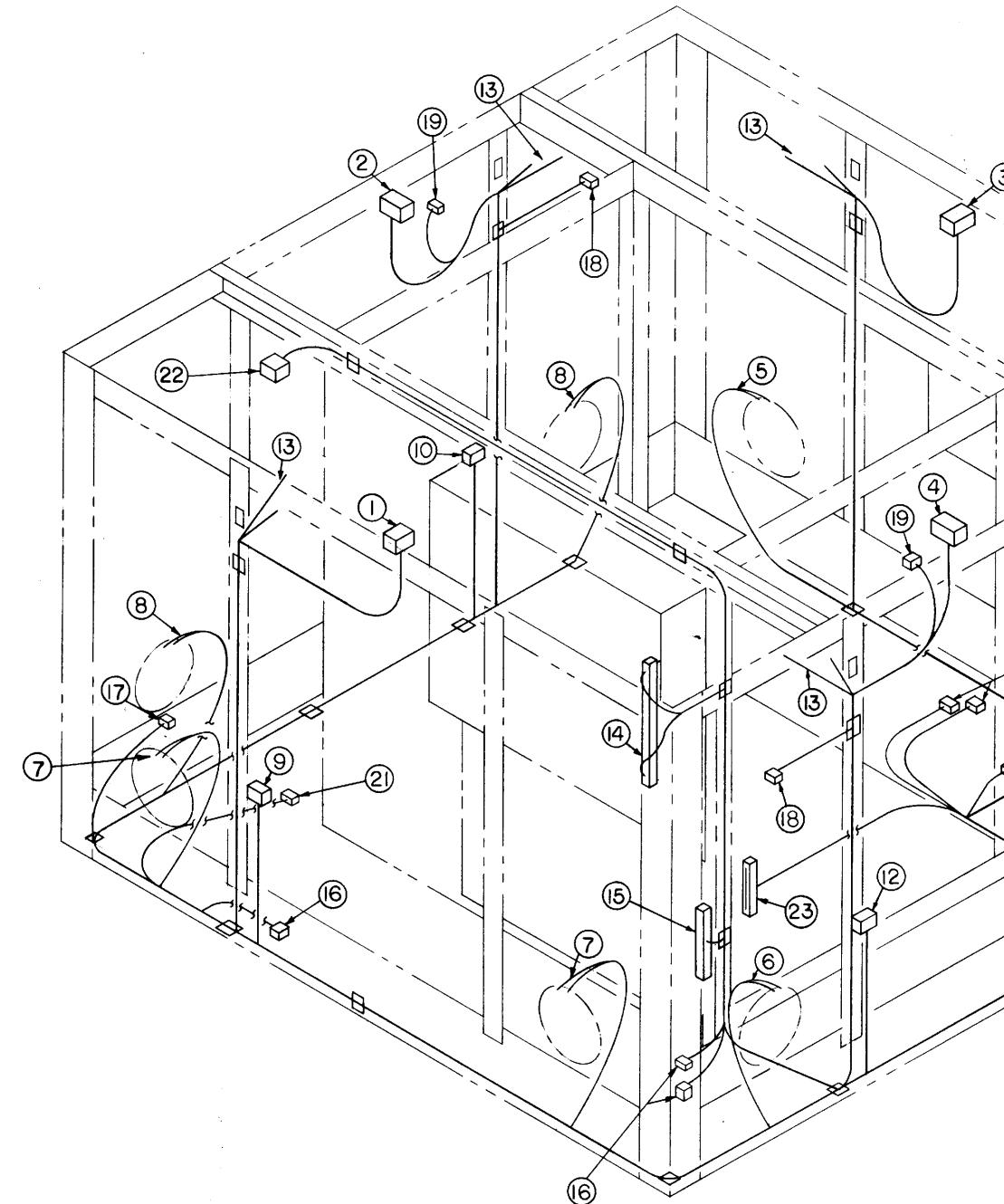
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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON:	CHECKED
FRACTIONS = $\pm 1/16$ $x = \pm .1$ ANGLES = $\pm 10^\circ$ $xx = \pm .03$ SURFACE FINISH \checkmark $xxx = \pm .010$	PROJECT ENGINEER
MATERIAL: SEE PL	DOCUMENT CONTROL
002313	DRAWING NO. B A002303-02
TANK	SCALE
NEXT ASSY	SHEET 2 OF
USED ON	1
APPLICATION	

ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030

**ASSY, JOYSTICK
(DUMMY BUTTON)**

8 7 6 5 ↓

D C B A



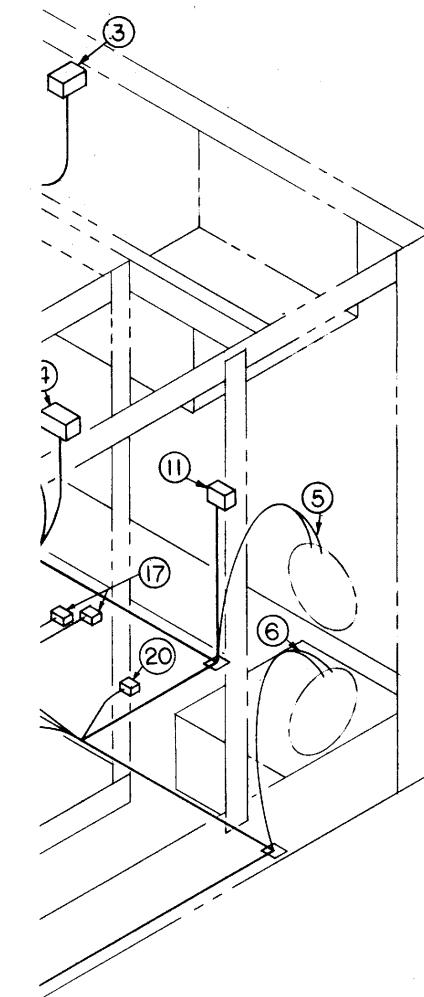
↓ 4 3 2 1

REVISIONS

SYM	DESCRIPTION	INITIALS and DATE		
		DRFTG	CHECK	ENGRC
A	PROD. REL.			

CONNECTIONS

- 1 P2 DIODE BOARD 1
- 2 P2 DIODE BOARD 2
- 3 P2 DIODE BOARD 3
- 4 P2 DIODE BOARD 4
- 5 VIOLET, TANK 1 & 2 SPEAKERS
- 6 BLUE, TANK 4 & 8 SPEAKERS
- 7 RED, TANK 5 & 6 SPEAKERS
- 8 GREEN, TANK 3 & 7 SPEAKERS
- 9 J4, TANK 5 & 6 COIN DOOR
- 10 J5, TANK 3 & 7 COIN DOOR
- 11 J6, TANK 1 & 2 COIN DOOR
- 12 J7, TANK 4 & 8 COIN DOOR
- 13 RED, INTERLOCK SWITCH
- 14 GAME BOARD
- 15 AUDIO BOARD
- 16 ELECTRONICS TRAY
- 17 A.C. POWER TO BILL ACCEPTOR
- 18 A.C. POWER TO FAN
- 19 TEAM SWITCH
- 20 ROWE CREDIT
- 21 ARDAC CREDIT
- 22 REMOTE CONTROL BOX
- 23 T.V.



INTERPRET THIS DRAWING PER USAS Y14.5	DRAWN BY BRR	DATE 3 22 76
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	CHECKED	
TOLERANCES ON		
FRACTIONS + 1/16 x = + .1	DESIGN ENGINEER	
ANGLES + 1° xx = + .03	PROJECT ENGINEER	
SURFACE FINISH ✓ .xxx = + .010	MATERIAL:	
	DOCUMENT CONTROL	
	APPROVED	
	APPLICATION	

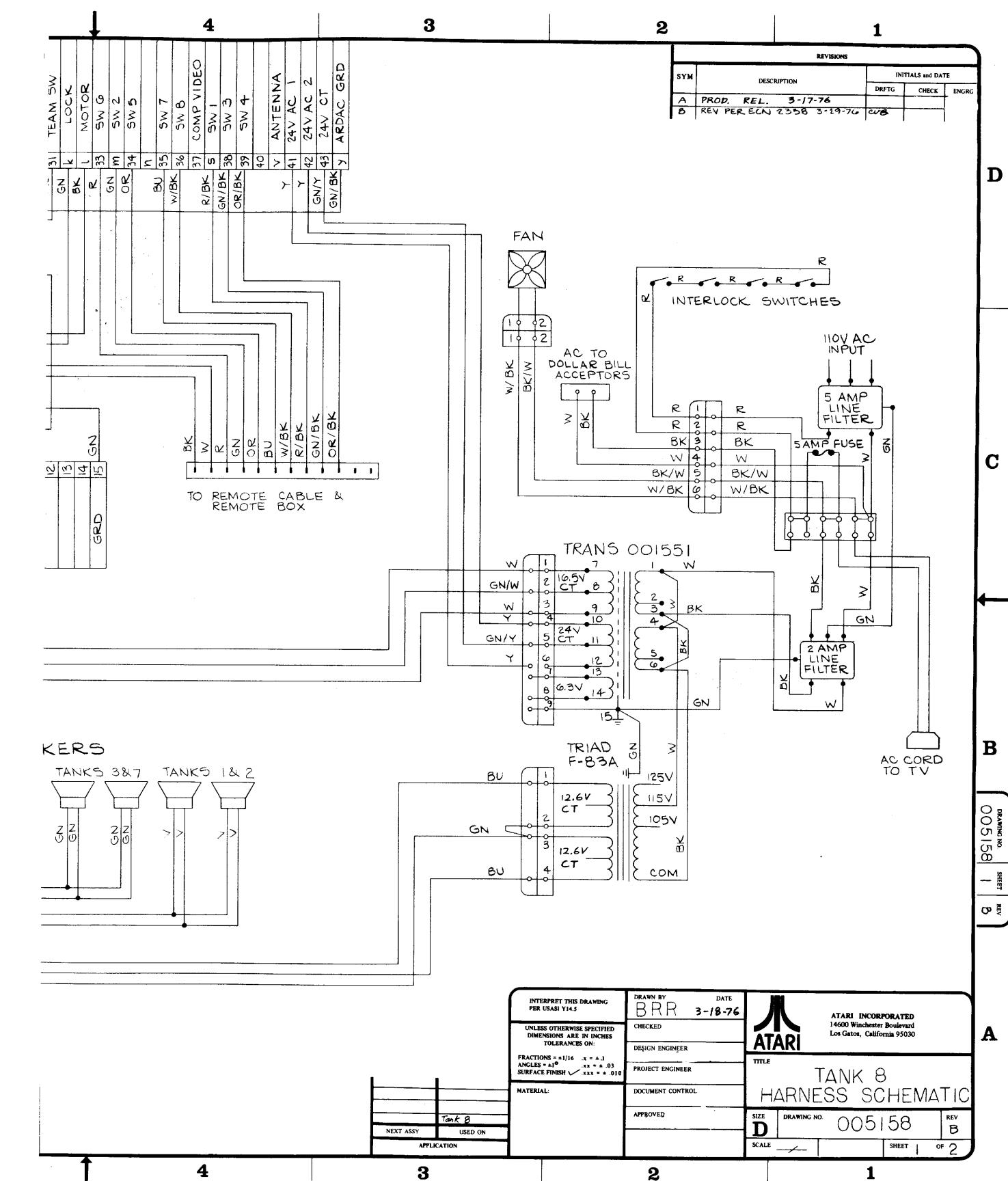
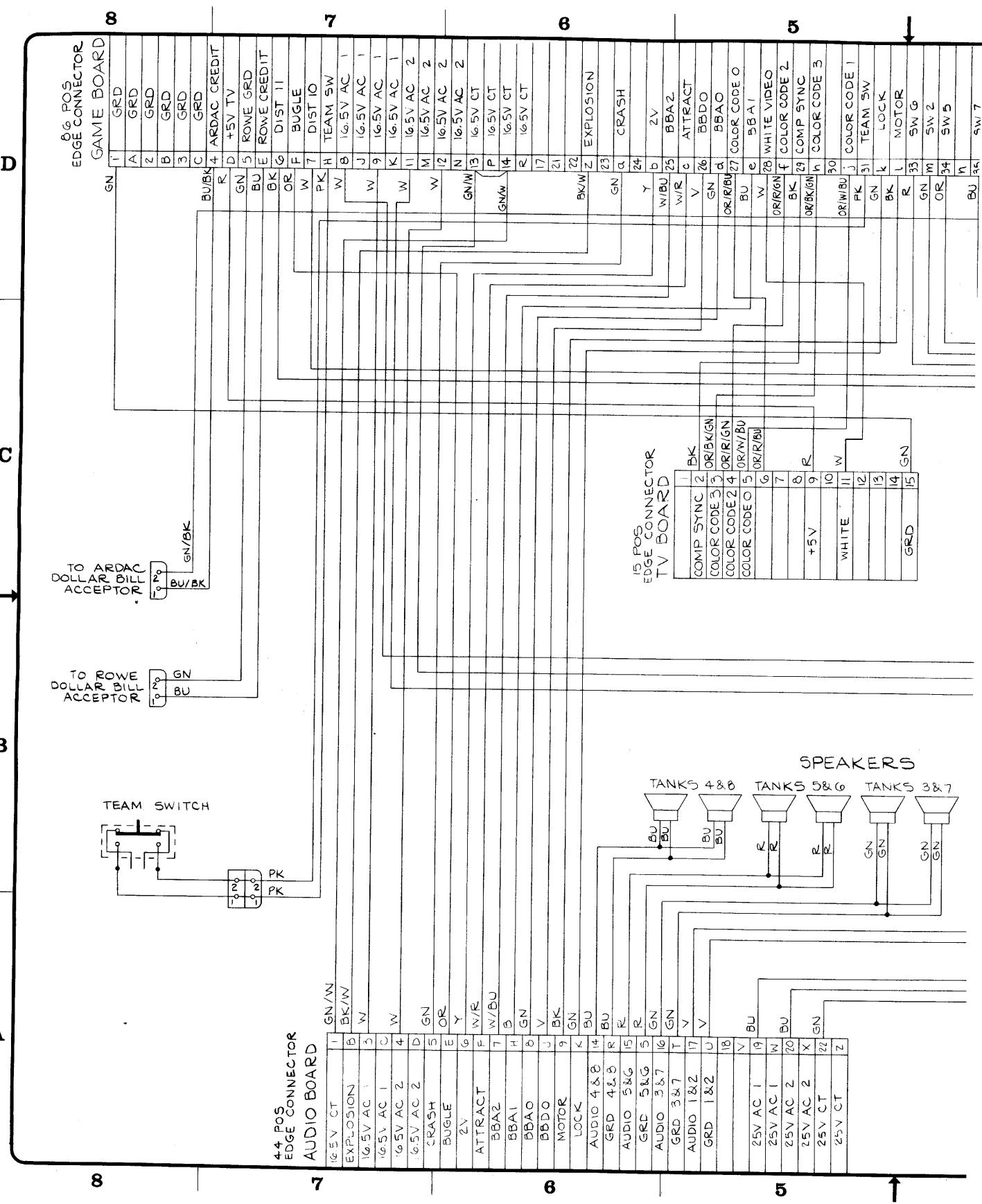
ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030

