

Rowe BC8 - BC35 Bill Changers
BA-3 to BA35 acceptors

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April 13,2005

This is another BEARNOTE written to help keep your operating costs down and your profits up!

When the new \$ 5 bill came out I saw the decline of the older Rowe bill changer but then Rowe change out with update kits for the BC 12, !2r and the 35 which converted them up to the newer BC1200, 1400 and 3500. However, the BC 9 to BC25 was left to be a \$1 changer. Then came OEMs like Capital vendor and others with kits for BC9s to BC35. In 2005 BC9 to 35s have been, or will be, updated with various acceptors and kits. Some third party kits even replace the original electronic control boards. With refurbished the hoppers and dispenser these updated Rowe bill changers have a new life cycle that **can last for decades**. I said and mean decades. I make this statement after making many updates and refurbishing on various Rowe bill changers going all the way back to the BC9. There is a kit for the BC-1 too. I am updated my BCx00 notes. For those who have and update the BC9 to BC35 series of bill changer I have updated these notes

Some of the new update kits include a 755 Bulb replacement. A red LED is used. I like that Bullet LED replacement. Watch the color code.

It does not work... What can I do?

This document will tender information pertaining to the BA3 - BA35 acceptors and BC8 to BC35 bill changers. I communicate with a very inhospitable negative manner so those who can only relate to a categorical or a positive written form will have to transpose the deliberations to a model that you can use. If need be, create your own document from the insight supplied.

BA 3 - BA 35 + BA 5 ACCEPTORS

- BA-3 early Used in early BC-8
Square plugs > a dead issue
- BA-3 late Used in BC8, 9, 10
Square plugs
- BA-20, 25 Used in BC11, 115, 20, 25
Rounded plugs
- BA-35 Used in BC12, BC12R, BC35
Rounded plugs
- BA-5 Used on old Jukeboxes

Rounded plugs

Note: BA- 5 -01 control unit for \$1 only.

BA- 55 -02 control unit -02 for \$1 and \$5.

Warning: The Jukebox BA-5 acceptors with (120v motor) and the BA-20, 25, 35 with a 24 v motor have the same type plugs. Never interchange these acceptors!

If you do; >>>> POOF >>>>!

BC8 to BC10 bill changers utilize a BA3 and Jukeboxes use a BA5. The BA3, 5, 15, 20, 25 and the BA-55 acceptors are obsolete per Rowe International. The BC 11, 115, 20 25 and 25MCs uses a BA-20 or BA-25 acceptor. The BC-12, 12R and 35 was introduced in 1983.

The BA-20, 25 and 35 acceptors all have the same plugs and wiring so they can be interchanged. These acceptors all accept \$1 and \$5 depending on the control board used. BC11/20 -01 board is \$1 only. The window picture on the acceptor may be only \$1, \$1 and \$5, or it may just a picture of the billhead with no dollar value shown.

The BC8 or BC9A1 machines are for \$1 only and use a BA-3 acceptor.

The BA-15 is used only in a BC9A15 is the first Rowe \$1 and \$5 machine.

There were adaptor cables made which allowed the BA-3 to be used as a BA-20, 25, or a 35 acceptor, and another cable for visa-versa. A BA-20, 25, 35 could be run on as a BA-3 for the BC8, BC9A1 or BC-10. One advantage of the adaptor for BA-3 to BA-20/35 is the BA-3 acceptor can be plugged into BC11, 115, 12, 12R, 20, 25, or 35 changers. Since these control units supply error codes when a bill is rejected this is a good way trouble shoot a BA-3 acceptor.

Obsolete Acceptors parts: Many of the BA35 parts are the same as the BA3 or BA20/25 acceptor. The motors for a BA3 are long gone but a BA35 motor can be used by cutting off the connector off the BA35 plug and putting the old BA3 motor plug on the new BA35 motor. The BA20/25 and BA35 use the same motor. Later, I will talk about the BA35 A/B acceptor -20 board update kit Rowe once offered. If you have the BA-35 A/B take note of the upcoming comments for the "A" and "B" position head on the newer BA35 acceptor.

Rowe has dropped support for the BC 8, 9 and 10s. This is reasonable from Rowe's point of view since the BC12-35 series of bill changers started in 1983.

We still work on the old machines [BC8 to BC35] but we cannot get all parts. Because most of the parts needed are used in later BC-12/35 and

BCxx00 models so we have been able to get what we have needed in most cases. We cannot get the custom IC used in the some of the BC-9s and BC-10s. If you have this IC problem you can consider getting an update kit for the bill changer.

Rowe has always designed bill changers to shut down when a major problem exists. The 755 bulbs behind the hoppers and the coin counters must be operational for the machine to work. It does not matter if you are not using that hopper position or not since the computer checks all the counters. If any one lamp/counter is not operational, the machine will shut down.

If a stacker home signal does not reach the computer logic, the machine will shut down. With the older boards for BC9s which use those plug in coin cards to select the coin count payout, all three cards must be plugged in and making contact. Two of the contacts on each coin card are an interlock. If that interlock is not made the machine will shut down. If you do not have a card that is not set the payout the way you want these cards can be modified by cutting copper and adding wires to set the payout from various hoppers.

In Rowe bill changers if the changer does not reach the given coin count in the allowed time the bill changer will shut down. A reset will be required. You really want to have your hopper in good condition so the changer does not go out of service.

Working on BA3 to BA-35 acceptors can be paralleled to working on a car that is tired and worn. It may be time to replace plugs, rotor, distributor cap, ignition wires, gas line filter, air filters, hoses, pipes and muffler, tires, etc. If a BA is tired and worn, it makes sense to replace all the worn parts in one shot. Remember when a BA is rejecting bills, the rejections put extra wear and tear on the acceptor diminishing its life. They are distinct levels performance so changing a single part in the acceptor might repair an acceptor but generally it takes several parts to get a worn acceptor back to normal. Usually when an acceptor reaches the repair shop, many parts may be replacement. I have worked on acceptors and calculated I did not have to replace the nylon bearings, rubber roller assemblies, etc because they appeared to be good. Even with a new motor/s and mag head, etc, I could not get good acceptance from many of these repaired acceptors. The vendor did not pay for the extra time but I spent many hours swapping motors, aligning heads, etc, attempting to get an acceptor working right. I would try everything, but in the end, I could not get good acceptance. Only after replacing the rollers, and nylon bearings, the acceptors came back to normal acceptance

ranges. What you, or I, think about a given part/s being OK may not be OK! This also includes the bills used testing the acceptance of the acceptor. One day I worked on an acceptor, cleaned the rubber rollers and put on two new belts. While the rubber assemblies did not look that great the acceptor acceptance was very good. Another acceptor appeared to have good rubber rollers and nylons bearing but still had very poor acceptance even after motor, magnetic head, pressure roller, belts, etc had been replaced. I had to good back and replace the roller shaft assemblies and nylon bearings. After these replacements are installed, the acceptor's acceptance was perfect. Playing it safe and replacing parts does not always work. Replacing the nylon bearings and shaft assemblies could put extra strain on a motor and a motor that ran ok may now fail to carry the extra strain. You have to replace the motor. An old motor be ok for a while but may fail in the near term.

Since any part can affect bill acceptance, or the return of a bill, which is not accepted, the question becomes what has to be replaced. Just as important is what else will go bad in the near or longer term. You could put in a rebuilt engine in your car and then find out you need brakes, battery, or a transmission, etc. Rowe does not work on any of the older acceptors, that being the old BA-3 to BA-25s. We still work on these older acceptors and it can get expensive if it has a bad motor and head. If they are bad, generally, the rest of the acceptor is also in bad shape and so many parts may need replacement. The worn parts brings the cost way up. If the acceptor is in bad shape this is the point where you might want to consider getting one of those update kits which includes replacing the Rowe bill acceptor.

There are two basic versions of BA3/35 motor gearboxes. The metal gears motor make a loud sound that make you think the gears are bad. Metal gearboxes on new motors can be very tight and you may have to break them in. Nylon geared motors are much quieter than the motors with metal gears.

Any BA acceptor with a flat center belt was given the designation: new center belt version. There are distinct versions of the flat belt acceptor. The front nylon shaft may vary. Some use a front nylon roller/shaft with a pulley and a long motor belt drives the shaft (BA3, 20, 25 and early BA35s types) while other versions (late BA35) use a short motor belt and the front roller is freewheeling. Verify part numbers before ordering parts. The flat belt takes a beating and generally requires replacement more than other parts. When a worn flat belt slips, you will get poor acceptance.

Replacing the flat belt requires removing the front

trim plate, solenoid, motor, C clips, pressure roller spring, and many screws including two on back vertical plate. The reason for all of this is to get at the shafts to slide sideways so the top plate must be free so the shaft/rollers can slide to one side without doing damaging the rollers. Be very careful with the pair wires going from the front to the rear photocell P4. If you are working on the acceptor upside down, the wires can end up between the front roller shaft and the plate. These wires can then slow down or even stop the motor from running. Make sure the photocell wires are not between the front shaft and top plate! Lookout for wire shorts of the solenoid and photocell wires that go between the two metal spacers that hold the solenoid in place. If you remove the solenoid, or just loosen the screws for the solenoid, the wires may get pinched and short to ground. Poof!

Be careful with the extra length of the solenoid wires. I have seen cases where the wires got down close, and even, under the rear vertical plate and the mag head pressure roller assembly. The pressure roller assembly could not move freely because the wires blocked the free movement pressure roller assembly.

The E clips are made with a press so there is a sharp and a smooth side. The smooth side goes towards the nylon bearing or rollers. The white and rubber rollers must be keep clean for proper operation and extended life of the bill acceptor. Dirt on the white rollers puts extra wear and tear on the rubber rollers. Take note that the rubber rollers are what actually grips and pulls the bill down the bill path. The rubber rollers must be soft and clean. For cleaning the rubber rollers the rubber drive cleaner is better than an alcohol cleaner. You can treat/clean the rubber rollers with rubber drive cleaner. A word of warning! Rubber drive cleaner may expand the rubber. If the cleaner is allowed to bead, or left wet, it will expand the rubber in those areas. Make sure the cleaner is applied evenly and then dry the rollers. Dry the edges too. The rollers must be entirely dry before the top plate is closed. An open bottle of drive cleaner can spill and it stinks. Do not let the cleaner get on plastic items like your plastic screwdriver, or your clothes > Some cleaners melt plastics and stinks too! Never store the acceptor stored for a long period with the top plate pinned in the down position. The pressure will put a hollow spot in the rubber rollers.

The white rollers and springs affect pressure on the rubber rollers. If the wire springs are bad, or the white roller shaft/s have deep groves, replace them. The top plate may be worn because the white roller shaft area has eaten away some the metal. Sometimes the springs and/or rollers are missing.

The magnetic head pressure roller can have problems that lead to poor acceptance. Some problems are metal particles are embedded into the rubber, the rubber is hard, deformed, or the roller will not rotate. There are different versions of the pressure roller so order the right one. The pressure rollers for A/B head must match the head position A or B on the -20 control board. There is a 1/4 inch difference. It is a good idea to replace the pressure roller when installing a new head. The older original bill changers and acceptors use the A position. With the new A/B top plate and bottom plate the A position is towards the outside edge. The B position is closer to the middle of the acceptor. With the older top plates, the head can only be installed in one position so the A or B lettering is not an indicator. The B position is only used with a BC-12/35 -20 boards. This -20 board has an A/B switch. The B head position with the -20 board had better rejection of Xerox bills. The -20 control unit does have the aux check switch, and increased \$1 accept switch and by turning these on and doing a power down/up, you can reduce many of the checks made on the bill and it will accept more bills. NOTE: The pressure roller position MUST match the head position A or B. Later on, I will explain why the B mode is not working out with some versions of the old style \$5 bills.

Metal particles can contaminate the rubber magnetic pressure roller and this will reduce or kill bill acceptance. Depending on the color of the metal, you may or may not see the particles. Long before Rowe made a tape-cleaning card for pressure rollers. I always keep scotch tape on the bench and always ran the tape over the roller to pick up the metal particles. I also made various form of plastic/Mylar tape cleaning strips I could use without taking the acceptor apart. Scotch makes various tapes including the double side coated # 665 transparent tape. With the various tapes, you can make your own tape cleaning strips.

The BA-15 uses a special mag head mounting so the A/B head will not work. If you really want to replace the head you will have to solder the new BA head to the old BA-15 head mounting strip.

Poor acceptance occurs when the head pressure roller does not ride tightly against the head. If you turn the acceptor upside-down and the acceptance improves, the pressure roller may need a new spring. The spring does affect the acceptance yet people very seldom replace the spring. You may expend time and money because the spring is weak, missing, or not hooked in place. Do not get smart and think you can tighten up the spring. I spent hours attempting to get an acceptor back to normal acceptance range with no results. Someone had tightened up the spring and

someone did a nice job taking turn off turns, but... it would only accept 2 out of 10 \$5 bills. There goes another bad quick fix by someone who thinks they have all the answers. A new spring and the acceptor's acceptance return to normal. Check the plunger that might stick in the solenoid. Dirt, oil or damage from salting can cause problems.

The bill pressure solenoid gets the voltage/control from the 30 vdc section of the power supply and control from the computer or logic board. A bad coil or its internal diode is bad it may damage the board. If you hook the bad acceptor to another board, it may blow the control board too. Always use an ohmmeter on the solenoid. Check the operation of the solenoid, and if it is not moving, the board, wiring, or solenoid may be bad. In a continuous run of twelve BA acceptors repairs, two had shorted solenoids. In another case, a BA55 control board had a blown solenoid transistor so there is a BA5 acceptor out there with a shorted solenoid or short in the wiring. Other problems could be the 30 vdc voltage, salted or rusty plungers, maybe someone put WD40, Dura Lube or oil on the plunger, etc. Oil on the plunger is a no-no! Stickation of the plunger could be due to residual magnetism. Swapping acceptors should only be done after you make sure the pressure solenoid is not shorted. A solenoid problem could blow the computer control center and leave you with two machines inoperative. Use the ohmmeter first before swapping!

As a side note: While I never use WD40 in or on Rowe bill changers I realize some people use and swear by its use for some applications. Having seen so many miss-uses of WD40 on/in Rowe changers, I stick to the general statement "don't use it."

Solenoid shorts or miss wiring can be quite dangerous to the control units. A diode is build into the solenoid and if you reverse the wiring or it has a short something will blow. Since we are dealing with 30 vdc if a transistor or ULN2003 control IC blows the damage can reach back to the microprocessor and blow it too. This is quite common with BC-12 and 35 control units.

Many acceptance problems fall outside the acceptor. Miss-adjustment of P1, P4 and mag, defective boards, connections, connectors, power control center, relays, motor speed capacitor in the power supply, etc, are just a few. Swapping a BA into a good machine will help you decide if the acceptor has problems, or not, provided you make the P1, P4, Mag adjustments.

