

# Electrical and electronics engineering

Profession



a report on practical training taken at Bhilai steel plant, Bhilai (C. G. )  
submitted to :- submitted by :- Prof. Sandeep Aysha Rahman Chandravanshi  
HOD, EEE submitted by :- Aysha Rahman Semester :- 4th sem branch :-  
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acknowledgement \* certificate \* introduction about SAIL \* Bhilai steel plant \*  
sources of raw material \* process flow of BSP \* electrical repair shop \* heavy  
maintenance electrical \* safety \* conclusion \* bibliography acknowledgment

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This is to certify that the report of B. E. 4th Semester, BHILAI STEEL PLANT  
project submitted by AYSHA RAHMAN bearing Roll No. : 3412509004 &  
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G. ), India. The project work as mentioned above is here by being  
recommended and forwarded for examination and evaluation.

\_\_\_\_\_ (Signature of Head of the department)

Date : STEEL AUTHORITY OF INDIA LIMITED | | Type Owned by | State-owned enterprise Public (NSE: SAIL, LSE: SAUD) Government of India | Industry | Steel | Founded | 1954 | Headquarters | New Delhi, India | Key people | Chandra Shekhar Verma (Chairman) | Production Revenue | 13.5 million metric tons/year \$9.629 billion (2010) | Net income | 1.520 billion (2010) |

Total assets | \$15.655 billion (2010) | Employees | 131,910 (2006) | Website | <http://www.sail.co.in/> | Steel Authority of India Limited A Maharatna Steel Authority of India Limited (SAIL) is the leading steel-making company; among the top five highest profit earning corporate and one of fastest growing Public Sector Unit in India. It is a public sector undertaking which trades publicly in the market is largely owned by Government of India and acts like an operating company.

It is a fully integrated iron and steel maker, producing both basic and special steels for domestic construction, engineering, power, railway, automotive and defence industries and for sale in export markets. SAIL is also among the five Maharatna's of the country's Central Public Sector Enterprises and is the 16th largest steel producer in the world. | | SAIL manufactures and sells a broad range of steel products, including hot and cold rolled sheets and coils, galvanized sheets, electrical sheets, structural railway products, plates, bars and rods, stainless steel and other alloy steels.

SAIL produces iron and steel at five integrated plants and three special steel plants, located principally in the eastern and central regions of India and situated close to domestic sources of raw materials, including the Company's iron ore, limestone and dolomite mines. The company has the distinction of being India's second largest producer of iron ore and of having the country's

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second largest mines network. This gives SAIL a competitive edge in terms of captive availability of iron ore, limestone, and dolomite which are inputs for steel making.

SAIL's wide range of long and flat steel products is much in demand in the domestic as well as the international market. This vital responsibility is carried out by SAIL's own Central Marketing Organization (CMO) that transacts business through its network of 37 Branch Sales Offices spread across the four regions, 25 Departmental Warehouses, 42 Consignment Agents and 27 Customer Contact Offices. CMO's domestic marketing effort is supplemented by its ever widening network of rural dealers who meet the demands of the smallest customers in the remotest corners of the country.

SAIL's International Trade Division (ITD), in New Delhi- an ISO 9001: 2000 accredited unit of CMO, undertakes exports of Mild Steel products and Pig Iron from SAIL's five integrated steel plants. With technical and managerial expertise and know-how in steel making gained over four decades, SAIL's Consultancy Division (SAILCON) at New Delhi offers services and consultancy to clients world-wide. SAIL has a well-equipped Research and Development Centre for Iron and Steel (RDCIS) at Ranchi which helps to produce quality steel and develop new technologies for the steel industry.

Besides, SAIL has its own in-house Centre for Engineering and Technology (CET), Management Training Institute (MTI) and Safety Organization at Ranchi. Our captive mines are under the control of the Raw Materials Division in Kolkata. The Environment Management Division and Growth Division of SAIL operate from their headquarters in Kolkata. | Ownership and Management The Government of India owns about 86% of SAIL's equity and

retains voting control of the Company. However, SAIL, by virtue of its ‘Maharatna’ status, enjoys significant operational and financial autonomy.

