

ASSESSMENT OF COMMON FAULTS ASSOCIATED WITH HOUSEHOLD ELECTRONIC APPLIANCES

O. A. Akinsanya; C. O. Okereke and T. R. Ayodele

Abstract

The incessant breakdown of electronic appliances in home and offices had led to the reduction in the value of the reliability and availability of such appliances. This study attempted to assess the faults associated with the household appliances namely: Television set, Radio set, VCD player and Video cassette player. The common faults, causes, section affected and the components affected in respective equipment were analyzed using simple percentage method. Misuse/ poor handling, operating stress occasioned by high voltages, environmental stress, sub standard components and dust were the causes of faults in household electronics appliance. The paper suggested the use of standard materials, automatic voltage regulator, regular servicing, and prevention of mechanical shock, proper ventilation and preventive maintenance as ways of improving the useful life of home appliances.

Introduction

Technology involves the use of knowledge of machines and process; skills and procedures in directing the great resources of nature for the benefits of mankind. Electricity is perhaps the most generally used form of energy available today and it is in a way convenient to use as through it basic amenities which are products of electronic are got to better our standard of living. Electronics appliances are items that rely on the movement of electrons to propagate/ deliver signals remote from source to be received visually as television system or in audio form as in the radio system. The ability to reproduce pictures electronically has proved so useful that many more applications of television are used now for education, industry, business and visual communication in general. (Bernard, 1975). Radio also has an irresistible fascination for people and its attraction grows ever greater when one considers the possibility of deriving professional livelihood from it (Ernest & Stuart, 1978).

The electronic appliances provide a medium of information dissemination, it serves as a companion during leisure times, it allows events to be viewed or heard, and through them educational, entertainment and new programmes are broadcast (Loveday, 1980).

It will usually consist of a number of components combined into circuits to execute a specific duty. Some of these components are resistors, capacitors, inductors, transistors, diodes, thyristors, integrated circuits etc. An electronic circuit is a collection of components connected together to perform a particular function, each component has its function in the operation of a circuit (Atoe, 2005). As wonderful as the electronics art is, failure do interrupt the access to this service provision. Failure is defined as the termination of the ability of equipment to perform its required function. It is an unsatisfactory condition involving loss of function or loss of acceptable quality, where operation continues, but at a substandard or inadequate quality. An appliance will be considered to have failed when it becomes completely inoperative, when it is still operative but unable to perform the required function and when it becomes unsafe for its continued use (Oroge, 1991). These faults prevent free flow of signals in the component thereby disrupting signal reception. Efforts made at reactivating a failed appliance is called electronic repair, done by persons of necessary theoretical knowledge and practical experience of the behavior of electronic components. This paper therefore assesses the

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common faults associated with household electronic appliances to identify causes of such faults, component most affected and ways of reducing fault occurrence in home appliances.

Methodology

The main source of the information of this research works was a well structured questionnaire administered at five major towns in Ondo and Ekiti State as shown in Table I. The towns covered are Ado-Ekiti, Akure, Ikere-Ekiti, Owo and Ondo. A total number of one hundred and twenty copies of the questionnaire were distributed out in the study area. The respondents are people that had technical knowledge in the field of electronics maintenance and repairs which included the electronic technicians, craftsmen and technologists. The questionnaire is designed to evaluate types of faults associated with common household appliances, causes of faults, cost of repair and possible methods/ways of reducing fault occurrence. Oral interviews were further conducted with users of the household appliances to get information on their feelings, understanding, attitude of repairers, and cost of repair and effect of faulted appliances in their day to day life. The appliances covered in this work include: radio/cassette player, the television set, the video cassette player (VCP), the compact disc player (CD) and the video compact disc player (VCD). An appliance is made of electronics circuits- a collection of components connected together to perform a particular function. The types of electronics component commonly encountered in today's appliances are integrated circuits; capacitors, resistors, inductors, diodes, transformers, relays, mechanism etc and they were investigated in this work. The mechanism consists of drive, lever, pulley, relay, belt, and bearing; is the electromechanical system of placing input into an electronics system.