MEASURE the 5 vdc at the acceptor. This voltage can be high, low, or be varying. The bulbs may look normal but do not take for granted the voltage

is ok. Just being lit is not good enough. Use only 755 bulbs. Some machines may develop a varying a 5 vdc voltage. The two caps on the bottom of the 5 volt regulator may have to be replaced. Use a 100 mfd electrolytic and a 2.2 mfd tantalum cap. Some units have a small disc cap that should be replaced with a 2.2 mfd tantalum. Some 5 volt regulators fail under a full load or with temperature. When there was a problem, I always replaced the 5 volt regulator with a 5 volt 3amp version. Perhaps a flashing C error may appear and this could be a bulb/photocell/board coin counter (behind hopper) problem but when you look at the bulbs they are lit. The voltage at the bulbs may not be at 4.8 to 5 vdc. Always use you meter!

Bill acceptor bulbs should be in red grommets so get rid of those old dried up black grommets. The bulb's hot spot must be centered over the plastic lenses so the light can fall on the center of plastic lenses and clean photocells. Wiring can be a problem. Check for loose terminal board screws on the acceptor. Shorts can occur between the lugs or lugs to the metal top plate. The plastic lenses may be cracked, damaged, and should be clean. [From my other notes: To clean plastics, LEDs, photocells, etc use plain water or Kodak camera lens cleaner. Other cleaners can damage the material and some cleaners [like glass cleaners] leave a film which affect the light transfer. Problems occur when bulbs other then 755 are used. Sometimes you can adjust P1 with another type bulb, but when you put the bill in the acceptor, the acceptor starts to run then it goes right into reverse. P1 and P4 adjustments exist and they must be adjusted.

Older Jukebox BA-5, 55 acceptors supply 10 vdc for the two bulbs which are connected in series, 5 vdc for each bulb. If one bulb blows, both bulbs will be out. Change both 755 bulbs when you have to replace a bulb.

The BA-3, BA-5 and BA-15 use # 757, 28 volt bulbs in the lower window display area. BA20, 25, 35 acceptors use 755 bulbs top and bottom.

BC10, BC11, BC115, and BC12 machines have the coin cup in the door. You will need a box or cup to catch the coins when working with these machines with the door open.

Bill path problems fall into many areas. Rubber rollers, white rollers, springs, etc. Belt pulley problems can exist and old pulleys should be replaced with a B version of the pulley. The rear timing belt may be to loose and those narrow shiny B1 belts gotta go. In general, the belts need replacing. A loose belt may have worn the pulleys. Check the motor pulley and the condition of the motor belt idler roller too. One update for older BA

acceptors is the creasing kit. The creasing kit improves creasing of the bill for better bill stacking. It also enhances anticheat features. When changing over to a creasing kit, replace the old rear double roller shaft assembly too. There is a disadvantage when updating to the newer creasing rollers. It takes more motor power to push the bill through the creasing rollers. A weak motor may not be able to handle strain of pushing the bill through the rear rollers. The motor may seem to run ok, but at a certain point, its power just drops off quickly. You may get 4, 7, etc error codes which are really speed related. When a bill is rejected you may get an E, or d, error or you may have other problems with a weak motor. Add a "weak motor" to the E and d in trouble shooting section of the manuals. The "d" as shown up on BC11/20/25 units. I hate to say it but new motors can be tight and have problems too. Over the years, I have several new motors that give me acceptance problems. Some had to be run for a while to break them in.

Murphy's Law strikes again!

Warning: The creasing kit plate is pointed and very sharp. Serious cuts and stabs can occur if you are not very careful when working near this anticheat metal plate. Sometimes the new creasing kit can tear bills or even be cheated. You may have to bend the points on the plate, one way or another, to correct a tearing or cheating problem. An old anticheat plate may be deformed (bent) and give you problems too.

The Juke Box BA-5, 55 does not use the creasing kit or and does not use an anticheat plate. The BA5/55 works ok with the single stacker and generally does not need the kit.

The pulley roll pins are removed with a 1/16" punch. Always put a metal block under the pulley when punching out the roll pins. You do not want to put the bang pressure on the nylon bearings. Nylon bearing damage could turn a simple job into a major repair. When re-installing the pulley roll pins, I do not use a hammer. Align the pin hole with the punch, and use a vise grip, or channel locks to squeeze the roll pins into place. Watch out for serious hand or finger damage if the tool slips.

The anticheat was modified early in the game. The old anticheat could hit could hit the photocell. The blade on the new anticheat is shifted to keep it away from the photocell. Make sure the anticheat spring is in the correct position and the anticheat lever is free to move. There is not much free space between the anticheat hole and the shaft. Dirt, Oil, junk, rust, wear, etc, on the shaft can impede the free movement of the anticheat. A tight action, even on a new anticheat, a bad anticheat shaft, or a dirty shaft, can all cause poor bill return, bad stacking, acceptance failures, and eating of the

bills. Inspect the lower part of the anticheat level where the bill rides along the edges. Generally you will find nicks and cuts which can catch the bill going either direction. This part seldom gets attention but it can cause many problems. An anticheat might get broken while cleaning or working on the acceptor. The anticheat shaft generally needs cleaning and inspection. Replace the shaft if it is bent or worn. Do not lubricate the anticheat lever or shaft.

In my Basic101 notes, I showed how a 'Just in time learning' computer EXPERT program might appear if we looked at a BA anticheat lever: Lets look the expert model with reference to a single item like an anticheat lever on a BA type acceptor. I do not consider myself an expert but I will give it a shot anyway. Try to imagine the following as computer HyperCard type graphic and data screens.

1. Anticheat lever serves two proposes.
 - 1a.1 Tell the computer when end of bill as occurred.
 - 1a.2 Keep someone from pulling the bill back out of the acceptor after credit is issued.
 - 1a.3 A new version of BA acceptor anticheat lever replaced the old version many years ago. This version shifts the lever to the right so it no longer hits or rubs against the photocell (P6).
2. The anticheat lever must move freely on the shaft. The lever is made of 3 different parts glued together and a spring.
 - 2a. 1 The inside diameter may be out of specs.
 - 2a. 2 The parts are glued together and may not be aligned.
 - 2a. 3 Excessive glue may have reduced the hole diameter.
 - 2a. 4 Excessive glue can effect the action of the spring
 - 2a. 5 A 'cracked' lever make stick on the shaft.
 - 2a. 6 The shaft for the lever may have dirt, oil, rust, etc, on it.
 - 2a. 7 The shaft for the lever may be bent.
 - 2a. 8 Spring may be not connected to the correct contact points.
 - 2a. 9 Spring may not have correct tension
 - 2a.10 Someone put oil on the shaft/anticheat.. A no-no!
 - 2a.11 The lever may catch on the fork plate below the lever.
 - 2a.12 Excess metal on top plate may keep anticheat from returning all the way.
 - 2a.13 Rear rollers can break loose from shaft and slide one way or another. If it slides toward anticheat level this can cause sticking or hang ups of the lever.
 - 2a.14 Molding ridge on the round center piece may bind or catch on top plate. You may have to file off.
3. The lever may be worn. The points where the bill

hits the lever can cause excessive wear, make cuts or nicks.

3a. 1 The lever is worn down enough to effect timing. Look for reduced material where the bill hits the lever.

3a. 2 Nicks or cuts catch the bill and prevent the bill from passing forward out of the acceptor.

3a. 3 Nicks or cuts catch the bill and prevent the reversal of the bill back out of the acceptor.

3a. 4 A sharp edge of the top plate may cut into the anticheat.

3a. 5 A bent anticheat plate can put extra pressure on the bill effecting acceptance level by slowing down the passage of the bill through the creasing rollers. It can also cause the creasing rollers to cut the bill as it passes through the creasing rollers.

4. The anticheat for a WBC [World Bill Changer] acceptor was updated.

4a. 1 The spring must be carefully put in the correct position where hits the top plate. It does not just snap into place.

4b. 2 The WBC [World Bill Changer] lever or replacement lever may not have the white strip glued to the lever so the light from the LED is reflected back to the cell.

5 Warning: The sharp points of both the old and new anticheat plates can be very sharp and it can cut like a razor. Keep away from these sharp edges.

With a "Just in time learning" program you get expert information when you need it by interaction with the program. The interaction feedback would be from related problems such as acceptance, eating of bills, poor stacking, \$5 bills in upper bill box, etc.

With all of the problems listed, why do vendors very seldom replace anticheat levers? Please put this list in your Magic Wand notebook. You may need this essential information some day! After the fact, it is easy to simply say; "Check the anticheat and if it is bad replace it. Always check the new one. Always remove the shaft holding the anticheat lever and shaft and clean it. Replace it if worn. Do not lubricate! Clean out the anticheat hole.

We are not done with anticheats yet. One day I had repaired an acceptor which was in fairly good shape. A new flat belt, new rear timing belt, anticheat level and two 755 bulbs and the acceptor was back in good shape. The test of some twenty to thirty bills showed good acceptance and no other problems were noted. The acceptor went back to the vendor. The next day the acceptor was back in the shop with a report which stated the acceptor was given a 9 error code when rejecting bills. I was stuck because the 9 error was pointing to the rear end of the acceptor which I had checked

the day before. The acceptor had been rebuilt about 1 1/2 years before this repair. Based on the manual's suggestions for a 9 reject error I checked the action of the anticheat level and found it to be tight when I pushed it in. I needed to find out why this anticheat lever was tight. I removed the spring and found the excessive glue under the spring area. At times, the spring got to a certain position fell into excess glue grooves on the anticheat and the spring would bind. This case proves you can check a part and have a working system but that does not mean your, or my, conclusions are valid. I presume by the time the acceptor left my test bed and it was placed into the machine, the spring had shifted slightly and problem showed up. Had the spring been moved a little bit before I had to re-test it I might have never seen the 9 problem on the test bed.

Photocells do go bad. Besides burning out (failing) and some may be slow to respond to the light changes quickly. Changing it is the best way to find out if it is bad. Please note these cells must be rewired the same way they can out. Do not swap the wires.

Many control units are tagged NG because the board does not work with an acceptor and the person knows the acceptor works with another control unit. There are reasons why this can happen. One is the photocell/s are weak and really out of spec and the board is be OK if the cell was up to spec. Another reason for failures is the contacts on the board and/or machine connector/s are dirty. The non-functional board is presumed to be defective but when swapping the board you scrape the connector's contacts and may correct the problem. A simple and, basic, cleaning of the bill changers cable connectors and board connectors may have gotten the unit back on line. When a board is repaired, or exchanged, we spend time looking for problems which do not exist in the control unit. Often we find basic P4 adjustments were not made. A valid service report generally does not exist and/or no an error code is not given. We always clean the control unit's contacts and use a know good acceptor.

A slow response of the cells or slowness of anticheat can cause a bill to be pushed out of the acceptor without giving a valid vend pulse. The machine steals the bill. Another stealing problem could be bad motor opto triac driver, triac/s or relays. The optic driver, triacs, or relay is told to turn off, but it remains on for a short period. The motor could run a little longer then it should. Instead of stopping, and reversing. The bill might pass right out of the acceptor and the bill is stolen. No valid vend pulse will be issued and the bill will not get pushed into the bill box. Some of these problems might be temperature related and/or only

occur occasionally. Presume the motor reverse does not occur. The bill moves forward then stops and the reverse does not take place. In a short time, another burst of motor forward occurs and the bill, which is now almost out of the acceptor is pushed forward and out of the acceptor. The bill is stolen. Keep an eye on the error display for any codes when the bill is passing through the acceptor.

Speed problems may be found in several areas. The speed is controlled by the motor itself, AC line frequency (normally not a problem), and by a phase shift network using a motor capacitor and a resistor. You will find if the cap is bad, the speed will be off or the motor does not have full power. The motor may even just sit there and hum. The same kind of condition may exist if the wiring or connectors are bad. Sometimes a cold connection or broken connection will cause problems. As an example, in the BC12 and BC12R power supplies, the phase resistor is mounted on the connector board in the back of the supply. Often the resistor lead connection gets broken away from the board and it has to be re-soldered. Belts and pulleys may be defective and can cause motor to lumber. The rear-timing belt is a predominant problem. Get rid of the shiny "B1" belts. Replace bad pulleys. When a belt jumps a pulley, the motor speed will be affected.

A tight motor belt will slow the motor down and a loose belt will jump. The manuals do give a timing procedure for checking motor speed but you have take the results with a grain of salt. This test is made without the strain of a bill passing through the bill path. If the speed test is unsatisfactory, it may fail for other reasons like wiring connections, or there is a problem with motor speed cap or resistor. Remember just because it passes the Rowe speed test, this does not mean the speed is ok when a bill travels down the bill path or the bill passes through the creasing rollers. Acceptors, changers, or the motors may have to be swapped to find out if the motor is defective. Normally when a loose belt rides out of the pulley the motor will slow down. You may not see it, but it happens. The motor belt idler roller hole may be out of round, the idler shaft pin loose or the plate/shaft could be bent. These items could cause the belt to tighten and affect the speed, stop the motor, or even keep it from starting. It may appear the motor is bad but it may be ok.

Bent shafts can cause speed problems. The rear double rubber output rollers rides close to the top plate. A bent shaft is not the only thing that can cause the roller to become out of alignment or cause extra wear and tear on an acceptor. A loose rear-timing belt or a bad pulley may cause belt jumping. The jumping puts a pull pressure on the

shaft and deforms the nylon bearing. As the nylon-bearing hole becomes larger, more belt jumps occur and the wear increases. Now you have done a complete rear end rebuilding job. Timing belt, nylon bearings, shaft roller assembly, pulley/s and maybe install a creasing kit if the acceptor did not have one. Perhaps the anticheat lever and the motor needs to be replaced. The BA may run ok in the forward direction, but when running in reverse, the rear rollers can get caught on the plate, shutter occurs and motor slow down can occur. In either case of forward, or backwards, rubbing of roller/s against the plate will cause problems no matter what causes it. Notice how each part affects another part and replacing just one part, say a timing belt is only part of the fix. Let us say the above conditions exist and you change the motor. You may have fixed the failure mode, but not what caused the failure in the first place. There is a little adjustment room of the vertical bracket plate. You may have to loosen all four screws and re-position the plate so it clears the rear rubber rollers. In a few rare cases adjustment did not work. The edges of the lower plate casting had to be filed down so it did not hit the rubber roller/s. This filing of the casting was only done after the adjustment of the vertical plate was done and the rubber still hit the plate's edges.

