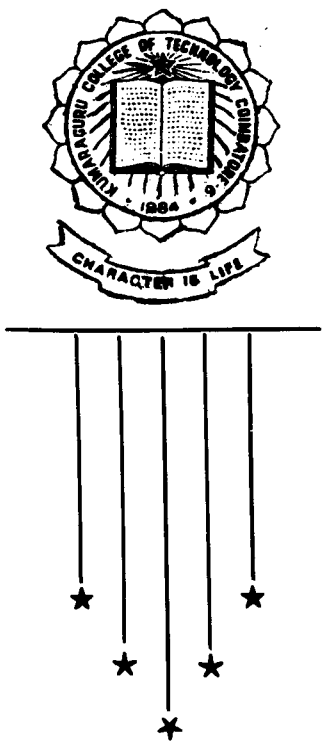
Trip, Announciation Cum Indication Panel For 75 H-P Air Compressor

Project Report



Submitted by

V. Chandra Sekaran
M. Rathina Raja Rajan
G. Sekar

Under the Guidance of

Mrs. C. V. Subbu Lakshmi, B.E.,

In partial fulfilment of the requirements for the Award of the degree of

BACHELOR OF ENGINEERING

in Electrical and Electronics Engineering of the Bharathiar University

Department of Electrical and Electronics Engineering

Kumaraguru College of Technology

Coimbatore-641 006

Department of Electrical and Electronics Engineering

Kumaraguru College of Technology

Coimbatore-641 006

Certificate

This is to certify that the Project Report entitled

Trip, Announciation Cum Indication Panel for 75 H-P Air Compressor

has been submitted by

Mr. V. CHANDRA SEKARAN ; M. RATHNA RAJA RAJAN , G. SEKAR

In partial fulfilment for the award of the degree of

Bachelor of Engineering

in Electrical and Electronics Engineering

Branch of the Bharathiar University

During the academic Year 1995-96

Guide

Mrs. C. V. SUBBULAKSHMI

PROFESSOR & HEAD
Dept. of Electrical & Electronics Engg
Kumaraguru College of Tech., Coimbatore

Head of the Department

Certified that the candidate with University Register No. .....

was Examined in Project work Viva-Voce by us on .....

Internal Examiner

External Examiner

PREMIER INSTRUMENTS & CONTROLS LIMITED

pricol

P.B. No : 4209, PERIANAICKENPALAYAM
COIMBATORE - 641 020, INDIA
PHONE : 0422 - 892901 to 7
TELEX : 0855 - 341 PIC IN
FAX : 0422 - 892028
CABLE : DASHBOARD

HRD-PROJECT-43
March 30, 1996

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the following :

1. **Mr V Chandrasekaran**
2. **Mr M Rathinarajarajan**
3. **Mr G Sekar**

Final year BE (EEE) students from Kumaraguru College of Technology, Coimbatore have completed their project in our organisation from July 95 to March 96.

During this period, their attendance and conduct were found to be good.

We wish them the very best for a bright future.

Jasper
J JASPER
HR DIVISION

ACKNOWLEDGEMENT

We express our thanks and profound gratitude to our beloved lecturer Mrs.C.V. SUBBULAKSHMI, B.E., and our former Assistant professor CHRISTIAN PAUL, B.E., M.Sc (Engg). for their valuable guidance and immense help at all stages of this project work.

We are elated to record our heartiest indebtness to our beloved professor and Head, Department of Electrical and Electronics Engineering, Dr.K.A. PALANISWAMY, M.Sc (Engg)., Ph.D., M.I.S.T.E., CEng(I)., F.I.E. for allowing us to do this project and providing us with all facilities.

Our thanks are due to principal Dr.S. SUBRAMANIAN, B.E., M.Sc (Engg)., Ph.D., SMIEEE for providing us all facilities to carry out this project work.

We express our thanks and profound gratitude to LT COL S. PURUSHOTHAMAN DGM HRD for giving opportunity to carry out our project in PRICOL and OFFICER MR. G.JASPER for having initiated the training process.

We whole heartedly express our gratitude and sincere thanks to Mr. G.SIVASALAPATHY, B.E., Senior Engineer, PMD and the Technicians of PRICOL for their valuable ideas which helped us in the successful completion of our project work.

We also wish to acknowledge our sincere thanks to our beloved parents, friends and faculty memebers who stood by outside in pain and pleasure during this project work.

SYNOPSIS

A big mechnical system like 75 H.P Air compressor supplying high pressure air to lot of pneumatic machines will have parameters such as temperature and pressure, exceeding of these parameters will make the machine to operate under alarming condition. Hence at this stage it is necessary to device a trip, announciation cum indication panel which will make the compressor to cut the operation when the parameters are exceeded.

In this project it is proposed to design and fabricate a control panel to monitor the operating state of the compressor. In the event of the pressure and temperature exceeding the specified limit, either alarm signal or trip signal is given depending on the severity of the condition. The unit is fabricated and tested at Premier Instruments and Controls Limited, Perianaickenpalayam, Coimbatore - 641 020.

CONTENTS

CHAPTER - I

1. INTRODUCTION

Our project is Trip announciation cum indication panel for a 75 H.P Air Compressor.

The control parameter are:

1. Discharge Air Pressure high
2. Lubricating oil pressure low
3. Cooling water pressure low
4. Discharge Air Temperature high
5. Lubricating oil Temperature high
6. Cooling Water Temperature high

These above said parameters under abnormal conditions will affect the compressor unit. To prevent these damages and to indicate cum announciation provision, the control panel is designed.

1.1. GENERAL DESCRIPTION OF 75 H.P AIR COMPRESSOR

" KHOSLA - CREPELLE " 75 H.P. Air compressors are of double acting horizontal crosshead type and are built in one, two and three rows. Each row consists of two opposed cylinders. The compressor is driven by a slip- ring induction motor through V - belt or direct drive. The flow diagram shown in Fig - 1.1 indicates the complete parts of compressor unit.

Each row has two crankpins arranged at 180^{o}. This type of compressor is balanced because two pistons of each row move in opposing directions. The primary and secondary components forces nullify each other and suppress all possibilities of Vibration ramming on the base. The efforts of each opposing crankpin are equal and create an axial couple without reaction on the bearing. Crosshead guides with low friction are fitted fo- giving on excellent guide to crosshead.

1.2 LUBRICATION - MECHANICAL PARTS

The main bearing, connecting rod bearings and crosshead are lubricated by oil pump. The compressor is equipped with heat exchangers, pressure gauges for air/oil and safety devices are also provided.