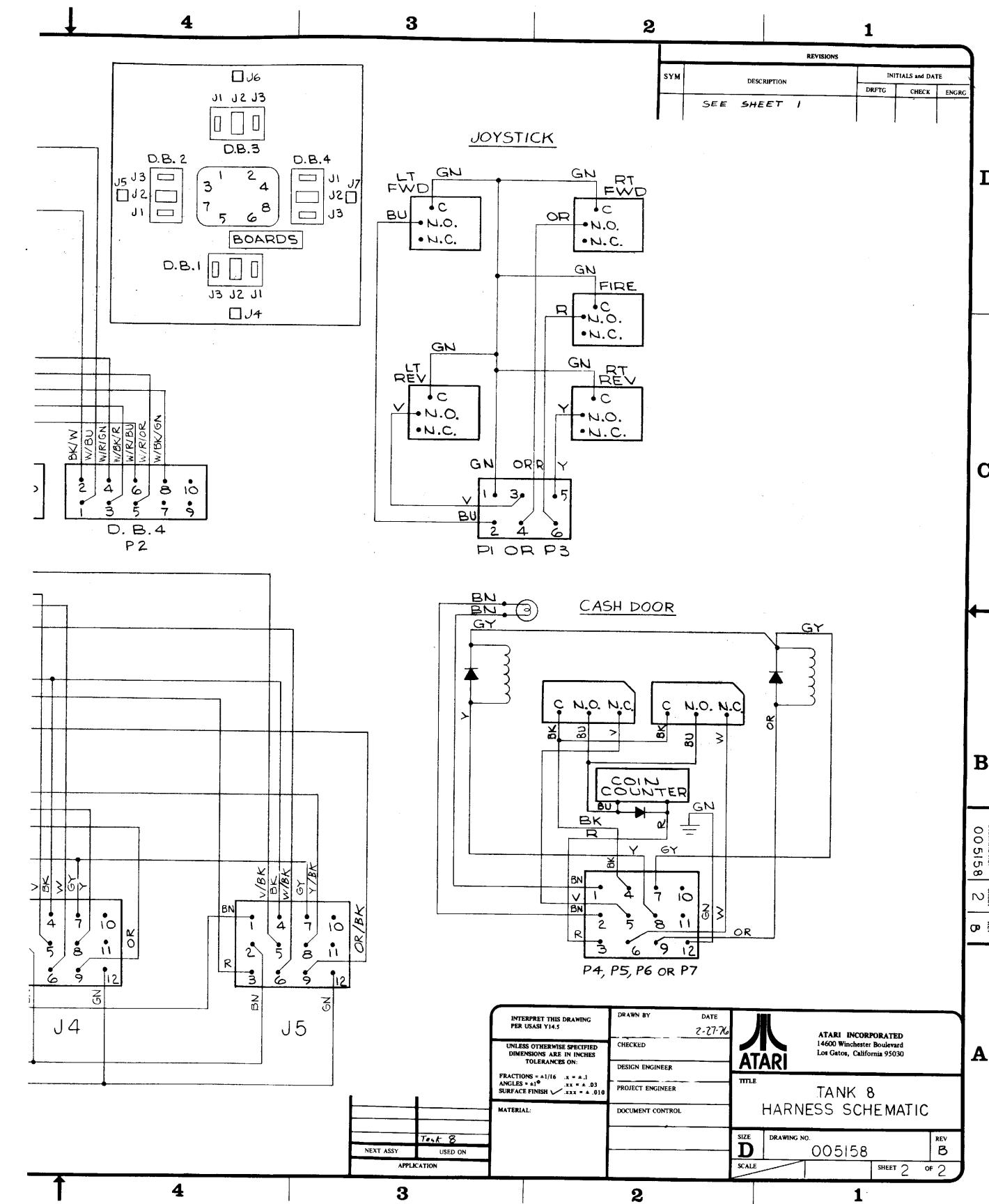
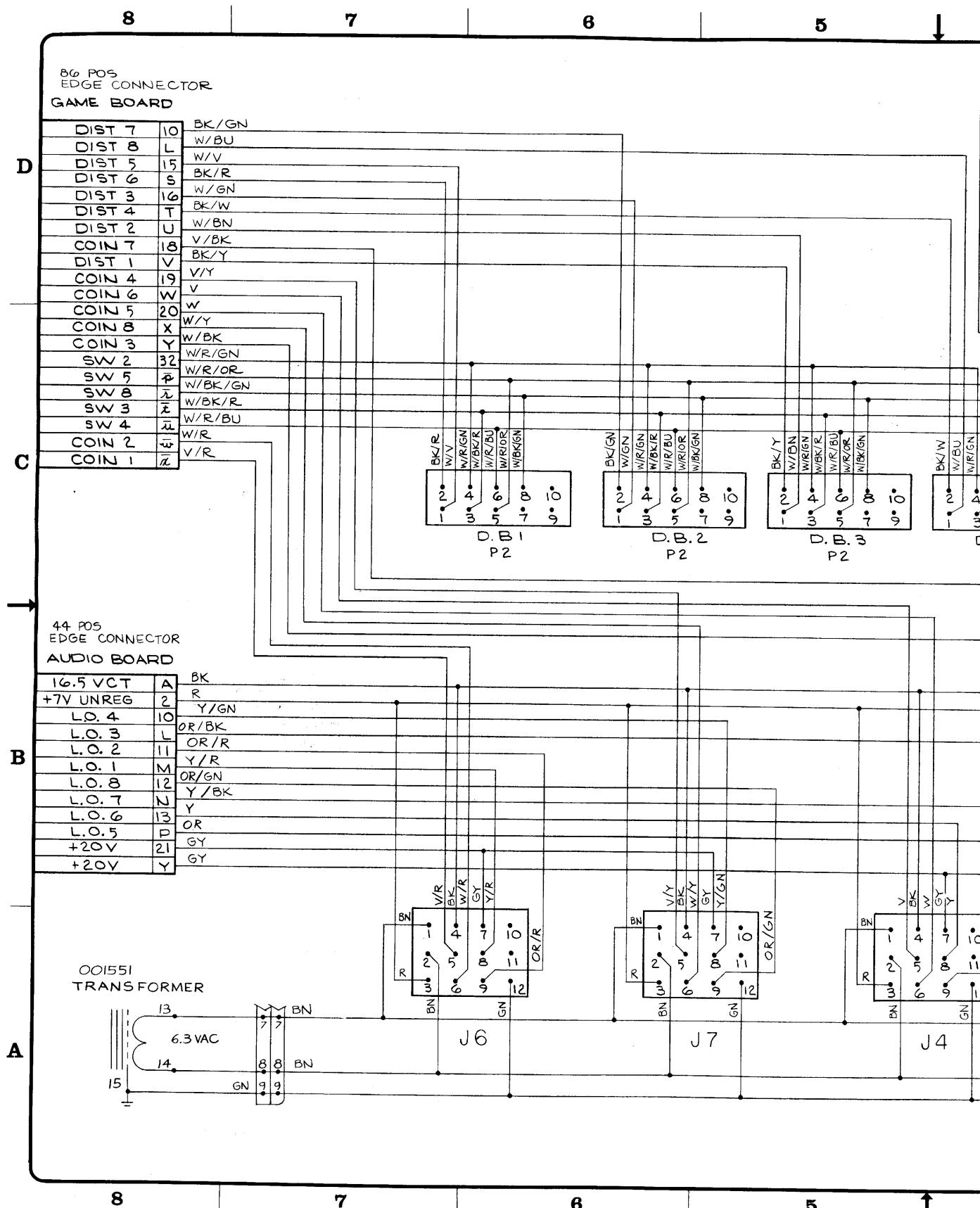
ATARI