The short motor belt may be loose and may jump. It gets worst as strain is put on the belt. The idler roller bracket does have a some adjustment. Loosen all the motor screws and push down on the idler so the belt is adjusted correctly. If the short motor belt is still too loose, there is a non-ROWE Bear mod. Make the holes in the bracket longer so the bracket/idler roller assembly can be pushed down and this will tighten the motor belt. I use Dremel tool to enlarge the screw holes upward. This allows you to push the plate downward thus tightening the belt. The mod should not be made until all other items are checked. Are you working with a new belt and is the bracket is ok? Is the pin holding the idler roller is ok or is the idler roller center hole worn, etc?

Another reason for motor slow down can occur if the center belt was replaced and the two wires ended between the front shaft and plate. Re-read my notes on replacing the center flat belt. Who knows maybe the wires were in the wrong place since day one!

Nylon bearings wear out and shafts may even cut into the side plates. If this happens, side plate replacement will be required. Use the Magic Wand oilier to keep the nylon bearings lubricated. Belt tensions should be just tight enough to keep the belt from jumping the pulley/s. Tight belts cause excessive damage to the bearings and slow the motor down.

This document covers faulty operation of items that can cause the acceptor to steal a bill. Motor control and/or relay or triacs for motor reverse could cause a problem. Many times people look at stealing of a bill as a case of the VEND and STACK did not take place. It could be a case the bill was not accepted and the bill was not returned. Bad parts such as the anticheat lever or a rubber roller is freewheeling on the rear shaft, etc, may cause the problem. Besides slipping, a loose rear rubber roller can slide and if it slides toward the anticheat lever can impede the free movement of the anticheat lever. This can create various errors and poor acceptance. As you can see problems maybe simple, or hard to find. It might be a missing E clip on the output roller shaft.

Bill jams can be caused by the unacceptable alignment of stacker. Stacker miss-alignment could cause a bill jam and bill may be eaten. A slow P6 photocell, or bad anticheat could cause the bill to pass out of the acceptor and it will not get stacked. Find out if the bill was really accepted in the first place. Watch the LED indicators on the board.

When looking at poor acceptance problems, consider it may be more than a single part. Each part could be operating at less than 100 %. If the control board mag gain is down 30 %, the mag head is down 30% and the pressure roller spring is down 20 %, we now have an acceptance range loss of 80%. We have not taken into account all of other factors that take away from acceptance of the bill such as poor motor capacitor, worn rollers, or any one or more worn parts. When we add a few intermitting wires or connector problems, we have major problems with the system.

There is no magic wand when it comes to locating a problem of acceptance. All the parts are inter-linked so swapping may be required to find out which part of the system is at fault. It might be the BA acceptor, cables, connectors, control unit, the power supply, large motor speed cap or a bad connection on speed resistor. Improper P1, P4, or mag adjustments could be the problem. Where error codes are given you might get a "Mag" [4] error and you cannot get it to work. The problem could be related to P1 adjustment being a bit too low or a photocell that has slow response. Make routine adjustments of P1, P4, and Mag gain. The manuals cover these adjustments. The mag gain adjustment should always be made.

There is a difference between \$1.00 and \$5.00 acceptance ranges. Generally, the \$5.00 has tighter specs and many acceptance failures occur with the \$5.00 bill show up long before the \$1.00 acceptance failures.

Mag adjust procedure – **The Bear's procedure**. –

The best Mag procedure is to work your way from both ends of the adjustment pot in steps. Once you find both start-end o'clock range positions of where the bill is accepted then put the pot in the middle of the two acceptance points. The \$5 acceptance range is generally narrower but you must do the mag adjustment with both \$1 and \$5 dollar bills to get an idea of the ranges for each. In most cases, (not always), the middle of the \$5 range will cover the \$1 range. Let us say the bottom end of acceptance is 6 o'clock and the upper end is 12 o'clock. Put the mag gain in the middle of the active acceptance range, in this example, at 9 or 10 o'clock which is slightly more toward the max gain point. Since bills do vary, if you have problems, try other bills. You may have to try slightly higher setting of P1 and/or P4 and always use 755 bulbs. Using other types of bulbs is a NO NO! Use the error codes and the manual to help pin point problem areas. You may find you are unable to adjust the mag gain or the adjustment drifts for some unknow reason. Besides connection/connector problems, the drift may be the result of something on the computer board or it could be power supply related. You may not see anything wrong on the LED indicators but voltages could be at the root of acceptance problem. It might be voltage levels, ripple, or noise problem. If you are having a problem, you have to measure the parameters at the time the problem exists. Keep an eye on the AC line voltage too. Read my Bear note: "Voltages_Ripple_False_positives".

A case comes to mind where there was a bad connection on the 30 vdc diode on the plug in power supply card. When the machine was off for a while it would start up ok then you could no longer adjust the mag gain and at some point later in time the mag LED would stay on all the time. Turn the power off for a while the machine would act normally then the cycle would start all over again. The same type of problems could also be in the computer control board or has I said bad connection/s and/or connector/s, or has I will point out later; someone installed the wrong part on the computer board.

Let us look at some cable/connector problems. The magnetic head has 1.2 to 1.3 vdc on BA20/25/35 acceptors (BC11-35s changers) and about .3 vdc on BA-3 (on BC8/9/10s). The voltage comes from the control board or mag amp card. To measure the voltage, just follow the two head wires back to the plug and measure the voltage with the acceptor connected. If the voltage is too high then you may have an open connection going towards the head. Maybe under the shrink tubing at the head or the pin connector is loose. You can use Ohms Law, (if you know how), to find a problem. The board supplies voltage and the head is the load. Do not solder the wires to the head. If you do not have the

small connector pin, make a small connector pin from another type of connector pin. You might have to squeeze it down a bit. Modify the pin so it works.

Head alignment may not be as easy as you think. You should use a known working system. The factory alignment is done on a special test bed with special optics. When installing a new head and change the pressure roller and spring. The head alignment is made with three (3) directions in mind, front to back, left to right and azimuth (angle). It is a trial and error item. You may be lucky and hit it the first time, but you could spend a long time getting it right. We covered A and B head position and matching the pressure roller to the head position earlier. With the B head position, you need -20 boards with the switch in the B position. All other control units except -20 units are A mode operation so use the "A" mode head position. Anytime you read the manual trouble descriptions, read the complete description before taking any action. Stopping short could miss-lead you and you may lose time finding the real problem. The manual does not cover all items and it presumes you know and use basic service procedures.

One example might be an error 4, "did not read 1st mag signal." Many items could cause this failure. A speed problem, mag adjustment, P1 or P4 adjustment or a bad computer board can cause the problem. Keep an open mind! The screws holding the lower casing in place might be loose or missing. Wires in the front under the motor might be under the input shaft. A screw holding the photocells in place are loose or broken. The top plate might be bent. Usually a single item fix may not be enough to get an acceptor back to a good acceptance level. The exception might be a worn center flat belt when the rest of the acceptor in good shape. You may get misleading error reports like, A or E, brings you to P4, P6 (anticheat), and/or rear end acceptor problems. After trouble shooting everything on the rear but you may be forced to change the motor even if you think it is ok. You have tried everything else and not fixed the problem. Do not be surprised if the rear end problems turn out to be a bad motor you thought was ok or a combination the motor plus other worn parts. There have been reports acceptors eating bills and I saw a bill get accepted, and then the motor went right into reverse as soon as it passed by the anticheat. I presume this reversing was the reason why the machine stole bills occasionally. There is stress on the motor as a bill goes through the rear creasing rollers and this can slow the motor down. These are the type of problems where you should try the acceptor in another machine and/or swap top sections to see if the problem is in the upper or bottom part of the acceptor. (Use the Divide by 2 rule).

If you have a working system and you are trying to locate a problem with another acceptor you can swap the upper section with a working unit or visa-versa. The idea is to find out which section, upper or lower is defective. Keep an eye on the rear section of the acceptor and swap unit with creasing rollers with other acceptors with creasing rollers or, non-creasing units with non-creasing units. Warning! The swap is only allowed when the acceptor of the same type. People are mixing the old style with flat rollers with new style creasing rollers when they swap top sections. This leaves with a lower section and top plate rollers mismatched at the rear of the acceptor. You now have two creasing and two flat rollers. This is a no no!

For those looking for and us less expensive repair shops for repair you may find you are not getting a bargain. Let me talk about a BC35 acceptor I looked at which had been repaired at another shop. The acceptor had been repaired about 11 months earlier. It appeared that the magnetic head had been replaced but the hardened uneven pressure roller had not been replaced. As a result, the new head was no longer new in that it had uneven wear that was excessive on one side of the head. The center flat belt was worn and I could not tell if it had been replaced when it was last repaired. I do not think it was. One of the reported problems was eating of bills and I think the anticheat level had never been replaced. The cuts and grooves in it were so deep that they must have been visible 11 months ago. It should have been replaced then. The person doing the work had not lubricated the acceptor so the bearings were dry and showing signs of wear. The timing and motor belt were stretched and had to be replaced. I leave it to you to decide if the vendor really got a low cost repair 11 months ago. How much time and money did he lose with the acceptor eating of bills and he had to get it repaired again in only 11 months.

Years ago the BC12/35 -20 kit was a good way to get a spare BC-35 acceptor and BC 12/12R/35/ -20 board. The kit was offered for an update to latest 1/4 offset BA35 acceptor and newer -20 board control board. The kit was offered for a number years at a discounted price of \$450 but those days are long gone. Just remember position A is used for older original acceptors or with a -20 board with "A" ON. "B" position heads which only works with -20 board switched to the B position.

Manuals get lost and there will come a day when you will not be able to buy them. Remember those little error codebooks and BC8, 9A1, 9A15, 10, 11, 115, 20, 25 35 manuals cannot be purchased anymore. Buy extra manuals now! Some machines are very old still running today but there are no manuals. You should have a master file copy or two on hand. There is no early acceptor parts list or

the data on the early units. I just (1993) winged a repair on early BC-8 mag/logic/power supply units without any schematics or parts list.

Your style of trouble shooting or service is yours and I do not presume I could change it. There is however, an order of things that should exist when serving equipment. You will need spare/s, tools, manual or whatever it takes to get the job done. The following is not a test of any kind but you can reference your work style and the way you attack service problems.

What type of machine, BC-what? I do not know!
Did you adjust/check P1, P4? No!
Did you measure the voltage on the bulb? No!
Are they 755s? I did not check!
Are the bulbs centered over the plastic lens?
I will look!

How did you adjust mag gain?
I didn't! Do I have to! I do not know how!
I don't have a manual!

What was the error code given when the bill was not accepted? I didn't know there was a code given!

I didn't look! Is it important!
Normally error codes are given when a problem or bill reject occurs. What did the manual say about the error code you got? I did not look for an error code!

I do not remember it!
I do not have a manual!
I do not have a spare xxx!
Did you check stacker alignment? No!
Do you have the correct mag head voltage? No!
What should it be?
I do not have a meter with me!
The meter is in the truck!

Etc,
I leave the "etc!" for you to fill in with your own style of doing things. Your order of things may differ then mine. Was the head pressure roller free to move? Is the timing belt a narrow shiny 'B1' belt? Is the belt loose? Is the anticheat lever damaged, worn, nicked and does it have free movement? Is there a loose rubber roller/s on the rear shaft? Is there a wiring short in the window lamp area? Did you check the motor belt tensions? Did you clean/check the connector plugs? Do you have loose connector pins in the connectors? Do you have bulbs, anticheat lever, photocell, belts, or a spare acceptor or control board? What did status LED indicators vend, hopper, and display indicate? Do you have a magic wand oilier and the manual?

Having the parts, meter, and tools you need is a must if you are going to fix even the simplest problems like changing an anticheat lever, timing belt, double output roller/shaft, pressure roller spring, 2.2 tantalum capacitor for BC12,35 5 volt regulator, rubber drive cleaner, belts, 1/16" punch,

metal block, 755 bulbs, Magic Wand oilier, etc.

You have to get and read my Bear notes on hopper: "Rowe Bill Changer Hoppers" and the stacker notes: "Rowe Stackers" information. Hoppers need good preventive cleaning with more than just simple brush cleaning. You need a good chisel tool to chisel away the caked dirt on the track coin side areas. Make a long wooden or plastic chisel out of hard wood or plastic or a second best is to grind or file the handle the non-brush end of hopper brush into a chisel. Use Dry/Slick to clean and lubricate the hoppers.

Stacking problems will occur. Problems may be items like defective motor, brake, brake spring, Residual magnetism (no rivet in metal brake arm), gear box, micro switch, switch actuator spring, switch adjustment, electronic driver assembly, stacker alignment, pusher plate alignment, damaged or nicked plastic chutes (guides), bill box adjustment (or slide back away from pusher plate), latch slides over bill box, junk jams such as (screws, washers, hopper brush, books, coins, etc), broken shafts, missing E clips, wrong stacker SEP/ALTERNATE switch setting, connectors, wiring, voltages, relay, computer board and, of course, slow or dragging when the bill comes out of the acceptor. Take out the bill box/es and watch the bills fall into the stacker.

Sometimes ohmmeter checks are not made by the service person and the second or third control board is blown when a board swap is made. Always check for shorts of motors, solenoids and wiring with the ohmmeter before swapping boards or acceptors.

I wrote notes on Jackpotting (Flashing F) problems [" Jackpotting, Fs, Bucket Power On, and Crashes"] but for those who want to see how extensive the problem can be, here is a list of just a FEW problems found to cause jackpots or flashing F problems. The items listed below are located within the machine but external problems such as AC line voltage dips, glitches, etc, which can also cause various machine problems.

You might be able to locate the F problem by inspection or changing parts like diodes but working in the field is hard to do when you have to tear the machine down to the level required to inspect or change parts in the machine. Here are just some of the F problems. Here are only a few of the types of problems you may see/find.

Solenoids:

A test of \$1 solenoid showed a short once in 1,500 vends and another one, (BC25), once in 2,501 vends.

Control board socket:

Bad connector pins. (Some people try to fix the connector on the board with a thick layer of solder. This wrecks the socket's female pins. This is a NO-NO!)

Control board:

Bad transistors in the driver and/or switching transistor. Control board, Cold solder joints on CPU, intermittent crystal, etc.. Loose connections on 5 volt regulator, or broken leads. Bad bypass caps, leaking relay driver transistor.

Coin lock out:

Relay coil shorting.

Wiring shorting at terminal strip in mech housing.

Hopper:

Shorting the 5 volts by pinching coin counter sensor cable.

Dispenser:

Cable pinched in back of dispenser. Cold solder joints on solenoid diodes, change diodes Pinched solenoid wire/s, under solenoids, metal covers, screws, etc.

Power supply card:

Intermittent and/or cold solder joint/s on board. Small 1N4001 diodes should be replaced (1N5404) 1N5404 diodes. Bad contacts on power supply card and/or socket. All burned or holes on contacts strips.