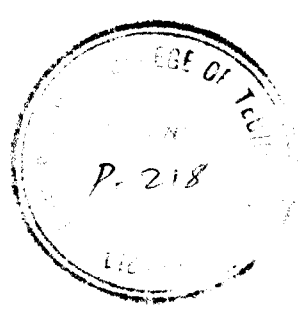
1.3 TWO STAGE COMPRESSOR

After compression, the air from the first stage cylinder, passes through the delivery valve to the watercooled heat exchanger provided in - between the first and second stage. There it is cooled very near to the atmospheric temperature and is sucked in by the second stage through the suction valves. In the second stage cylinder, the air is compressed again to the required pressure and enters to the delivery header connected to the second stage cylinder and then to the after cooler if provided, and finally to the air receiver.

1.4 GOVERNING BY PRESSURE REGULATOR

The pressure of air in single and two stage compressor is automatically governed by the pressure regulator provided for the purpose. When the pressure in the air receiver reaches the prescribed limits, the air pressure acts on the valve cone of the pressure regulator, cone valve lifts upward and allows the air to pass through the pipes to the decompressor system fitted on the suction valve of cylinders. Air thus entered will keep the suction valve plate lifted from the valve seat so that whatever air is compressed goes back to the atmosphere and no further compression takes place. When the air pressure in the air receiver falls to the present limit, the cone valve again sits on the seat by closing the port due to spring tension and air entrapped between the pressure regulator and decompressor is immediately released from the pressure regulator top. Compressor again starts till the pressure reaches its limit.

In place of pressure regulator electromechanically operated pressure switch is provided.



1.5 CYLINDERS

The cylinders are made of graded cast iron are fitted on each end with detachable end covers provided with adequate well designed waterjackets to ensure efficient cooling of the surface coming in contact with high temperature compressed air cylinders utlize streamlined air passages and maximum number of valves are provided to minimize pressure drop.

1.6 INTERCOOLER

The watercooled intercooler of ample cooling capacity is mounted right over the cylinder. This reduces floor space besides offering simple and neat appearance. It effectively reduces temperature of the compressed air of first stage before it enters into second stage cylinder. It has a nest of tubes in-reverse direction. Alternatively intercooler with water passing through the tubes and air circulating outside reverse direction can be supplied, it is also equipped with a safety valve, drain cock and in built moisture separators.

1.7 OIL PUMP

The oil pump is gear type and is driven directly by the crankshaft. The pump is mounted on the front end of the crankcase opposite to the flywheel end. The lubeoil pump feeds lubricating oil to the main bearings, connecting rod bearing and crosshead of one side. The priming of the oil pump is effected by the releasing of air from the brass plug fitted in the secondary filter flange. The oil pressure is regulated by adjusting the screw provided on the oil pump housing turning clockwise will increase the pressure and vice versa.

1.8 ELECTRIC MOTOR

The motor used in air-compressor unit is 3-phase slip-ring Induction motor. The slide rails are fitted to the motor base such that the bolts remain exactly in the centre of the hole of the rails so that small adjustments on all sides is available for final adjustment of the electric motor. The centre distance between the flywheel and electric motor are equal.

1.9 WATER LINES

A water header is provided near the cylinders to branchoff the inlet water coming from the main supply. Each pipeline to the cylinders is provided with a valve to regulate the water supply passing through the cylinders. The discharged water from the cylinders is led to a pipe fitted with funnel so that the water flow is visible and be regulated to control the cooling water temperature.

1.10 LUBRICATION OIL

The temperature rise of the oil should be relatively low (not more than $70^{o}C$) and the viscosity should therefore have a value of $5\text{-}8^{o}C$ for a temperature $50^{o}C$. The lube oil pressure is 1.5 - 2.58 g/cm^{2}.

1.11 WATER COOLING ARRÄNGEMENT

A pressure of 1.5 to 2 kg is necessary for obtaining proper circulation. The water temperature at the exit should not be more than 50 ^{o}C. It is good to install an alarm device in case of stoppage of water supply and or insufficient flow rate to avoid over heating. The highly efficient intercooler required to cool the compressed air by the first stage before going to the second stage is placed above the compressor and in the axis of each row of cylinders. It has equipped with a safety valve and draincock.

1.12 ELECTRICAL UNLOADING

When the pressure in the air receiver reaches to the pre-set pressure, the pressure switch makes electrical contact with solenoid valve which gets de-energised, opens the air passage to the suction valves of the cylinders, and the passage to the atmosphere is closed.

1.13 PROCEDURE FOR STARTING THE ELECTRIC MOTOR (M.E.I. STARTER)

Push the green' button and the handle of circuit breaker is in ON' position and at the sametime hold the starter button pushed to give few turns to motor and check if direction of rotation is correct, then keep the push botton pressed and turn the hand wheel of Rotor Starter slowly to full ON' position.

The motor is likely to be burnt if it is on No - LOAD while starting the compressor.

1.14 ACCESSORIES

For lube oil the cutting in pressure for the compressor is to be adjusted at 1.5 kg/cm^2 and differential pressure should be adjusted at 0.5 kg/cm^2. The pressure switch will be tripped off the motor when the oil pressure falls below 1 kg/cm^2 g. The cut in pressure should be 1 kg/cm^2 and the differential pressure should be 0.5 kg/cm^2. The pressure switch will trip the motor when the pressure drops below 0.5 kg/cm^2.

1.15 TROUBLE SHOOTING

1. If the oil pressure is not constant, pressure gauge needle will oscillate.

2. The pressure gauge needle of the oil pressure remains Zero.

3. The output of the compressor has decreased

4. Pressure increases in the receiver when the compressor is unloaded

5. Valves are noisy

6. The pressure increases in the intercooler

7. The compressor knocks

8. The cylinders are overheated

9. Water in the cylinder

1.16 SPECIFIED LIMITS

The folliwng are the specified limits for six parameters.

