Design of MCC control panel using Electrical AutoCAD

N.C.Vaidya
Asst. Professor
Department of Electrical Engineering
VPKBIET Baramati

Sayali Hipparkar
Department of Electrical Engineering
VPKBIET Baramati

Manisha Bansode
Department of Electrical Engineering
VPKBIET Baramati

Abstract— **Functional design recommendations and field practices for motor control centers (single- and three-phase 50 Hz) are provided in this paper. The features and practices described in this paper are intended to help in automation of industries for controlling various motors. The information within this paper are intended to augment the existing requirements of applicable standards for motor control centers. This paper also provides recommendations for manufacturer, installer, and user for safety-related concerns. It also provides a framework from which specifiers/users can select specific MCC features and system characteristics that are applicable to their specific situation and needs. The recommendations in this paper complement safety requirements and procedures as stipulated by workplace safety standards.**

This paper provides information and features of a general panel. These panels are widely used in different industries, factories and other organization. Control panels play a vital role in automation sectors which is a recent trend.

Keywords—motor control center, automation

I. INTRODUCTION

A control panel is a flat, often vertical, area where control or monitoring instruments are displayed or it is an enclosed unit that is the part of a system that users can access, such as the control panel of a security system (also called control unit).

They are found in factories to monitor and control machines or production lines and in industries like Power, Steel, Cement, Sugar, Pharmaceutical, Textile, Refineries, Mining, Shipyards nuclear power plants, ships, aircraft, mainframe computers etc. Older control panels are most often equipped with push buttons and analog instruments, whereas nowadays in many cases touch screens are used for monitoring and control purposes.

II. APPLICATION OF MCC PANEL

This type of panels are used in industries which have motors used for different purposes. Wherever there are many number of motors used in fulfillment of a task, all such motors can be controlled from one place and one panel. MCC (Motor Control Center) panel is used for controlling the motors. In our designing of MCC panel these motors are used for special purpose i.e. for removing dust and dirt.
Bauxite is an ore of Alluminium. Ores are processed to obtain alluminium in its purest form. During this different processes taking place are Fragmentation, cleaning, processing etc. All such processes are controlled using motors. And these motors are controlled on a single panel.

1. Proving Arc Flash Resistance
2. A Facility has an emergency generator that feeds into buildings electrical system via Emergency switchboard MSEB
3. Power distributed throughout a commercial or industrial application is used for a variety of applications such as heating, cooling, lighting and motor-driven machinery.
4. Motor control center technology for oil and gas, industrial applications

III. SPECIFICATIONS OF PANEL

1. System Voltage: 415 VAC, 3 Ph. - 4 wire, 50 Hz
   Control Voltage: 240 VAC from common control transformer
2. Construction: Floor mounting, Free standing, Compartmentalized
3. Fabrication: Degree of protection -IP52
4. Powder Coating: Epoxy Powder Coated Paint Shade - Black
5. Cable Entry: Top
6. Bus bars: Electrolytic grade aluminum busbars
7. Wiring: Control Circuit-1.5sq.mm
   Power Cicuit-4.0sq.mm
8. Colour Code: Power Ph. - Red, Yellow, Blue
   Control supply- Grey for Phase
   Black for Neutral
9. Others: 20% Spare Control
   Approx. weight of Panel - 2150 kg

IV. WIRING

Install the line and load conductors sized in accordance with the NEC. Use copper wire only for control terminations. Use conductors with a temperature rating but regardless of the insulation temperature rating, select the wire size on the basis of wire ampacity. Using a higher temperature wire ampacity table often results in a smaller cross-section of copper available for carrying heat away from terminals. Install insulated wire and cable at a temperature sufficiently warm to prevent the insulation from cracking or splitting.

Lugs furnished with the MCC and its components are for Class B and Class C stranding. Verify the compatibility of wire size, type, and stranding with the lugs furnished. Where they are not compatible, change the wire or lugs accordingly. If crimp lugs are used, crimp with the tools recommended by the manufacturer.

A. Types of wiring

NEMA Type B wiring

Each control unit is factory assembled with devices in wired within the unit. In addition, all control wiring is carried to unit terminal blocks mounted on the right-hand side of the unit. Bring the field wiring of control wires from a horizontal wire way into the vertical wire way on the right-hand side of the applicable control unit and terminate the at the unit terminal blocks.