Component breakdown (bad parts). Anywhere:

Loose wires and broken wires on connectors in power control unit, transport, terminal areas (including at dispenser block). Bad motors. Short to ground of 30 vac or 30vdc which goes to the acceptor as one example. It could be any 5, 14, 30, 40 or 117 voltage short or open. Metal object such as a screw or nut could fall into the wrong place.

Power control center. Loose cables, cold solder connections on power control interconnect terminal and boards Short or bad (break-down) 30 vdc pass transistor. Bad connections in crimp connection and terminals. Bad coin counter or counter diode/s. Bad caps on 5 volt regulator, use 100 mfd and 2.2 Tantalum to replace disk capacitor, power relay or bad connections at relay socket.

When replacing the 5 volt regulator I like to use the 5 amp UA78H05KC replacement.

Acceptor:

Shorting bill pressure solenoid in acceptor. Breakdown of diode inside bill pressure solenoid.

Dual Stacker:

Breakdown of \$1, 5 solenoid, diode in stacker.

As you can see, the problem may not be confined to one area or unit in the machine. Replacing just the board to fix the problem with the board but it may not fix the problem which caused the board to fail in the first place. Things degenerate quickly if the basic checks like checking solenoids, wiring and diodes are not made before replacing or swapping units like a power supply, dispenser, stacker, computer board, etc.

The hard thing about these problems is checking something with a meter does not mean the part checked is OK under real time load conditions. Improper packing results in shipping damage. Many times the back end of the acceptor is damaged. Sometimes the front trim casting gets broken and/or damage is done to the side plates when the trim casting is hit.

Some vendors presume too much and think the supplier should have all the answers. A case in point: Vendor: "Send me the belts for the BA." Does the acceptor have long or short motor belt? Does it have a flat center belt in the front of the acceptor? Which type of input roller assembly (there are three types)? If you do not know what belts you need, or have, on the BA, how can another person give you the right parts? Check your manual yourself and find the correct part numbers!

Vendors presume a given problem will exist when equipment is sent in for repair but this is not always true. A simple adjustment of P1 or P4 may not be done when a swapping of a board or acceptor. A combination of a board and acceptor works while another does not. The vendor presumes one or the other unit is defective. Neither unit is defective and just a routine adjustment of P1, P4, or Mag was needed. We get over two units a week where a vendor expends extra time and money because they presume there is a problem in a given unit/s and it is not in the units. Extra time is expended checking for possible problems which never existed in the unit the first place. Most vendors do not place a written error report with the equipment when it is sent for service, exchange, or for just a test. A vendor should never presume no adjustments are required after it comes from the repair shop but that is not true.

It is essential to identify what error code you get when a bill is rejected (look at display or status LED when bill is returned) and then look at the manual for the error code. Even those who should know better, disregarding the error code and to start exchanging equipment can get you totally lost. You may have no idea of what to do next and expend time, money, and get no valid results. I know many vendors think looking at error codes is non-essential and waste of time or is not important in

locating and fixing the problem. If time and money are not important to you, and/or you do not mind being a below par service person, keep ignoring the error display codes and status LEDs. My records show some companies send in equipment for repair and only ten percent actually had real problems. When normal adjustments (P1, P4, Mag) are made, or switch settings are made the equipment tests OK. Generally these vendors cannot tell you what error code existed or what the problem was. No error report is given or a report goes like this; " It didn't work or the bills goes in 1/2 the way."

Does this sound like you?

Mr. S : What was the error code when the bill was rejected?

Vendor : I did not see any?

Mr. S : Did you look at the error status display when the bill was rejected?

Vendor : No! or I looked but I do not remember what it was!

There are instances where getting an error code is an important part of service wisdom. There are only a hand full of service people who always communicate the reasons, error codes, or the number of error blinks, when they remove the equipment from service. Error and problem reporting is important because the problem may not show when the unit is tested and extra time has to be spent looking for a given problem which does not exist when the unit is tested or we may have a problem which only shows up intermittently.

Sometimes people do try to use, or report, an error code to help fix their equipment but they have not learned how to read the error code correctly. The most common error is the confusion between the flashing and non flashing codes on a control unit. On the BC11/20/25/25mc unit to the left of the error display is an LED. When a flashing error occurs, the LED blinks on and off to indicate a flashing code exists. The display letter or number does not flash! A flashing problem is a serious fault and the machine is out of service. The out of service light will be lit and the stacker will be pushed forward into the bill box and the 40 vdc LED is not lit. Normally a non-flashing code will appear on less serious problem such as the error code when a bill is rejected. Many vendors have the board and/or acceptor is serviced and we may get the report; "I have a steady "C" error. When the units are checked, the "C" problem is not found. Why not? You guessed it, the error was a flashing "C". They did not look at the LED next to the display. It was flashing but they did not see it. They did not note the machine was out of service, the stacker was pushed into the bill box, the 40 volt led was off and when they put a bill into the acceptor, the motor did not start. Please note these "out of service"

conditions just listed are reasons why equipment is sent in for repair, and normally the error code is not given. If the equipment tests OK and the flashing LED does not blink, we have two serious problems in C example. The first ponderous problem is an "operator error" when the error was noted as a steady C instead of a flashing C error. This error lead the service person down the wrong path and trouble shoots the acceptor and control board. This error expends a great deal of time and money. If the "operator error" did not occur, the person would be fixing the real problem and found the manual states a flashing "C" the problem relates to the coin counters and bulbs behind the hoppers. Maybe a bulb behind the hopper is not lit. An additional "operator error" occurs if they see a bulb is not lit and presumes the machine should work if the hopper position with the dead bulb is not used. We have come full cycle and now you can see why the person was attempting to get the acceptor and/or control board fixed instead the simple fix of replacing the # 755 bulb on the dispenser. It is a no win situation!

The above touches on a dilemma for vendors because this problem does not involve special complicated mechanical, electrical, or electronic processes. This is a serious paradox. If the problem is a simple as a burned out 755 bulb/s, then the fix is change the light bulb. "No room in margin" and reducing your costs mandates corrective action be taken to locate and correct these types of dilemmas from re-occurring. One reaction might be a report form used for any given problem. The type, model, serial number (if one exists), correct error code, status, number of blinks, etc, must be listed along with the problem and action taken. How can anyone fix anything when the correct input information does not exist? How can someone look at a manual for help without right error code? This is how they do it: Simple go ahead and expend extra time and money which should not be expended. This sounds harsh, but paying the bill is detrimental to the bottom line. How many times have you, or your service people, been asked the following questions and what was the response given?

" What type of machine, BC what, etc? "

" What unit are we talking about? "

" What was the error code? "

" Was it a flashing code? "

" How many status blinks did you get? "

" What did the manual say about the error code? "

In other notes I show you a slip of paper that fits into a repaired acceptor and when a service person uses the spare acceptor he has a handy slip of paper which has question form printed on the slip and once filled in the information the person can put the filled out from into the bad acceptor. Use whatever system it takes to get the reporting done.

Most vendors cannot answer these questions the first time around. Many times the answer to these questions is: "I will go back and check," "I did not look at it" and more often, "I do not have a manual, meter, etc." These responses indicate an order of things that leads to the liquidation of the repair budget with extra un-warranted expenses, time wasted, travel expenses, the check and/or repair costs and maybe shipping charges. Sometimes the cost is an expensive repair bill. Additional income dollars may be lost because the equipment is off line.

Keep a # 755 bulb with wires in the machine! Maybe a bulb or its wiring is intermitting and I have seen cases where a vendor looked at the bulb and saw it was lit. The fix for a problem might be just to replace bulbs and check the wiring. Voltage on the bulbs should always be checked. Invest in manuals and enforce the usage of them. In order to use a manual, you need the error code, etc. Not having a manual in the machine, or truck, suggests a person does not need the manual and so he/she does not need to know what the error code is.

There are all kinds of excuses for not having or using the manual but the expense of one light bulb dilemma more than pays for the cost of manual after you add up the total time and money expended and negative income flow while the machine is down. Other operator errors besides not noting flashing or non flashing error include miss-reading the letters and numbers that are given.

Another dilemma can exist which can create a serious paradox for the vendor. This occurs when flashing LED does not light as it should when a flashing error really exists. With a flashing error exists the out of service light is lit, the stacker is moved forward into the bill box and the acceptor is not ready to pull a bill into it.

As stated earlier, another problem could be not reading the error code display correctly or part of the display is defective.

| | | | |
|--------------------------|--------------------------|--------------------------|---------------------|
| # 6 | Letter b | Missing segment | |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | What appears as a 5 |
| <input type="checkbox"/> | <input type="checkbox"/> | ?_ | is really a 6 |

Make sure you read the display correctly. People have looked at the display from a bad angle and flip the number or letter to the wrong code. Sometimes a segment of the LED may be non-operational and the result is the wrong code is read. Always check the bill return switch and/or test to see that the display test figure 8 is operational and all segments are lit. These types of problems can and do occur and can lead a person to go off

on a wild goose chase.

Check all seven (7) segments!

When a serious error code exists and the AC power is killed the original error code is lost. When the power is turned back on a [1] will appear as the error code. However, there are times when this does not happen. If the Bill Return circuit is made (micro switch bad, miss-adjusted, etc) the machine will come up with a flashing [8] and the manual will direct you to other parts of the machine like the coin mech counters and not to the bill return switch and/or circuit. If the machine comes up with an [8] when powered up also see manual section on a steady 8 even if the 8 is flashing and check the bill return lever and micro switch. Put this one in your notebook!

Getting back to the [1] error code. This is not the error that put the machine out of service. Many vendors turn off the AC power to reset the machine before they look at the error code. The error code is masked by a [1] error code. This will not help you find the reason why the machine went out of service. If you are lucky, the problem will show up again when you reset the computer but sometimes the machine will reset and operate correctly. Chances are you may spend an hour or two checking the machine and there is no error. The problem may re-occur after you leave or the next day, etc. Lets presume it was a "E" and the right motor ran. It dropped an extra coin in the last vend bucket \$1. This means the \$1 bucket is holding \$1.25 and since you did a power down, you may have missed seeing the "E" displayed. Maybe you did not count the change in the buckets so you have not idea of what happened. At best, a report might read like this: Machine out of service. Did AC power on off reset. Got a [1] error but everything was OK. Problem did not show up again while I was there.

Or this:
Machine out of service. Error display was displaying an "E" The manual said a motor ran. Pushed reset. Used TEST switches to dump all three buckets. The \$1 bucket had 5 quarters in it, the rest had normal counts. Right and left hoppers were empty. Center motor may have run when it should have been off. I checked cables for shorts and pinching. Nothing was found. It may be a defective board which caused the center motor to run so I installed my spare board in an attempt to eliminate a call back. Check this control board for bogus center motor run condition.

A computer board may give you a [1] and the 40 VDC LED is out but you are not able to find another fault code because no one turned the

power off. Was it one of many power problems? This one may be hard to find if you seldom use a meter. The circuit that senses a power loss really comes from the DC power going to the board. Everything may seem ok except sometimes you get a [1] error. You may find the 14 volt LED looks ok but, in fact, the 14 vdc voltage is too low and/or has a lot of AC ripple on it. Everything seems to work so you do not check the voltage at the computer board. Change the power supply card or check connectors and cables, etc, to find out why the voltage is low. The voltage may be down to 9 or 10 volts, and/or it may have high AC ripple on it, or maybe the line voltage is just too low. I do not know if you ever checked the 14 vdc with a meter and chances are you never use the AC scale on your meter to check the AC ripple component of a DC voltage, in this case the 14 VDC voltage. For some unknown reason your Basics 101 training or schooling may not have showed, or told you, about using AC scale of your meter to measure the AC ripple content present on a DC voltage. Checking the DC voltage and ripple VAC is Basics 101 and a simple way to locate the type of [1] error problem we just wrote about.

There are some conditions for error codes that might be misleading. You may have a two hopper machine but the control unit does handle three (3) hopper changer. You might get an error code such as a flashing "E" and the problem could be in the circuit for the center hopper motor. You may not see, or hear, a center hopper motor run in your two-hopper changer but... it will still shut down with the flashing "E" error code which is a motor ON when it should be OFF error.

Getting back to acceptors, sometimes people attempt resolve a problem and do more harm than good as in the case of using WD40, belt dressings, or tightening springs too much. When this occurs, problems go beyond normal wear and tear occur. Some quick fixes used by vendors do more harm than good. What can I say to you " anything to get it going people " after I see some repair people attempting to get away with not using recommended # 755 bulbs and then down the road have to send the acceptor for repair which it has strange problems and errors codes which are totally eliminated by putting in # 755 bulbs. How is your supply of 755 bulbs? As you can see, or will discover in time, some short term and/or low cost repairs may not work as you presume they should. Some of these non-valid repairs will end up costing you superfluous time and money. We also see, even after many years, a problem which we have not seen before. You will also see what I have been writing about when I say some problems have to be addressed at the site and not in the changer.

Four cases of acceptors cutting bills were phoned in on February 8 and 9, 1995. I was shown two bills that were cut lengthwise. One was cut into two parts and the other one was cut into three parts. Cuts occurred at the inside edge of the creasing rollers. I had already called Rowe and they told me the anticheat plate might be bent to far. On one acceptor, I replaced the anticheat plate with a new one and rounded the ends of the nylon creasing rollers. Since the crease in the bill appeared to be less than the cut bills I returned the acceptor. When comparing the anticheat plate I had taken off and it looked like a new one. I called Rowe again and told Phil I did not see the plate as a problem and asked if he could check to find out what else it could be. Another Rep (Ken) said he had gotten reports of cutting bills and it seemed to be related to cold weather. Phil then suggested it maybe the nylon rollers were affected by the cold. This made sense since we were in a very cold spell. I had never seen the problem on my test bench. Mr. Car Wash who had one acceptor that cut bills told me he would look further into the problem on the 8th. He came in late on the 9th for other things which had to be done. He did have the acceptor that cut bills. He had a BC-12R with a working heater and he had looked at the problem earlier that day. We were in the low 20's temperature during the days and 0 to 10 degrees during the nights. He had taken the acceptor out of the machine and it was cold. He hand cranked a bill into the acceptor. When it reached the rear rubber rollers and lower creasing rollers, he saw the bill being cut. I got the acceptor and the white creasing rollers were not sharp so that left only the rubber rollers. I found the problem! The rubber edges next to inside edge of the creasing rollers were very sharp. I rounded off the inside edges of the rubber rollers which cut the bills by running the acceptor motor and removing the edges with a file. A test showed the cease in the bill was not has sharp. After the acceptor was re-installed in the changer. In a few days Mr. Car Wash reported the problem no longer existed. What Rowe had finally said, "Cold" was only part of the problem but Rowe did not have a valid fix. Rounding off the sharp edges of the rear lower rubber rollers was the proper fix. This was been reported to Rowe so it is up to them to find out why they did not have valid fix, what has happen to these rubber rollers causing the problems have started to show up now. I wish to thank Mr. Car Wash for finding and helping us solve the problem of bills being cut which gets worst with colder weather. Other owners of BC12R in 1995 and this year (1996) reported the same problem and we were able to tell them how to fix it.

