Temperature Stability Analysis of DC motor

(At M/S Sunflag Iron and Steel Co. Bhandara)

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INTRODUCTION

This project presents the development of a dynamic temperature control system for the DC Motors of Main Stands in Rolling Mill to reduce the heating of the DC motor when load is increased in M/S Sunflag iron and steel Co. Bhandara. The mill equipped with following capacity main motors where the system to be implemented.

1. 8 Nos. 350 KW DC Motor for roughing Mill

2. 6 Nos. 450 KW DC Motor for Intermediate Mill

3. 4 Nos. 600 KW DC Motor finishing Mill

For each motor forced cooling system is used by using 11KW Blower motor and Heat exchanger for controlling the temperature of the motor within the norms. This is the conventional system used in all industries. The existing system used dynamic cooling system for DC motor of main stands in rolling mill to reduce the power consumption of the blower motor but it does not analyze at what cooling factor or time the main stands DC motor temperature is stable. Hence the present system is again modified to analyze cooling factor of the DC motor. Total 18 nos. 11 KW Blower motors used for the cooling of main stand motors. As Blower of the main stand controlled by the dynamic cooling system but the flow of water and air for cooling purpose is continuous. Current rating of the main stands DC motor 1050A then at 40% of load heat loss is

$$P = I^2R$$

$$420^2 * 0.001 = 176.4W$$

Which is higher value of heat loss? The proposed work increased the cooling rate and reduces the heatinPg of the DC motor up to 30% to 50 %.

1. LITERATURE SURVEY

1.2.1 A Constant Air Flow Rate Control of Blower for Residential Applications

Abstract—This paper presents a technique to control a blower for residential applications at constant air flow rate using an induction motor drive. The control scheme combines a variable volt/hertz ratio inverter drive and an average motor current regulation loop to achieve control of the motor torque-speed characteristics, consequently controlling the air flow rate of then blower which the motor is driving. The controller is simple to implement and practical for commercialization. It is also reliable, since no external pressure or air flow sensor is required. Both a theoretical derivation and an experimental verification for the control scheme are presented in this paper.

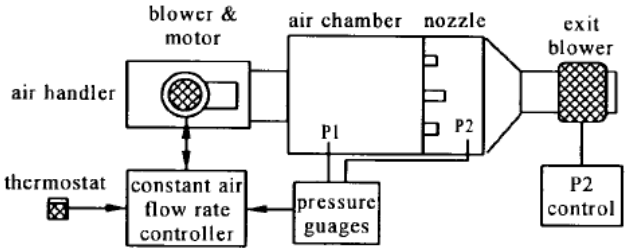


Fig.Scehematic of the experimental setup

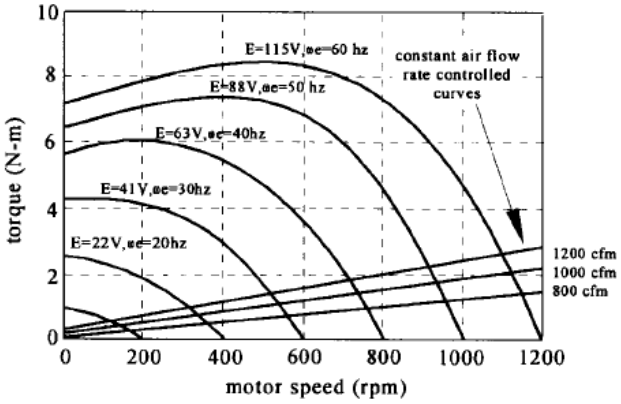


Fig. Torque-versus-speed curves at various voltage E and torque versus-speed curves when the air flow rate = 800, 1000, and1200 CFM

1.2.2 Water Flow Control for Air-conditioner using Inverter-Controlled Induction Motor Drives

Abstract: Since induction motors are widely, used for water flow control of air-conditioning system, it is possible to apply inverter controlled induction motor drives to achieve variable-water-volume (VWV) control instead of using conventional on-off control. The objective of this paper is to investigate the applications of inverter-controlled induction motor drives to the variable-water volume control for the circulated cooling water pump of air conditioners such that the flow rate of cooling water varies with load conditions and thereby increasing the efficiency of the system. Experimental results derived from the packaged air-conditioning units with 10 hp circulated cooling water pump demonstrate that significant amount of power saving can be achieved.