NEMA Type C wiring

Each control unit is factory assembled with devices inter-wired within the unit. In addition, all control wiring is carried to unit terminal blocks on the side of the unit and from these unit blocks,along with load wiring through Size 3, to master terminal blocks located at the top or bottom of the structure.

B. Overload Relays

Overload relays are provided on Freedom starters. Four sizes are available for overload protection up to 114 A.

Features include:

• Selectable manual or automatic reset operation

• Interchangeable heater packs adjustable ±24% .Heater packs for 32 A overload relay will mount in 75 A overload relay—useful in derating applications such as jogging

• Class 10 or 20 heater packs

Use Class 10 heaters with fusible or thermal-magnetic breaker disconnects only

• Bimetallic, ambient-compensated operated. Trip-free mechanism

• Electrically isolated NO and NC contacts

• Overload trip indication

C. Motor control protector

After installation of the control center, each MCP must be adjusted to actual motor full-load amperes (FLA) so that it will trip at any current that exceeds starting inrush. This setting provides low-level fault protection. The first half-cycle inrush will vary with the motor characteristics. Motors with locked-rotor currents of 6 times motor full-load amperes will usually require an instantaneous magnetic setting of 7 to 11 time's motor full-load amperes to prevent tripping when starting.

IV. Overload Relay Heater Selection

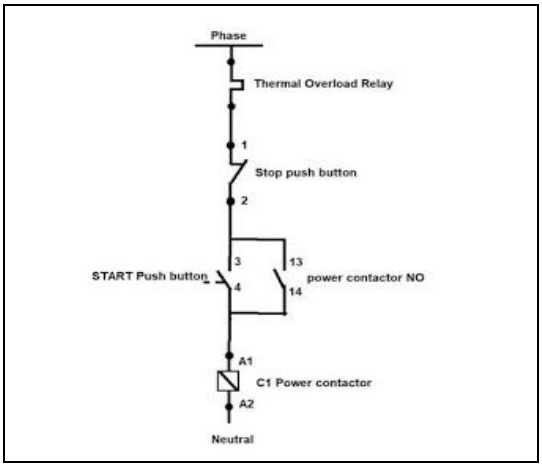
A. Heater Selection and Installation

Heaters should be selected on the basis of the actual full load current and service factor as shown on the motor nameplate or in the motor manufacturer's published literature. When motor and overload relay are in the same ambient and the service factor of the motor is 1.15 to 1.25, select heaters and set FLA adjustment dial from the heater application table. If the service factor of the motor is 1.0, or there is no service factor shown, rotate the FLA adjustment dial counterclockwise one-half (1/2) position. The conductors attached to the terminals of an overload relay act as a heat sink and are a consideration in establishing the current rating of each heater element.

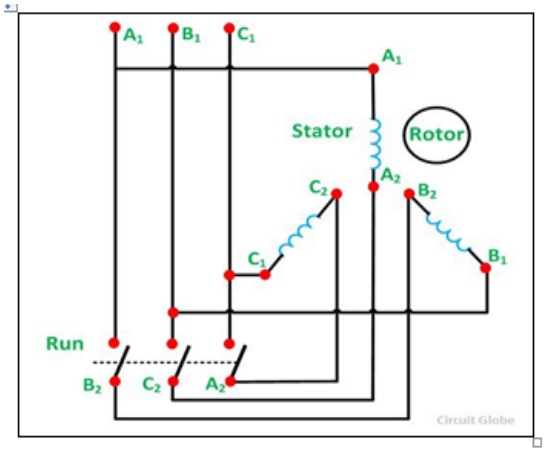
V. Starters

A.DOL Starter

To prevent damage to the windings due to the high starting current flow, we employ different types of starters. The simplest form of motor starter for the induction motor is the Direct On Line starter. The DOL starter consist a MCCB or Circuit Breaker, Contactor and an overload relay for protection.



B. Star Delta Starter



Star delta starter is used to reduce the starting current drawn by the motor. Start the motor in STAR and then, when the motor has gained sufficient speed, change its connections to DELTA to allow the motor to run at its full speed and torque from then on. The motor starts as star connected, ie, voltage reduced by root(3), current reduced by root(3) and power reduced by 3. After the motor starts, it is switched to delta connection and runs normally.

