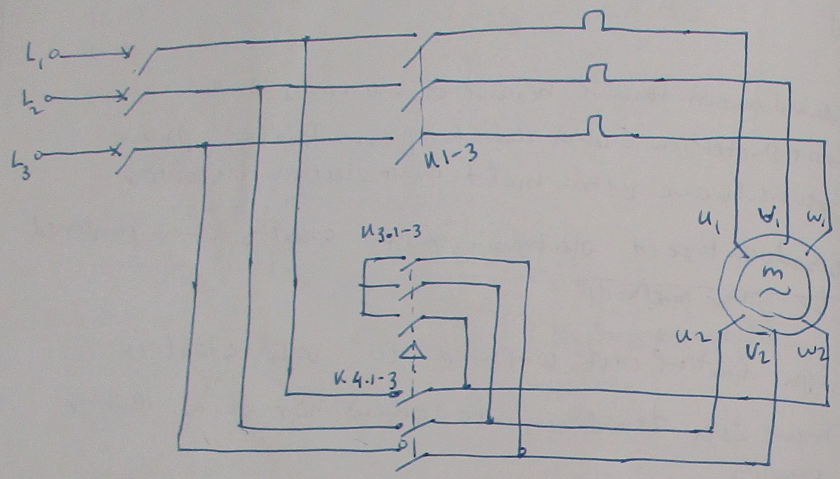
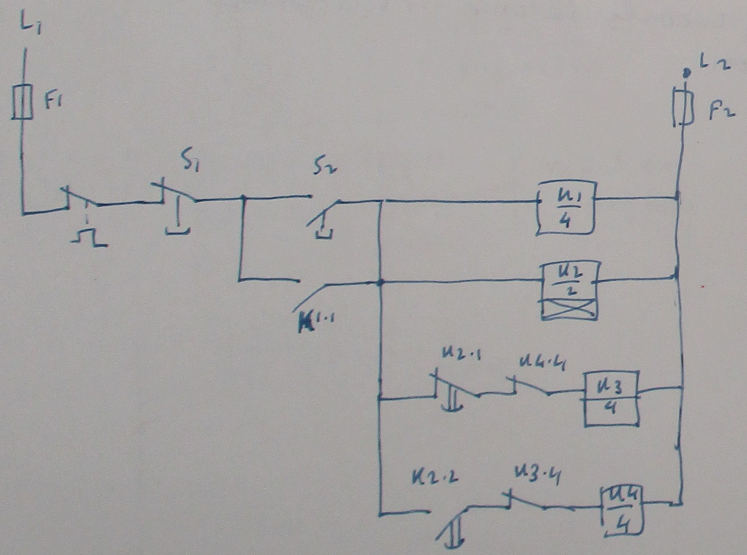
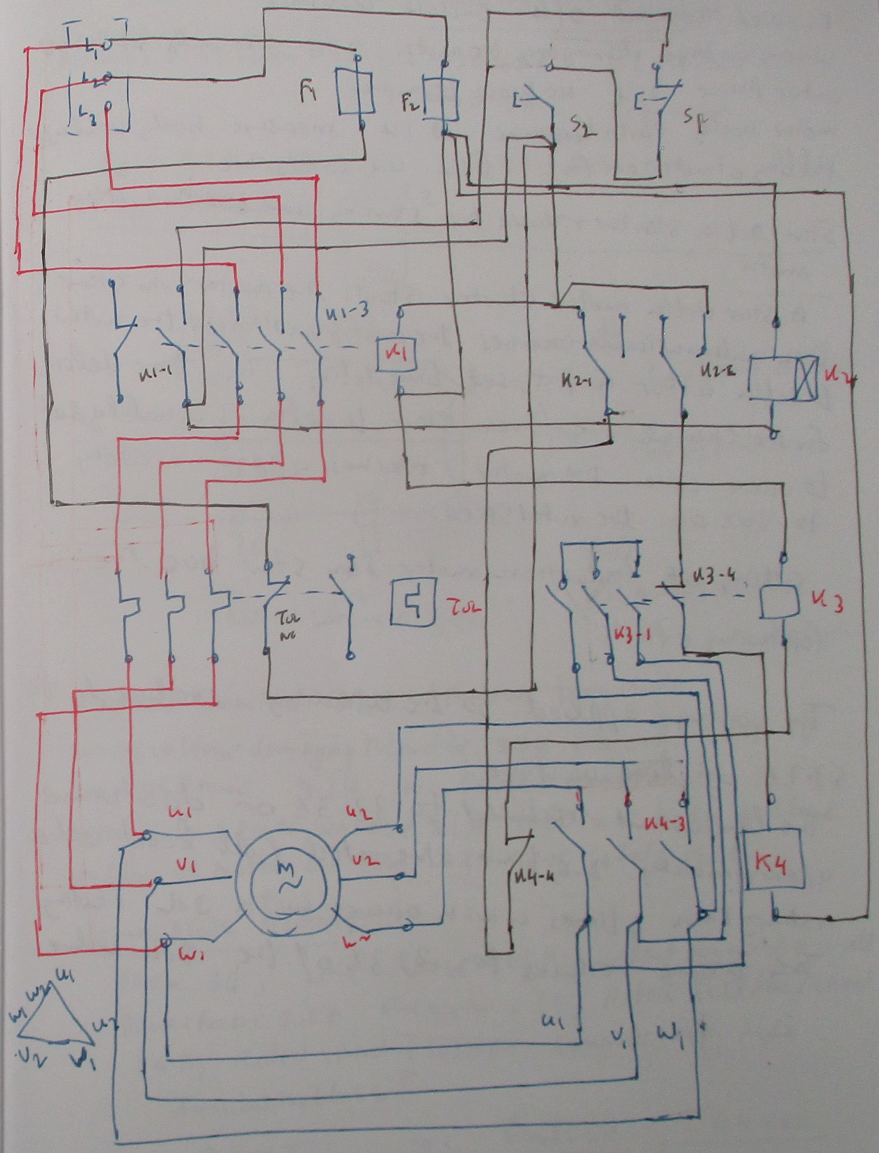
9.1.1 Star Delta motor starter connection