MAJOR UNITS Integrated Steel Plants| \* Bhilai Steel Plant (BSP) in Chhattisgarh \* Durgapur Steel Plant (DSP) in West Bengal \* Rourkela Steel Plant (RSP) in Orissa \* Bokaro Steel Plant (BSL) in Jharkhand \* IISCO Steel Plant (ISP) in West Bengal | | Special Steel Plants| \* Alloy Steels Plants (ASP) in West Bengal \* Salem Steel Plant (SSP) in Tamil Nadu \* Visvesvaraya Iron and Steel Plant (VISL) in Karnataka | | | | Joint Ventures| | | \* NTPC SAIL Power Company Pvt. Limited (NSPCL) \* Bokaro Power Supply Company Pvt.

Limited (BPSCL) \* Mjunction Services Limited \* SAIL-Bansal Service Centre Limited \* Bhilai JP Cement Limited \* Bokaro JP Cement Limited \* SAIL ; MOIL Ferro Alloys (Pvt. ) Limited \* S ; T Mining Company Pvt. Limited \* International Coal Ventures Private Limited \* SAIL SCI Shipping Pvt. Limited \* SAIL RITES Bengal Wagon Industry Pvt. Limited \* SAIL SCL Limited| | bHILAI STEEL PLANT The Bhilai Steel Plant (BSP) - a public sector undertaking run by the Steel Authority of India - built with Soviet co-operation and technology, and began production in 1959.

Located in Bhilai, Chhattisgarh is India's only producer of steel rails, and is a major producer of rails and heavy steel plates and structural components. In the 2004-05 fiscal year, it is the Steel Authority of India Limited's most profitable plant. This steel plant was set up with the help of the USSR. Nine - time winner of Prime Minister's Trophy for best Integrated Steel Plant in the country. The plant is the sole supplier of the country's longest rail tracks of 260 metres. With an annual production capacity of 3. 53 MT of saleable steel, the plant also specializes in other products such as wire rods and

merchant products. Since BSP is accredited with ISO 9001: 2000 Quality Management System Standard, all saleable products of Bhilai Steel Plant come under the ISO umbrella. At Bhilai ISO: 14001 have been awarded for Environment Management System in the Plant, Township and Dalli Mines. It is the only steel plant to get certification in all these areas. The Plant is accredited with SA: 8000 certification for social accountability and the OHSAS-18001 certification for Occupational health and safety.

These internationally recognised certifications add value to Bhilai's products the best organizations in the steel industry. Among the long list of national awards it has won, Bhilai has bagged the CII-ITC Sustainability award for three consecutive years. Bhilai Steel Plant manages a well planned township (Bhilainagar) which has 13 sectors. It was deliberately located in what was then regarded as a remote and "backward" rural area, profits being secondary to employment in the planning priorities of the time.

BSP currently has nearly 55, 000 permanent workers on its direct pay-roll, of whom approximately three-fifths work inside the 17 square kilometer plant and the remainder for its associated mines and quarries, and for the purpose-built BSP township. This compares with a regular workforce of 63, 400 in 1987. In addition, on any one day there are at present something in the region of 8, 000 contract workers employed by the plant and the township, and a further 3, 500 - 4, 000 employed by the mines. BSP has for some years shown a profit, and is widely regarded as the most successful of those in the Indian public sector.

It runs at its four million ton capacity; produces cheaper steel, and has a record of considerably more harmonious industrial relations than any of the

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other state-run steel plants, and also than the vast majority of private sector factories which now surround it, and for which it served as a magnet. Though local job creation was one of its main objectives, and though the principle was soon established that one member from every family which had relinquished land should have an automatic right to BSP employment, the local Chhattisgarhis were initially reluctant recruits.