This cold problem backs up many cold and hard facts I have and will write about. Many problems have to be found and fixed at the site under conditions that exist at the time the time the

problem is occurring. Neither Rowe nor I have all the answers and in many cases you are the ones who define the problems and conditions and even the fixes that resolve a given problem. The people who find and fix problems, as in this case, and many other cases, make my job a lot easier and help you keep your equipment on line.

Sometimes problems come and go and I never find out why. In 1998, I was able to nail down one reason why problems occur and may not show up on the test bed. We all know humidity can cause system problems and in June 1998 heavy rains were connected to BC12/35 board failures. In these cases the people pulled the boards as soon as failures occurred and I got to test them. In three cases on the same day, I found each of the boards had the same problem. The foam pads on the back of the board were old and compressed, in fact, stuck to the copper side of the board. I could feel the dampness in the foam pad. I had to clean off the old pads with a stiff brush. I got a new pad (part # 251897-01) and installed it on the back of the board. Problems such as computer lock-up, buckets firing, hopper motors running, and poor acceptance went away. With a damp pad any type of problem might occur. A normal routine maintenance item is to replace old foam pads on the back of computer boards. As a side note, Rowe uses this foam on the back of various computer boards so keep an eye open for bad/old foam pads. Any high humidity area like car washes, Laundromats, any other high humidity areas should inspect the foam bad and replace it if is old and compressed.

A problem has shown up with poor acceptance of \$5 bills using the B position magnetic head option and the -20 control unit in B head mode. Depending on the bills, large amounts of bills were rejected with 4 and H errors. When Rowe was asked about this problem they claimed it was the bills and there was nothing that could be done about it. Well Mr. Car Wash had to have \$5 acceptance so we elected to turn the magnetic head and the head pressure roller assembly around to the A mode position and put the -20 board switch to the A position. The A mode puts the head closer to the edge of the acceptor rather than B mode which is nearer the middle of the acceptor. With ten \$5 bills using the B position we had gotten 4 rejections with H error. After conversion of the B mode to A mode and the board switched to the A position mode, all the bills were accepted. I presume that Rowe is right, and over time, the \$5 bills have changed enough and is effecting the accept rate of \$5 bill to go down. The only fix I know of right now is to switch the B head option back to an A option. That is, switching the head and pressure roller towards the side of the acceptor, (A mode), rather then toward the center

and then putting the -20 control board head switch to the A position.

Vendors who may not care about A or B option have to be aware of it because they may get or swap a B option acceptor (Pressure roller and magnetic head 1/4" toward center rather than right side) because these B option acceptors only work right with -20 control unit. Acceptance will be poor if used with the older control units or if the A - B switch on the -20 control unit is not in the B position. Since the beginning of 1995 the BA series of bill changers have noted problems in accepting \$5.00 bills. It has been rumored that the newer bills are made with a different process and a coating has been added. For what even reasons, fives are getting harder to accept. BC12 BC35 -01 to -20 control board have two switch which allow you to accept more bills. One is increased \$1 acceptance and the other allows you to disable some of the \$5.00 checks. By turning on these switches and then turning off the power switch for a few seconds, then turning the power on again you will have less check made and accept more bills. The other side of the coin is with these switches on less checks are made and you may get acceptance of Xerox type copies of bills. It is a paradox type of problem. None of this is to imply keeping the switches off will keep the system from even accepting Xerox type copies. Rowe's response to date has been to update by purchase a newer BCxx00 machine or buy an update kit to the newer type (BCxx00) machines. In 1995 Rowe stopped making the BCxx00 kits fro a while but later nut soon put the kits back on line. Even these newer machines have been know to accept copies but where Rowe once got the copies that were accepted Rowe has taken corrective action and released new software. For the most part, to Rowe's credit, once a problem is defined they take corrective action.

Another case of acceptance problems and changes over the years was a case where I got a BC35 machine to work on which had a factory rebuilt BA35 acceptor and a factory -06 control unit. The vendor had been going crazy for several months because he was seeing poorer acceptance then he had before the acceptor and board were exchanged. Along with the bill chnager I got \$105.00 of \$5 bills and 6 \$1.00 bills which the machine would not accept. I went crazy for a while because the bills would be rejected with H error codes. After fooling around for a while, I realized the bills must all be "bad". I called the vendor and asked where he got the bills and he told me when someone complained the changer would not take a bill he would keep it and give them another bill to use. I also found out the machine would not accept a bills at a failure rate of 1 out of 25 to 30 bills. These test bills were some of the bills the machine

would not accept. He stated he had not seen this high rejection rate with the old acceptor and board. I could not accept these bills using his machine or other BC35 equipment. I could not prove what board he originally had because he did not exchange the board with us and he did not have any paper work which stated what version board he had originally but I concluded it was an old -01 board. Since this man wanted to be able to accept these "bad" bills I had to get back to a -01 board to get back to the type of acceptance he had before. The testing had been two different machines (his and my test bed) would only accept a bill now and then but most were rejected all of the time. With the converted board (-01) in the machine all the bills were accepted. With two of these acceptances of \$5.00 bills I did have to stick one bill in 3 times and another 2 times. Another interesting part of the testing was testing the bills on my BCxx00 test bed (the newer model bill changer with a BA50 acceptor and 2.4 programming) and most of the bills were accepted. We are walking about 27 bills, which were picked (held aside), because the BC35 bill changer with a -06 board would not accept them. Just one more point. I spent hours testing and none of this had to do with bad BA35 acceptors (pressure roller, heads, etc), boards, power supplies, motor speed caps, etc. We were dealing 4 other new acceptors, 4 boards in total, his machine acceptor and board, etc, and my test bed which is really a complete machine. What we are dealing with here is a batch of collected bad bills collected over a period and a comparison of the old -01 board and the next version that was the -06 board. Would I take an -06 board and make it a -01 board based on what I found? No, a Xerox problem could arise and I presume the -01 might accept Xeroxes easier than the -06 board. Remember this vendor was dealing with bills he collected over time and the amount was a very small percentage of the total number of bills that were accepted during the collection period.

Sometimes people do not handle problems with jukeboxes and vending machines as they handle video games. If they have a game problem one of the first things they do is measure the AC line voltage and take DV voltage readings on the power supply. Here is an example and real problem where people waste time chasing ghosts when there is a major problem with older jukeboxes with BA 5 or BA 55 acceptor problems. They have control unit or acceptor/acceptance problems and since the rest of the box seems ok, they attack the acceptance problems by exchanging or attempting acceptors and control unit but in fact the real problem is the BA 5 or BA 55 control units needs at least 8.5 voltage to operate correctly. Any number of errors and problems can occur if the voltage coming from the main juke power supply is low and generally with aging the 8.5 volts drops. You can

mod the old power supply cards closer to newer designed cards and insure the 8.5 volts is maintained. Rowe has new switching power supply cards that supply > 9 vdc. An always procedure with most equipment problems is to measure voltages and with these old jukeboxes and even CD100A/B it is a must if you want to reduce down time, problems and cut down on wasted time which does not address the real problem; low voltage which shows up as acceptance or other problems with the bill acceptor or it's acceptor control unit before it shows up on the rest of the juke box.

While we are talking about these older BA5/55 juke boxes there are some units where the Mag gain light shows a signal is there when it is just standing there. You get poor or no acceptance. This condition may be caused by the magnetic head shield touching the metal on acceptor. Make sure the shield is not touching any metal.

A vendor called because one of his people could not get a machine back on line. He had to leave the machine down but he had swapped the board into another machine and it still had the same problem. The error code was 6. The vendor wanted another board. I asked if the person adjusted P1 and P4 or noted what the P1 and P4 board LED indicator status was. He did not check P1 or P4 LEDs nor adjusted P1, P4. Looking at status LEDs and making these adjustments is basic to proper machine operation and these are very basic items. The instructions are in the book and generally posted in/on the equipment, yet... all too often, many people refuse to look at them or do what is says to do. They come with a board and/or acceptor that are NG, but in fact, they are ok. This adds to down time, service call repeats, and the bottom line. Do you have to get an exchange of a board or acceptors when the only requirement is a 755 bulb change or a routine adjustment like P1 and P4 adjustment? Maybe it needs checking and resetting a switch! Can you afford wasted hours plus extra repair or exchange costs? I will sight one case where many hours were lost because someone had moved the P1 (front) bulb to far back and it was not aligned over the plastic lens. P1 was adjusted but the acceptor accepted \$ 1 bills but it only accepted 1 out of 10 \$5 bills. I pushed the bulb over the lens, adjusted P1 and P4, and the system accepted all bills, Oversights can be expensive!

What will you find when you look at a BA acceptor? Here is a real BA-5 (it could be any BA acceptor) acceptor case history, I did not make this up:

1. One bulb was an old 755, the other one was not a 755. Remember this acceptor is a BA-5 and the two bulbs are connected in series. They must both be 775 bulbs. If forced to use a short fix, both should be the same type of bulb. Bruno's rule is to

use only the correct bulbs, in this case, 755's and nothing else.

2. One retainer, spring and E clip missing right side of the anticheat shaft.
3. The rear end of the top assembly was floating.
4. Anticheat shaft was very dirty.
5. The top plate had the creasing rollers but the lower back rollers where the non-creasing rollers type. Mixing different types of rollers is a no no.
6. The rear-timing belt was one of those shiny, narrow, "B1" belts that should always be replaced.
7. Rear creasing roller shaft nylon bearing worn, maybe because of # 6 listed above.
8. The motor belt adjustment was too loose and the motor belt and the motor gear had excessive wear from the slipping belt.
9. The flat center belt was worn and deformed.
10. Pressure roller for magnetic head very hard and deformed.
11. Spring for the Pressure roller for magnetic head was weak.
12. The rubber rollers were dry, dirty and needed rubber drive cleaner.

It appears the top of this acceptor was a top that came from an acceptor that had very little use and it was put on the acceptor that had a lot of use. This would account for the new creasing rollers on the top plate while the lower section still had the older rollers. It appears this was a quick fix by some one. Did you notice some of the items are operator errors, operator over sights, or short term fixes which were never corrected? Could this have been one of your acceptors?

After reading all my notes, would you ferret out the above problems items just listed? If you had to fix this acceptor, would you have the parts? More important how much of this list would you let slide by without taking any action? The head was in very good condition but not the head pressure roller and it's spring. I cannot compel you to amend your order of things or what is the best way for you to reduce unnecessary expenses. As I said earlier; No room in margin and reducing un-warranted expenses mandates corrective action be taken. Mandated report writing of the problem and error code/s, on paper for you, or your service people, puts focus on the problem and it is a narrative of the problem/s you and your people may encounter.

Here is a real example of what one vendor does. A BC 35 control unit failed and this is the written report the vendor service person attached to the control unit. "Flashing E Left hopper motor chattering." Is this the way you report problems?

What is your order of things when a problem occurs? You can evaluate yourself on your order of things. Try answering those questions I listed earlier the next time a dilemma occurs. Write it all

down on paper and attached a copy to the unit! I talk about preventive stuff a lot. Here is one for you! If the AC power on-off switch on a long narrow BC-12 type supply is a little loose, would you tighten it? I know of a few cases were some one decided it was not important. Later on, there was no power on the machine. They may, or may not, have checked the AC voltage at the power connect plug inside the machine but if they had power there, the machine was still dead. With a loose switch, the switch wire connector can hit ground. Since the AC power is routed with connectors mounted on that interface card mounted in the rear of the power supply, the copper carrying the AC voltage can burn away to nothing. The machine is now dead! Actually, the switch shorting to the metal cabinet may take out the AC wiring/circuit at any number of places along the AC path to the outside world. I get at the interface connector board backside by removing the four screws holding it in place. I remove the slide out power supply card, the transformer screws and pull up black motor cap so I can get at the screws in the back. I reach the 1/4" screws with a REAL long 1/4" nut driver that reaches from the front all the way back to the back wall. Another option is to use a real long, or series of interconnected, 1/4" extension/s. The same problem of no AC power with a twist. A vendor had no AC power and I told him about a loose AC power switch and the burnt out copper on the interface connector board in the back of the BC12 power supply. I ended up getting the machine for service. I opened up the power supply and AC power switch was loose enough to short to ground. I tighten the switch and bent the lower contact so it would not hit ground. I removed the interface board and found someone had already put a wire jumper where the copper had burned away. I was still not getting AC to the hot side of the power switch. I noted who ever soldered the jumper had put enough heat on the small connector pin and it was intermittent because the pin moved down and away from the solder blob. I fixed this but I still had no AC power to the switch. I found AC at the connector pin where the AC leaves the board. The voltage was going into the connector male pin but the female connector pin was not making contact. I pulled the pin on the connector that plugs into the board assembly and found the pin contact had melted away. Since the wire jumper was on the board the copper could not has a fuse and something else had to blow. In this case, the pin contact melted away. Remember when dealing with something like this, the open can be almost anywhere along the path. In order to locate an open or intermittent in a path we have check the path on a point-to-point basis. How you attack the problem will depend on your order of things.

I have to tell you not all problems can be fixed by swapping parts of the system. Looking at a BC35

Out of service light circuit we see the 30 vdc is fed into a 150 ohm resistor located in the power supply which lowers the voltage when the light is turned on. The resistor (low side) goes up to the light on the front door. The other side of the light goes down to the computer control board and when the bill changer is in trouble the light is turned. This is a very simple circuit but what happens when there is a break in the wire, or wires, between the resistor and the light and/or the wire which goes from the light down to the control computer? The 30 vdc voltage may never reach the light and/or the light cannot be turned on if the wires down to the computer has an open. One real case both the feed to the light and wire to the control unit were open between where they come out of the bracket that holds the acceptor connectors and the light up on the door. Someone must have pulled on these wires at on time and they were broken. The insulation on each wire showed no signs of stress or breakage. Finding something like this is nothing more then simple basics yet these kinds of problems may end up being hard for you to find because your style is not to look at the manual and follow things along from point to point. Winging it will not help you find the problem. I use many ways to find a problem like this. My meter probes are filed down to a fine point so I can prick into the insulation of a wire. I know the voltage will be 30vdc on the hot side until the light starts drawing current then it will drop down. I use a clip lead to ground on the low side of the light so I do not have to worry about the computer on return to ground to turn the light on. After I get the 30 vdc up to a good bulb then I can work on the return end. I am not trying to tell you how to apply your basics to a problem like this one but I just want to point out there are several ways to use a voltmeter, ohmmeter, light bulb with clip leads, clip leads and/or jumper wires, etc or a combination of this items to find the problem. In this case, I used all of them to find the problems. I fixed the problem by splicing new wires to replace both of the bad sections of broken wires. At some point in time, you or someone else, has to get into the nitty-gritty of problems like broken wires or bad connections.