Exposed Terminal D/H Enclose Terminal
wrong voltage damaging the motor D/H use only 3φ 415V
out of Phase D/H No loose terminal
motor body earth Leakage D/H measure body voltage
Falling of meter on foot D/H use safety shoe.

Star/delta starter reduces the starting current of induction motor

A star delta motor starter starts the motor in star then automatically changes the configuration of the motor to delta after a pre-set time delay. The time delay for the change over from star to delta is usually set to occur when the motor reaches approximately 70-80% of the rated speed.

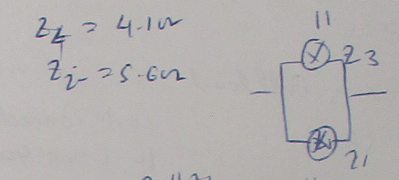
Setting of induction motor in star has the following effects.

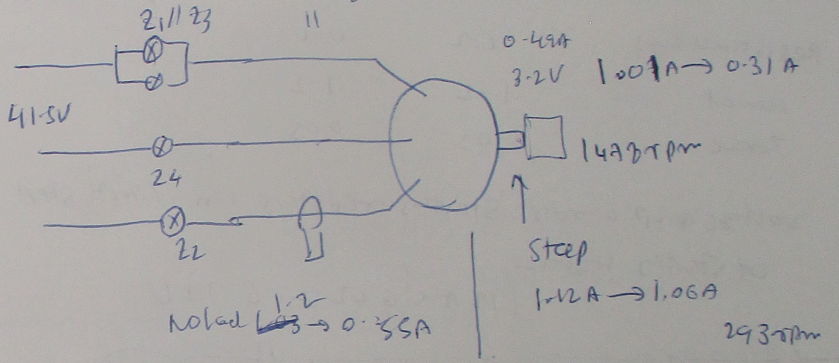
The voltage applied to the winding is reduced to 57.7% of line voltage.
The line current reduced to 33.3% of DOL value approximately 2-6 times the rated full load value rather than 6 times which occurs with DOL starting
The torque reduces to 33.3% of the DOL value.

9.2 connect a primary resistance motor starter

No load = 0.05 N-m 1.2 → 0.65 A 1154 rpm
L2 → 0-3 A. 1480 rpm

Z_4 = 4.1Ω
Z_2 = 5.6Ω
$Z_1 \| Z_3$ = 6Ω





Exposed Terminal D/H Enclose terminals
wrong voltage damaging the motor D/H use only 3φ 41.5V
out of Phase D/H No Loosed terminal
motor bodas earth Leakage D/H measure body voltage
Falling of motor on foot D/H use safety shoe.