Location : Forty kms west of Raipur, the capital city of Chhattisgarh, along the Howrah-Mumbai railway line and the Great-Eastern highway, stands Bhilai Steel Plant (BSP). Source of Raw Materials: 1. Iron Ore

.... Dalli, Rajahara Mines 2. Lime Stone .... Nandini Mines 3. Manganese .... Balaghat Mines 4. Sinter .... Sintering Plants (SP-2, SP-3) 5. Coke .... Coke Ovens (Coke sorting plants) 6. Converter Slag .... SMS – I Captive mines

Iron-ore| - Dalli-Rajhara Iron Ore Complex, 80 kms from Bhilai | Limestone| - Nandini, 23 kms from Bhilai| Dolomite| - Hirri, 150 kms from Bhilai| Coke Ovens BATT NO. | NO. OF OVENS| OVEN HEIGHT(M) | COAL HOLDING CAPACITY PER OVEN (T) | USEFUL VOLUME PER OVEN CU. M. | SP. HEAT CONSPN. KCAL/KG| 1-8| 65| 4. 3| 16. 8| 21. 6| 625-675 | 9&10| 67| 7. 0| 32. 0| 41. 6| 625-675 | Blast Furnaces \* 3 of 1033 Cu m capacity each \* 3 of 1719 Cu m capacity each \* 1 of 2355 Cu m capacity Hot Metal Capacity: 4. 70 MT / year PROCESS FLOW OF BSP PRODUCTS OF BSP A. FINISHED PRODUCTS Rail & Structural Mill Rails in 13m, 26m, 65/78 m length and welded panels of 130m / 260m length Indian Railways, Export Heavy Structurals Construction, Crane Rails, Cranes, Crossing sleepers, Broad gauge sleepers \* Merchant Mill Lt. Structurals, Engineering and Construction, Med. Rounds (Plain & TMT),

Heavy rounds (Plain) \* Wire Rod Mill Wire Rods- Plain Construction, Wire Rods- TMT, EQ Wire Rods Electrodes \* Plate Mill Plates Boilers, Defence, Railways, Ship building, LPG cylinders, Export B. SEMIS

Billets (from BBM), Re-rollers Blooms (from BBM), Narrow width slabs, CC Blooms, Killed Slabs C. Pig Iron Foundry D. By Products Coal Chemicals, Ammonium Sulphate (Fertiliser) Tar and tar products, (Pitch, Naphthalene, Creosote Oil Road Tar, Anthracene oil, Dephenolised oil, PCM etc. ), Benzol & its products (NG Benzene, Toluene, Xylene, Solvent oil, By. Benzol etc. ), Processed Slag Granulated slag from CHSG Plants & SGP for cement manufacture. RODUCT-MIX| TONNES/ANNUM| Semis | 5, 33, 000| Rail & Heavy Structural | 7, 50, 000| Merchant Products (Angles, Channels, Round & TMT bars)| 5, 00, 000|

Wire Rods (TMT, Plain & Ribbed) | 4, 20, 000| Plates (up to 3600 mm wide) | 9, 50, 000| Total Saleable steel | 31, 53, 000 | Requirements for producing of one ton of Hot Metal (Specific Consumption) Iron Ore .... 459 Kg Lime Stone .... 850 Kg(Depending on Sinter Usage) Manganese .... 800 Kg(50% in burden) Sinter .... 35 Kg Coke .... 08 Kg

ELECTRICAL RERAIP SHOP JOB FLOW CHART PLANT RECEIPT & ISSUE AT ERS TESTING MACHINE &

SPARE PART ASSEMBLY COMMUTATOR WINDING & MAGNET TRANSFORMER VARNISHING TASKS done in ers \* Assembles electrical parts such as alternators, generators, starting devices and switches; following schematic drawings, using hand, machine and power tools. \* Repairs and rebuilds defective mechanical parts in electric motors, generators and related equipment, using hand tools and power tools. \* Tests for overheating, using

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speed gauges and thermometers. \* Rewinds coils on core while core is in slots, or make replacement coils, using coil-winding machine. Replaces defective parts such as coil leads, carbon brushes and connecting wires using soldering equipment. \* Installs, secures and aligns parts using hand tools welding equipment and electrical meters. \* Rewires electrical systems and repairs or replaces electrical accessories. \* Reassembles repaired electric motors to specified requirements and ratings, using hand tools and electric meters. \* Disassembles defective units using hand tools. \* Measures velocity, horsepower, r. p. m, amperage circuitry and voltage of units or parts using electrical meters and mechanical testing devices. Cuts and removes parts such as defective coils and insulation. \* Adjusts working parts such as fan belt tension, voltage output, contacts and springs using hand tools and verifies corrections using gauges. \* Tests charges and replaces batteries. \* Inspects parts for wear or damage or reads work order or schematic drawings to determine required repairs. \* Cuts and forms insulation and inserts insulation into armature, rotor or stator slots. \* Refaces, reams and polishes commutators and machine parts to specified tolerances using machine tools. HEAVY MAINTENANCE ELECTRICALS  
MAINTENANCE OF MOTORS