I will now repeat my some opening paragraph and add more comments about update kits:

In 2005 BC9 to 35s are being uses has mainly \$1 only bill changers and many have been, or will be, updated with various acceptor and kits. Some third party kits even replace the original electronic control boards. Today the early bugs with these new kits have been fixed. With refurbished the hoppers and dispenser these updated Rowe bill changers have a new life cycle that will last for decades. I make this statement after making an updates and refurbishing on various Rowe bill changers going all the way back to the BC9. Rowe has also may update kits too and update BC35,

BC12 and BC12R to the newer BCxx00 series.

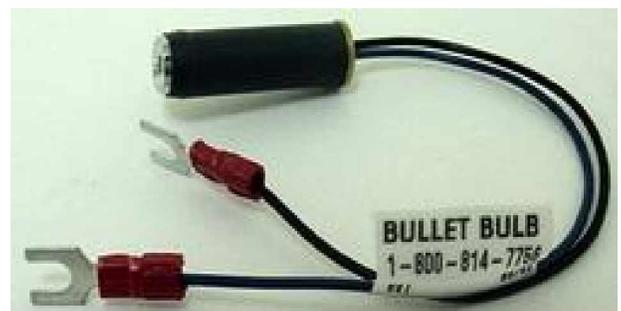
With most of the Rowe Kits you keep the stacker, hoppers and dispenser and everything else is replaced with the new BCxx00 parts and parts you need to make the update. When it comes to the BC1400 kit you can also get the kit with a new replacement dispenser with two small coin buckets and one large coin bucket.

I will not get into kit numbers here because ove thyears to get changed but keep in mind there is the original double dump changers and now these is the a new FAST PAY version of the Rowe bill changers.

Some of the update kits include a 755 Bulb replacement.

I gotta tell you I think Rowe is one of the best bill changers ever made and therefore I think an investment in update/s will give you good return on investment provided you are will to expend funds and/or time for hopper refurbishing. In my hopper notes I tell you how to do the hopper refurbishing yourself. When it comes to Rowe, I talk decades not years. There are many Rowe bill changer have owners that have told me they wish they had known updates kits where coming and they kick themselves in the xxx for dumping their Rowe bill changers. Because there are some many update kits, I will not get into the various kits but I will say I have had good luck with Capital Vending kits and their service support has been great. I will attach a picture of an early BC25/35 type kit to these notes to give you an idea of what they look like in the changer. Nowadays the frame are painted black. When ordering you have to know what type of changer you have and if you want \$1 and \$5 or \$1 to \$20 acceptance and what size bill box you want on the acceptor.

Some of the new update kits include a 755 Bulb replacement. A red LED is used. I like that Bullet LED replacement. Watch the color code. You can purchase the bullet LED as a separate item.



////////// ***** \\\\\\\\\\\

Murphy's laws does exist so just because a part is new does not mean it is a good part. You now know about anticheat levels, motors, rubber roller which freewheeling on the shaft, and maybe a pressure roller that does not roll, etc. When things do not work out right, remember new part may not be good! We have talked about any given section of a machine, such as a acceptor, is only one part of the system and the other sections must be up to spec if the system is going to work.

Listed a parts sheet I use when working on BA type acceptors. There are different types of BA acceptors and the breakdown list covers most common items. Older acceptors used in BC 8, 9, 9A15, 10, 11, 115, 25 and 25mc are obsolete and you may not be able to get some of the parts. As one example, the motor for a BA-3 or 15 no longer exists. You have to get a BA35 motor, cut off the new plug and re-solder or crimp the BA3 old brown connector to the newer -04 motor. Watch out, there is CW, CCW and common wires. Do one wire at a time. There are three (3) types of the front input shaft/rollers front for the BA acceptors. You may have to splice the old connector to a new pressure solenoid, and if you do, remember there is a build in diode so watch which way wires go, other wise, 'POOF' goes a control board. There are two (2) types of nylon bearings, large and small ones, so look before ordering the bearings.

These notes should supply give you an idea of what to look for so you can decide what parts you will need. As an example, a photocell, anticheat lever and anticheat creasing kit if your acceptor needs the update. Remember a weak motor may not be able to handle the additional strain of the creasing rollers.

Mark off the parts you need on a Xerox copy of the list that is on the next page. Look at the acceptor and manual when ordering parts.

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I find check custom check sheets cover most of the common tests and problems.

10 Check sheets July 4, 1993

BC11 / 25 / 25MC CONTROL UNITS ...

- 01 BC 11/20 \$1
- 02 BC 25 \$1 \$5
- 03 BC 25 MC \$1 \$5
- 08 BC 25 HS \$1 \$5
- 09 BC 25 MC HS \$1 \$5

=====
Checking the Unit =====

1. Open cover.

2. Does Board match cover, example -01 board in BC25 -02 cover.

01 = BC-11/20 02 = BC25 03 = BC25 MC plus there are

BC25 - 08 HS and BC25 MC - 09 HS versions.

3. Inspect board for bad connections (make sure to check VR connections). Voltage regulator leads may be broken or loose.

4. Clean and inspect board contacts, fill the holes in connectors if needed. 'Just a little bit will do ya' , DON'T pile the solder on. Use foil tape to repair really bad connector pads.

5. Inspect the TIP102's for heat damage, check with ohm meter. Replace the bad ones. If bad, Check the driver/s transistor.

6. Check .39 resistor near voltage regulator, Replace if cooked or bad. Sometimes, people have put in a 3.9 ohm resistor which is wrong.

7. Check 22 ohm and Q10. Replace if bad.

8. Replace the 2.2 mfd's in mag amp section. Measure the caps before installing them. An off tolerance cap, such as 1.9 mfd, could change the frequency and it will not work right. Chances are the caps have not been replaced unless board has been in for service before. If not sure, when board is tested, bad, poor, or wrong value caps will result in low mag gain or very little mag gain range. Measure the new 2.2 caps with cap meter before installing them !

9. If C15 is disc cap, replace it with 2.2 mfd tantalum.

10. Clean all dip switches with contact cleaner (Dry gas works !).

11. WARNING ! The board has 120 vac on it ! (If CPU board is not operating there will be no 40 volts.) Plug board into TEST BED. Look at bucket and motor leds on the TE680 tester for failures when power is turned on. The motors and buckets should remain quiet. Look at display for error codes

| | | | | |
|---------|------|--------|---------|------------|
| Buckets | LEFT | CENTER | RIGHT | |
| | \$1 | 25c | 50c,\$5 | |
| TIP102 | Q17 | Q15 | Q16 | |
| Drivers | Q20 | Q18 | Q19 | Resistors, |

may be bad !

| | | | | |
|--------|------|--------|-------|--------|
| Motors | LEFT | CENTER | RIGHT | |
| | Q27 | Q25 | Q26 | Triacs |
| | Z15 | Z13 | Z14 | Optos |

13. Adjust P1, P6 making sure P1, P4 LEDs work.

14. Heat board with heat gun to locate heat failure.

note: If possible leave unit on test over_night.

15. BC11/22 or BC 25 Board Turn on all count switches and do test vends:

\$1 15,15,15
\$5/50c 15,15,15
25c 7 - 7

MC 25 MC Board Make sure center banks of \$1, \$5 switches are OFF and the other count switches are all on. Then do test vends:

\$1 63
\$5 63
25c 63

Since you are in MC test mode, you have to repeat test 3 times to cycle thru all 3 motors.

16. Do mag adjustment. Find low and hi ends of acceptance range. Put control at 2/3 of the acceptance range found. Check acceptance and operation of the board. See #17 below.

17. When bill is accepted, check the LEDs: Hopper, Credit, etc.

18. Turn TE680 despenser switch to center off, Check for 'C' on the display and LED flashing

19. Push the "F" test button on the test unit. 'F' error should appear on the display and the Flashing LED should also appear.

Note: I added F Test is a 7.5 ohm 5 watt resistor from cold end of a solenoid to Ground. Flashing "F" should appear.

20. If the unit is not running or error free, repair it.

21. Put number work label on board and outside the outside cover.

- notes -

A few track record shows bad:

Bad connectors and connections, always check for copper breaks a 5-volt regulator. Many times the copper at center will be broken.

Display LED, IC driver for LED display, bad LEDs including the special flashing 'Fault' LED.

P1, P4, P6 transistors and 74150 IC. Not reading multiplexer lines.

Pots - P1, P4 and Mag.

Coin Counts none or bad due to bad diodes and

counter bypass caps.

F problems are hard to find but it could be non-operating computer and/or computer crash. The small bypass on tip102.s could be bad so replace it.

Mag op amp, Zener / 220 ohm

TIP102's and drivers. Triacs / opto's and burned resistors.

Power relay driver transistor.

Crystal

BC 11-25 op amp voltages

1 1.15
2 1.21
3 .59
4 .14
5 1.93
6 19.88
7 18.63
8 12.04
9 23.80
10 13.35
11 1.92
12 .58
13 1.20
14 1.13

=====

Let me end these notes with this comment; Much of what you have read comes from me, but confirmation of the problems and fixes came from people out in the field too. Without their help, these notes would not be as embellished as they are. I wish to thank those who have provided. As Johnny 5, Sock or Data might say);

" GREAT INPUT, THANK YOU! "

May the manual be with you!

Cleaning Mag Head Pressure Rollers

Rowe has designed a card using paper and thin double sided tape to clean ink, dirt, and other contaminants off the magnetic head pressure rollers. The one sticky side is attached to the paper and when you are ready to use the card remove the protective aper to expose the sticky tape. Then stick the card into the acceptor. While the cards were made for the BA50 acceptor they can be used on all Rowe acceptors (except the RBA-7) and other acceptors. Some aceptorst do not pull the paper into the acceptor so you will have to hand crack the acceptor. People who have seen me work know I always use tape to clean the roller/s under the magnetic head/s.



Rowe Part #
252548-01

Rowe now has a card
for the RBA-7.
Use
252548-03

Bruno

Clean51T.pgs Mar 05, 2005 1T



To join the MAGIC WAND CLUB buy one of NECo's Trinity Oilers or a similar type.

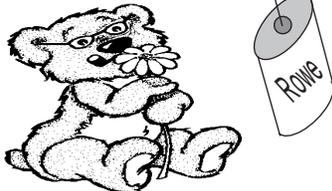
Your dues are:

- 1 Buy an oiler, Trinity, Radio Shack's Lubricator # 64-2301A or Rowe's silicone lubricant 270628-01
- 2 Use it for preventive maintenance.

- Warning -
3 Over lubrication and/or getting oil on the belts voids your membership. More is not always better !

When the oiler is empty you will be a full member in the :

The
MAGIC
Wand
CLUB !
Bruno



The
Bear does
use them !



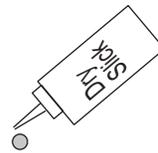
Re-Grip
Rubber
Cleaner

Rubber and belt cleaning should be done when cleaning and lubricating the acceptor. It should be at least once a year and more often in a dirty location. Do not over use the rubber cleaner ! Apply evenly with a soft cloth until clean. Wipe off all excess including the edges. Re-Grip is a cleaner and revitalizer.

Cleaning Rowe Hoppers and Dry Slick !

What can you use to clean and lubricate Rowe Hoppers and clean coin mechs ? Brushing alone is not good enough. Make a wooden or plastic chisel to clean off the hard dirt on either side of the chain. You can grind or file the end of the hopper brush to make a chisel. The product called Dry/Slick is a very good cleaner when wet and when it dries it leaves a surface film which does not collect dirt. It also lubricates the hopper chain. I do not recommend Dry/Slick use where a build up will cause a serious tightening (such as tight shaft and nylon bearing). There is no problem when used on a Rowe hopper or on the coin mech area where the coin slides.

If you can't get hoppers to work right remember "Bruno" can refurbisher your hopper and fix the rivet problem too. . Generally the cost per hopper is \$80-\$100 if it has normal wear and tear.



More good
stuff !



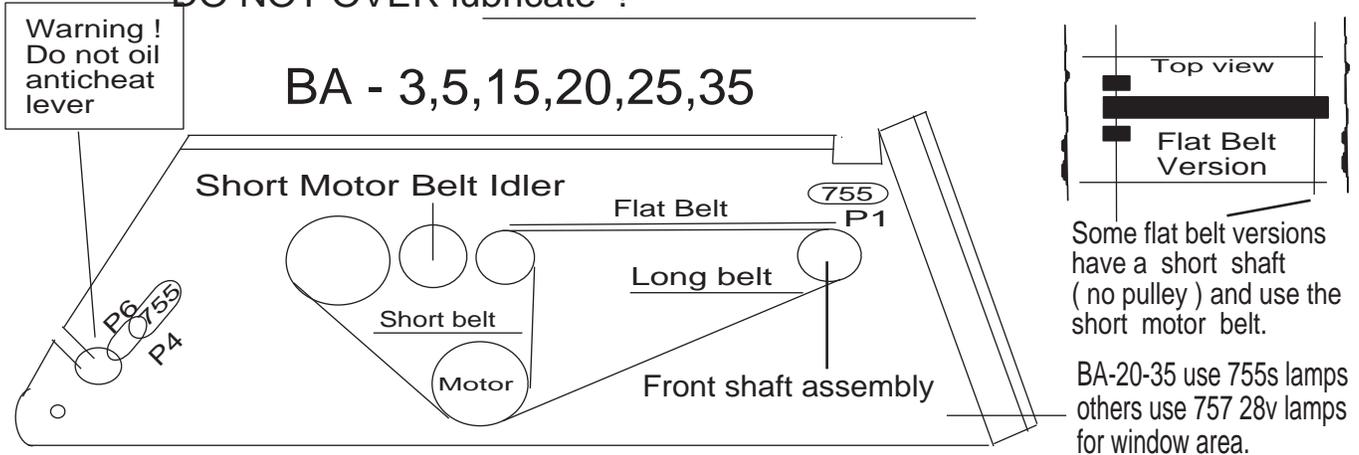
Using those Cleaning Cards on Rowe Acceptors ?

Rowe original recommended using **denatured alcohol** (paint or hardware store) to clean Rowe bill acceptors so how can you use these cleaning cards? First, let the cards dry and then apply denatured alcohol on the paper to clean the acceptor. After cleaning with a wet card **ALWAYS run a dry card into the acceptor.**

Over kill should be avoided so **do not** use the cards every week, or month, but just when the belts start to get dirty. You can judge time between card use after the first time use by inspecting the amount of dirt picked up on the card.

BA 3-35 Acceptor lubrication and cleaning

Needle point lubricate every \$30,000 or at least twice a year.
DO NOT OVER lubricate !