1. AIR LINE:

1. Safety valve failure - S_1 - 3 kg / cm^2

Pressure

S_2 - 12 kg/cm^2

2. Air Temperature

Outgoing - 50 ^oC
Before aftercooling

T_1 - 135 ^oC

T_2 - 65 ^oC

T_3 - 145 ^oC

T_4 - 55 ^oC

2. WATER LINE

1. Inter cooler pressure - 2 kg/cm^2
2. Temperature - 50 ^oC

3. LUBRICATION

1. Pressure : 1.5 to 4 kg/cm^2
2. Temperature : 75 to 80 ^oC

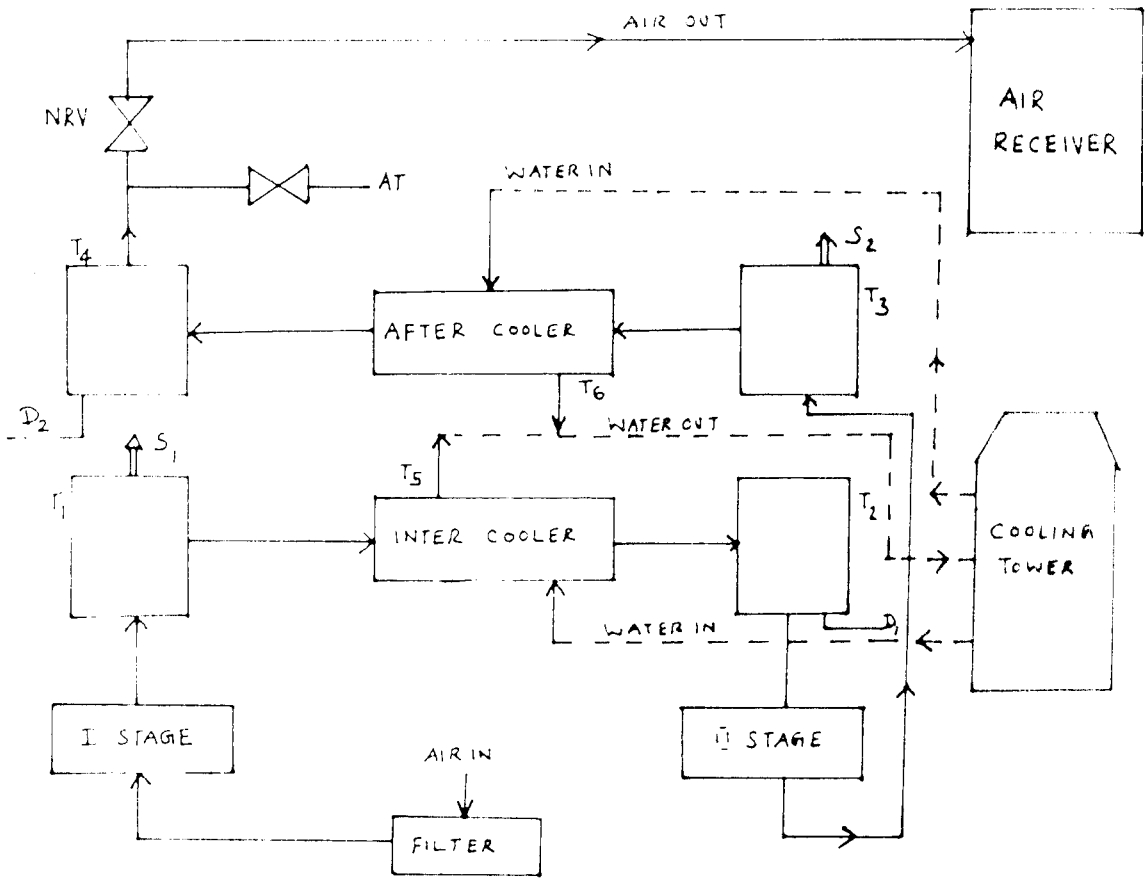


Fig 1.1 Flow Diagram

T1 - Temp erature before cooling after I stage
T2 - Temperature after cooling I stage
T3 - Temperature before cooling after second stage
T4 - temperature after cooling second stage
T5 - Outgoing water temperature from Intercooler
T6 - Outgoing water temperature from after cooler

S1,S2- Safety valves
D1,D2- Auto Drains
AT- Air temperature (outgoing)
NRV- Non return valve
⟶ - Air line
----> - Water line

CHAPTER - 2.

2. COMPONENT DETAILS

2.1. RELAYS

Relay is a device by means of which an electric circuit is controlled by change in the other circuit. Relays are automatic. There are several types and application of relays. Relays are essential components of protective systems.

2.1.1 PROTECTIVE RELAYING

Protective relaying is necessary for every electricl plant, and no part of the power system, is left unprotected. The choice of protection depends upon several aspects such as type and rating of protected equipment, its importance, location, probable abnormal conditions, cost etc.. Each needs certain adequate protection.

The protective Relaying senes the abnormal condtions in a part of the power system and gives an alarm or isolates that part from the healthy system.

The relays are compact, self contained devices which respond to abnormal condition. The relays distinguish between normal and abnormal condition. Whenever an abnormal condition develops, the relays close its contacts. Thereby the trip circuit of the circuit breaker is closed. Current from the supply flows in the trip-coil of the circuit-breaker and the circuit breaker opens and the faulty part is disconnected from the supply. The entire process, occurence of fault- operation of relay-opening of circuit breaker-removal of faulty part from the system is automatic and fast.

2.1.2 FUNCTIONS

1. To sound an alarm or to close the trip circuit- breaker so as to disconnect a component during an abnormal condition in the component which include overload, under-voltage, temperature rise, unbalanced load, reverse power, under- frequency, short-circuit etc.

2. To disconnect the faulty part quickly so as to minimize the damage part and to prevent the subsequent faults.

3. To localise the effect of fault by disconnecting the faulty part from the healthy part, causing least disturbance to the system.

4. To disconnect the faulty part quickly so as to improve the system stability, service continuity and system performance. Transient stability can be improved by means of improved protective relaying.

IMPORTANCE OF PROTECTIVE RELAYING

Inadequate protection can lead to a major fault that could have been avoided. The damage can be eliminated or minimized. The thermal overloading of motor prevents the overloading of motor and thereby the insulation failure is avoided. The protective relaying helps in improving service continuity and self-evident.

2.1.3 MASTER RELAY

This is a protective relay used for protecting the electrical devices. It is a device which closes its contacts, when operating quantity reaches certain predetermined magnitude per phase. Closing of relay contacts initiates an alarm circuit or an indication circuit.

2.1.4 OVERLOAD RELAY

This relay responds to increase in current which depends upon the load. The Relay is as shown in figure - 2.1 The relay which we are using works as that of electro-mechanical relays. Here there are coils, movable elements, contact system etc. The operation depends upon whether the operating Torque/force is greater than the restraining torque/force. Relay operates when operating torque is produced by electromagnetic attraction of electric current. The restraining torque is given by springs.

SINGLE PHASING PROTECTION

While one tripping slider in the relay acts to trip the relay under overload conditions, a second slider acts to trip the relay under single phasing conditions. The accelerated tripping takes place at a tripping current approximately 85% of 3 phase Tripping current.

2.2 BASIC CONNECTIONS OF TRIP CIRCUIT

The basic connections of the circuit breaker control for the opening operation is illustrated as shown in Fig.2.2. The protected circuit X is shown by dashed line. When a fault occurs in the protected circuit, the relay (2) connected to current Tranformer and potential Transformer actuates and closes its contacts (6).

Current flows from the battery (5) in the trip circuit (4). As the trip coil of the circuit breaker (3) is energized, the circuit breaker operating mechanism is actuated and it operates for the opening operation. Auxillary switch a' is an important item in the circuit.

2.3 PRESSURE SWITCH

This switch is of RT 110 Type. Its rating is 104, 380V with starting current of 30 Amps. The pressure controller is set by rotating the knob, at the same time reading the main scale. The difference is set by rotating the differential adjustment nut to the value, indicated by the use of nomogram. The maximum operating pressure is thus the sum of the setting pressure and differential.