The key to minimizing motor problems is scheduled routine inspection and service. The frequency of routine service varies widely between applications. Including the motors in the maintenance schedule for the driven machine or general plant equipment is usually sufficient. A motor may require additional or more frequent attention if a breakdown would cause health or safety problems, severe loss of production, damage to expensive equipment or

other serious losses. Written records indicating date, items inspected, service performed and motor condition are important to an effective routine maintenance program.

From such records, specific problems in each application can be identified and solved routinely to avoid breakdowns and production losses. The routine inspection and servicing can generally be done without disconnecting or disassembling the motor. It involves the following factors: Dirt and Corrosion:

1. Wipe, brush, vacuum or blow accumulated dirt from the frame and air passages of the motor. Dirty motors run hot when thick dirt insulates the frame and clogged passages reduce cooling air flow. Heat reduces insulation life and eventually causes motor failure. 2. Feel for air being discharged from the cooling air ports.

If the flow is weak or unsteady, internal air passages are probably clogged. Remove the motor from service and clean. 3. Check for signs of corrosion. Serious corrosion may indicate internal deterioration and/or a need for external repainting. Schedule the removal of the motor from service for complete inspection and possible rebuilding. 4. In wet or corrosive environments, open the conduit box and check for deteriorating insulation or corroded terminals. Repair as needed. Lubrication: Lubricate the bearings only when scheduled or if they are noisy or running hot.

Do NOT over-lubricate. Excessive grease and oil creates dirt and can damage bearings. Heat, Noise and Vibration: Feel the motor frame and bearings for excessive heat or vibration. Listen for abnormal noise. All indicate a possible system failure. Promptly identify and eliminate the source of the heat, noise or vibration. Winding Insulation: When records indicate a tendency toward

periodic winding failures in the application, check the condition of the insulation with an insulation resistance test. Such testing is especially important for motors operated in wet or corrosive atmospheres or in high ambient temperatures. Brushes and Commutators (DC Motors): 1. Observe the brushes while the motor is running. The brushes must ride on the commutator smoothly with little or no sparking and no brush noise (chatter). 2. Stop the motor. Be certain that: \* The brushes move freely in the holder and the spring tension on each brush is about equal. \* Every brush has a polished surface over the entire working face indicating good seating. \* The commutator is clean, smooth and has a polished brown surface where the brushes ride.

NOTE: Always put each brush back into its original holder. Interchanging brushes decreases commutation ability. \* There is no grooving of the commutator (small grooves around the circumference of the commutator). If there is grooving, remove the motor from service immediately as this is a symptomatic indication of a very serious problem. 3. Replace the brushes if there is any chance they will not last until the next inspection date. 4. If accumulating, clean foreign material from the grooves between the commutator bars and from the brush holders and posts. 5.

Brush sparking, chatter, excessive wear or chipping, and a dirty or rough commutator indicate motor problems requiring prompt service. Figure 1. Typical DC Motor Brushes and Commutator Brushes and Collector Rings (Synchronous Motors) 1. Black spots on the collector rings must be removed by rubbing lightly with fine sandpaper. If not removed, these spots cause pitting that requires regrinding the rings. Figure 2. Rotary Converter

Armature Showing Commutator And Slip Rings. 2. An imprint of the brush, signs of arcing or uneven wear indicate the need to remove the motor from service and repair or replace the rings. . Check the collector ring brushes as described under " Brushes and Commutators". They do not, however, wear as rapidly as commutator brushes. BEARING LUBRICATION: Introduction Modern motor designs usually provide a generous supply of lubricant in tight bearing housings. Lubrication on a scheduled basis, in conformance with the manufacturer's recommendations, provides optimum bearing life. Thoroughly clean the lubrication equipment and fittings before lubricating. Dirt introduced into the bearings during lubrication probably causes more bearing failures than the lack of lubrication.

