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# Details: Thermography Audit of Ring Spinning Machine in Cotton Industry

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***Abstract*— Electrical Energy audit is one of the most important steps of green energy management in every association. Mostly for every small, medium, or large industry require high energy intensity, a balanced system, energy flow process required all over the operation of the plant. To meet the requirements, a Thermal imaging audit is one of the most important parts of the electrical safety audit. In a thermal imaging audit identify the actual temperature of a specific device or section location. In this paper a conducts a thermal imaging audit is conducted in the textile industry, Nagpur, and finds out the minimum, maximum, and average temperatures of the card, motor, bearing, housing, and different major equipment. Based on the audit, provide suggestions and recommendations.**

***Index Terms*— Electrical safety; thermography, ring frame, Motor, Power Quality.**

## I. INTRODUCTION

The science of infrared thermography uses electronic optical instruments to measure and identify radiation and correlate it with surface temperature. Thermal imagers are capable of presenting infrared radiation coming from the body visually by converting it into electric signals. The newest analysis tool for a thorough energy audit is infrared thermography, since thermal cameras are an efficient way of observing problems with wall cavity insulation, ceiling insulation, and moisture. Thermal imaging can locate various areas in electrical installations that are challenging to locate with conventional techniques. One diagnostic tool for figuring out the best course of action to improve the energy efficiency of electrical installation is infrared thermography. Infrared thermography assessments and walkthrough, preliminary, and comprehensive energy audits are among the energy audit services provided to a variety of industries, including construction and electrical [1-2]

Thermography Energy Audit by URS indicates the organization's adherence to efficient energy-saving technologies and measures using thermal cameras, and as a truly Auditing Firm, offers Value Auditing Services in Energy Auditing by suggesting energy-efficient measures within the deep insulation, wall cavity, etc. Auditing Services of URS are designed to meet Global Standards that deliver Credibility in the adoption of Energy Saving Measures using thermal imaging. To achieve this objective, professionally trained auditors having expertise in thermal imaging are deputed to identify 'Opportunities and Measures for Improvements' in Energy Auditing.

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## II. RING FRAME

### *A. Ring spinning*

A device known as a ring frame is used in the spinning process. The bobbin is transformed into yarn by it. Either manually or automatically, the bobbin from the fly frame of the preceding step is installed on the ring frame. The material is stretched by the ring frame u sing drafting 2s and 140s. When compared to open yarn, ring yarn is finer and more hairy.

### *B. Advancement is required*

Numerous modifications have been made to ring spinning to continuously enhance output, effectiveness, and quality. air conditioning is required in addition to air suction and air pipes. The benefits and drawbacks are listed below. [ 4-6]

Benefits include the following:

- The production of yarns with outstanding durability.
- Measuring excellent yarn spun.
- Perfect for unique yarns.
- It is flexible in terms of quantity and blend dimensions.
- The drawing section has the best control over pace, and the yarn evenness is superb. Yet, too many short fibers might cause uneven yarn.

It is possible to create finer yarns than using an open-end spinning method. Some drawbacks are as follows:

- There are more stages in the process. Comparing roving stages to other systems, they are an additional process.
- The fibers are damaged by the traveler's rapid speed.
- The police force has a finite capacity.
- Energy cost is very high.
- Low rate of productivity

Main Parts of Ring Frame:

The main parts of the ring frame are as follows [8]

- Roving Bobbin: Inserted in holders.
- Roving Guide: To feed roving correctly.
- Creel: To hold the roving bobbin over the roller beam.
- Guide Rail: Guide the roving into the drafting.

### *C. The Ring Fram Zone*

There are four different kinds of zones in all.

- First creel zone
- The draft area
- Zone of twisting
- The wind zone.

## III. RESULT

### *A. Main Motor*

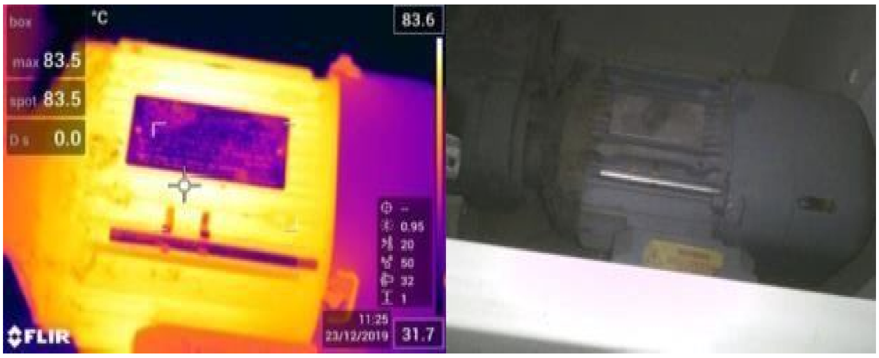


Figure 1. Belt motor found a heated condition at bale Plucker
a) IR Image b) Visible Image