The signal to the control circuit is transmitted by the switch unit which is activated by a mechanical valve assembly. In this mechanical valve assembly, the pressure when falls below the setvalue, it lifts down and thus the control circuit receives the signal from the siwtch unit through a wire passage.

2.4 TEMPERATURE SWITCH

This belongs to thermostat RT 100 type, Its maximum temperature is 70 ^{o}C and the maximum temperature of sensor is 490 ^{o}C.

2.5 SETTING OF TEMPERATURE SWITCH

The thermostat is set by rotating the knob, at the same time reading the main scale. The differential is set by rotating the differential adjusting nut to the value indicated by the use of nomogram. The maximum operating temperature is thus the sum of the present temperature and differtial.

There is a mechanical sensing unit which responds to the change in Temperature.

2.6 PUSH BUTTON

The push button switch is as shown in the figure 2.3. In this unit the pressure switch when is activated, the spring like arrangement lifts the plate to which the input terminal is connected, is lifted up. The contacts in the output side gets link with the input terminal and thus the output signal is received. When the pressing event is finished, the contactor returns back to its original position. Thus the push button makes contact during the instant of pressing.

2.7 FUSE

The fuse is used for protection. Its ratings are 20 Amps, 415 V, 3W NS H Type. The control fuse in the pannel board isolates the control circuit when the ratings exceed.

2.8 INDICATORS

The Indicators are used to know the fault in the unit. The LED used is of Binay Type. Its Ratings are 220 V+/- 40 V AC 50 Cycles/Sec. The LED s are fixed in such a way that to prevent damage to lens is removed lens before tightening bezel on to the adopter. Lens is fit only after bezel has been tightened.

2.9 ELECTRIC MOTOR

The 3 - Phase slipring induction motor is used.

Ratings:

Voltage : 415 Volt

Current : 94 AMP

Rev/min : 1475

Output : 55 KW (75 H.P).

2.10 PROGRAMMABLE TIMER

The HEF 4541B is a programmable timer which consists of 16 stage binary counter, an integrated oscillator to be used with external timing components, and automatic power- ON reset and output control logic. The frequency of the oscillator is determined by the external components Rt and Ct within the frequency range 1 HZ to 100 HZ. This oscillator may be replaced by an external clock signal at input Rs. The timer advances on positive going transition of Rs. A low on the auto reset input (AR) MR regrets the counter independent of all other inputs.

A high at the input $\overline{AR}$ turns off the power on reset to provide a low power discipation of the timer. The 16 stage counter divides the oscillator frequency by 2^8, 2^{10} 2^{12} or 2^{16} depending on the state of address input (A0, A1). The divided oscillator frequency is available at output O. The phase input (PH) features a complementary output signal. If the mode select input (MODE) is low or high the timer can be used respectively as a single transition timer or 2^n frequency divides.

PIN DETAILS

A 0, A1	-	Addres inputs
MODE	-	Mode select input
$\overline{AR}$	-	Auto reset input
MR	-	Master reset input
PH	-	Phase input
RTC	-	External resistor connection (Rt)
GC	-	External Capacitor Connection (Ct)
RS	-	External resistor connection (Rs) or External clock input.

FREQUENCY SELECTION TABLE

A0	A1	Number of counter stages n	$\frac{f_{osc}}{f_{out}} = 2^n$
L	L	13	8192
L	H	10	1024
H	L	8	256
H	H	16	65536

FUNCTION TABLE

Inputs				Mode
$\overline{AR}$	MR	PH		
H	L	X	X	Auto reset Disabled
L	L	X	X	Auto reset enabled
X	H	X	X	Master reset active
X	L	X	H	Normal operation selected division to output
X	L	X	L	Single cycle Mode
X	L	L	X	Output initially low, after reset
X	L	H	X	Output initially high, after reset

The timer is initialised on a reset pulse and the output changes state after 2^{n-1} counts and remains in that state (latched). Reset of this latch is obtained by master reset or by a low to HIGH transition on the MODE input.

2.11 CONTACTORS

Contactor is a protective device which keeps the input and output terminals normally ope (NO)/Normally connected (NC) during normal operating condition due to the re-straining force of spring. The NO position becomes NC/NC postion becomes NO during abnormal condition due to the electro-magnetic force of attraction produced by an electro-magnet. The diagram shown in figure 2.4 clearly shows its operation.

Contactor consists of two contacts

1. Fixed contacts
2. Movable contacts and electro-magnetic coil. The moving contacts are connected with the iron plate.

During abnormal condition, the current passes through the coil and gets energised. The electro-magnetic force of attraction is developed by an electro-magnet which tends to lift the iron plate upwards so that the moving contacts gets connected with the fixed contacts.

STAR-DELTA STARTER

This method is used in the case of motors which are built to run normally with a delta-connected stator winding. It consists of a two-way switch which connects the motor in star for starting and then in delta for normal running. The usual connections are shown in fig 2.5. When star connected, the applied voltage over each motor phase is reduced by a factor of $1/\sqrt{3}$ and hence the torque developed becomes 1/3 of that which would have been developed if motor were directly connected in delta. The line current is reduced to 1/3. Hence during starting period when motor is connected, it takes 1/3 as much starting current and develops 1/3 as much as would have been developed if it were directly connected in delta.

RELATION BETWEEN STARTING AND FULL-LOAD TORQUES

I.st per phase = $1/\sqrt{3}$ I.sc per phase where,

I.sc is the current per phase which delta connected motor would have taken if switched on to the supply directly (however, line current at start = 1/3 of line I.sc

Now $T.st \propto d.p \dfrac{I.st^2}{s}$

At starting $s=1$

Therefore $T.st \propto d.p \; I.st^2$

$$T.f \propto d.p \dfrac{I.f^2}{s.f}$$

$$\frac{T.st}{T.f} = \frac{I.st^2}{I.f^2} \; s.f$$

$$= \frac{I.sc^2}{(\sqrt{3}\ I.f)^2} \; s.f$$

$$= \frac{1}{3} \frac{I.sc^2}{I.f^2} \; s.f$$

$$= \frac{1}{3} a^2 \; s.f$$

since $I.sc/I.f = a$

Here, I.st and I.sc represent phase value.