Too much grease can over pack bearings and cause them to run hot, shortening their life. Excessive lubricant can find its way inside the motor where it collects dirt and causes insulation deterioration. Many small motors are built with permanently lubricated bearings. They cannot and should not be lubricated. OILING SLEEVE BEARINGS: As a general rule, fractional horsepower motors with a wick lubrication system should be oiled every 2000 hours of operation or at least annually. Dirty, wet or corrosive locations or heavy loading may require oiling at three-month intervals or more often.

Roughly 30 drops of oil for a 3-inch diameter frame to 100 drops for a 9-inch diameter frame is sufficient. Use a 150 SUS viscosity turbine oil or SAE 10 automotive oil. Some larger motors are equipped with oil reservoirs and usually a sight gage to check proper level. (Fig. 3) As long as the oil is clean and light in colour, the only requirement is to fill the cavity to the proper level with the oil recommended by the manufacturer. Do not overfill the

cavity. If the oil is discoloured, dirty or contains water, remove the drain plug. Flush the bearing with fresh oil until it comes out clean.

Coat the plug threads with a sealing compound, replace the plug and fill the cavity to the proper level. When motors are disassembled, wash the housing with a solvent. Discard used felt packing. Replace badly worn bearings. Coat the shaft and bearing surfaces with oil and reassemble. Figure 3. Cross Section of the Bearing System of a Large Motor

**GREASING BALL AND ROLLER BEARINGS:** Practically all Reliance ball bearing motors in current production are equipped with the exclusive PLS/Positive Lubrication System. PLS is a patented open-bearing system that provides long, reliable bearing and motor life regardless of mounting position. Its special internal passages uniformly distribute new grease pumped into the housing during regreasing through the open bearings and forces old grease out through the drain hole. The close running tolerance between shaft and inner bearing cap minimizes entry of contaminants into the housing and grease migration into the motor. The unique V-groove outer slinger seals the opening between the shaft and end bracket while the motor is running or is at rest yet allows relief of grease along the shaft if the drain hole is plugged. Figure 4) The frequency of routine greasing increases with motor size and severity of the application as indicated in Table 1. Actual schedules must be selected by the user for the specific conditions. During scheduled greasing, remove both the inlet and drain plugs. Pump grease into the housing using a standard grease gun and light pressure until clean grease comes out of the drain hole. If the bearings are hot or noisy even after correction of bearing overloads (see "Troubleshooting") remove the motor from service. Wash the housing and

bearings with a good solvent. Replace bearings that show signs of damage or wear.

Repack the bearings, assemble the motor and fill the grease cavity. Whenever motors are disassembled for service, check the bearing housing. Wipe out any old grease. If there are any signs of grease contamination or breakdown, clean and repack the bearing system as described in the preceding paragraph. Figure 4. Cross Section of PLS Bearing System (Positive Lubrication System) **HEAT, NOISE AND VIBRATION** Heat Excessive heat is both a cause of motor failure and a sign of other motor problems. The primary damage caused by excess heat is to increase the aging rate of the insulation. Heat beyond the insulation's rating shortens winding life.

After overheating, a motor may run satisfactorily but its useful life will be shorter. For maximum motor life, the cause of overheating should be identified and eliminated. As indicated in the Troubleshooting Sections, overheating results from a variety of different motor problems. They can be grouped as follows: \* **WRONG MOTOR:** It may be too small or have the wrong starting torque characteristics for the load. This may be the result of poor initial selection or changes in the load requirements. \* **POOR COOLING:** Accumulated dirt or poor motor location may prevent the free flow of cooling air around the motor.