TITLE
TANK 8
HARNESS INSTALLATION

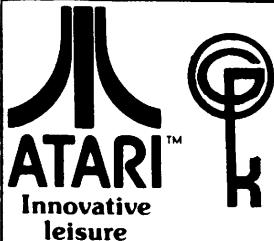
SIZE D DRAWING NO 005301 REV A

SCALE SHEET 1 OF 1





TANK 8



ASSEMBLY TITLE / ASSEMBLY, ELECTRONICS TRAY P/L A005163

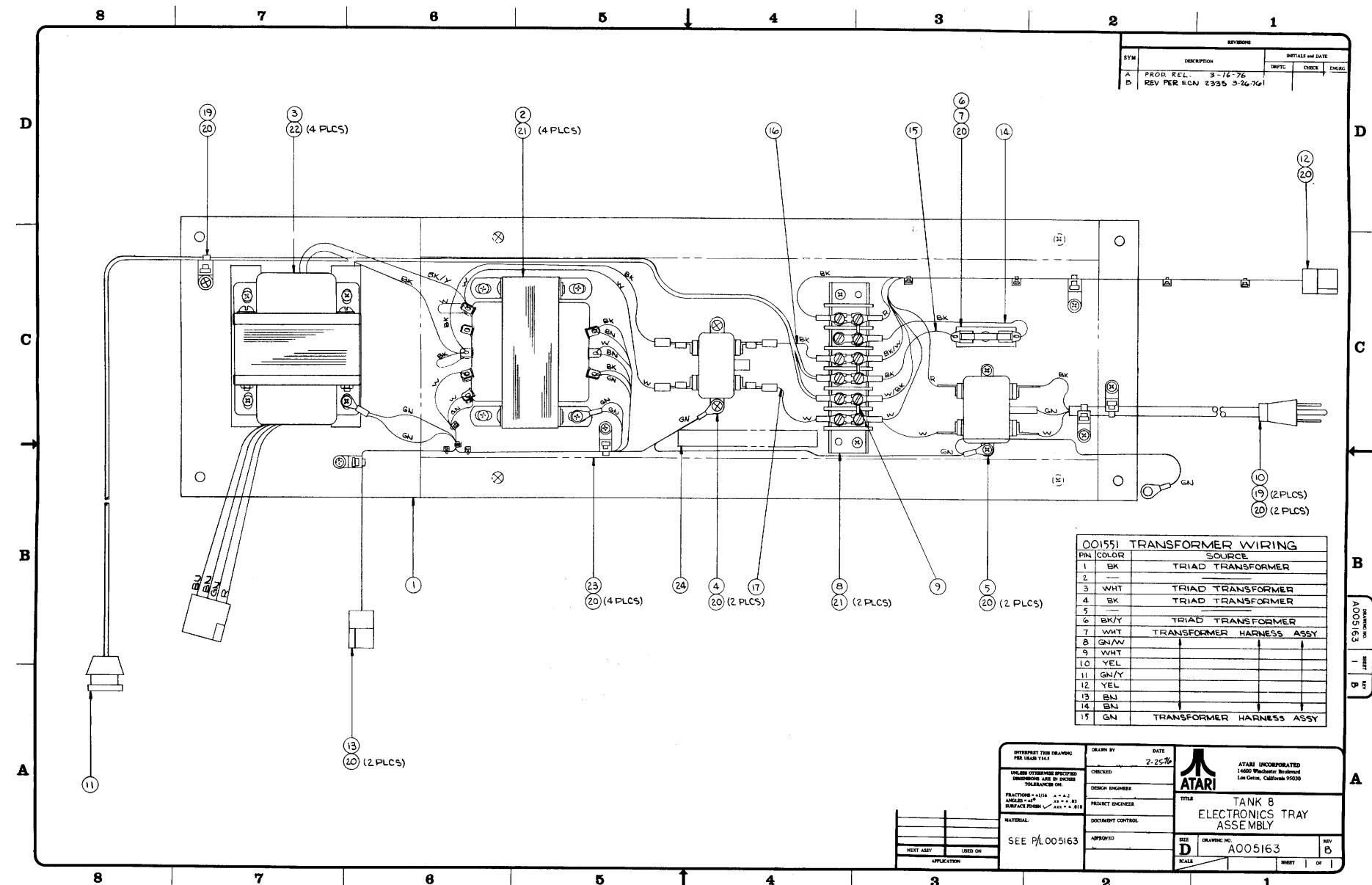
PARTS LIST SPECIFICATION

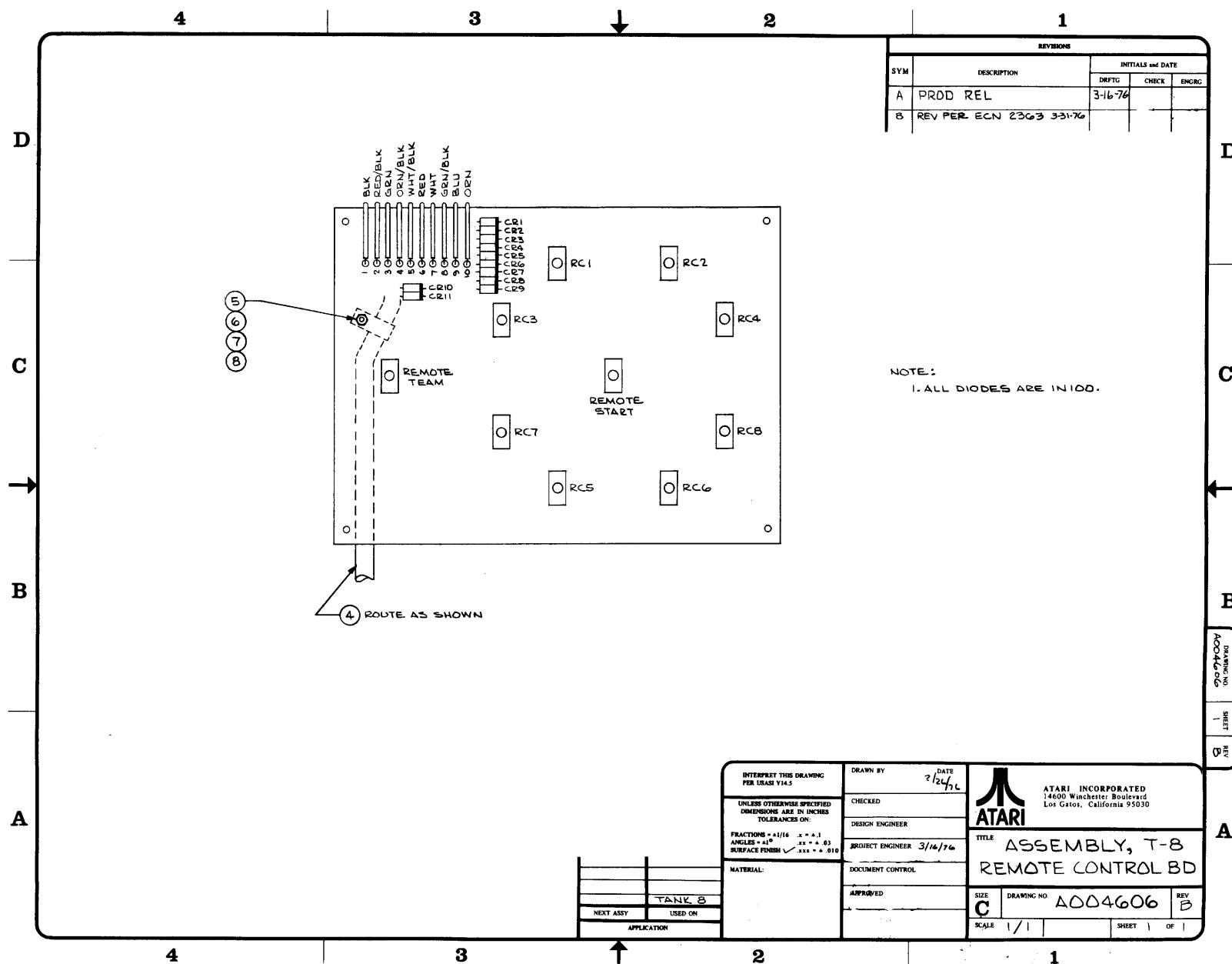
Page 1 of 1

Drawn	
Checked	Mech. Eng
Proj. Eng.	Elec. Eng
	REV. B

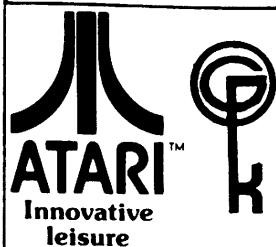
Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REL	3-16-76					
B	Rev per ECN 2335	3-26-76					

Item	Part Number	Qty.	DESCRIPTION	
1	004537	1	Tray, Electronics	
2	001551	1	Transformer	
3	A005164-01	1	F-83A Transformer Termination Assembly	
4	41-2001	1	Filter, Power Line 2 AMP	
5	41-2003	1	Filter, Power Line 5 AMP	
6	79-3201	1	Fuse Holder	
7	46-201502	1	Fuse, Slo-Blow, 5 AMP	
8	79-11806	1	Barrier Strip, 6 Contacts	
9	79-16001	3	Jumper, Barrier Strip	
10	54-405	1	Power Cord Belden #17425 (or equal)	
11	A005226-01	1	T.V. Power Cord Assembly	
12	A005226-02	1	A.C. Power Harness Assembly	
13	A005162	1	Transformer Harness Assembly	
14	A004577-11	1	Jumper Wire Assembly (Blk)	
15	A004577-12	1	" " " (Blk)	
16	A004577-13	1	" " " (Blk)	
17	A004577-14	1	" " " (Wht)	
18				
19	78-25001	3	Screw Down Tie Wraps	
20	72-6608	15	Screw, Sht. Metal, Pan Hd., Phil., #6 x $\frac{1}{2}$ Lg	
21	72-6812	6	" " " " " #8 x 3/4 Lg	
22	72-6824	4	" " " " " #8 x 1 $\frac{1}{2}$ Lg	
23	005086	1	Transformer Cover	
24	000871	1	Label	