Name Plate Details

Phase 3φ, Line voltage 41.5V, output power 44 watt Power factor 0.67 frequency 50; Rated full load current 1.6A Rated speed 1365 rpm connection λ-Δ
Insulation class F

$P_{out} = \frac{2\pi NT}{60} \rightarrow T = \frac{P_{out} \times 60}{2\pi N} = \frac{44 \times 60}{2 \times 3.1416 \times 1365}$
$= 0.3\ N\text{-m}$

Primary Resistance starting - no load

without connection to motor shaft

value	step 1	step 2
Resistance	6Ω	0Ω
current (A)	1.01	1.2
Torque (N-m)	0.05	0.05

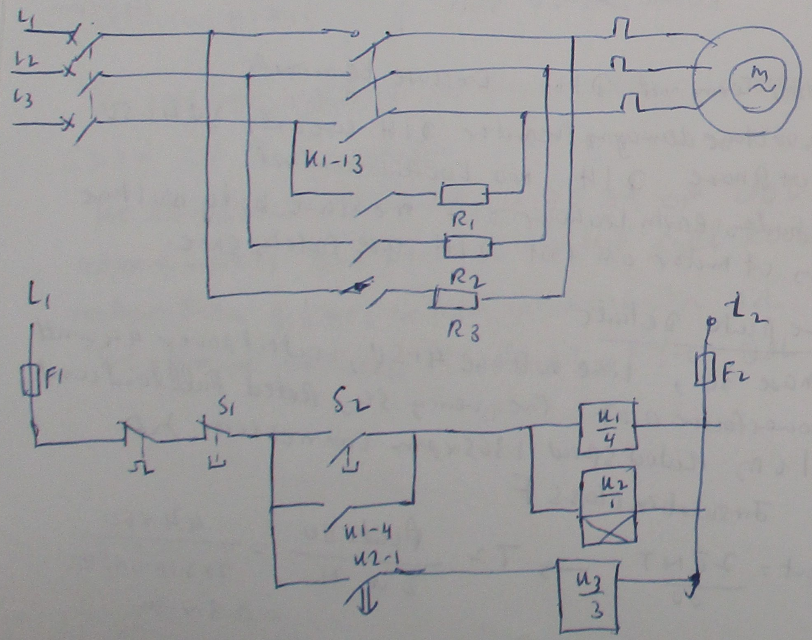
Primary Resistance starting Full load

with connection to torque gauge

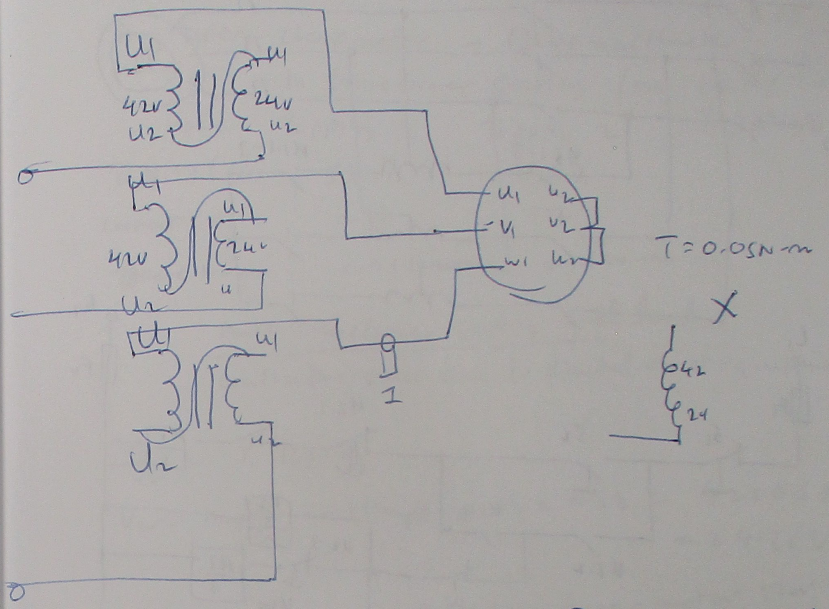
value	step 1	step 2
Resistance (Ω)	6Ω	0Ω
current	1.12	1.2
Torque	0.05	0.05

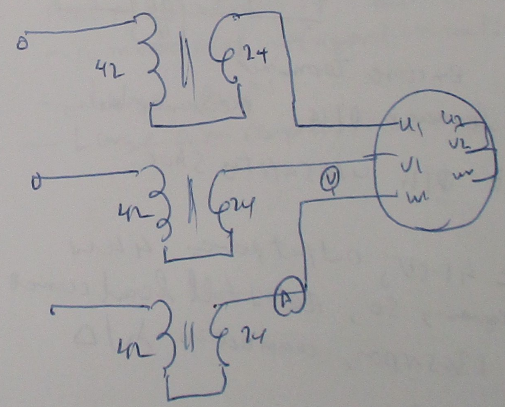
voltage drop across starting resistance in first step of starting sequence