In other cases, the motor may draw heated air from another source. Internal dirt or damage can prevent proper air flow through all sections of the motor. Dirt on the frame may prevent transfer of internal heat to the cooler ambient air. \* **OVERLOADED DRIVEN MACHINE:** Excess loads or jams in the driven machine force the motor to supply higher torque, draw more current and

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overheat. Table 1. Motor Operating Conditions

Motor Horsepower	Light Duty(1)	Standard Duty(2)	Heavy Duty(3)	Severe Duty(4)
Up to 7-1/2	10 to 40	50 to 150	Over 150	
	10 years	7 years	4 years	1 year
	7 years	years 1-1/2	years 6 months	4 years 1-1/2 years 9 months 3 months
	9 months	4 months	3 months	2 months

\* Light Duty: Motors operate infrequently (1 hour/day or less) as in portable floor sanders, valves, door openers. \* Standard Duty: Motors operate in normal applications (1 or 2 work shifts). Examples include air conditioning units, conveyors, refrigeration apparatus, laundry machinery, woodworking and textile machines, water pumps, machine tools, garage compressors. \* Heavy Duty: Motors subjected to above normal operation and vibration (running 24 hours/day, 365 days/year).

Such operations as in steel mill service, coal and mining machinery, motor-generator sets, fans, pumps. \* Severe Duty: Extremely harsh, dirty motor applications. Severe vibration and high ambient conditions often exist. \* EXCESSIVE FRICTION: Misalignment, poor bearings and other problems in the driven machine, power transmission system or motor increase the torque required to drive the loads, raising motor operating temperature. \* ELECTRICAL OVERLOADS: An electrical failure of a winding or connection in the motor can cause other Windings or the entire motor to overheat. Noise and Vibration

Noise indicates motor problems but ordinarily does not cause damage. Noise, however, is usually accompanied by vibration. Vibration can cause damage in several ways. It tends to shake windings loose and mechanically damages insulation by cracking, flaking or abrading the material. Embrittlement of lead wires from excessive movement and brush sparking at

commutators or current collector rings also results from vibration. Finally, vibration can speed bearing failure by causing balls to "brinnell," sleeve bearings to be pounded out of shape or the housings to loosen in the shells.

Whenever noise or vibrations are found in an operating motor, the source should be quickly isolated and corrected. What seems to be an obvious source of the noise or vibration may be a symptom of a hidden problem. Therefore, a thorough investigation is often required. Noise and vibrations can be caused by a misaligned motor shaft or can be transmitted to the motor from the driven machine or power transmission system. They can also be the result of either electrical or mechanical unbalance in the motor. After checking the motor shaft alignment, disconnect the motor from the driven load.

If the motor then operates smoothly, look for the source of noise or vibration in the driven equipment. If the disconnected motor still vibrates, remove power from the motor. If the vibration stops, look for an electrical unbalance. If it continues as the motor coasts without power, look for a mechanical unbalance. Electrical unbalance occurs when the magnetic attraction between stator and rotor is uneven around the periphery of the motor. This causes the shaft to deflect as it rotates creating a mechanical unbalance. Electrical unbalance usually indicates an electrical failure such as an open tator or rotor winding, an open bar or ring in squirrel cage motors or shorted field coils in synchronous motors. An uneven air gap, usually from badly worn sleeve bearings, also produces electrical unbalance. The chief causes of mechanical unbalance include a distorted mounting, bent shaft, poorly balanced rotor, loose parts on the rotor or bad bearings. Noise can also come

from the fan hitting the frame, shroud, or foreign objects inside the shroud. If the bearings are bad, as indicated by excessive bearing noise, determine why the bearings failed.

Brush chatter is a motor noise that can be caused by vibration or other problems unrelated to vibration. WINDINGS: Care of Windings and Insulation Except for expensive, high horsepower motors, routine inspections generally do not involve opening the motor to inspect the windings. Therefore, long motor life requires selection of the proper enclosure to protect the windings from excessive dirt, abrasives, moisture, oil and chemicals. When the need is indicated by severe operating conditions or a history of winding failures, routine testing can identify deteriorating insulation.