TANK 8



ASSEMBLY TITLE ASSY, REMOTE CONTROL BD. P/L A004606

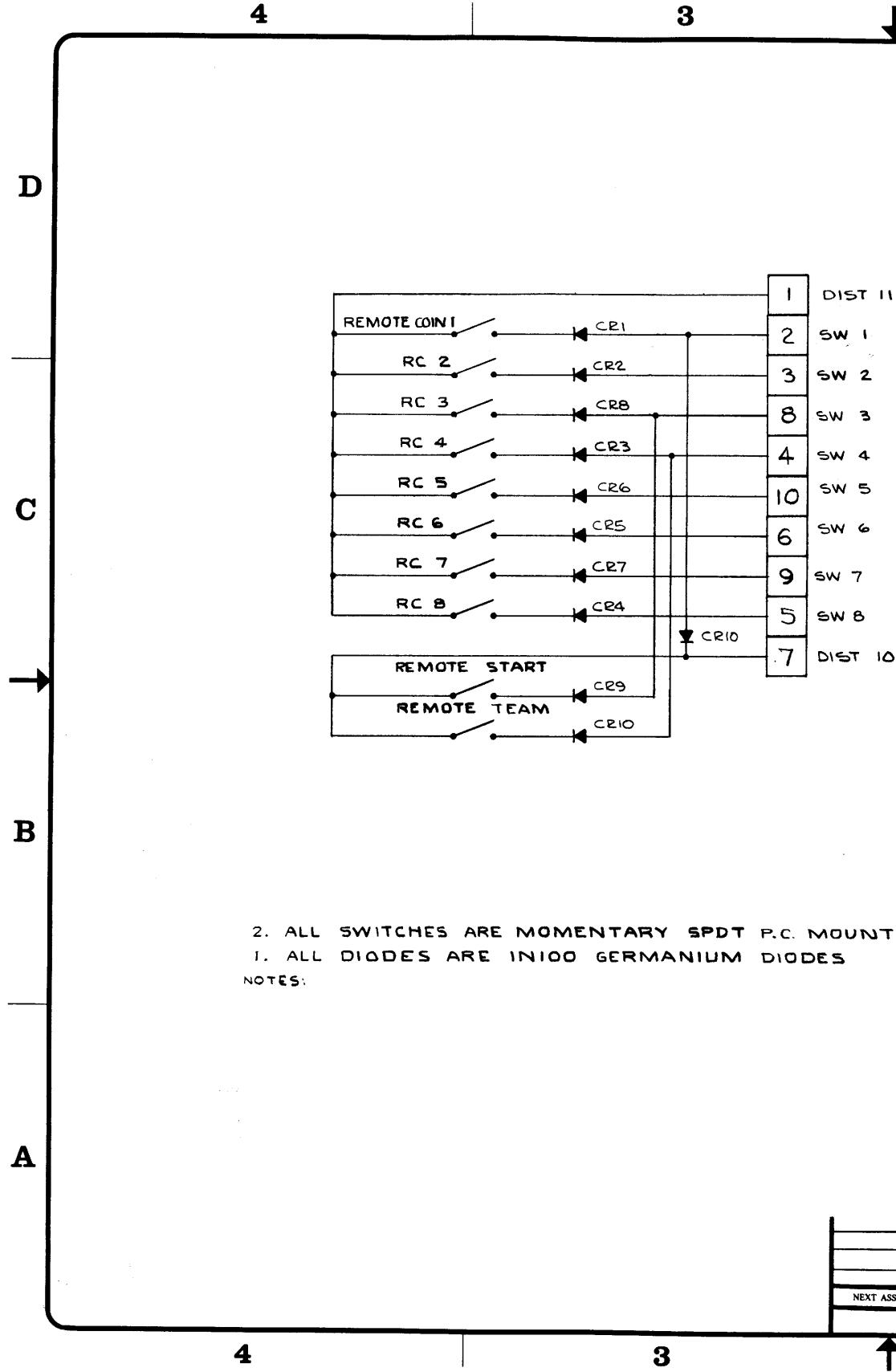
PARTS LIST SPECIFICATION

Page 1 of 1

Drawn		
Checked	Mech. Eng.	
Proj. Eng.	Elec. Eng	REV. B

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD. REL.	3/16/76					
B	Rev per ECN 2363	3-16-76					

Item	Part Number	Qty.	DESCRIPTION
1.	004607	1	Printed Circuit Board
2.	31-IN100	11	Diode, IN100
3.	62-007	10	Switch, SPDT Momentary, Pushbutton
4.	A005463	1	Cable Assy.
5.	78-25001	1	Cable Tie, Screwdown
6.	72-24075	1	Screw, Mach, Phil Hd, #4-40x7/16" Steel
7.	75-054	1	Lockwasher, Int Tooth, #4
8.	75-9145	1	Nut, Hex, Machine #4-40



2. ALL SWITCHES ARE MOMENTARY SPDT P.C. MOUNT
 1. ALL DIODES ARE IN100 GERMANIUM DIODES
 NOTES:

2 1

D C B A

REVISIONS		INITIALS and DATE		
SYM	DESCRIPTION	DRFTG	CHECK	ENGRG
A	PROD REL	3-16-76		
B	REV PER ECN 2363 3-31-76			

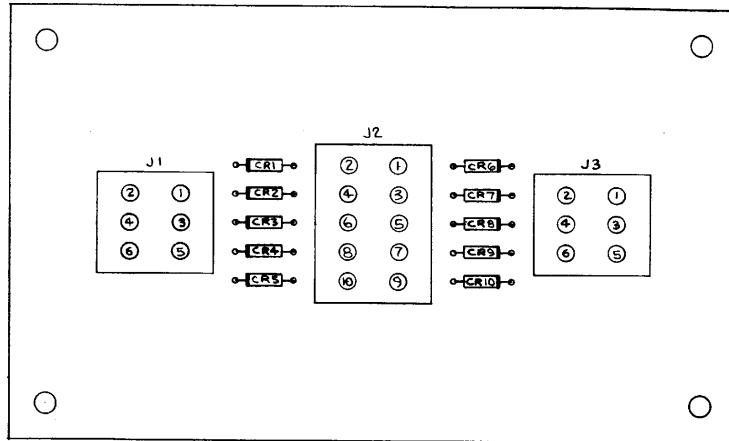
DRAWING NO.
 SHEET REV

ATARI
ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030

INTERPRET THIS DRAWING PER USASI Y14.5		DRAWN BY VJ DATE 1/22/76	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS = ±1/16 .x = ±.1 ANGLES = ±1° .xx = ±.03 SURFACE FINISH ✓ .xxx = ±.010		CHECKED	
DESIGN ENGINEER		PROJECT ENGINEER 3/16/76	
MATERIAL:		DOCUMENT CONTROL	
TANK 8 USED ON		SIZE C DRAWING NO. 004606 REV B	
APPLICATION		SCALE — SHEET 1 OF 1	

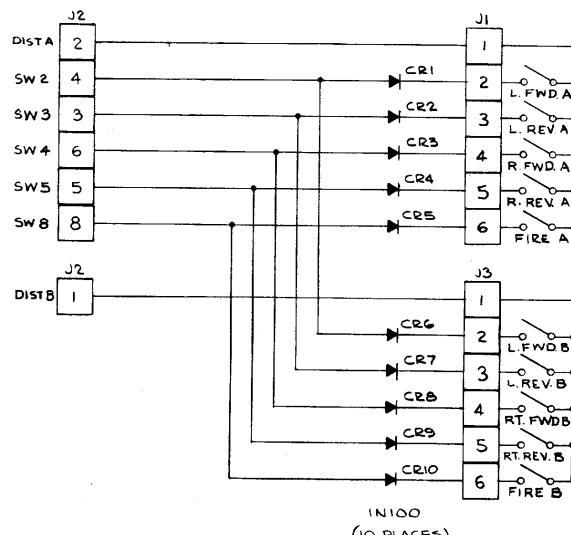
**SCHEMATIC DIAGRAM,
T-8 REMOTE CONTROL BD.**

2 1



NOTES:
1. ALL DIODES ARE IN100.

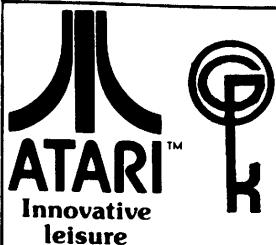
		INTERPRET THIS DRAWING PER UGAI Y14.5	DRAWN BY <i>[Signature]</i>	DATE 1/27/76	ATARI INCORPORATED 14600 Winchester Boulevard Los Gatos, California 95030		
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON:	CHECKED <i>[Signature]</i>	DESIGN ENGINEER <i>[Signature]</i>	TITLE ASSEMBLY		
		FRACTIONS = A/16 X = A.1 ANGLES = A ^o Z = A .03 SURFACE FINISH ✓ ZZZ = A .010	PROJECT ENGINEER 3/16/76	DOCUMENT CONTROL	CONTROL PANEL MATRIX BD		
		MATERIAL: SEE P/L004608	APPROVED <i>[Signature]</i>	SIZE C	DRAWING NO. A004608	REV A	
NEXT ASSY USED ON APPLICATION				SCALE 2/1	SHEET 1 OF 1		



(IN100
(10 PLACES)

		INTERPRET THIS DRAWING PER UGAI Y14.5	DRAWN BY <i>[Signature]</i>	DATE 1/28/76	ATARI INCORPORATED 14600 Winchester Boulevard Los Gatos, California 95030		
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON:	CHECKED <i>[Signature]</i>	DESIGN ENGINEER <i>[Signature]</i>	TITLE SCHEMATIC DIAGRAM		
		FRACTIONS = A/16 X = A.1 ANGLES = A ^o Z = A .03 SURFACE FINISH ✓ ZZZ = A .010	PROJECT ENGINEER 3/16/76	DOCUMENT CONTROL	MATRIX BD		
		MATERIAL: SEE P/L004608	APPROVED <i>[Signature]</i>	SIZE C	DRAWING NO. 004608	REV A	
NEXT ASSY USED ON APPLICATION				SCALE —	SHEET 1 OF 1		