$1.12\,A \times 6\,\Omega = 6.72\,V$



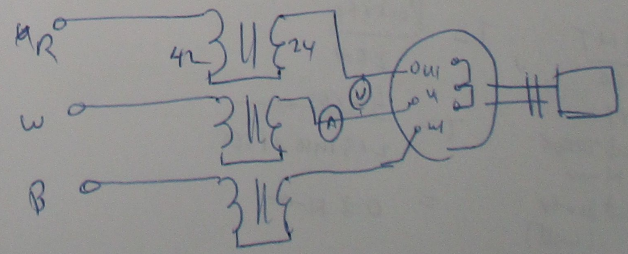
9.3 connect an auto transformer starter

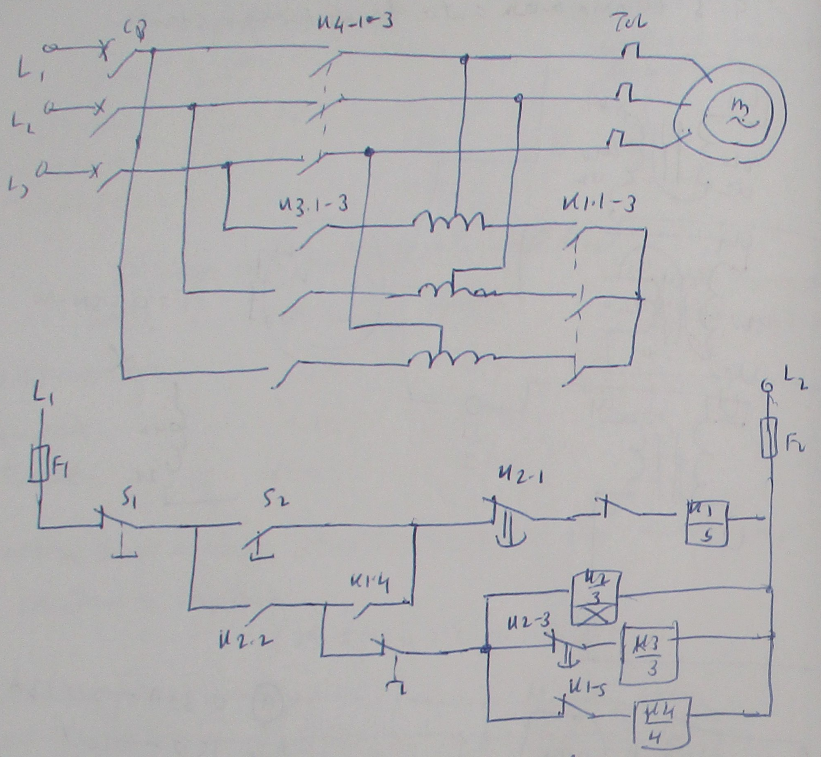




A 0.33A → 0.13A

V 15V → 12V





Exposed terminal D/H Enclose Terminal

motor ~~eddy~~ body earth leakage D/H measure body voltage

Falling of motor on foot D/H use safety shoe.

Name Plate details

Phases – 3, Line voltage 415V, output power 44kW, power factor 0.87, Frequency 50, Rated full load current 160A, rated speed 1365 rpm, connection Y/Δ

Insulation class – F

$$P_{out} = \frac{2\pi NT}{60}, \quad T = \frac{P_{out} \times 60}{2\pi N}$$

N = speed rpm

T = Full load torque N-m

P_{out} = out put power (watt)

$$T = \frac{44 \times 60}{2 \times 3.1416 \times 1365}$$

$$= 0.3 \text{ N-m}$$

Torque meter – Torque gauge – Torque scale 0> 1 N-m FSD

Torq tester – Clamp meter – Fluke multimeter

Auto transformer starting (no-load)

Vale	Tapping 1	Tapping 2	Tapping 3
Tapping (%)	58 %	100 %	
current (A)	0.33	1.72	
Torque N-m	0.015 N-m	0.05 N-m	