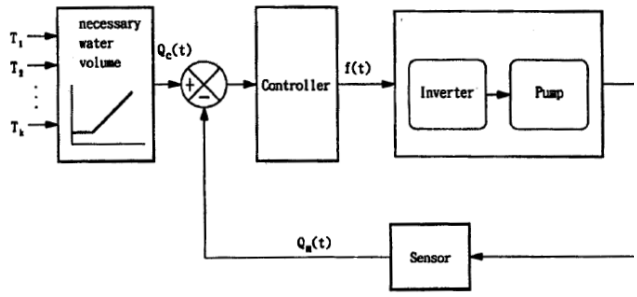


Fig.Block diagram of the control system for experimental set-up

1.2.3 A New Approach to Cold Mill Drive Equipment Air Cooling

Abstract:- Dominion Foundries and Steel Limited (DOFASCO) of Hamilton, ON, commenced single-shift production on the new No. 2 Five- Stand Cold Rolling Mill in July 1976. The mill employs a new integrated systems approach to the cooling of the mill drive motors, associated electrical control equipment, mill process and service areas, and buildings. The new approach represents an improvement in cold rolling mill electrical equipment cooling and ventilating methods. As described, the new approach results in cost and operating advantages over established methods.

Integrated Cooling System:-

The cold rolling mill has the following air handling systems combined to form an integrated system:Electrical equipment room, mill and reel drive converters (control islands), mill and reel drive transformers, mill and reel drive motors, mill building, oil cellar, fog exhaust system.

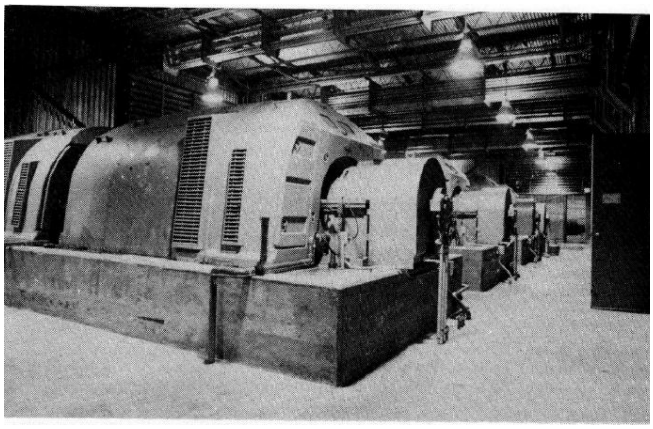


Fig. Main drive motor room.

1.1 DATA COLLECTION

1.1.1 Main DC Motor:-

BHEL, 350KW, 750/1500 RPM, 580V (DC), 640A, TYPE:-1HS-5404-5NE Field voltage:-220V (DC), 16A Excitation, S1-Duty Cycle Class F insulation

Description: - Three different ratings DC motor are used to carry the load whose ratings are mentioned as above. These DC motors are controlled by rectifier. When the load on the motor increases the heating of motor winding takes place so that cooling is provided through the impeller connected to blower motor.

1.1.2 Blower Motor:-

11KW, 2 Pole, 160 M (Frame Size), Foot wounded,
415V, 20A, 50Hz, S1-Duty Cycle Class B insulation

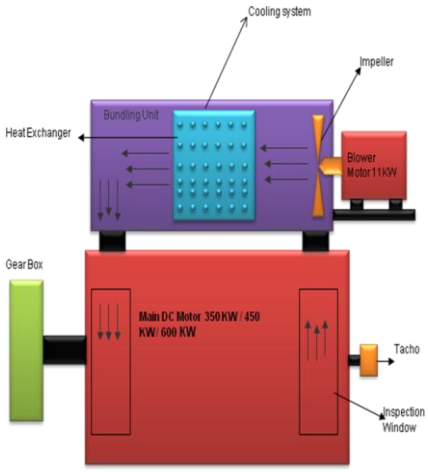
Description: - The blower motor is used to circulate the air through the main DC motor winding. Generally, to this blower motor one impeller is connected which circulates the air through the motor winding.Impeller is nothing but the one circular mechanical equipment having blades on its circular periphery. The rating of the blower motor is mention as above.

1.1.3 Load:-

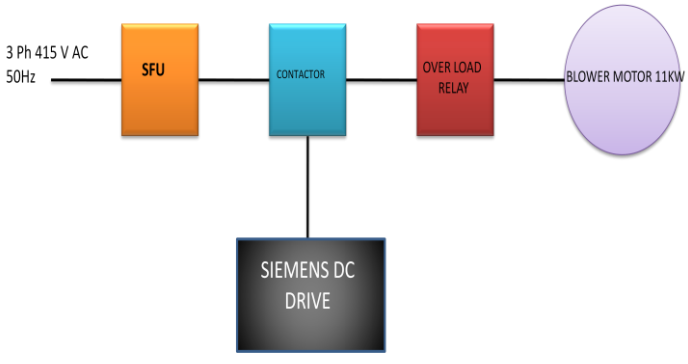
Vary: - 0-120%

Description: - Load is in the form of product i.e. in the form of steel bars with different diameter as per the requirement of customer. As the diameter is small heating of the winding will be less so cooling rate also increases and vice versa. Load can be vary from 0-120% of full load.