TANK 8



ASSEMBLY TITLE	ASSY, CONTROL PANEL MATRIX BD. P/L A004608
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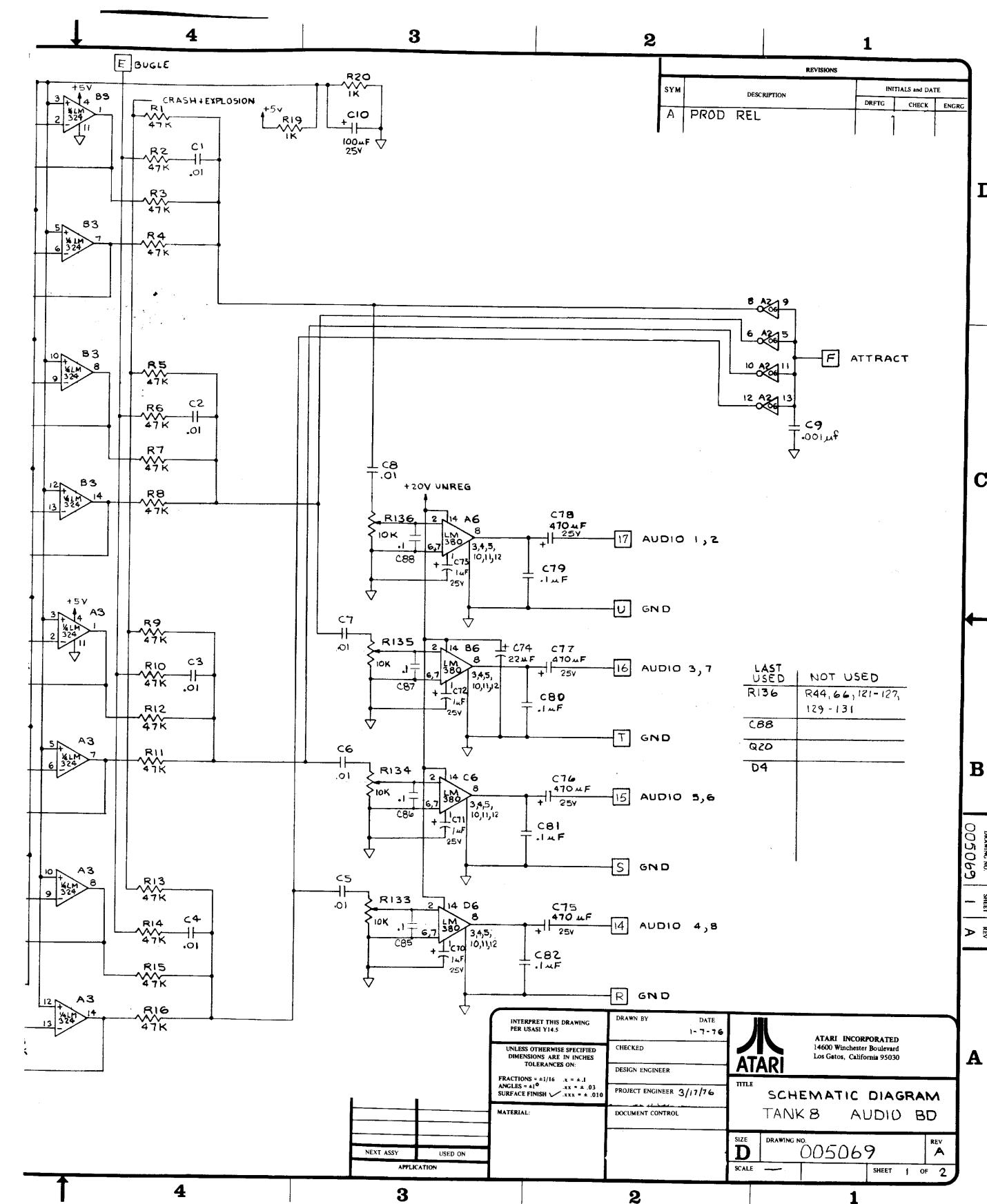
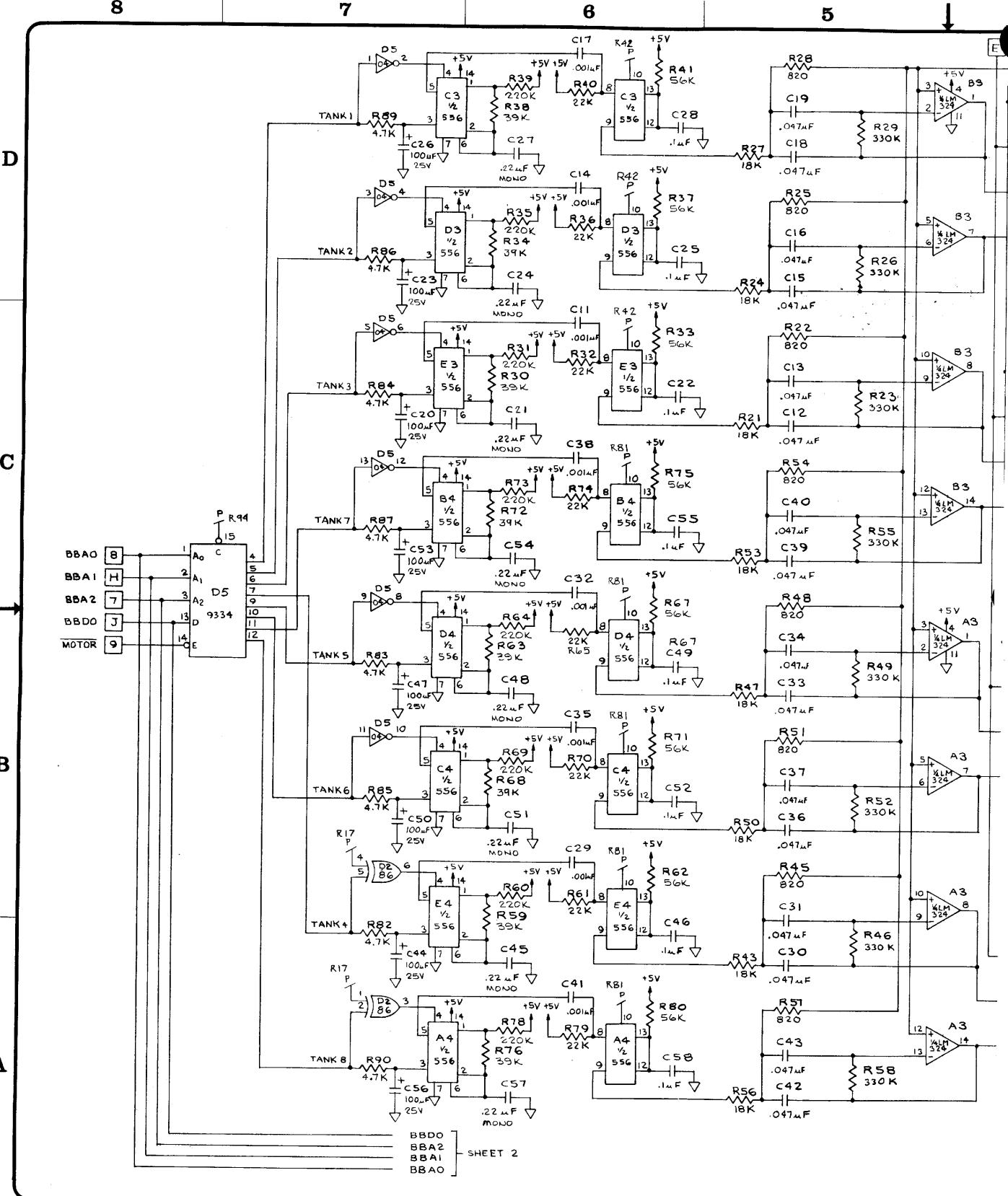
PARTS LIST SPECIFICATION	
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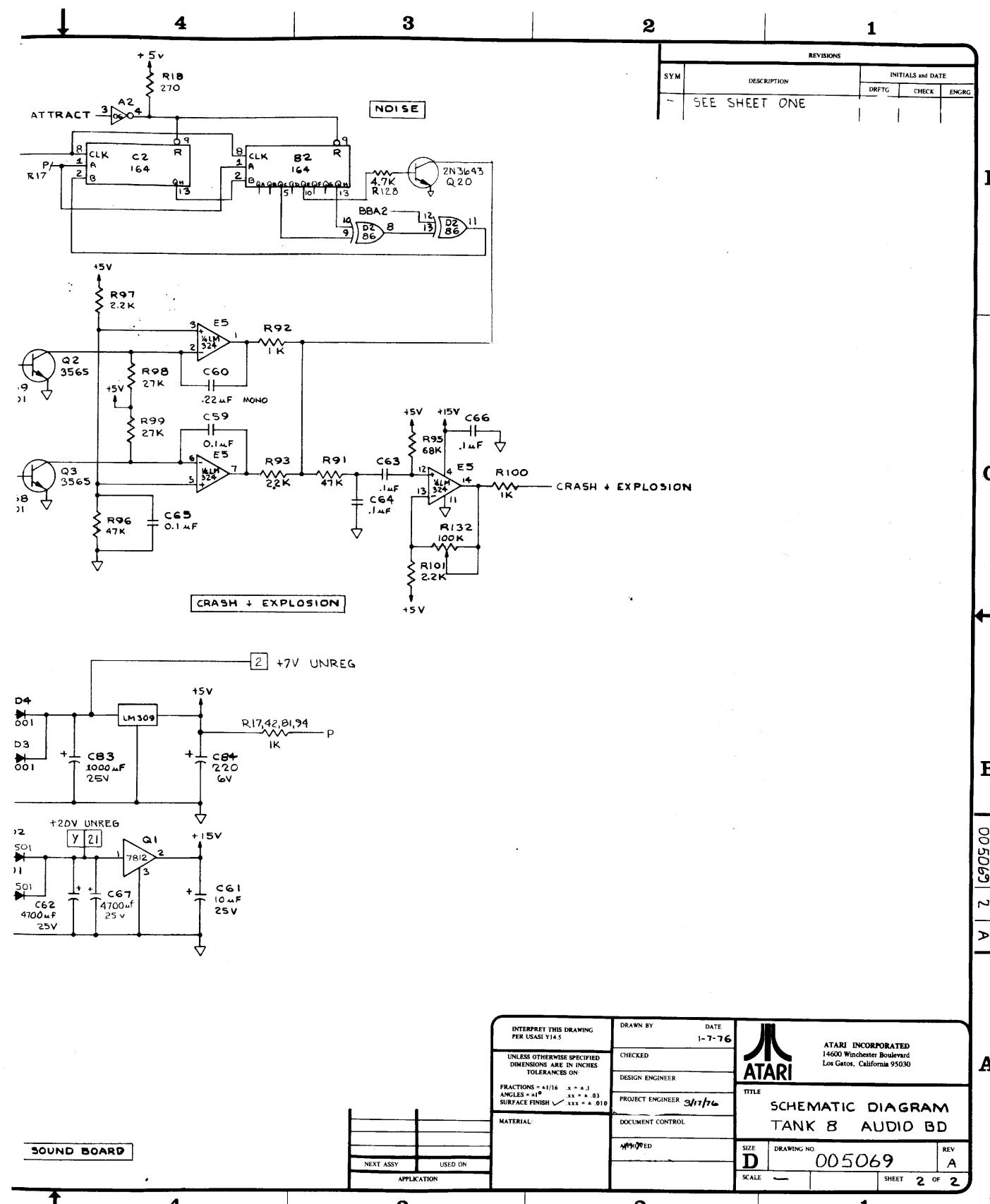
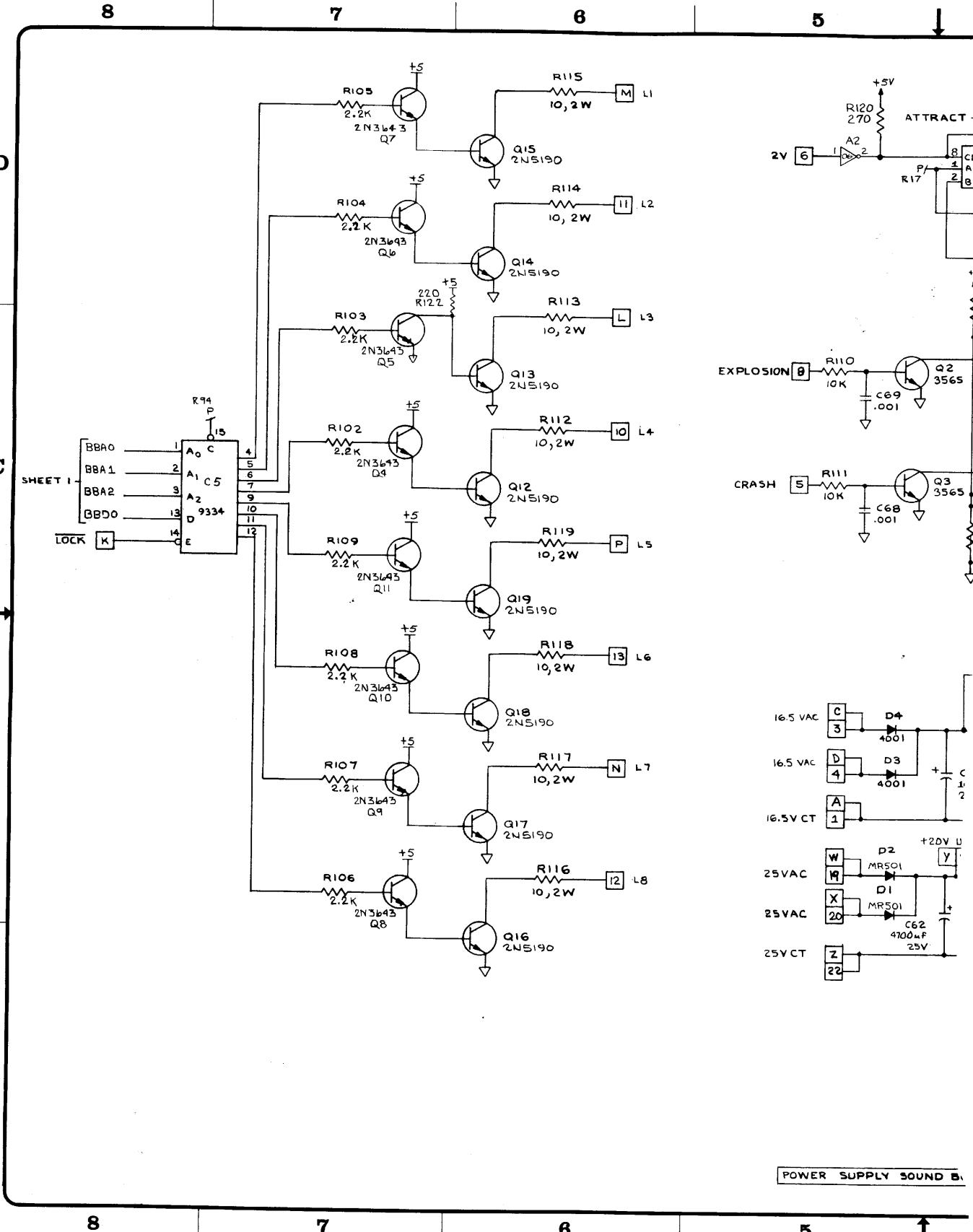
Page 1 of 1