Auto Transformer starting full load

watch the video due to limitation of equipment

$\frac{V_1}{V_2}$ = % Tapping

V_2 – motor voltage = $V_1 \times 0.58$ = 42×0.58

= 24.36 V

Real applications of Auto transformer motor starting

– commercial refrigeration units

– Large pumps

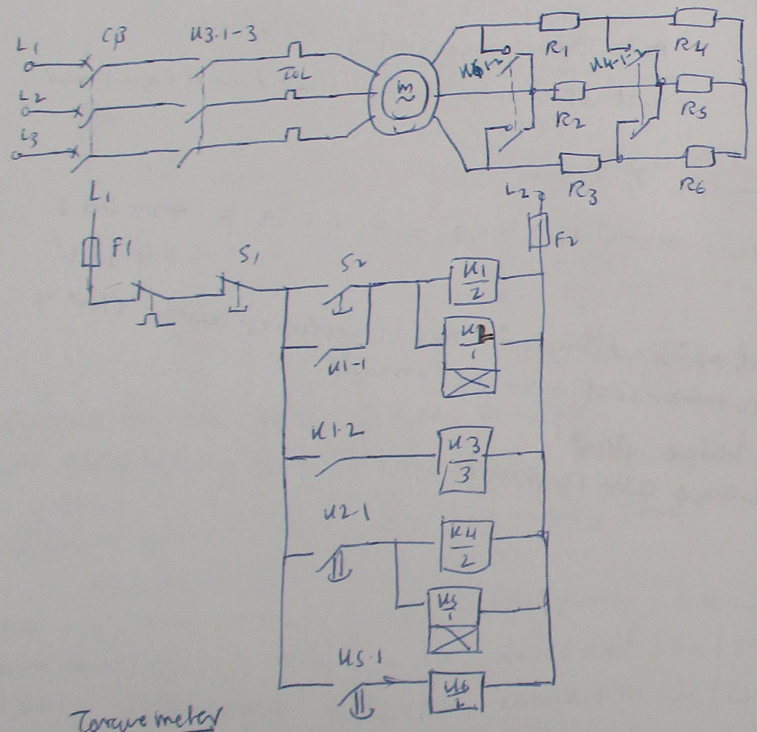
– Large air compressors.

9.41 connected a secondary resistance motor starter

Exposed terminals D/t Enclose terminal motor body earth fault leakage D/t measure body voltage

Falling of motor on feet D/t use safety shoe.

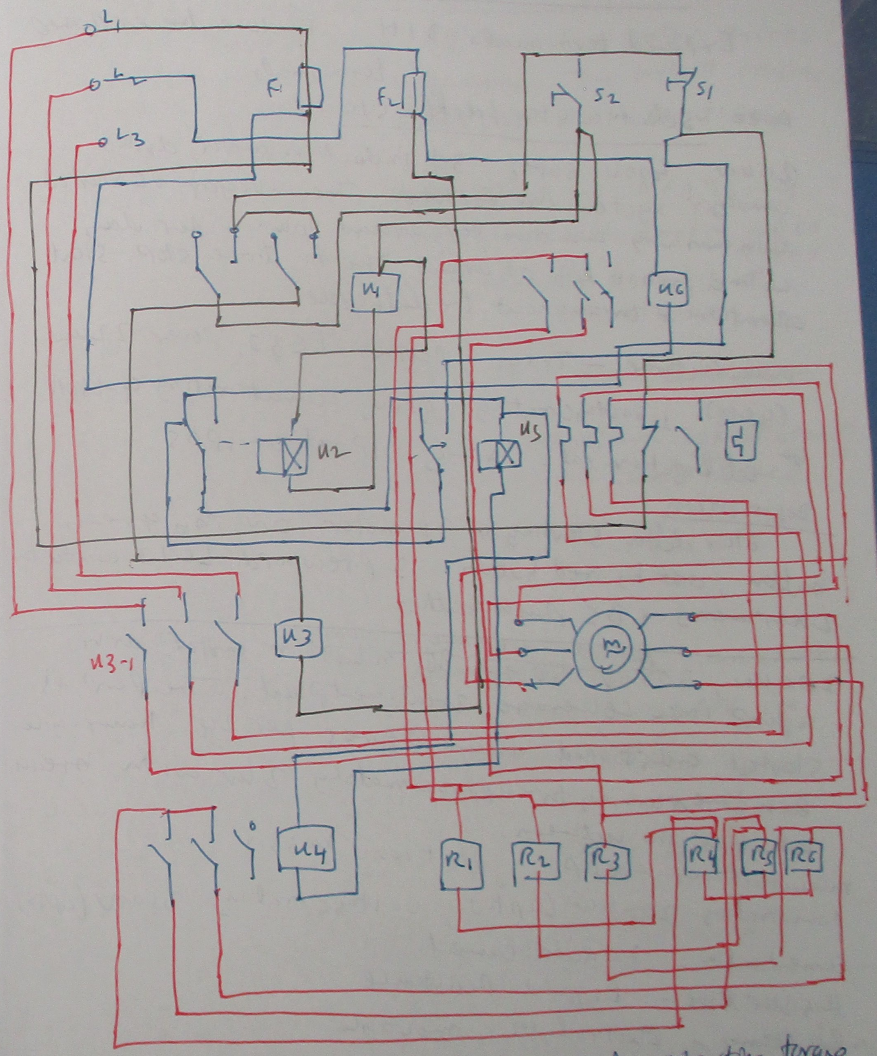
$$T = \frac{P_{out} \times 60}{2\pi N} = \frac{44 \times 60}{2 \times 3.1416 \times 1365} = 0.3\ N\text{-}m$$