Results and Discussion

One hundred and twenty copies of well structured questionnaires were distributed randomly. The percentage of questionnaires that were completed and returned was 92% as shown in Table 1 and this allowed our analysis to be based on operational and environmental condition that existed in the towns.

From Table 2, television has the highest number of faults (31%), Video compact disc (VCD), has 26%; video cassette player has 24% while radio/cassette player has 18% of total faults recorded. The level of complexity in television set is responsible for the high level of faults recorded. The complicated functional parts or sections are inter-related and connected; therefore there is tendency for occurrence of two or more faults at a time in a television set. This evaluation makes troubleshooting in television set to be more tedious and time consuming as compared to other equipments. The electronics circuit in TV has highest number of electronic components and high voltage supply which one must be conscious of. All these points or factors necessitate a careful and time-consuming troubleshooting in Television set and in turn increases the cost of repair than in any other equipment.

From Table 3, resistor related faults accounts for highest causes of appliance failure. It has the highest percentage in all the equipment with 34.5%, 33.3%, 16.7%, and 18.9% respectively in TV set, Radio set, VCD player, and video cassettes player. Resistor related faults are due to open circuit, ageing, partial contact, dry joints and mechanical wears. It may also be due to the diverse functions of resistor ranging from being used as ordinary connector, fuse and voltage limiter or dropper. Use of sub standard materials in the manufacturing of the components also cause decrease or increase in the resistance value of the resistor thus leading to abnormal voltage supply to the active device (s) which the resistor is connected to and this might also lead to damage in other active and passive components.

Assessment Of Common Faults Associated With Household Electronic Appliances

IC related faults were also high with 34.5% in television set and 22% in VCD player. It is an active device which is dependent on the operational conditional of other passive device surrounding it. It is a major functional device which controls other operations like switching and sensing. It is always a major fault when it's faulty and it is mostly due to high voltage supply above its rated value. These factors altogether make of 56% of faults in TV set to be associated with ICs. Inductor, transistor and diode related faults are low in all appliances studied and each accounted for 6%, 4% and 3% of total faults in television set and 1%, 2% and 3% in radio cassette player respectively. Failure in capacitor is mostly caused by voltage surge above the rated value of the capacitor. Also, since capacitors are mostly found in tuner stage and perform the function of tuning the radio set to a desired frequency, failure occasionally result in air spaced variable types as a results of loose plates due to the effect of continuous tuning to achieve resonance frequency. The intermittent contact and fluctuations in capacitance value may also occur due to loss of electrolyte through leaking seal caused by pressure, thermal or mechanical shock as in aluminum electrolytic capacitor. Capacitor related faults accounted for 8.5%, 6%, 2% and 3% in television set, radio cassette player, VCD and video cassette player respectively. Mechanism related faults accounts for 50% and 37% respectively in both VCD player and video cassette player.

Mechanism operation involved pulley arrangement connected by belts and driven by motor. Mechanism related faults are due to mechanical shocks and vibrations, dust, weakened belt, damaged parts, non alignment and frictional stress. IC related faults account for 22% in VCD player. This is because it is an active device that controls the operation of the set and it is always affected by voltage surge in the supply. Transformer related faults account for 17% of faults is radio cassette player, 5.5% in VCD and 6.3% in video cassette player. Transformer faults are caused by voltage surge, overloading and insulation failure. Inductor related faults account for 10% in television and 3% in radio set. It is mainly used in turning circuit in radio set and television.

Table 4 shows faults occurrence in relation to sectional grouping. Control and switching section accounted for 49% while power stage related faults and mechanism related faults has 24.6% and 26.3% respectively. Control and switching stage have the highest fault occurrence in all equipment because they are predominant in the circuits and are sensitive to variation in the operating conditions.

Table 5 shows cost and duration of clearing faults in the appliances. Fault tracing and clearing in television set required more time due to its complex nature and makes troubleshooting to be longer and stressful. The longer troubleshooting duration and high cost of components makes the cost of repair to be high as compared to other appliances. A duration of repair of one hour in radio cassette player costs #600 due to the nature of the fault and non- complexity of the circuit as against a one hour duration of repair which costs about #1500 in television set.