Drawn	
Checked	Mech. Eng.
Proj. Eng.	Elec. Eng
	REV. A

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD. REL.	3/16/76					

Item	Part Number	Qty.	DESCRIPTION
1.	004609	1	Printed Circuit Board
2.	79-58004	2	Header, 6 Pin (AMP 1-380999-0)
3.	79-58005	1	Header, 10 Pin (AMP 1-380991-0)
4.	31-IN100	10	Diode, IN100





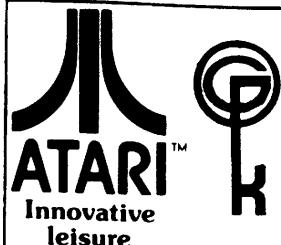
INTERPRET THIS DRAWING PER USASI Y1.4	DRAWN BY I-7-76
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DATE
TOLERANCES ON	CHECKED
ANGLES = ±1° xx = ± .1	DESIGN ENGINEER
xx = ± .03	PROJECT ENGINEER 3/17/76
SURFACE FINISH ✓	MATERIAL:
FRACTIONS = 1/16 x = ± .015	DOCUMENT CONTROL
ANGLES = ±1° xx = ± .03	APPLIED
xx = ± .015	SIZE D DRAWING NO 005069 REV A
TITLE ATARI INCORPORATED 14600 Winchester Boulevard Los Gatos, California 95030	
SHEET 2 OF 2	

SOUND BOARD

Atari Logo

**SCHEMATIC DIAGRAM
TANK 8 AUDIO BD**

TANK 8



ASSEMBLY TITLE	ASSY., AUDIO BOARD	P/L A005069
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PARTS LIST SPECIFICATION		Page 1 of 3
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Drawn		
Checked	Mech. Eng.	
Proj. Eng.	Elec. Eng	REV. A

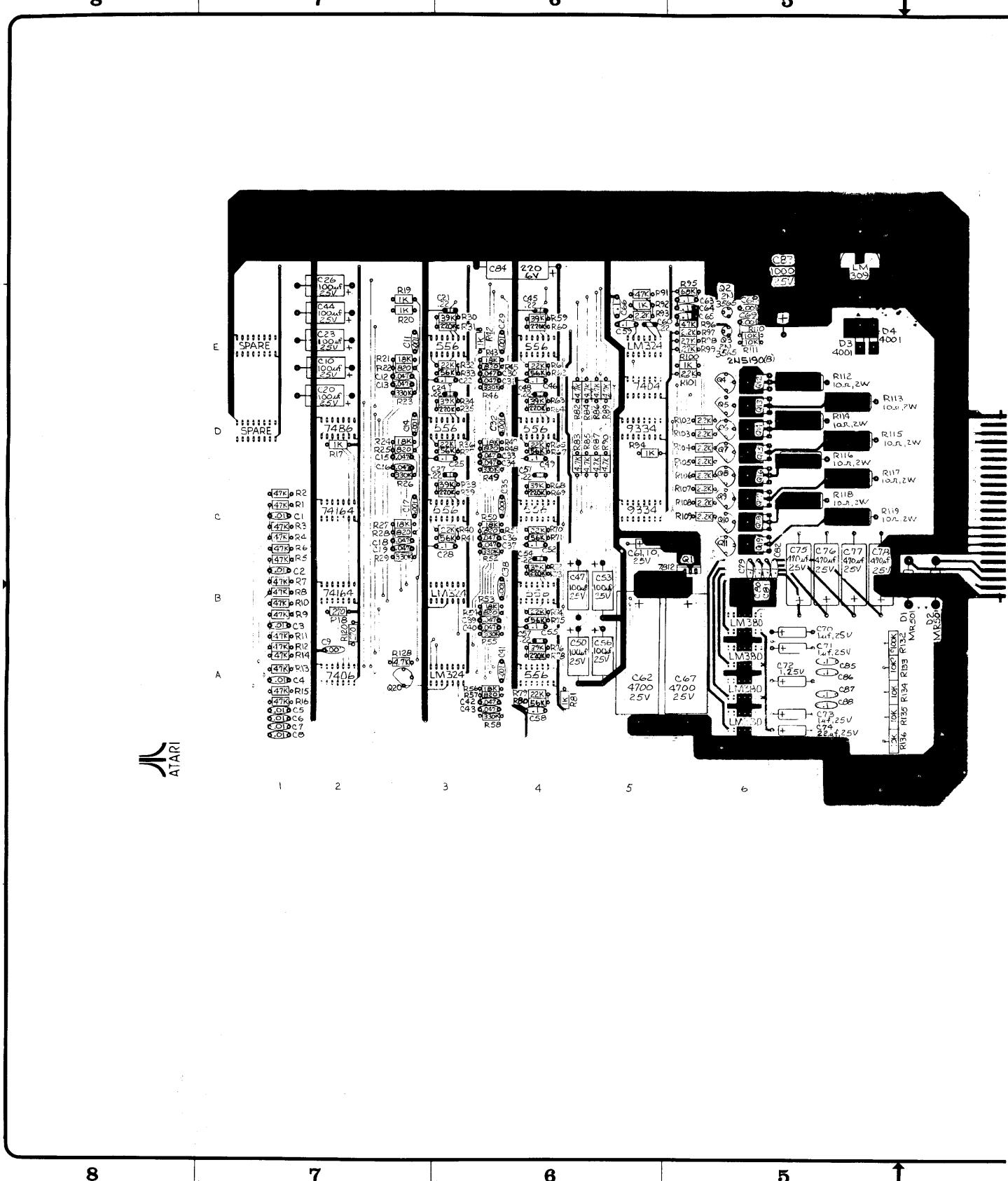
Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD REL						

Item	Part Number	Qty.	DESCRIPTION			
1.	005070	1	Printed Circuit Board			
2.	10-5102	8	Res, Carbon Comp, $\frac{1}{2}$ w, 5%, 1K		R17,19,20,42,81, 92,94,100	
3.	10-5103	2	" " " " 10K		R110, 111	
4.	10-5183	8	" " " " 18K		R21,24,27,43,47, 50,53,56	
5.	10-5222	11	" " " " 2.2K		R93,97,101-109	
6.	10-5223	8	" " " " 22K		R32,36,40,61, 65,70,74,79	
7.	10-5271	2	" " " " 270Ω		R18,120	
8.	10-5273	2	" " " " 27K		R98,99	
9.	10-5333	4	" " " " 33K		R30,38,59,63	
10.	10-5334	8	" " " " 330K		R23,26,29,46, 49,52,55,58	
11.	10-5472	9	" " " " 4.7K		R82-87,89,90,128	
12.	10-5473	18	" " " " 47K		R1-16,91,96	
13.	10-5821	8	" " " " 820Ω		R22,25,28,45, 48,51,54,57	
14.	10-5393	8	Res, Carbon Comp, $\frac{1}{2}$ w, 5%, 39K		R30,34,38,59, 63,68,72,76	
15.	10-5683	1	Res, Carbon Comp, $\frac{1}{2}$ w, 5% 68K		R95	
16.	13-5100	8	" " " " 2w, " 10Ω		R112-119	
17.	10-5563	8	" " " " $\frac{1}{2}$ w, 5%, 56K		R33,37,41,62 67,71,75,80	

TANK 8

ASSEMBLY TITLE ASSY., AUDIO BOARD			P/L A005069
PARTS LIST SPECIFICATION			REV. A
Item	Part Number	Qty.	DESCRIPTION
18.	10-5224	8	Res, Carbon Comp, $\frac{1}{4}$ w, 5%, 220K R31,35,39,60,64, 69,73,78
19.	19-315103	4	Trimpot 10K R133-136
20.	19-315104	1	Trimpot 100K R132
21.	24-250105	4	Cap, Elect, 1uf 25V C70-73
22.	24-250106	1	" " 10uf 25V C61
23.	24-250107	9	" " 100uf 25V C10,20,23,26,44, 47,50,53,56
24.	24-250108	1	" " 1000uf 25V C83
25.	24-250226	1	" " 22uf 25V C74
26.	24-060227	1	" " 220uf 6V C84
27.	24-250477	4	" " 470uf 25V C75-78
28.	24-250478	2	" " 4700uf 25V C62-67
29.			
30.	27-250102	11	Cap, Cer Disc .001uf 25V C9,11,14,17,29,32, 35,38,41,68,69
31.	27-250103	8	" " ".01uf 25V C1-8
32.	27-250104	21	" " ".1uf 25V C22,25,28,46,49, 52,55,58,59,63- 66,79-82,85-88
33.	27-250473	16	Cap, Cer Disc .047uf 25V C12,13,15,16,18,19 30,31,33,34,36,37, 39,40,42,43
34.			C21,24,27,45,48,
35.	29-011	9	Cap, Monolithic .22uf 51,54,57,60
36.	31-IN4001	2	Diode, IN4001 D3,4
37.	31-MR501	2	Diode, MR501 D1,2
38.			
39.	34-2N5190	8	Transistor, 2N5190 Q12-19
40.	34-2N3643	9	" 2N3643 Q4-11,20
41.	34-2N3565	2	" 2N3565 Q2,3
42.			
43.			
44.	37-7404	1	I.C. 7404
45.	37-7406	1	I.C. 4706
46.	37-7486	1	I.C. 7486
47.	37-74164	2	I.C. 74164
48.	37-556	8	I.C. 556
49.	37-9334	2	I.C. 9334

ASSEMBLY TITLE ASSY, AUDIO BOARD			P/L	A005069
PARTS LIST SPECIFICATION			REV. A	Page 3 of 3
Item	Part Number	Qty.	DESCRIPTION	
50.	37-LM324	3	I.C. LM324	
51.	37-LM380	4	I.C. LM380	
52.	37-LM309	1	Regulator LM309	
53.	37-7812	1	" 7812	Q1
54.				
55.	72-1608C	2	Screw, Mach, Pan Hd. Phil #6-32 x $\frac{1}{2}$ " Cres	
56.	75-056	2	Washer, Lock, Int. Star #6	
57.	75-916C	2	Nut, Mach, Hex #6-32 Cres	
58.	72-1406C	8	Screw, Mach, Pan Hd, Phil #4-40 x 3/8 Cres	
59.	75-054	8	Washer, Lock, Int. Star #4	
60.	75-914C	8	Nut, Mach, Hex #4-40 Cres	
61.	75-014S	8	Washer, Flat #4 Steel	