Clean the photo cells and plastic lenses with Kodax lens cleaner. Clean the center flat belt (flat belt version) and rubber rollers with rubber drive cleaner or denatured alcohol, and the mag head pressure roller with scotch tape as needed. Needle point lubricate ALL the small nylon bearings and the motor belt idler shaft and roller. DO NOT get oil near or in the anticheat (flipper) lever. Use only # 755 bulbs on top plate assembly.

There are three (3) different types of front shaft assemblies. Nylon roller with no belt pulley (short belt), nylon roller with long belt pulley and rubber roller with long belt pulley. If you need one, get the right version.

BA_lube.ps Jan 01, 2002 1G



To join the MAGIC WAND CLUB buy one of NECo's Trinity Oilers or a similar type.

Your dues are:

- 1 Buy an oiler, Trinity, Radio Shack's lubricator # 64-2301A or Rowe's silicone lubricant 270628-01
- 2 Use it for preventive maintenance.

- Warning -

- 3 Over lubrication and/or getting oil on the belts voids your membership. More is not always better !

When the oiler is empty you will be a full member in the :

MAGIC Wand CLUB !

Bruno



755 Bulbs

While other bulbs may work with Rowe equipment, it is best to use # 755 bulbs. Other bulb types have caused problems which would not have occurred if the # 755 bulb was used. You can buy bare 755s, or with the wires already soldered to the bulbs.

Always center the 755 hot spot over plastic lenses and adjust both P1 and P4.

Use 755s

Bruno



- 21116002 Pin Linkage pin for pressure roller assembly
- 21312401 Idler roller O
- 21312501 Roller Idler little nylon for top assembly -O-
- 21312801 Belt Motor Long front roller drive BA 25 down[b]
- 21328601 Roller arm assy OLD head pressure roller
- 21328604 Roller arm assy NEW head pressure roller/offset
- 21329001 Spring Tension for pressure roller ^^^
- 21339801 Light sensors assembly - P1,P4,P6 /o\
- 21342701 Spring for 6 top rollers -/-
- 21384603 Bill pressure solenoid BA-35
- 25073801 *Belt Short rear timing belt ====
- 25076002 Mag head BA3,20,35 etc
- 25076201 Shaft-roller small 2 rub p--O-----O-
- 25076202 Shaft-roller small 2 rub + nyl p--O--O--O-
- 25076601 Shaft-roller drive 3 large) p--O--O--O--p
- 25076607 Shaft-roller drive rear 2 large p--O-----O-
- 25076801 Shaft-roller-front rubber p---(r)-- BA-25down
- 25076802 Shaft-roller-front flat belt p---(n)-- BA-35flat
- 25076804 Shaft-roller-front flat belt --(n)-- BA-35flat
- 25076901 Shaft-Pivot rear top for anti-cheat & retainers
- 25078601 Grommet (red) (o)
- 25096301 Shaft-rear output for creasing rollers -----
- 25166801 Bulb >-----755 with wires and lugs
- 25186401 *Belt Flat (center) for BA35
- 25222201 Timing pulley large
- 25222202 Timing pulley small
- 25222204 Timing pulley (large for Motor drive)
- 25227501 Pin connect pin for mag head
- 27032301 Lower track kit
- 27033701 Creasing kit 2+2 nylon rollers and plate
- 35075401 Anti-cheat lever (Flipper)
- 35082002 Belt motor Short BA-35
- 35118901 Bill artwork (just picture of bill head)
- 37003601 Adaptor cable from BA-3 to BC-12-20-25-35 NLA
- 65022401 Front trim casting
- 65022503 Top casting
- 70093401 Cable clamp (side)
- 70121010 Spacer for top cable
- 70143001 E clip, small, for pressure roller pivot pin
- 70146003 Bearing nylon (small)
- 70146010 Bearing nylon (large)
- Bulb # 755
- Bulb # 757 28v lower window lamps for BA-3/15

BAPARTS1FBearnotes f10b

Jackpot, Flashing "F" Solenoids, Diodes

Excessive current was drawn threw the bucket resistor. Look for damage of one or more of the bucket solenoids and you should also replace the solenoid diodes with 1N5404 diodes. Failure to take action may result in damage to the control unit again !

Bruno



ba_fh755 Jan 01, 2002 1G

Hopper Motor problem ?

Was excessive current was drawn by at least one of the hopper motors ? Do you have wiring or connector problems now ? Before using another board you should check the wiring, motors, ratchet couplings and look for hoppers which jam. Maybe you have jamming at the rivet and agitator. Perhaps it is time to have the hoppers refurbished by me !

Failure to take corrective action could result in very serious damage to the replacement motor or Control unit.

Bruno



ba_fh755.ps Jan 1, 2002

Jackpot, Flashing "F" Bucket power ON

Any bucket solenoids cooked ?
Did you get an error code ?
When did the problem occur :
When changer first turned on ?
Just standing there, ?
When giving out coins, ?
What was the jackpot value ?
Was it more than just one value ?
Did you count coins left in the escrow buckets ?
What else did you see or hear ?

If it is an older BC-XX00 changer have you updated to -02 power supply card ?

What happen ?
When ?



755 Bulbs

While other bulbs may work with Rowe equipment, it is best to use # 755 bulbs because other bulb types have caused acceptor and dispenser problems which would not have occurred if the # 755 bulb was used. You can buy bare 755s, or with the wires already soldered to the bulbs.

Always center the BA acceptor 755s hot spot over plastic lenses and adjust P1 & P4.

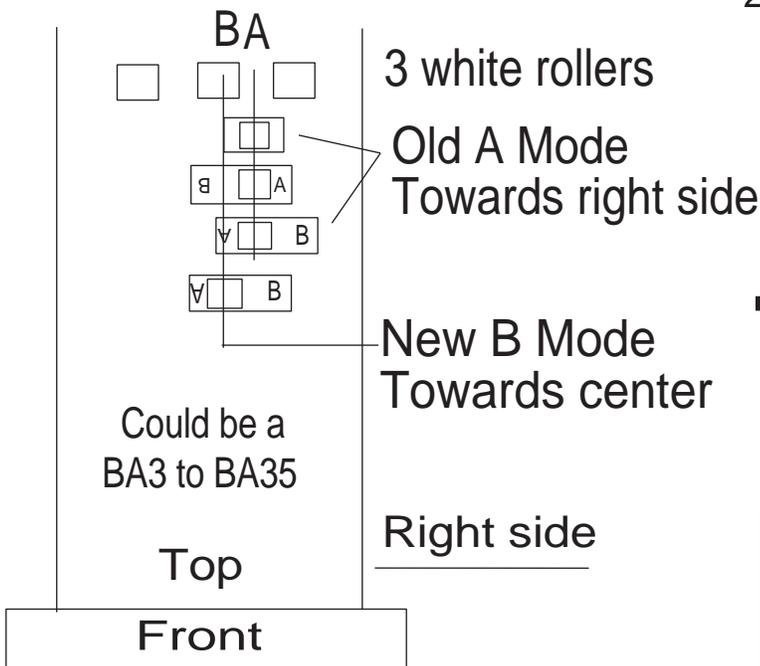
If ANY of the coin counter 755s behind the hoppers is dead the machine will shut down. Machines with error message will have a C on the display . If you have to replace a dispenser bulb, replace all of them.

Do you have
755 bulbs ?



BA acceptor A or B Head position

Older BA acceptors have a Mag head position called "A" mode. A newer acceptor may be A or B mode. In the older A mode the Mag head is closer to the right side. The B mode is moved towards the center. The B mode is only used with a -20 board with the head switch in the "B" mode position. **The pressure roller must be directly under the mag head in either A or B modes.**

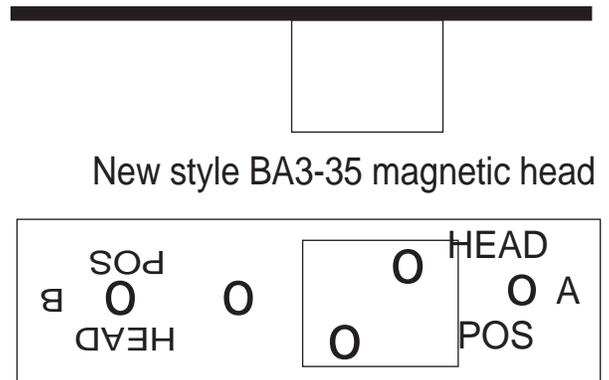


New Mag Head B Position

The new B position did help get higher security but over the years the \$1, and \$5 bills have changed enough so the B option became critical to accept today's bills. I have already converted several B option acceptors back to the A option by turning the mag head, pressure roller around and switching the -20 board back to A mode in order to get a better acceptance rate. Depending on the test bills, I saw a 20 to 40 % increase in acceptance.



Bruno



Time to update ?

With the new bill types used today consider the update kits. Rowe does have: BC12 to BC1200, BC12R to BC1400 and BC35 to BC3500 kits. Capital Vending has BC1 and BC-9 to BC35 kits. Many users have had good luck with updating the changers.



A word to the wise !

Bruno

BC-12, BC-12R and BC-35 Bill Changers

The BC12, 12R, 35 machines do need a certain amount of preventive maintenance and cleaning. Below is information on cleaning the hoppers at least once an month. Lubrication of the dispenser motors and coin escrow assembly is also needed. The acceptor bearings should be lubricated every six months. Do not lubricate the anticheat flipper lever or it's shaft. Like all changers, many problems have to do with the acceptor getting tired and worn. I see many BA35s with the flat center totally wiped out. By the time I see the acceptor many other parts are worn. Every rejected bill cuts the life of the acceptor by 2 bills. If several attempts are made to accept a bill that will cut the life by 14 bills. If many vital parts are worn it may be cheaper and better to get an BA35 exchange.

Problems include not having, or using, 755 bulbs. Read instructions and adjust P1, P4 and Mag. When problems occur, before doing anything, look at, and write down the code displayed on the board. Look at the manual for help. When sending in equipment, always include a detailed note why the equipment was removed and what error code/s appeared. You can not the your problem will show up when we test the board. In many cases, the problem does not show up. Over the years Rowe has made several versions of the computer board.

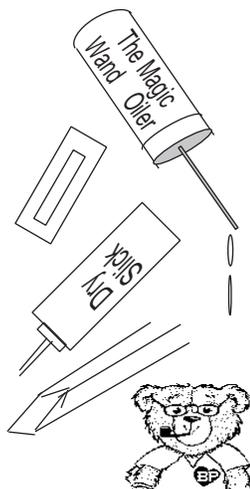
UPDATING BC 12 12R 35 to BC-1200, BC1400, BC3500

Since the onset of the new \$5 bills these machines cannot accept the new #5 bill and there is no simple conversion, Some companies are now making conversion kits which replace the bill acceptor and stacker with another acceptor/stacker and the kits have a special harness to interface new acceptor with the bill changer. Prices range from \$480 to \$700 depending on the kit. A better choice, while more expensive, is Rowe's conversion kit to the current models: BC12=BC1200, BC12R=BC1400, and BC35=BC3500. These Rowe kits keep the dispenser, hoppers, coin mech and single or dual stacker and uses a new power supply, control board, BA50 acceptor and a harness. The Rowe kit will allow you to do \$1,5,10,20s (new and old bills). A few really early BC12Rs which do not have 3 escrow sections (2 small and 1 large escrow compartment).

When considering kits allow for extra funds to get the hoppers refurbished and maybe repair other items repaired like bucket doors and motor brakes. Generally I can refurbish your old hoppers for \$80 to \$100 each. This refurbishing can add years to your hopper life and is a good investment. You will find how to refurbish hoppers in my Bear Hopper Bear notes. Do it now before you get to much wear and tear on the hoppers.

CLEANING ROWE HOPPERS !

Just brushing a Rowe hopper is not good enough to get rid of dirt build up on either side of the chain, A person should not scrap the plate with a sharp object like a screw-driver or use something like steel wool. Would you use these items to scrap a teflon coated pan ? Of course not ! You can make a wooden chisel out of hard wood or file/grind the back end of the hopper brush into a wooden chisel.



Rad Dry Slick !

What can you use to clean Rowe hoppers and coin mechs ? The product called Rad Dry Slick is a very good cleaner when wet and when it dries, it leaves a slick surface film which does not collect dirt. I do not recommend its use where a build up will cause a serious tightening. (such as tight shaft and nylon bearing). There is no problem when used on a Rowe hopper or on the coin mech area where the coin slides.

" May the Magic Wand Oiler and the manual be with you ! "

BC12_35.ps
Jan 01, 2002 1Q

BC-11, 115, 25, 25MC Bill Changers

Like all bill changers they need a certain amount of cleaning and lubrication. Below is information on cleaning the hoppers at least once an month. Lubrication of the dispenser motors and the coin escrow assembly is also needed. The acceptor bearings should also be lubricated every six months. Do not lubricate the anticheat flipper lever or it's shaft. Many problems have to do with the acceptor getting tired and worn. acceptor. Every rejected bill cuts the life of the acceptor by 2 bills. If several attempts are made to accept a bill that cuts the life by 14 bills and you will lose 14 accept passes of the acceptor. Repair of the BA20 acceptor is the only option.

Other problems include not having, or using, 755 bulbs. Read the instructions and adjust P1, P4 and Mag. When problems occur, before doing anything, look at, and write down the code displayed on the board. Look at the manual for help. When sending in equipment, and always include a detailed note why the equipment was removed and what error code/s appeared.

There are several versions of the computer board. When asking for an advance you MUST know the version computer board you have. The Rowe part number located on the cover of the board -01, 02, 03, 08, 09 etc. Getting the wrong board could cost you the price of the exchange + \$ 100.00. Do not assume we know which board you have,or need. We do not exchange non-offical boards with \$1,\$5 upgrades without the proper cover. We however do repair these boards. We do make conversions from a \$1 only BC-11 to a \$1 & 5 BC25 or BC25MC and we also make other conversions.

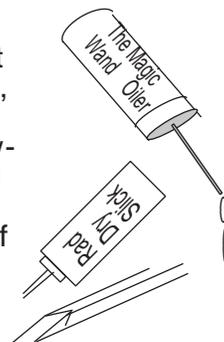
Rowe has stopped full surport of these machine in September 1993 however most parts are the same used in the BC35 series. The BA 20 and 25 acceptors are not loan-exchanged since Rowe does not exchange or repair these acceptors any more. We do repair BA-20, BA-25 acceptors but the price can run from \$15.00 to \$370.00. To date we have been able to get the parts required to do the job. In 1999 Rowe. stopped repairing BC11/20/25 control boards. We still repair the BC11/20/25 control boards. We do not accept loans of non-repairable or those low cost "partially" converted BC11 to \$5 BC25/25MC board or old version 1 of these boards.