This method is cheap and effective provided the starting torque is required is not to be more them 1.5 times the full-load torque. Hence, it is used for machine tools, pumps and motor - generators etc.,

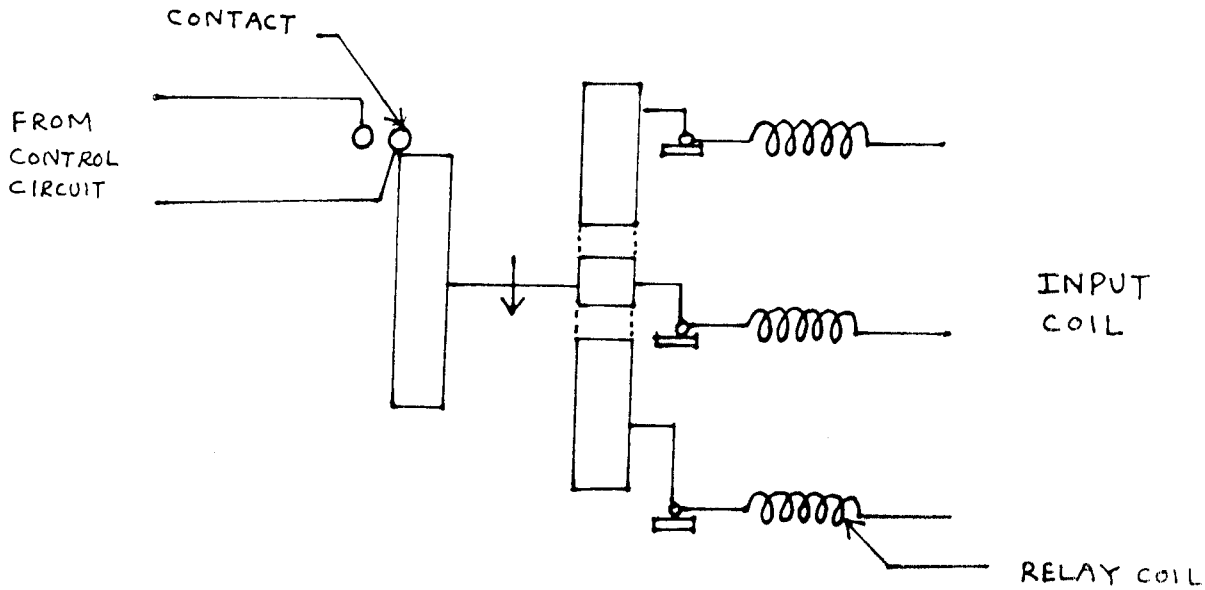


Fig 2.1 Overload Relay

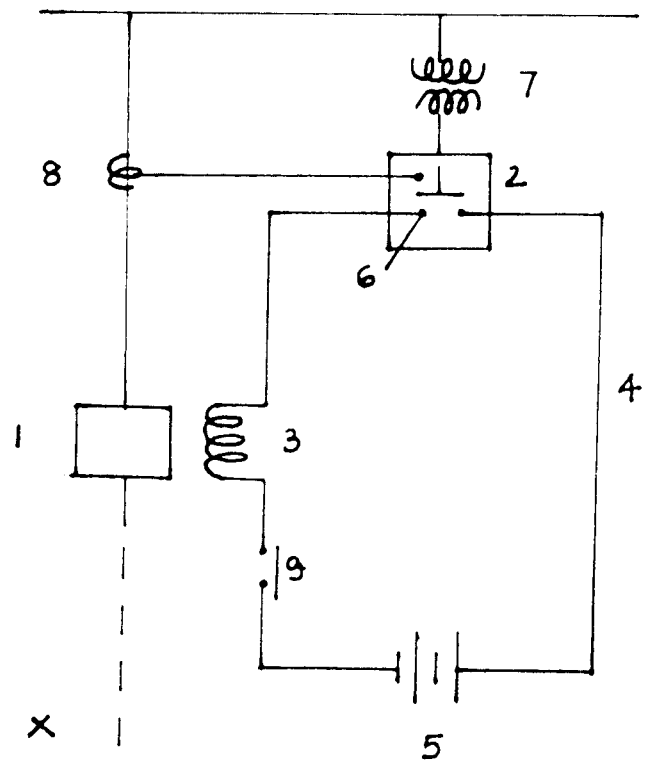


Fig 2.2 simplified diagram of circuit Breaker control of opening operation

1. Circuit breaker
2. Relay
3. Trip coil of C.B
4. Trip circuit
5. Battery
6. Relay contacts
7. Potential Transfermer
8. Current Transformer
9. Auxiliary switch contacts