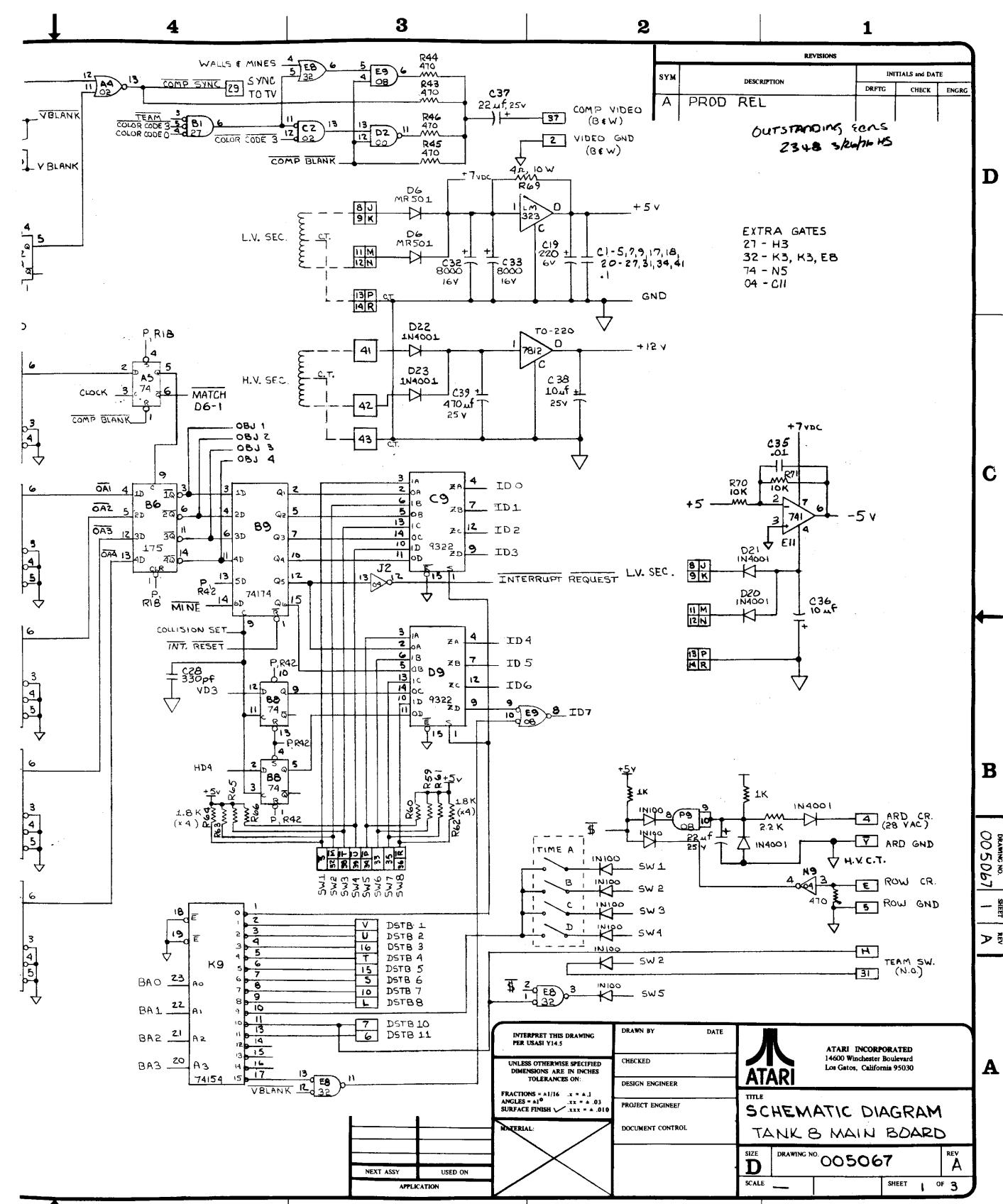
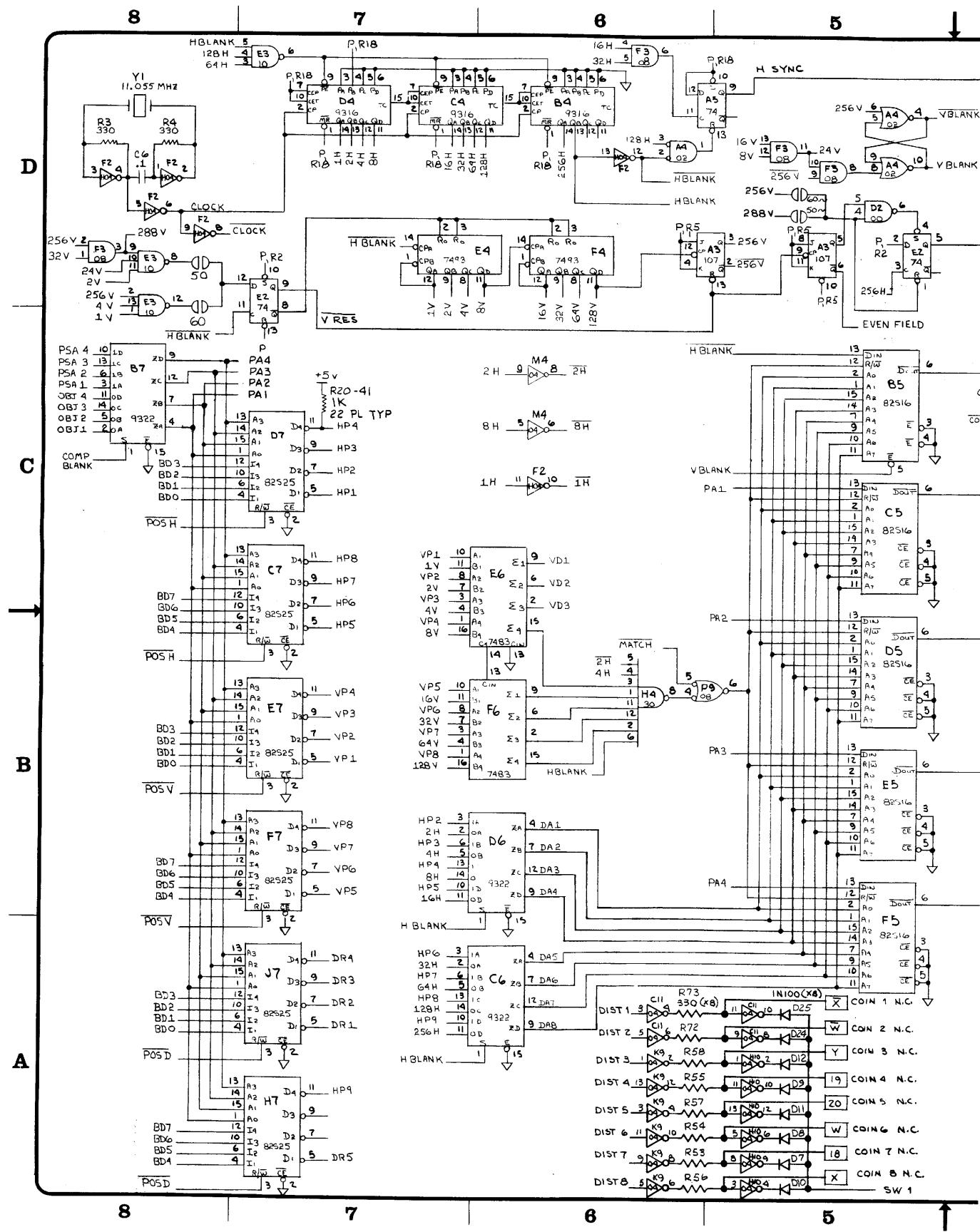


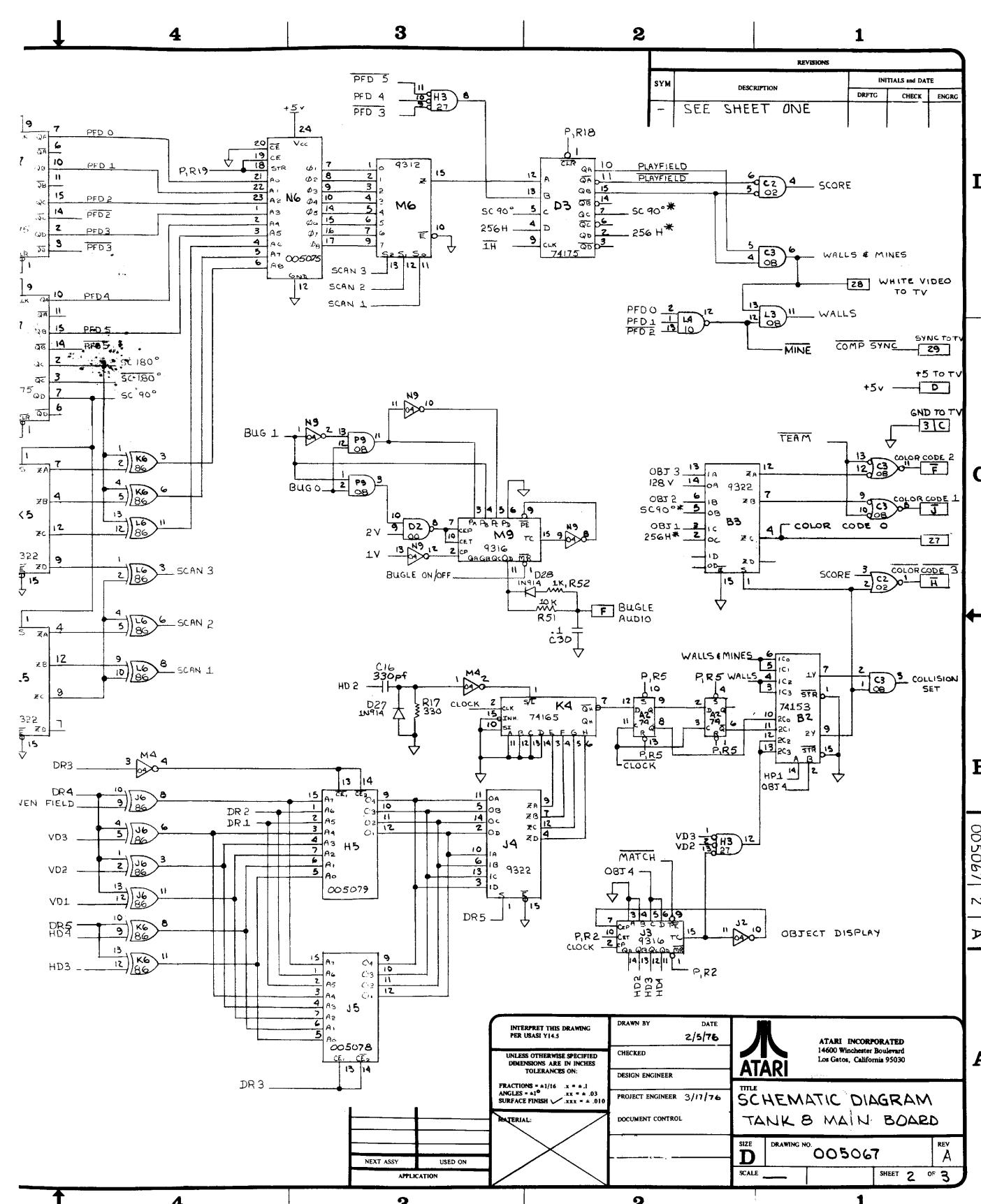
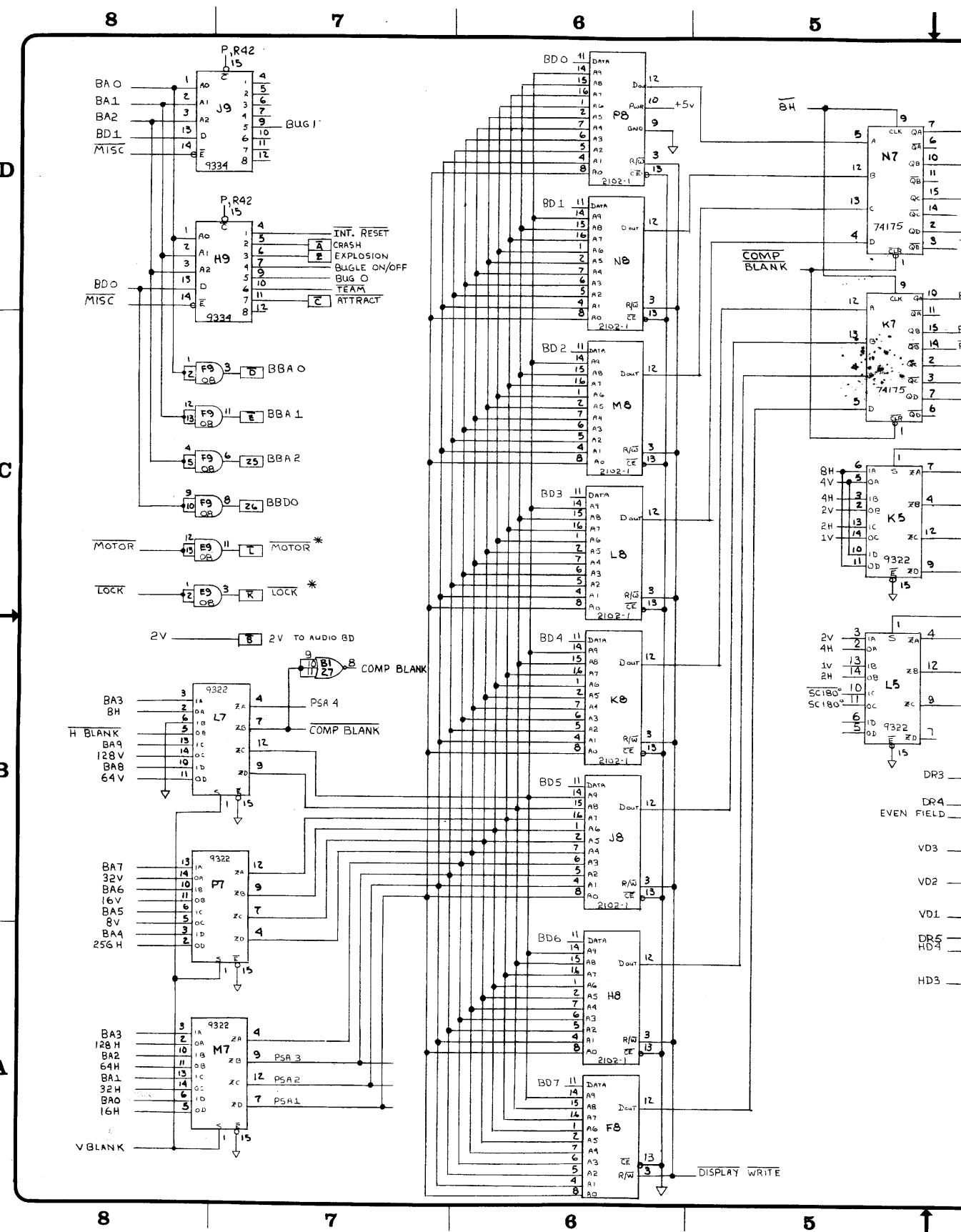
REVISIONS				
SYM	DESCRIPTION	INITIALS and DATE		
		DRFTG	CHECK	ENRG
A	PROD REL			3-12-76