Conclusion

From the study, resistor and integrated circuits (ICs) have high failure rate in television and radio sets. Mechanism related problems are rampant in VCD player and video cassette players. The electronic control and switching section of the appliances gets faulty more frequently than other sections.

The useful life of household appliances could be sustained if components faults are checked by methods of careful handling to prevent shock, use of stabilized power supply and regular servicing of the appliances. It is important to always allow the appliance to be handled by competent persons to avoid further damages to the appliances during repair.

Recommendation

1. The manufacturers should adopt the choice of components that exhibits tolerable temperature characteristics in the design and construction of electronic circuits to enhance the stability of the ratings and the operational characteristics of the passive components.
2. Manufacturer should always use standard materials with stable chemical characteristics so as to enhance the reliability and the availability of such equipment.
3. Consumer or user should see the use of automatic voltage regulator (AVR) as a necessary need to protect electronic equipment against current and voltage surge.
4. Preventive maintenance should always be carried out periodically by the user on the equipment by blowing and cleaning for ingress of dust which may result in long-term degradation of insulation and increased contact resistance.
5. Competent electricians with adequate knowledge and practical experience should always be allowed to effect maintenance and repair of our household appliances.
6. Aged household appliances should be replaced to pave way for modern ones with improved design considerations

Table 1: Questionnaire Distribution

Town	Number Of Questionnaires Distributed	Number Of Questionnaires Returned	Percentage
Ado-Ekiti	30	30	100%
Akure	30	28	93%
Ikere- Ekiti	20	16	80%
Owo	20	18	90%
Ondo	20	18	90%
Total	120	110	91.7%

Table 2: Troubleshooting Level in Repair

Appliances	Television	Radio/Cassette Player	Video Compact Disc Player	Video Cassette Player
Number Of Faults	36	21	30	27
Percentage	31%	18%	26%	24%

Table 3: Component Failure Study

Appliances/ Component	Television	Radio/Cassette Player	Video Compact Disc Player(VCD)	Video Cassette Player (VCP)
Integrated Circuits	20 (34.5%)	2 (5.5%)	8 (22.2%)	2 (6.3%)
Capacitors	5 (8.5%)	6 (16.7%)	2 (5.5%)	3 (9.4%)
Resistors	20 (34.5%)	12 (33.3%)	6(16.7%)	6 (18.9%)
Inductors	6 (10.3%)	1(2.8%)	-	-
Transistors	4 (6.9%)	2 (5.5%)	-	2 (6.3%)
Diodes	3 (5.2%)	3 (8.3%)	4 (11.1%)	3 (9.4%)
Transformer	-	6 (16.7%)	2 (5.5%)	2 (6.3%)
Mechanism	-	4 (11.1%)	18 (50%)	12 (37.5%)
Motor	-	2 (5.5%)	4 (11.1%)	2 (6.3%)
TOTAL	58 (100%)	36 (100%)	36 (100%)	32 (100%)

Table 4: Faults across Functional Sections

Appliances	Television	Radio Set	VCD Player	VCP	Remark
Power Stage	7	6	7	8	24.6%
Control& Switching	29	17	5	5	49.1%
Mechanism	-	4	18	8	26.3%
Total	36	27	30	21	114 (100%)

Table 5: Cost and Duration of Repair

	Description of faults	Equipment	Average repair time	Average cost of repair
1	No contract problem	Television	2 hours	2000
2	Continuous blowing of fuse	Television	1 hours	1500
3	Display of tiny horizontal line on the screen	Television	3 hours	2500
4	Incorrect colour separation	Television	2 hours	2000
5	Station interference problem	Radio	1 hour	800
6	No sound in output	Radio	1 hour	500
7	Cassette not rolling	Radio	30mins	400
8	No picture problem	VCD	1 hour	1200
9	No disk reading problem	VCD	30mins	300
10	No sound in the output	VCD	1 hour	800
11	Rejection of cassette	VCP	1 hour	800
12	No output at all	VCP	1 hour	600
13	Unstable picture output	VCP	30mins	400

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