X. Protected elements

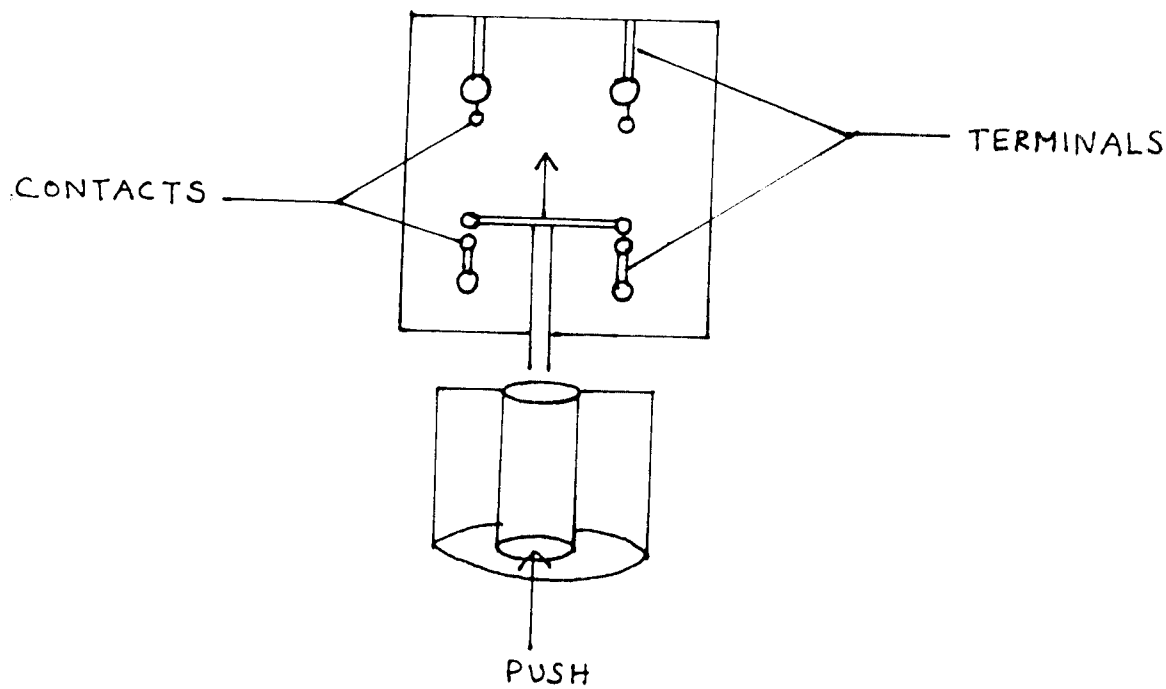


Fig 2.3 Push Button

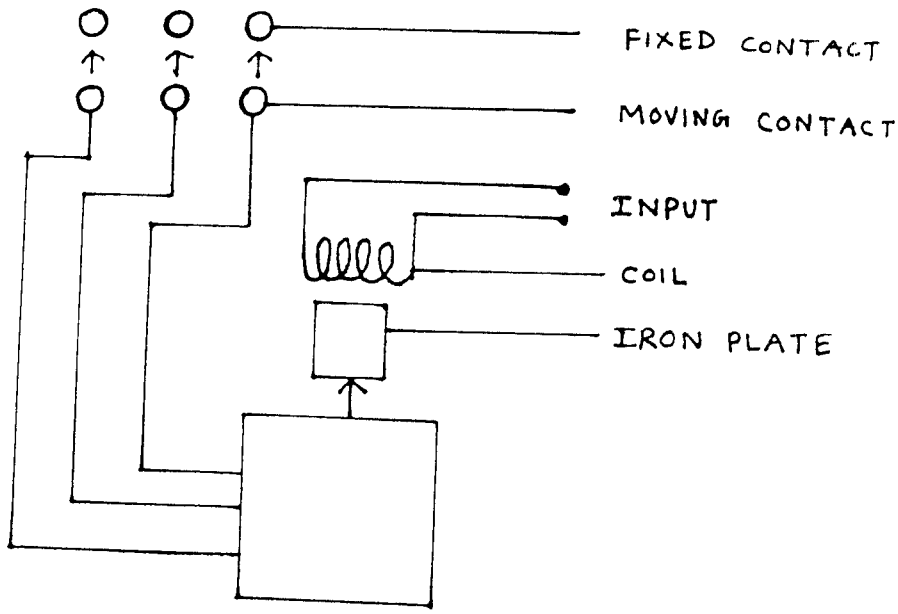


Fig. 2.4 Contactor

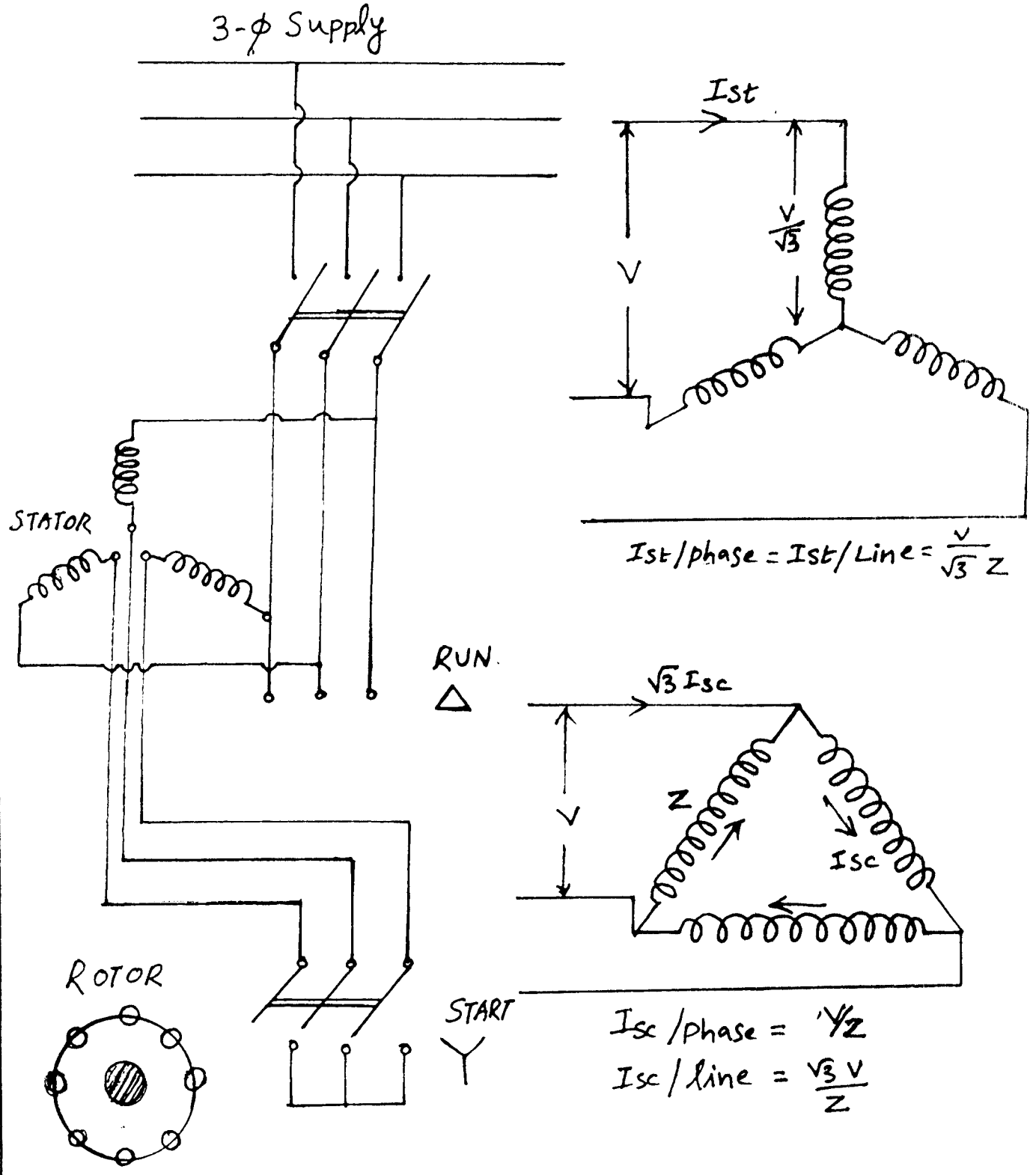


Fig 2.5 Star – Delta Starter

CHAPTER - 3

DESIGN - PRINCIPLE OF OPERATION

The circuit diagram is clearly indicated in figure 3.1

When the push button P.B2 is pressed, the D contactor and the timer T come to the closed position. Hence the timer part starts counting the time which is preset initially. It is also changeable. Also the star coil gets energised. When the star coil gets energised, the star contactor initially in the Normally open position comes to Normally closed position. So the Master relay coil gets energised and its contactor connected parallel to the push button comes to the normally closed position for hold on.

Since the star coil is energised in the power circuit, the contactor will come to the Normally closed position and A_2, B_2, C_2 will get shorted and the motor will run at star. When the Master relay coil is energised, its contactors comes to the closed position, the supply will be given to the induction motor.

After the preset value of the time, the timer switch T_1 opens, simultaneously the timer switch T_2 closed and also when T_1 opens, the star coil supply is not given.

Hence the star contactor will come into Normally open position, but T_2 is closed. So the star coil which was already in normally closed position will energize the D coil and corresponding D contacts will close. Hence the supply will go to the Master relay coil and the motor is conected to the supply. Since the D coil is energised, the D contactor in power circuit will connect the motor in delta fashion. So the motor will run at delta in running condition.