TABLE I. THERMOGRAPHY REPORT OF MAIN MOTOR

| Parameter | Temperature |
|---|---|
| Component temperature | 83.6 °C |
| Initial temperature | 31.7 °C |
| Affectivity | 0.95 |
| Transference | 1.00 |
| typical temperature | 83.0 °C |
| Range of calibrations | -20.0 °C to 250.0 °C |

Remark: The conveyor drive belt motor at Bale Plucker was found heated and suggested checking the following things

- Motor winding condition and bearing condition 2. Lubrication schedule 3. Belt Alignment 4. Cleaning condition

*B. Doffer Motor*


Figure 2. Doffer Motor Found Heated Condition At Card No-2
a) IR Image b) Visible Image

TABLE II. THERMOGRAPHY REPORT OF DOFFER MOTOR

| Parameter | Temperature |
|---|---|
| Component temperature | 70.8 °C |
| Initial temperature | 37.6 °C |
| Affectivity | 0.95 |
| Transference | 1.00 |
| typical temperature | 70.0 °C |
| Range of calibrations | -20.0 °C to 250.0 °C |

Remark - 1. Motor winding condition and bearing condition 2. Lubrication schedule 3. Cleaning condition 4. Belt Tension

*C. Doffer motor at the card*

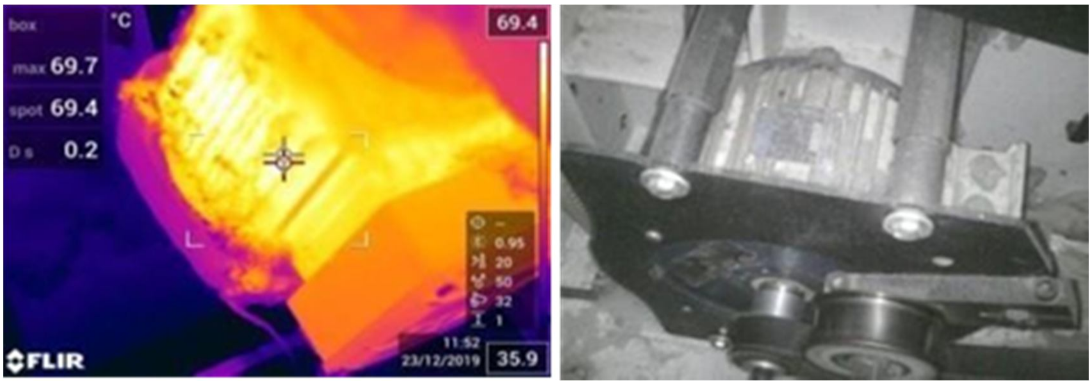


Figure 3. Doffer Motor Found Heated Condition At Card No-2
a) IR Image b) Visible Image

TABLE III. THERMOGRAPHY REPORT OF DOFFER MOTOR AT A CARD

| Parameter | Temperature |
|---|---|
| Component temperature | 69.4 °c |
| Initial temperature | 35.9 °c |
| Affectivity | 0.95 |
| Transference | 1.00 |
| typical temperature | 69.0 °c |
| Range of calibrations | -20.0 °c to 250.0 °c |

Remark- Doffer motor at card no. 4 found in a heated condition. Suggested checking the following things. 1. Motor winding condition 2. Lubrication schedule 3. Cleaning condition

*D. Cylinder Bearing*


Figure 3.4. Cylinder bearing housing lhs at card no-1 found heated condition
a) IR Image b) Visible Image

TABLE IV. THERMOGRAPHY REPORT OF CYLINDER BEARING

| Parameter | Temperature |
|---|---|
| Component temperature | 76.4 °c |
| Initial temperature | 35.0 °c |
| Affectivity | 0.95 |
| Transference | 1.00 |
| typical temperature | 76.0 °c |
| Range of calibrations | -20.0 °c to 250.0 °c |

Remark- Cylinder bearing housing LHS at card no. 1 found in heated condition. Suggested to check the following things Lubrication schedule 2. Cleaning condition 3.Check bearing condition