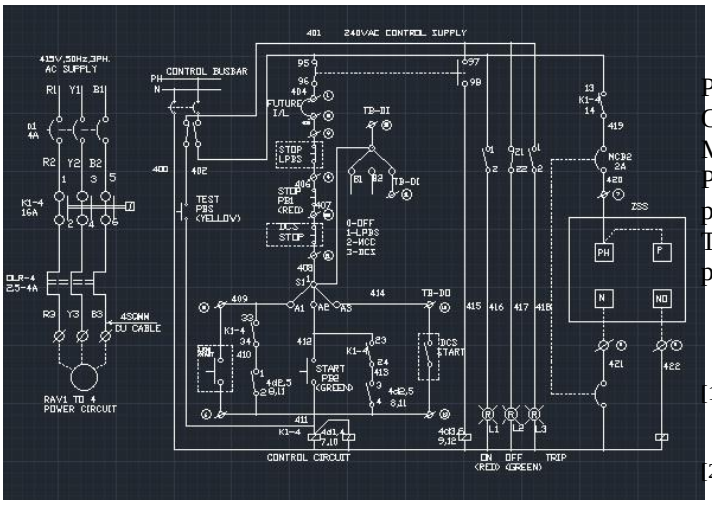
VI. MAINTENANCE

Preventive maintenance should be a program, a scheduled periodic action that begins with the installation of the equipment. At that time, specific manufacturer's instruction literature should be consulted, then stored for future reference. Follow-up maintenance should be at regular intervals, as frequently as the severity of duty justifies. Time intervals of one week, or one month, or one year may be appropriate, depending on the duty. It is also desirable to establish specific check lists for each control, as well as a logbook to record the history of incidents. A supply of renewal parts should be obtained and stored.

This control equipment is designed to be installed, operated, maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment,its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state,and national regulations, as well as safety practices, for this class of equipment.

VII. DESIGNING OF MCC PANEL

The Design of control panel is done using Electrical Autocad. **AutoCAD** is a commercial computer-aided design (CAD) and drafting software application. Developed and marketed by Autodesk, AutoCAD was first released in December 1982 as a desktop app running on microcomputers with internal graphics controllers. Before AutoCAD was introduced, most commercial CAD programs ran on mainframe computers or minicomputers, with each CAD operator (user) working at a separate graphics terminal. Since 2010, AutoCAD was released as a mobile- and web app as well, marketed as AutoCAD .



AutoCAD Architecture (abbreviated as ACAD) is a version of Autodesk's flagship product, AutoCAD, with tools and functions specially suited to architectural work.

Architectural objects have a relationship to one another and interact with each other intelligently. For example, a window has a relationship to the wall that contains it. If you move or delete the wall, the window reacts accordingly. Objects can be represented in both 2D and 3D.

In addition, intelligent architectural objects maintain dynamic links with construction documents and specifications, resulting in more accurate project deliverables. When someone deletes or modifies a door, for example, the door schedule can be automatically updated.

Spaces and areas update automatically when certain elements are changed, calculations such as square footage are always up to date.

AutoCAD Architecture uses the DWG file format but an object enabler is needed to access, display, and manipulate object data in applications different from AutoCAD Architecture. Using this AutoCAD we have designed few sections of MCC(motor control center)panel like Incomer, Feeder, Power Control circuit, Alarm Annunciator etc.

AutoCAD Architecture was formerly known as AutoCAD Architectural Desktop (often abbreviated ADT) but Autodesk changed its name for the 2008 edition.

As of AutoCAD 2019 all discipline-specific packages are bundled into a single AutoCAD release.

ACKNOWLEDGMENT

Presented BE work has been developed with the help our Guide Prof. N.C.Vaidya. We would also like to thank Mr.Jayram Patil (Unique controls Pvt.Ltd.Nanded Phata,Pune) for his kind coperation during the project and paper work. This project is successful only with his help.

This paper presents the complete designing of MCC control panel in Electrical Autocad software.

REFERENCES

[1] Donald C. Roe (2003) "Recent innovations in controlling dust emissions in the bauxite/alumina industry ,water technologies and technical paper" Suez water technologies and solution .

[2] Freedom 2100 motor control center installation and maintenance manual

[3] Mark Anglin Harris" Dust Reduction in Bauxite Red Mud Waste using Carbonation, Gypsum & Flocculation"