Since the onset of the new \$5 bills these machines cannot accept the new #5 bill and there is no simple conversion, however, some companies are now making conversion kits which replace the bill acceptor and stacker with another acceptor/stacker and the kits have a special harness to interface new acceptor with the bill changer. Prices range from \$480 to \$700 depending on the kit. When considering such kits allow for extra funds to get the hoppers refurbished and maybe repair other items repaired like bucket doors and motor brakes.

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" May the Magic Wand Oiler be with you ! "



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What can you use to clean Rowe hoppers and coin mechs ? The product called Rad Dry Slick is a very good cleaner when wet and when it dries, it leaves a slick surface film which does not collect dirt. I do not recommend its use where a build up will cause a serious tightening. (such as tight shaft and nylon bearing). There is no problem when used on a Rowe hopper or on the coin mech area where the coin slides.

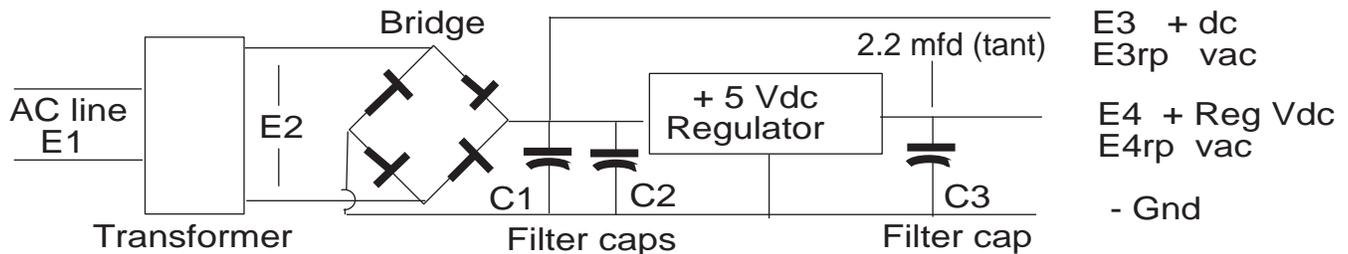
BC11_251M.pgs
JAn 6, 2002

A Power Supply Bear Note: Ripple and Noise - Part I

by Bruno D Puglia

Measuring voltages including AC line voltage is a basic procedure which all service people should know how to do. I have only been in the Game/vending field a short time but I have noted only a few of the people take an AC ripple-noise measurement on a Vdc voltage line. Normally the ripple-noise measurement is done with a oscilloscope but this is beyond most vendors since they do not carry a scope with them. Should a person measure the AC ripple part of a DC voltage and can they do it without a scope ? I think the answer is yes.

There are many problems which are due to a faulty power supply or low AC line voltage. One problem is a faulty filter cap (alla C1) where the DC voltage may be close to normal but the voltage has a large ripple value. As the ripple value increases what actually happens is the instantaneous voltage drops. These dips can create all kinds of system problems which you do not relate to power supply problems. A regulator may keep the average dc voltage close to the normal value but there are small (or large) dips in the output voltage.



| | | | |
|-----------------------|----------|----------|--------------|
| AC line voltage | E1 vac | 117 vac | |
| Transformer secondary | E2 vac | 11 vac | |
| DC voltage out | E3 vdc | 14 vdc | |
| Ac ripple/noise | E3rp vac | .475 Vac | or 475 mv ac |
| ----- | | | |
| DC Reg. voltage | E4 vdc | 5 vdc | |
| Ac ripple/noise | E4rp vac | .033 Vac | or 33 mv ac |

How did I measure the AC ripple/noise readings without using a scope ? I read the vdc first and logged the dc voltage, then without moving the leads, I switch the meter to the AC scale. My digital meter was now reading the ac ripple-noise voltage. You have to be careful if your meter has auto scaling because the meter may switch to " MV" so the reading of E3rp would be .475 or 475 and the "MV" would be shown on the meter display.

LED voltage status indicators are not a good indicator of what the value of what voltage is nor how much ripple is on the DC voltage.

The hard part for you will be knowing where to measure system voltages and what the values should be. You should start measuring and recording Vac, Vdc and Vac ripple/noise when the system is operational. The load on the power supply will effect the DC and ac ripple-noise values. The ripple / noise basics also apply to switching type supplies. Keep good records !



Power_01 Jan 7, 2002 1D
Bruno

May the meter be with you !

A Power Supply Bear Note: Ripple and Noise - Part II

by Bruno D Puglia

In order to give you an idea of how to build a history of voltage and ripple data I have recorded measurements taken from working power supplies used in the BC-11, 115, 12, 12R, 20, 25, 25MC, and 35 bill changers. I then took the max and min measurements from each voltage section along with the ripple/noise (Er) reading from each section and placed them into the chart listed below.

| | 5v | | 14v | | 30v | | 40v | |
|-----|------|------|-------|------|-------|------|-------|------|
| | E | Er | E | Er | E | Er | E | Er |
| Max | 5.10 | .040 | 14.28 | .600 | 30.84 | .040 | 43.20 | .036 |
| Min | 4.91 | .035 | 13.90 | .430 | 27.59 | .006 | 42.10 | .030 |

E = DC Voltage(Vdc)

Er = Ripple / noise
 . AC Voltage (Vac)

Looking at one example (with an average of 122 vac line voltage), the 14 v section had a range of 14.28 to 13.90 Vdc and a ripple range of .600 vac (600 mv ac) down to .430 (430 mvac). I know when you locate a bad power supply ,or power supply card, you get it replaced or repaired. There are times when you needlessly replace the computer center unit to resolve a problem but the real problem could be too much ripple on the 14 vdc line. A boucket door may not fully open because the 40 vdc line has too much ripple on it. There are many problems which relate to the ripple voltage.

When the voltages measured are outside the parameters shown above, the supply is repaired. These repairs include replacing diodes, filter caps, and other parts or perhaps cleaning wire leads and then re-soldering bad connections. Sometimes the contacts or the connector for power supply card had to be repaired. In some cases, the 30 Vdc pass transistor or the 5 Vdc regulator mounted on the main housing of the power supply had to be replaced.

One example of a voltage sliding down is where the 5 volts drops from 5 vdc down to some lower value. If you turn off the power supply, even for a second, the low voltage may restore itself to 5 volts for a period of time. Measurements must be taken before you turn the supply off. One fix for this problem is to replace the small cermic disc cap (.1 mfd) on the bottom of the 5 vdc regulator with a 2 . 2 mfd tantalum capacitor (Rowe part # 7 00251-07). Ref: See Ripple part 1 - C3.

As a general rule 5 Vdc regulators need an input of at least 8.5 vdc and anything below this value may effect the system's operation. Low voltage including the a high ripple factor can cause various system problem. An example of low 8.5 vdc is often found in Juke box power supplies. This can occur in both old er or new Juke boxes. Very few service people measure the 8.5 vdc and even less make the AC ripple / noise voltage measurement.

In other systems the voltage for a CBA-2 or UCBA-2 where 12 vdc (under load - motor running) is required. Where the voltage is taken from an existing power supply and not from a Rowe CBA-2 UBA-2 transformer power supply , the voltage may be just too low for good operation. Even if works for while, as the acceptor ages, it's acceptance may fall off to no acceptance.

Just measuring a voltage at the source does not mean the voltage reaches the load. Connectors, wire and it's IR drop, bad crimps, loose terminal screws, etc, are just a few of the factors to consider. Voltage measurements should be taken when the problem is occurring and the AC line voltage measurement should taken too. If you cannot be there when the problem is occurring, use a meter with a Max-Min hold recording feature (such as Fluke 12 Multimeter).

What we are dealing with is voltage and ripple measurements plus the use of your meter and your order of doing things. For those who did not know about ripple / noise measurements perhaps this will help you get started. Be advised that many of the voltages listed in manuals are not correct so do not go crazy if you do not come up with the voltage listed. You may see 24 vdc listed in the manual and measure 32 vdc. This is where keeping data in a notebook and taking measurements on a working system is a good place to start. Always measure the AC line voltage.



Bruno

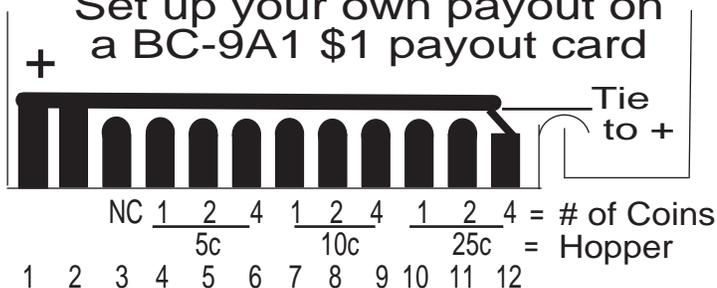
May the meter be with you !

Power_02 Jan 7,2002 1D

MEASURE the 5 vdc at the acceptor. This voltage can be high, low, or be varying. The bulbs may look normal but do not conclude the voltage is ok. Just being lit is good not enough. Use only 755 bulbs. Some machines may develop a varying a 5 vdc voltage. The two caps on the bottom of the 5 volt regulator may have to be replaced. Use a 100 mfd electrolytic and a 2.2 mfd tantalum cap. Some units have a small disc cap which should be replaced with a 2.2 mfd tantalum cap. Some 5 volt regulators fail under a full load, where other bulbs other than 755s are used or with temperature. Keep a meter, caps and a 5 volt regulator handy. Perhaps a flashing C error may appear and this could be a bulb (behind hopper), photo cell coin counter or board problem. You may think the bulbs look normal but the voltage at the bulbs may not be at 4.8 to 5 vdc. Use a meter to check the voltage. The Tantalum 2.2 mfd part number is 700251-07.

The same type of problems can occur if the power supply card is not supplying 14 VDC and just because the 14 vdc LED is lit this does not mean the voltage is at 14 vdc. The 5 volt regulator on the power supply may not be operating correctly and may have to be replaced. The regulator is the transistor looking device on the power supply and is the one NOT covered by the black cover. Do not mix up the 2N3055 transistor and the voltage regulator.

Set up your own payout on a BC-9A1 \$1 payout card



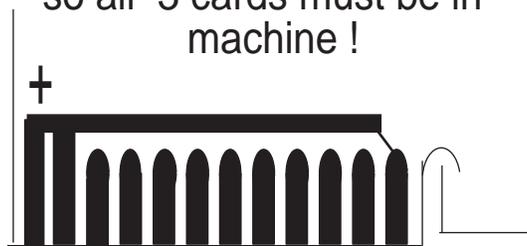
You can make your own BC9 payout card by connecting a count to the long + copper bar above the count connectors. I have tied # 12 to the + bar and this will give out 4 coins from the 25c hopper. With this layout you can make the card payout anything you need up to 7 coins per hopper.

Another Bear-note from Bruno



BC9A1

These cards are an interlock so all 3 cards must be in machine !



These two pins connected together are an interlock. Without all three interlocks in place the machine will not operate.

Bill acceptor bill pressure solenoid and other solenoid/diode problems.

While I will use the word "transistor" in the real world, depending on the control unit, the device might be a transistor or linear driver IC. I am also writing about other type solenoids like bucket solenoids (which use external diodes) and the dual stacker \$1/\$5 solenoid.

Sometimes I find the acceptor pressure solenoid transistor shorted. I can replace and make sure the card is working, but more often then not, I don't know what caused the transistor to fail. I have to rely on you to know, or find out if the acceptor pressure roller and/or wiring is is shorted or not. If it is you will blow the transistor again. One day I had to check three logic cards (from the same company) and all three cards had a blown pressure roller transistors. I presume someone plugged these cards into a bill changer which had an acceptor which had a shorted bill pressure solenoid or short wiring in the wiring. In this case a logic card from a BC9 or BC10 and a BA3 acceptor.

There is an internal diode connected across the bill pressure solenoid coil used in BA acceptors. When you check the coil and/or diode use both the normal ohms scale and the diode scale. An open diode can cause the pressure roller solenoid transistor to failure. Failure to check the solenoid and diode before turning on the power may result in another board failure.

If this box is checked you may have a BA3 solenoid and/or wiring which is shorted or perhaps you have an open diode. Failure to check it may mean cooking the logic card.

If this box is checked you may have a bucket solenoid problem.



Bruno

If you have a good looking BC-9 you can forget these cards and gut the BC9 and install one of those Capital Vending Kits for the BC9. I have done two of them and they worked out great, You keep dispenser and hoppers and the rest of the changer is gutted. Even those 3 relays go. Install new control board and a Mars acceptor and you have a new 1 and 5 bill changer. They even give you 3 of those bullet LEDs to replace the 755 bulbs in the dispenser. 1 early bug with the LEDs was debugged months ago.

Capital Vending BC-11, 20, 25, 12, 35 Kits
by Bruno Puglia Feb 21, 2003

Basically here is what a Capitol Vending Kit looks like when installed in Rowe bill changers. Some kit users have not plugged in the coin mech connector or have cut the wires going to the lockout relay coil in the coin mech. You do have to disconnect the bill return switch as part of the installation. Some vendors did have trouble getting the system to work because they used switch settings for the Mars acceptor given in the instruction sheets. Actually you have to use the switch settings listed on the black box in the cable harness. **Use the VN2400 or VN2500 switch settings listing on the box in the cable harness.** Make sure you tie off the cable going to the acceptor otherwise when sliding the mounting back it may cut into the acceptor cable. Other than the problems listed users have had good results with these kits. Many users have let me refurbish their hoppers so they have extended the basic life of the changer several years. You can now get a \$1000 bill box.



At some point in time you may want to check out my other Bear notebook articles because they contain a great deal of related material. You will find them on Bruno's Page in <http://www.eastcoastamusements.com/> then: left click on: **Visit his page for service notes and tips.** **OR:** <http://www.eastcoastamusements.com/services.htm> and then click on the BEAR with the flower!!

Note: These files were checked with Acrobat Reader 7.0. Earlier versions **may not** view/print correctly. I know version 5.0 will not work correctly.

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You will want to check the East Coast Amusements site for revised or new articles. I do have more titles in the works. Here are some the posted articles.

ROWE 4900 ACCEPTOR ISSUES
ROWE BC-1 BILL CHANGER
THE MAGIC WAND (Dick's - my favorite)!
CONNECTORS - FIXING AND TESTING (another good one)
ROWE BILL CHANGER HOPPER REPAIR
MEASURING VOLTAGES
BUCKET POWER ON ERRORS
ROWE STACKERS
MAG HEAD LOOP SECRETS
DREMEL & ROWE STUFF
FEK MOTOR TEST UNIT
OBA ACCEPTORS
JACKPOTTING, FS, BUCKET POWER ON & CRASHES
BC-8 to BC-35 Bill Changers
CBA_UCBA
Basics_101
BCxx00_bill_changers

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To East Coast Amusements
> THANKS ! Bruno

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