Another part of the control circuit is having the pressure and temperature switches. Hence the corresponding pressure and temperature limits are preset initially. When the presure and the temperature limits exceeding the prescribed values, this is sensed by 3 temperature switches and 3 presure swtiches.

Consider the contactor R_1 when the particular temperature limit is exceeded, say lube oil temperature high, then the corresponding temperature switch will sense the temperature limit and when it is more than the preset value, it will close the contactor R_1 and is connected to a contactor coil C1'. The corresponding coil of C1' gets energised and the contactor portion C1'', of C1' which was originaly in normally open position shifts to Normally closed position, the supply will energises the Master relay Coil. Hence this will make the contactor corresponding to it to open, so the supply is cut off for the control circuit. So, when the supply is cut off the Master realy coil is not energised and the Motor is isolated from the 3 phase supply and protected. Hence the aircompressor is quite safe, if any of the temperature and pressure parameters exceed. The same way there will be corresponding switches for the rest of five parameters and the circuit operates under alarming condition by tripping the motor and hence indirectly making the air compressor to come to rest.

WORKING OF ANNOUNCIATION PART

Here when any one of the six parameters exceed then the corresponding switches (temperature & pressure) will come into Normally closed position and hence the Announciator relay coil will get energised even when any one of the switch closes and hence this will make A.R coil's contactor to push to Normally closed position. As a result supply will go to the buzzer and the buzzer will operate.

WORKING OF INDICATION PART OF THE CIRCUIT

Here when any of the alarming condition is reached, then the corresponding switch closes and the current will flow through the LED's and it will make it to glow.

Hence for each of the 6 parameters there will be 6 LED's which will indicate which parameter is exceeded.

HOLD ON CONTACT

Two hold on contacts are provided because when there is any such parameter exceeding its limit then the LED will be glowing on continously for infinite time. If a hold on contact is provided then by hearing the announication, worksmen can come and can able to reset the hold on button. It will stop the LED's glowing.

Another push button is provided where the buzzer part is present and hence at alarming conditions, the buzzer will start sending sound and hence the worksmen can push the button and stop the buzzer announcing and can attend the fault easily.