*E. Opening Roller*

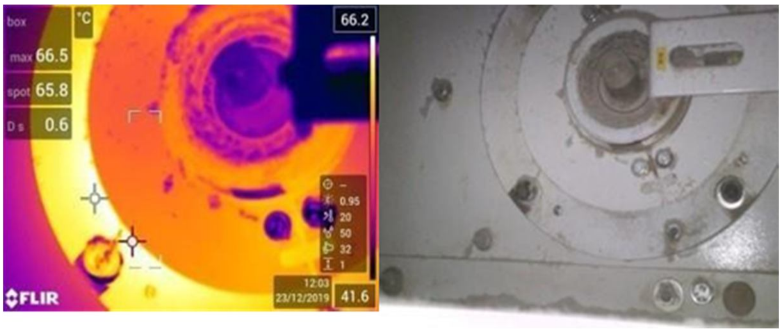


Figure 5. opening roller bearing housing at card no-3
a) IR Image b) Visible Image

TABLE V. THERMOGRAPHY REPORT OF OPENING ROLLE

| Parameter | Temperature |
|---|---|
| Component temperature | 66.0 °c |
| Initial temperature | 34.0 °c |
| Affectivity | 0.95 |
| Transference | 1.00 |
| typical temperature | 66.0 °c |
| Range of calibrations | -20.0 °c to 250.0 °c |

Remark- Opening roller bearing housing LHS side card no. 3 found a heated condition. Suggested to check the following things
1. Check side frame jamming 2. Lubrication schedule 3. Cleaning condition 4. Check bearing condition

*F. Cylinder-bearing housing*


Figure 6. Cylinder bearing housing at card no-3 found heated condition
a) IR Image b) Visible Image

TABLE V. THERMOGRAPHY REPORT OF CYLINDER BEARING HOUSING

| Parameter | Temperature |
|---|---|
| Component temperature | 66.0 °c |
| Initial temperature | 34.0 °c |
| Affectivity | 0.95 |
| Transference | 1.00 |
| typical temperature | 66.0 °c |
| Range of calibrations | -20.0 °c to 250.0 °c |

Remark- Cylinder bearing housing LHS at card no 03 found heated condition. Suggested to check the following things
1. Lubrication schedule 2. Cleaning condition 3. Check bearing condition.

*G. Card Feed Motor*

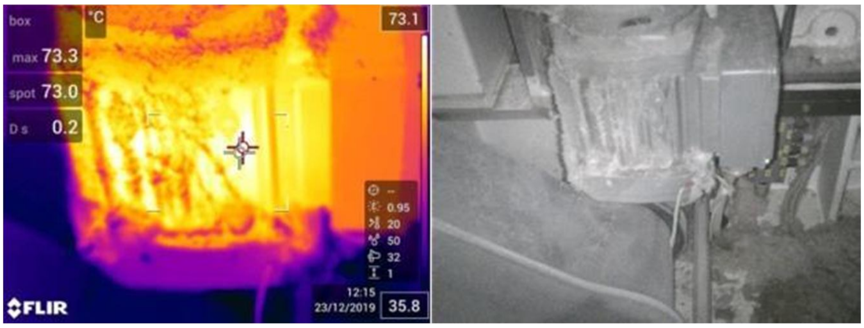


Figure 7. Card feed motor at card no found heated condition
a) IR Image b) Visible Image

TABLE VI. THERMOGRAPHY REPORT OF CARD FEED MOTOR AT CARD NO-5

| Parameter | Temperature |
|---|---|
| Component temperature | 73.1 °c |
| Initial temperature | 35.8 °c |
| Affectivity | 0.95 |
| Transference | 1.00 |
| typical temperature | 73.0 °c |
| Range of calibrations | -20.0 °c to 250.0 °c |

Remark- Suggested check the following things 1. Bearing condition and motor winding condition. 2. Motor servicing schedule 3. Lubrication schedule 4. Cleaning Schedule

## IV. Thermography Data of Card

TABLE VII. SHOWS THE THERMOGRAPHY DATA OF THE CARD

| Doffer Bearing Housing | | | | | | | | Cylinder bearing housing | | |
|---|---|---|---|---|---|---|---|---|---|---|
| M/C no | Doffer motor | Brush motor | Main motor | L.H.S | R.H.S | M/C pulley | Cylinder pulley | L.H.S | R.H.S | Fan motor |
| 1 | 63.3 | 62.3 | 51 | 38 | 44.3 | 51.1 | 40.9 | 76.4 | 66.2 | 42.1 |
| 2 | 70.8 | 61.7 | 53.2 | 42.8 | 43.9 | 49.6 | 42.1 | 59 | 55 | 42.5 |
| 3 | 67.8 | 61 | 55 | 39.9 | 41.6 | 51 | 39.3 | 78.3 | 60.5 | 48.1 |
| 4 | 69.3 | 65.1 | 46.4 | 46.9 | 47 | 45.3 | 42.8 | 69.1 | 65.5 | 43 |
| 5 | 65.7 | 62.7 | 47.8 | 51 | 42.1 | 46.8 | 46.5 | 62.6 | 61.4 | 43.3 |
| 6 | 67 | 55.8 | 47.1 | 39 | 47.8 | 45.7 | 43 | 41.3 | 49.8 | 40.8 |
| 7 | 62 | 57.2 | 48 | 38.5 | 45.4 | 45 | 41.6 | 53.9 | 67.4 | 41.1 |