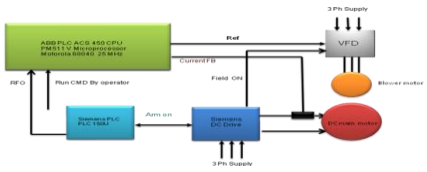
1.2 PROJECT SCHEM METHADOLOGY



1.4.1 EXISTING BLOWER MOTOR CONTROL SCHEME

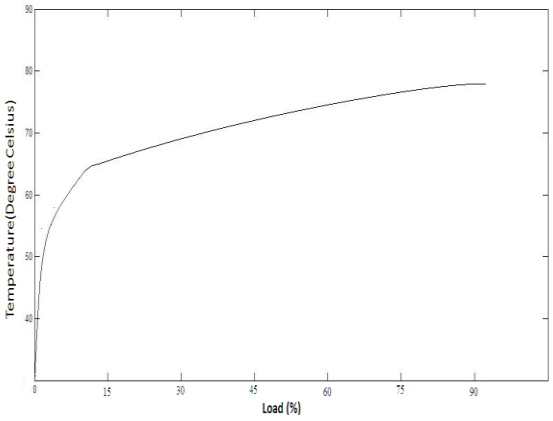


1.2.1 EXISTING CONTROL SCHEME



1.3 TEPERATURE STABILITY ANALYSIS

LOAD (%)	TEMPERATURE (Degree Celsius)	AIR FLOW (CFM)
30	63	4235
33	63.8	4238
35	64.2	4243
37	64.4	4246
38	64.7	4250
40	65	4470
42	65.3	4473
43	65.5	4473
45	65.6	4473
47	65.8	4474
50	66	4481
53	66.8	4490
55	67.4	4523
56	68	4544
57	68.5	4550
58	68.9	4550
60	71	4665
61	71.3	4685
63	72	4723
64	72.2	4740
67	73	4843
68	73.6	4850
70	74.1	4945
71	74.5	4968
73	74.9	5045
74	75	5176
76	75.8	5287
78	76	5347
80	76.7	5389
81	77	5476
82	77.2	5497
85	73.8	5567
87	74.7	5687
89	75.7	5798



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[7] Industrial Survey

EXISTING RESOURCES

Sr. No.	Existing Drive Specification	Motor Details	Venders Scope of Supply
Stand 1-8	kw- 350, DC Volts- 580, DC Amp- 640, Primary Volts-600, Primary Current-522-24-A, Connections-Non reversible, Pulse No-6, Type of cooling-forced air, Max Amb-50 digree C, Spec-IE4-146, Load-motor armature, Division- ED banglore Year-1987, Make-BHEL	Type-1HS5 404-SNE, Kw-350, Rpm-750/1500, Volts-580, Amp-640, Insu-F, Exc-SEP, Exc volts-220, Exc Amp-15, Lubricant-Grease, Eff-94.6, Spec-IS:4722, Division-Hardwar,Year-1987, Make-BHEL	1.ARM Control scheme suitable for existing drive . 2. Field with reversible control scheme 3. Ambient Temp 50 deg 4. Retrofiting of the supplied scheme 5. cold and hot trial. 6 . suitable for 0-10V speed reference.
Stand 9-14	kw- 450, DC Volts- 520, DC Amp- 920, Primary Volts-600, Primary Current-750-72-A, Connections-Non reversible, Pulse No-6, Type of cooling-forced air, Max Amb-50 digree C, Spec-IE4-146, Load-motor armature, Division- ED banglore Year-1987, Make-BHEL	Type-1HS5 501-SEL, Kw-450, Rpm-600/1500, Volts-520, Amp-920, Insu-F, Exc-SEP, Exc volts-220, Exc Amp-23.5, Lubricant-Grease, Eff-95, Spec-IS:4722, Division-Hardwar,Year-1987, Make-BHEL	1.ARM Control scheme suitable for existing drive . 2. Field with reversible control scheme 3. Ambient Temp 50 deg 4. Retrofiting of the supplied scheme 5. cold and hot trial. 6 . suitable for 0-10V speed reference.
Stand 15-18	kw-600, DC Volts-600, DC Amp-1050, Primary Volts-600, Primary Current-856-8-A, Connections-Non reversible, Pulse No-6, Type of cooling-forced air, Max Amb-50 digree C, Spec-IE4-146, Load-motor armature, Division- ED banglore Year-1987, Make-BHEL	Type-1HS5 503-SCR, Kw-600, Rpm-600/1500, Volts-600, Amp-1050, Insu-F, Exc-SEP, Exc volts-220, Exc Amp-33, Lubricant-Grease, Eff-95, Spec-IS:4722, Division-Hardwar,Year-1987, Make-BHEL	1.ARM reversible Control scheme suitable for existing drive 3 Nos. 2. Field with reversible control scheme 1 N0 . 3 Ambient Temp 50 deg 4. Retrofiting of the supplied scheme 5. cold and hot trial. 6 . suitable for 0-10V speed reference.