Torque meter

Torque gauge - Torque scale 0 > 1 N-m FSD

Torq Tester - clamp meter - Fluke multimeter



Increase in rotor resistance reduces the starting torque

Increase in rotor resistance reduces the starting torque

9.4.2 Select motor starters

Exposed terminals, DIH Enclose the exposed terminals

Select a star/delta starter

20 kw, 400V, 50Hz 3ϕ induction motor drive conveyer system in factory. The conveyer is started each morning and run for around 10 hours per day with a probability of around two to three stop-start operations throughout the duty cycle.

manufacturer – Tesys, part no LE3D, power 22kw (upto), voltage rating 415V, current rating 9-150A

utilization cat: AC-3, IP rating – IP65.

Description

Star delta starting of 3ϕ motor ON by green button, off by red button. 3 Prewired LC1D contactor 2 harmony XB5 push button.

---

200 kw, 3000V 50Hz primary resistance starter 3ϕ induction motor drives a pump in a sewerage treatment plant. The pump is started and stopped around 8 times per 24 hour cycle. Each time running for approximately 2 hr with a break of 1 hr in between.

manufacturer – NHP, part no – M350

power rating 200 kw (upto), voltage rating 3500V (upto)

Current rating – 7x rated current.

Resistor type – Liquid Resistance.

Resistance – Electrolyte, movable

utilisation cat – ~~SP~~ SFAU 31-101, AFA 25-105

Smp starter catalogue 2025.

IP Rating – 55

Description – Liquid resistance starter, motor control application.

Select a secondary resistance starter

10000 kw, 4000 V, 50Hz 3ϕ induction motor drives an impact crusher at a quarry. The impact crusher is subject to eight or more stop-start operations throughout each duty cycle

manufacturer – Pulse Tech, part no AFA 25-105

Power rating – 2000 – 20,000 kw, voltage rating upto 4500V

Current rating – upto 2100A, Resister type Liquid resistance

Resistance – Electrolyte - movable.

utilization cat: BIM ARC, High speed servo drive

IP rating – 65

Description - Smooth motor acceleration salient operation

Adjustable starting time, Air cooled, water cooled heat exchange.

Y-Δ Starter

Advantage – Low cost

Disadvantage

With Y/Δ starter, between Y and Δ connections there is an open transition that can result in current transient and high torque.

Primary Resistance Starter

Advantage – Smooth acceleration without line current surge.

Disadvantage – It will produce heat in resistance.

Auto Transformer Starter

Advantage – Provide highest starting torque with lowest starting current

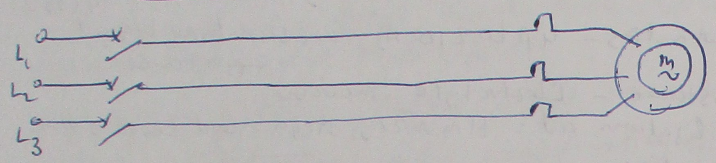
Disadvantage – Low power factor, higher cost, space limitation due to its larger size.