Such motors can be removed from service and repaired before unexpected failures stop production. Whenever a motor is opened for repair, service the windings as follows: 1. Accumulated dirt prevents proper cooling and may absorb moisture and other contaminants that damage the insulation. Vacuum the dirt from the windings and internal air passages. Do not use high pressure air because this can damage windings by driving the dirt into the insulation. 2. Abrasive dust drawn through the motor can abrade coil noses, removing insulation. If such abrasion is found, the winding should be revarnished or replaced. . Moisture reduces the dielectric strength of insulation which results in shorts. If the inside of the motor is damp, dry the motor per information in " Cleaning and Drying Windings". 4. Wipe any oil and grease from inside the motor. Use care with solvents that can attack the insulation. 5. If the insulation appears brittle, overheated or cracked, the motor should be revarnished or, with severe conditions, rewind. 6. Loose

coils and leads can move with changing magnetic fields or vibration, causing the insulation to wear, crack or fray. Revarnishing and retying leads may correct minor problems.

If the loose coil situation is severe, the motor must be rewound. 7. Check the lead-to-coil connections for signs of overheating or corrosion. These connections are often exposed on large motors but taped on small motors. Repair as needed. 8. Check wound rotor windings as described for stator windings. Because rotor windings must withstand centrifugal forces, tightness is even more important. In addition, check for loose pole pieces or other loose parts that create unbalance problems. 9. The cast rotor rods and end rings of squirrel cage motors rarely need attention.

However, open or broken rods create electrical unbalance that increases with the number of rods broken. An open end ring causes severe vibration and noise. TESTING WINDINGS Routine field testing of windings can identify deteriorating insulation permitting scheduled repair or replacement of the motor before its failure disrupts operations. Such testing is good practice especially for applications with severe operating conditions or a history of winding failures and for expensive, high horsepower motors and locations where failures can cause health and safety problems or high economic loss.

The easiest field test that prevents the most failures is the ground-insulation or 127 megger test. It applies DC voltage, usually 500 or 1000 volts, to the motor and measures the resistance of the insulation. NEMA standards require a minimum resistance to ground at 40 degrees C ambient of 1 mega ohm per kv of rating plus 1 mega ohm. Medium size motors in good condition will generally have mega ohmmeter readings in excess of 50 mega

ohms. Low readings may indicate a seriously reduced insulation condition caused by contamination from moisture, oil or conductive dirt or deterioration from age or excessive heat.

One megger reading for a motor means little. A curve recording resistance, with the motor cold and hot, and date indicates the rate of deterioration. This curve provides the information needed to decide if the motor can be safely left in service until the next scheduled inspection time. The megger test indicates ground insulation condition. It does not, however, measure turn-to-turn insulation condition and may not pick up localized weaknesses. Moreover, operating voltage peaks may stress the insulation more severely than megger voltage.

Experience and conditions may indicate the need for additional routine testing. A test used to prove existence of a safety margin above operating voltage is the AC high potential ground test. It applies a high AC voltage (typically, 65% of a voltage times twice the operating voltage plus 1000 volts) between windings and frame. Although this test does detect poor insulation condition, the high voltage can arc to ground, burning insulation and frame, and can also actually cause failure during the test. It should never be applied to a motor with a low megger reading.

DC rather than AC high potential tests are becoming popular because the test equipment is smaller and the low test current is less dangerous to people and does not create damage of its own. CLEANING AND DRYING WINDINGS Motors which have been flooded or which have low megger readings because of contamination by moisture, oil or conductive dust should be thoroughly cleaned and dried. The methods depend upon available

equipment. A hot water hose and detergents are commonly used to remove dirt, oil, dust or salt concentrations from rotors, stators and connection boxes.

After cleaning, the windings must be dried, commonly in a forced-draft oven. Time to obtain acceptable megger readings varies from a couple hours to a few days. **BRUSH AND COMMUTATOR CARE** Some maintenance people with many relatively trouble-free AC squirrel cage motors forget that brushes and commutators require more frequent routine inspection and service. The result can be unnecessary failures between scheduled maintenance. Many factors are involved in brush and commutator problems. All generally involve brush sparking usually accompanied by chatter and often excessive wear or chipping.

Sparking may result from poor commutator conditions or it may cause them. The degree of sparking should be determined by careful visual inspection. The illustrations shown in Fig. 5 are a useful guide. It is very important that you gauge the degree number as accurately as possible. The solution to the problem may well depend upon the accuracy of your answer since many motor, load, environmental and application conditions can cause sparking. It is also imperative that a remedy be determined as quickly as possible. Sparking generally feeds upon itself and becomes worse with time until serious damage results.