NOTES:
1. ALL UNMARKED TRANSISTORS ARE 2N3643.

MODIFICATIONS TO AUDIO ASSY'S USING 005070 REV B P.C.BDS:
1. CUT AND LIFT PIN 12 OF D2.
2. JUMPER LIFTED PIN 12 TO PIN 3 OF D5.

INTERPRET THIS DRAWING PER USASI Y14.5	DRAWN BY	DATE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS $\pm 1/16$, $\pm 1/32$, $\pm 1/64$ ANGLES $\pm 10'$, $\pm 5'$, $\pm 1'$ SURFACE FINISH $\pm .000$ to $\pm .010$	CHECKED	
DESIGN ENGINEER		
PROJECT ENGINEER 3/17/76		
MATERIAL:	DOCUMENT CONTROL	
TANK 8		
NEXT ASSY	USED ON	
APPLICATION		
SHEET 1 OF 1	SIZE D	DRAWING NO A005069 REV A





8 | 7 | 6 | 5

↓ 4 | 3 | 2 | 1

D

D

C

C

B

B

A

A

	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	
DIST 1	COIN	L.FWD	L.REV	RT.FWD	RT.REV	UNUSED	UNUSED	FIRE	TANK 1
DIST 2									TANK 2
DIST 3									TANK 3
DIST 4									TANK 4
DIST 5									TANK 5
DIST 6									TANK 6
DIST 7									TANK 7
DIST 8	COIN	L.FWD	L.REV	RT.FWD	RT.REV			FIRE	TANK 8
DIST 9	TIME 0	TIME 1	TIME 2	TIME 3	UNUSED				GAME TIMER
DIST 10	REMOTE ON	TEAM	REMOTE START	REMOTE TEAM	\$ BILL	UNUSED	UNUSED	UNUSED	REMOTE + MISC
DIST 11	RC1	RC2	RC3	RC4	RC5	RC6	RC7	RC8	REMOTE COIN

DRAWING NO.
005067
3 SHEET
REV A

INTERPRET THIS DRAWING PER USASH Y14.5	DRAWN BY	DATE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON:	CHECKED	
FRACTIONS: ANGLES = $\frac{1}{16}$ IN. ± .1 SURFACE FINISH ✓ $\frac{xx}{xx} \pm .010$	DESIGN ENGINEER	
PROJECT ENGINEER	DOCUMENT CONTROL	
APPROVED	SIZE D	DRAWING NO. 005067
	SCALE —	SHEET 3 OF 3

X

ATARI INCORPORATED
14600 Winchester Boulevard
Los Gatos, California 95030

ATARI

TITLE SCHEMATIC DIAGRAM
TANK 8 MAIN BOARD

8 | 7 | 6 | 5

↑ 4 | 3 | 2 | 1



TANK 8

ASSEMBLY TITLE / MAIN P.C. BOARD ASSY. P/L A005067

PARTS LIST SPECIFICATION

Page 1 of 4

Drawn

Checked

Mech. Eng.

Proj. Eng

Elec. Eng

REV.

A

Rev.	Description	Date	Apprv.	Rev.	Description	Date	Apprv.
A	PROD. REL.	3/11/76					

Item	Part Number	Qty.	DESCRIPTION	
1.	005068	1	Printed Circuit Board	
2.	10-5100	2	Res, Carbon, $\frac{1}{4}w$, 5%	10Ω R7, 14
3.	10-5102	33	" " " "	1K R1,2,5,11,16, 18-42,47,50,52
4.	10-5103	5	" " " "	10K R9,12,51,70,71
5.	10-5153	1	" " " "	15K R68
6.	10-5182	8	" " " "	1.8K R59-66
7.	10-5220	2	" " " "	22Ω R6,15
8.	10-5222	1	" " " "	2.2K R48
9.	10-5331	11	" " " "	330Ω R3,4,17,53-58, 72,73
10.	10-5333	1	" " " "	33K R67
11.	10-5471	8	" " " "	470Ω R10,43-46,49, 79,80
12.	10-5472	2	" " " "	4.7K R8,13
13.	10-5821	5	" " " "	820Ω R74-78
14.	19-808W4P0	1	Res, Wirewound, 10w, 20%, 4Ω	R69
15.				
16.				
17.	24-060227	1	Cap, Electrolytic 220μf, 6v	C19
18.	24-160808	2	" " 8000μf, 16v	C32,33
19.	24-250106	2	" " 10μf, 25v	C36,38
20.	24-250226	2	" " 22μf, 25v	C29,37
21.	24-250477	1	" " 470μf, 25v	C39
22.				
23.	27-250103	1	Cap, Ceramic Disc, .01μf, 25v	C35

TANK 0

ASSEMBLY TITLE / MAIN P.C. BOARD ASSY. P/L A005067

PARTS LIST SPECIFICATION

REV. A | Page 2 of 4

Item	Part Number	Qty.	DESCRIPTION	
24.	27-250104	25	Cap, Ceramic Disc, .01μf, 25v	C1-9,12,13,17,18, 20-27, 30,31,34,41
25.	27-250334	1	" " ".33μf, 25v	C40
26.				
27.	28-101330	2	Cap, Dipped Mica, 33pf, 100v	C10,15
28.	28-101680	2	" " " 68pf, 100v	C11,14
29.	28-101331	2	" " " 330pf, 100v	C16,28
30.	31-IN100	16	Diode, IN100	D3,4,7-18,24,25
31.	31-IN914	4	Diode, IN914	D19,26-28
32.	31-IN4001	6	Diode, IN4001	D1,2,20-23
33.	31-MR501	2	Diode, MR501	D5,6
34.				
35.	33-2N3644	1	Transistor, 2N3644	Q2
36.	34-2N3643	1	Transistor, 2N3643	Q1
37.				
38.	37-7400	2	Integrated Circuit, 7400	
39.	37-7402	2	" " 7402	
40.	37-7404	6	" " 7404	
41.	37-74H04	1	" " 74H04	
42.	37-7408	9	" " 7408	
43.	37-7410	2	" " 7410	
44.	37-7427	2	" " 7427	
45.	37-7430	1	" " 7430	
46.	37-7432	2	" " 7432	
47.	37-7474	6	" " 7474	
48.	37-7483	2	" " 7483	
49.	37-7486	3	" " 7486	
50.	37-7493	2	" " 7493	
51.	37-74107	1	" " 74107	
52.	37-74145	1	" " 74145	
53.	37-74153	1	" " 74153	
54.	37-74154	1	" " 74154	
55.	37-74165	1	" " 74165	
56.	37-74174	1	" " 74174	
57.	37-74175	4	" " 74175	
58.	37-9312	1	" " 9312	
59.	37-9316	6	" " 9316	

TANK 8

ASSEMBLY TITLE MAIN P.C. BOARD ASSY.			P/L
PARTS LIST SPECIFICATION			Rev. A Page 3 of 4
Item	Part Number	Qty.	DESCRIPTION
60.	37-9321	1	Integrated Circuit 9321
61.	37-9322	12	" " 9322
62.	37-9334	2	" " 9334
63.	37-741	1	" " 741
64.	37-LM323	1	Regulator LM323
65.	37-8T28	2	Integrated Circuit 8T28
66.	37-7812	1	Regulator 7812
67.			
68.	66-024PIT	1	Switch, DIP, 4 x SPST S1
69.	62-001	1	Switch, Momentary SPST N.O. S2
70.			
71.	72-1608C	2	Screw, Mach, Pan Hd, Phil, #6-32 x 1/2" Cres
72.	75-016	2	Washer, Flat, #6
73.	75-056	2	Washer, Lock, Internal Star #6
74.	75-916C	2	Nut, Hex, Mach #6-32 Cres
75.	78-06001	1	Heatsink
76.	78-16005	1	Silipad
77.	79-1400234	1	Header, Flex Cable, 34 Pin
78.			
79.	79-42516	4	Socket, Zero Insertion Force, 16 Pin
80.	79-42524	7	" " " " 24 Pin
81.	79-42540	1	" " " " 40 Pin
82.			
83.	90-105	1	Crystal, 11.055 MHZ Y1
84.	90-6001	1	Integrated Circuit
85.	90-6002	1	" "
86.	90-7001	8	RAM, 1024 x 1, 2102-1
87.	90-7002	2	Integrated Circuit
88.	90-7005	6	RAM, 16 x 4 82S25
89.	90-7008	5	RAM, 256 x 1 82S16
90.			
91.	005071	1	Program ROM 1
92.	005072	1	" " 2
93.	005073	1	Program PROM 3A (82S115)
94.	005074	1	" " 3B (82S115)
95.	005075	1	Character PROM (82S115)

TANK 8

ASSEMBLY TITLE MAIN P.C. BOARD ASSY.			P/L AB05067
PARTS LIST SPECIFICATION			REV. A Page 4 of 4
Item	Part Number	Qty.	DESCRIPTION
96.	005076	1	Decode PROM, MSB (82S129)
97.	005077	1	Decode PROM, LSB (82S129)
98.	005078	1	Tank Picture PROM, R0-R3 (82S129)
99.	005079	1	Tank Picture PROM, R4-R7 (82S129)