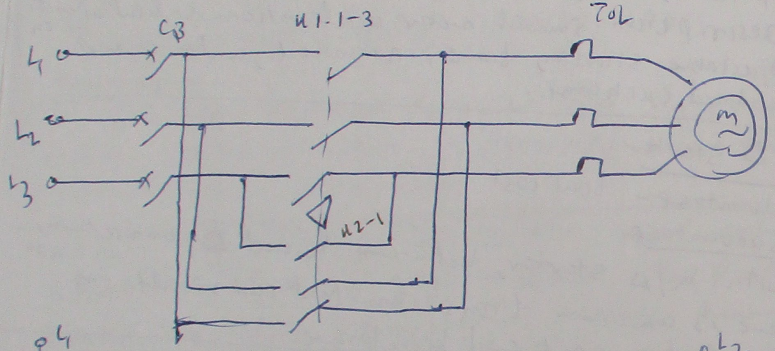
Secondary resistance starter

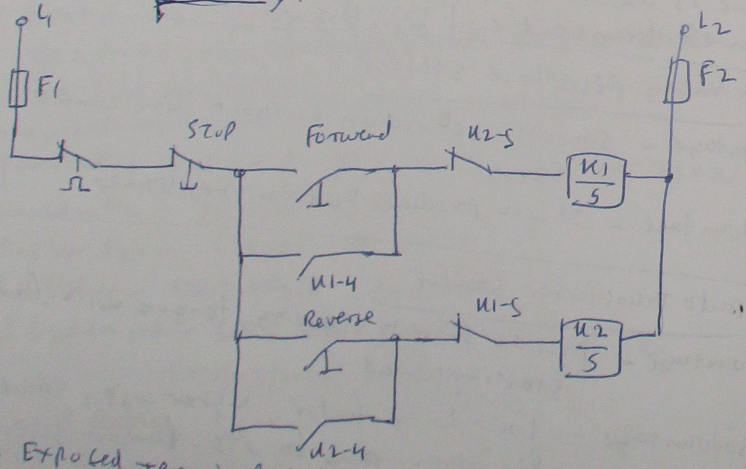
Advantage - Smooth acceleration without line surge

Disadvantage - It will produce the heat

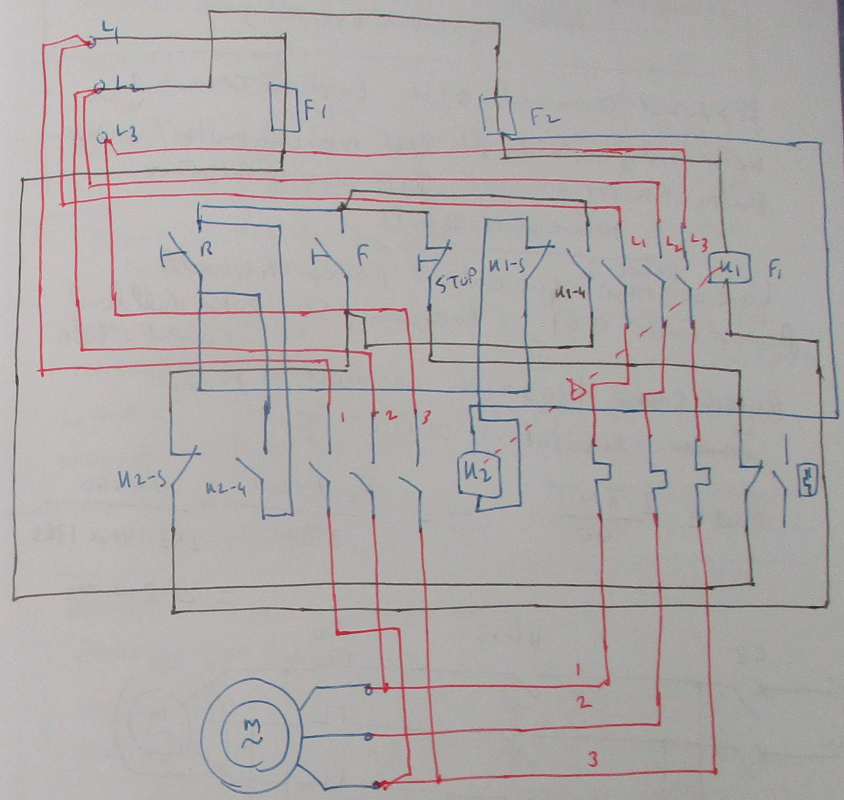
10.1 connect a motor reversal circuit







- Exposed terminal - D/H Enclote terminal
motor body earth fault - D/H measure motor body voltage
Falling of motor bon foot D/H Use safety shoe.



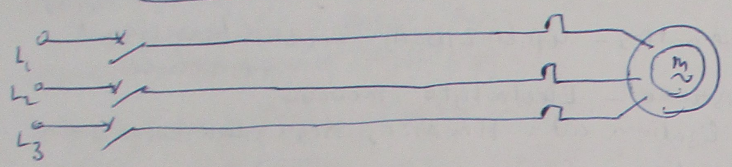
NO	Item	manufacturer	Brief description
1	U1 control Relay	FINDER	miniature control relay 250V 415/250V Transformer
2	U2 control Relay	FINDER	miniature control relay 250V 415/250V Transformer
3	Thermal overload	ABB	Thermal overload relay Electronic control
4	F - Push button	schneider	Push button spring return normally open
5	R - Push button	schneider	Push button spring return normally open
6	STOP Push button	schneider	Push button spring return normally close
7	INTERlock	TESYS	mechanical interlock