Some of the causes are obvious and some are not. Some are constant and others intermittent. Therefore, eliminating brush sparking, especially when it is a chronic or recurring problem, requires a thorough review of the motor and operating conditions. Always recheck for sparking after correcting one

problem to see that it solved the total problem. Also remember that, after grinding the commutator and properly reseating the brushes, sparking will occur until the polished, brown surface reforms on the commutator. Figure 5.

#### Degrees of Generator and Motor Sparking

NOTE: Small sparks are yellow in colour, and the large sparks are white in colour. The white sparks, or blue-white sparks, are most detrimental to commutation (both brush and commutator). First consider external conditions that affect commutation. Frequent motor overloads, vibration and high humidity cause sparking. Extremely low humidity allows brushes to wear through the needed polished brown commutator surface film. Oil, paint, acid and other chemical vapours in the atmosphere contaminate brushes and the commutator surface. Look for obvious brush and brush holder deficiencies: 1.

Be sure brushes are properly seated, move freely in the holders and are not too short. 2. The brush spring pressure must be equal on all brushes. 3. Be sure spring pressure is not too light or too high. Large motors with adjustable springs should be set at about 3 to 4 pounds per square inch of brush surface in contact with the commutators. 4. Remove dust that can cause a short between brush holders and frame. 5. Check lead connections to the brush holders. Loose connections cause overheating. Look for obvious commutator problems: 1. Any condition other than a polished, brown surface under the brushes indicates a problem.

Severe sparking causes a rough blackened surface. An oil film, paint spray, chemical contamination and other abnormal conditions can cause a blackened or discolored surface and sparking. Streaking or grooving under

only some brushes or flat and burned spots can result from a load mismatch and cause motor electrical problems. Grooved commutators should be removed from service. A brassy appearance shows excessive wear on the surface resulting from low humidity or wrong brush grade. 2. High mica or high or low commutator bars make the brushes jump, causing sparking. 3.

Carbon dust, copper foil or other conductive dust in the slots between commutator bars causes shorting and sometimes sparking between bars. If correcting any obvious deficiencies does not eliminate sparking or noise, look to the less obvious possibilities: 1. If brushes were changed before the problem became apparent, check the grade of brushes. Weak brushes may chip. Soft, low abrasive brushes may allow a thick film to form. High friction or high abrasion brushes wear away the brown film, producing a brassy surface. If the problem appears only under one or more of the brushes, two different grades of brushes may have been installed.

Generally, use only the brushes recommended by the motor manufacturer or a qualified brush expert. 2. The brush holder may have been reset improperly. If the boxes are more than 1/8" from the commutator, the brushes can jump or chip. Setting the brush holder off neutral causes sparking. Normally the brushes must be equally spaced around the commutator and must be parallel to the bars so all make contact with each bar at the same time. 3. An eccentric commutator causes sparking and may cause vibration. Normally, concentricity should be within .001" on high speed, .002" on medium speed and .04" on slow speed motors. 4. Various electrical failures in the motor windings or connections manifest themselves in sparking and poor commutation. Look for shorts or opens in the armature

circuit and for grounds, shorts or opens in the field winding circuits. A weak interpole circuit or large air gap also generate brush sparking. SAFETY ACCIDENT in industrial sector defines any incident which has potential to cause injury to human, loss of property and damage to environment. Causes for occurrence of accident \* Unsafe Act \* Unsafe Conditions Hazards \* Conditions prevailing in work place finally leading to accidents.

Types \* Mechanical \* Electrical \* Chemical \* Environmental Precautions \* Look overhead \* Watch steps \* Wear shoes and helmets \* Take care of the flow opening \* Avoid lose clothing \* Always carry your I-D card CONCLUSION

In this project, I have studied the working of electrical repair shop and about the function of Bhilai steel plant. I have obtained some knowledge about \*

Rolling mill \* Blast furnace \* Electrical repair shop \* Motor windings

BIBLIOGRAPHY NOTES TAKEN DURING THE TENURE OF THE VOCATIONAL

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