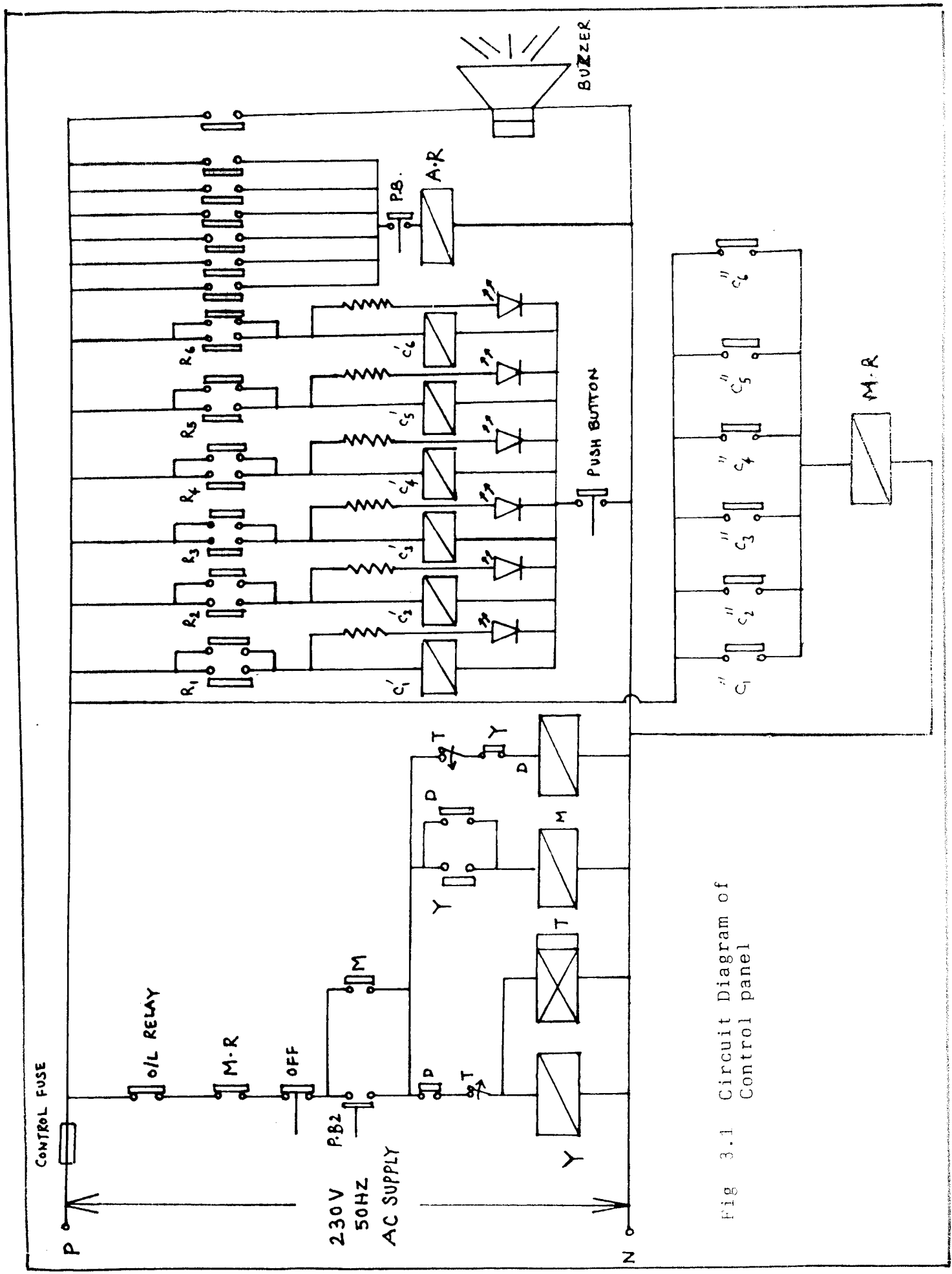


Fig 3.1 Circuit Diagram of Control panel

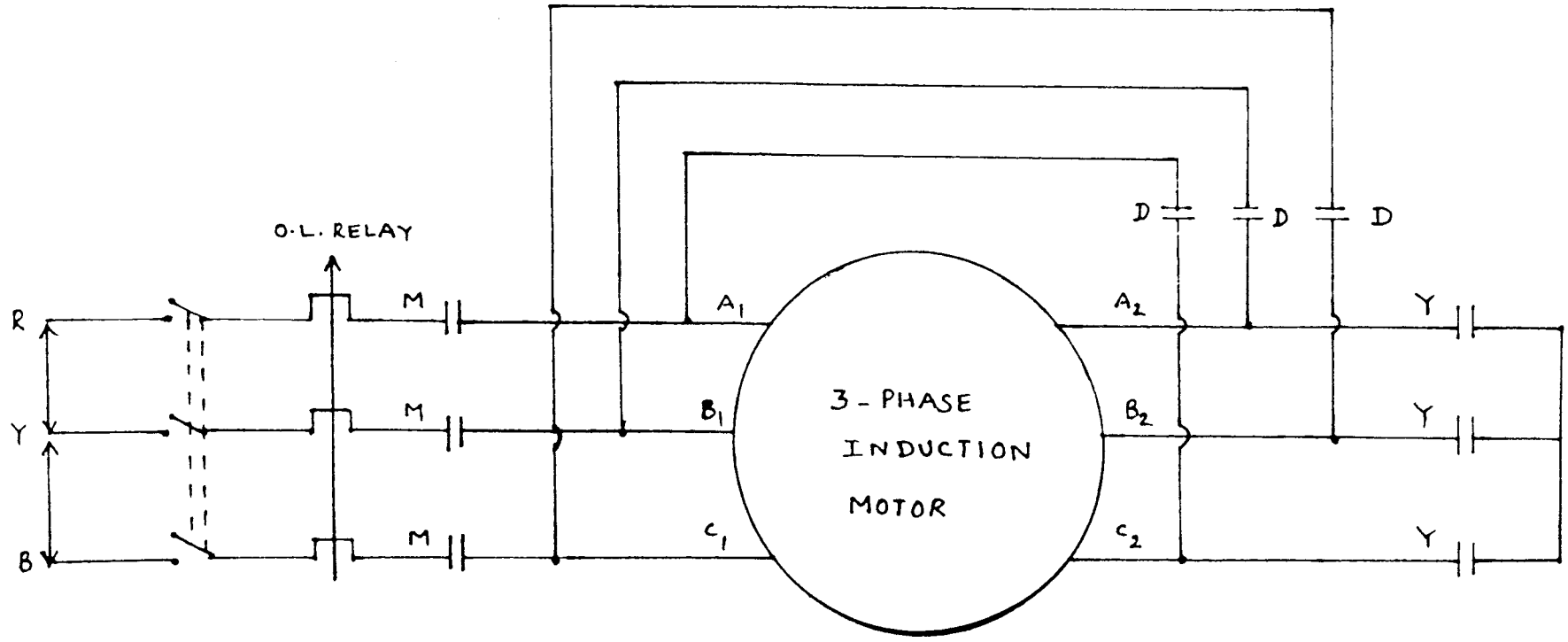


Fig 3.2 Power circuit for a three phase Induction Motor

CHAPTER - 4

FABRICATION

First the M-S plate of area 45 X 25 cm^2 is taken. The plug in connectors are fixed in the sideway of the plate. The contactor fixing channel is attached to M-S plate by bolting screws. The PVC wire channel is first arranged in a regular manner adjacent to the contactor fixing channel. Care must be taken such that sufficient spacings are provided. The wires used are of 7/0.3 rating.

Then the relay connection work was started. The eight relays are arranged. In these three for pressure parameters and the other three for Temperature parameters. The Seventh relay is master relay and the eigth relay is Announciation relay. All relays are Normally opened (NO) relays.

4.1 CONNECTIONS

First the supply is given via fuse to each relay. All Neutral points from eight relays are made common and it is connected to supply neutral. The supply to second point of input sides are taken from first point of each first six relays. The bottom ends of all relays are shorted for hold on position.

The sensing wire from each parameter is given to the bottom ends of corresponding relays. If any fault occurs, the master relay is to be operated, for this the hold on prevails and the output end of second point of each relay is given to master relay coil. Thus it is energised.

Similarly the third points are made as loop and their corresponding output is given to alaram reset push button, and then to announication relay. The LEDS are connected from the output Terminal of each realy which are in hold on postion.

The above finished work with relays are kept inside a M.S box and are placed in the compressor unit. The LED's and peeper are placed in a separate box nearer to the previous one.

4.2 ADVANTAGES

1. Protection of electric motor: Whenever anyone of the control parameters are exceeded, the master relay trips off the circuit. Thus the motor is prevented from damages. Whenever the motor is overloaded, the overload relay comes into function and trips off the motor.

2. The mechanical mode of control makes lot of difficulties to the operator. In our Electrical control pannel the control is automatic. Since the Master relay used is on hold on position during the abnormal condition, the operator can easily trace the fault and rectified it.

3. The Buzzer produces alarm signal during fault condition unitl the reset push button is pressed by the operator. Also the indicator glows, indicating the fault occuring in the unit. Thus the operator can easily identify the fault in the unit.

4. When the lubricating oil Tempearture and the cooling water Temperature go higher, the piston ceasing and mechanical parts of the compressor gets expanded and damaged. These main damages can be prevented by using control panel.

5. The compressed high pressure air is used in the whole unit. Some of the pneumatic operations are as follows:-

1. Turning
2. Trimping
3. Cleaning
4. Gauge pressing
5. Pneumatic lifting
6. Pneumatic clamping
7. Lathe Bend Movement
8. Pumping

CHAPTER - 5

CONCLUSION

A control panel for 75 H.P Air Compressor unit has been designed and fabricated at premier instruments and controls limited. The unit has been tested and found to work satisfactorily. The pressure and temperature of the compressor unit are maintained within the specified limits. In the case of these qualities exceeding limit, the control panel gives out alarm signal or a trip signal depending on the nature of severity. Provision has been made to identify the fault location in the compressor unit. This electrical control panel enables to the compressor unit to operate safely.

REFERENCES

1. PRADEEP YAMMIYAVAR, "CONTROL PANEL DESIGN", CEDT Publications,1987.
2. D. ROY CHOUDHARY, SHAIL JAIN, "LINER INTEGRATED CIRCUITS", Wiley Eastern limited, NEW DELHI, 1994.
3. A.K. SAWHNEY, "A COURSE IN ELECTRICAL AND ELECTRONICS MEASUREMENTS AND INSTRUMENTATION", Dhanpat Rai and Sons, NEW DELHI, 1986.
4. ERNEST V. DOEBLIN, "MEASUREMENT SYSTEMS APPLICATION AND DESIGN", Mc graw Hill publishing co, 1965.
5. SUNIL S. RAO, "SWITCHGEAR AND PROTECTION", Khanna publishers, NEW DELHI, 1973.
6. SONI, M. BHATNAGAR, U.S AND GUPTA, P.V., "A COURSE IN ELECTRIC POWER", Dhanpat Rai and sons, 8th revised Edition, 1976.
7. Dr.S.L. UPPAL, "ELECTRICAL POWER", Khanna publishers, NEW DELHI - 6, 1984.
8. CERNI, R.H., AND FOSTER, L.E., "INSTRUMENTATION FOR ENGINEERING MEASUREMENT", John Wiley, NEW DELHI, 1965.
9. "75 H.P KHOSLA AIR COMPRESSOR MANUAL", PRICOL, COIMBATORE.