TABLE VIII. THERMOGRAPHY DATA OF THE CARD

| | | Opening roller frame | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| M/C no | Opening roller motor | *L.H.S* | R.H.S | Chute feed motor | Card feed motor | Philipson Brush motor | Delivery motor | Can changer | Licker in Bearing housing (LHS) | Lickerin Bearing Housing (RHS) |
| 1 | 48.1 | 43.8 | 47.9 | 49.6 | 69.4 | 60.6 | 67 | 39.2 | 58 | 53.2 |
| 2 | 56.3 | 44 | 46 | 53 | 60.9 | 52 | 57.6 | 39.2 | 61 | 58 |
| 3 | 55 | 66.2 | 48 | 53 | 62.7 | 69.5 | 52.1 | 39.4 | 70.2 | 65 |
| 4 | 51.8 | 43.7 | 44.6 | 48.4 | 55.7 | 64.3 | 53.1 | 39 | 59.3 | 70.3 |
| 5 | 54.8 | 47.2 | 64.8 | 52.2 | 73.1 | 58.6 | 53.5 | 38.9 | 58.4 | 56.9 |
| 6 | 59.7 | 46.5 | 42 | 49.8 | 61.9 | 56.2 | 58.1 | 38.2 | 60 | 73.3 |
| 7 | 55.5 | 44.2 | 45.5 | 55.3 | 64.2 | 67.5 | 50.9 | 39.8 | 52.9 | 64.4 |

TABLE IX. THERMOGRAPHY DATA OF RING CARD

| Drafting Motor/Gearbox H.S | | Drafting Motor/Gear box | | Head Stock Gearing | |
|---|---|---|---|---|---|
| RHS | LHS | RHS | LHS | LHS | RHS |
| 85.6/72.4 | 95.3/75.2 | 83.4/75.7 | 74.4/69.3 | 65.4 | 65.4 |
| 79.8/66.8 | 80.6/68.5 | 77.5/70 | 73.4/68.1 | 65.1 | 63.4 |
| 66.2/77.5 | 84.1/73.2 | 74.6/68.2 | 69.8/65.7 | 63.1 | 63 |
| 87.5/74.4 | 92/79 | 89.4/78.2 | 89.3/77.3 | 54.6 | 63.1 |
| 86.3/75.7 | 82.2/75.2 | 78.3/72.1 | 72.4/68.1 | 62.3 | 54.6 |
| 88.9/75.3 | 86.7/75.3 | 77.3/72.1 | 73.2/65.8 | 65.1 | 62.3 |
| 89.4/78.8 | 85.2/73 | 83.7/74.2 | 78.5/72.1 | 65.9 | 65.1 |
| 92.1/79.7 | 91.7/71.3 | 81.1/73.2 | 89.7/74.8 | 53 | 65 |
| 89.2/75.3 | 93.6/78.1 | 91.9/71.1 | 87.2/69 | 62.7 | 53 |
| 92.5/75.4 | 98.2/78.1 | 80.1/72 | 84.4/70 | 63.1 | 62.7 |

Tables no.4.1,4.2, and 4.3 show the thermography data of different ring cards. In Table 1 maximum temperature doffer the motor, Machine no 2 is 78.30 °C and the cylinder bearing house is LHS 70.80 °C. In Table 2 maximum temperature opening roller frame LHS is 66.20 °C, and Lickerin is LHS 73.3.80 C. In Table no 3 maximum temperature drafting motor LHS is 98.20 °C. For the maximum temperature given suggestions and recommendations are provided.

## V. Conclusion

Although thermography is a very useful technique for electrical installation maintenance and energy audits, assessment and decision- making can be challenging with this method. In this paper find out the maximum and Minimum temperatures of different motors, cards, and bearings. In this audit find out the main motor temperature are 83.0 °C ,Doffer Motor are 70.0 °C, Cylinder Bearing temperature are 76.0 °c , Card Feed Motor temperature are 73.0 °c and Drafting Motor/Gearbox L.H.S are 98.2.0 °c The maximum temperature is found between 98.2.0 C. and  minimum temperature are 70.0 °C . For the maximum temperature given suggestions and recommendation for minimization of temperature.

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