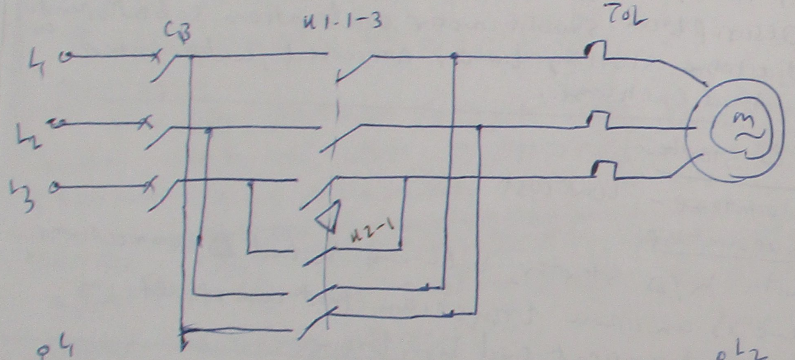
Secondary resistance starter

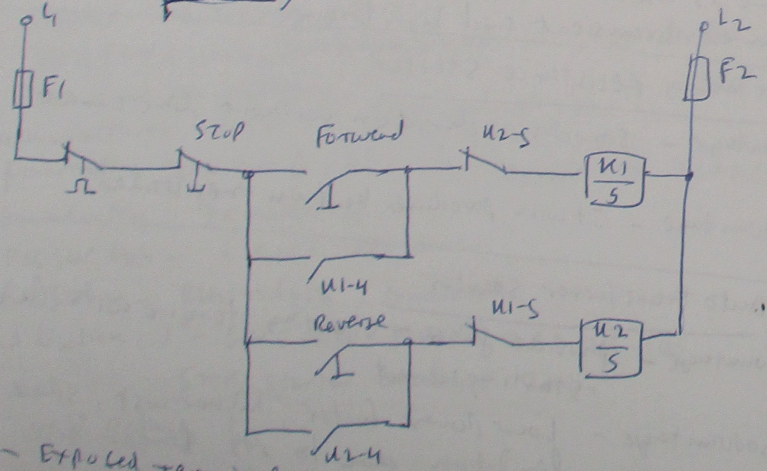
Advantage - Smooth acceleration without line surge

Disadvantage - It will produce the heat

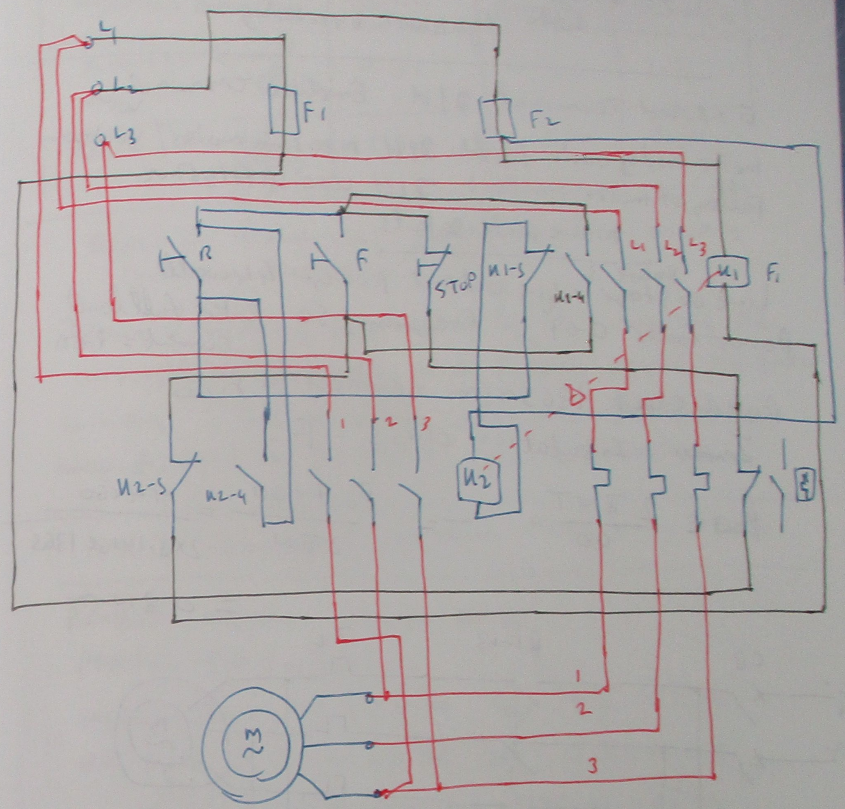
Lo.1 connect a motor reversal circuit







- Exposed Terminal - D/H Enclose Terminal motor body earth fault. D/H measure motor body voltage
Falling of motor bon foot D/H Use safety shoe.



NO	Item	manufacturer	Brief description
1	K1 control Relay	FINDER	miniature control relay 250V 415/250V Transformer
2	K2 control Relay	FINDER	miniature control relay 250V 415/250V Transformer
3	Thermal overload	ABB	Thermal overload relay Electronic control
4	F - Push button	schneider	Push button spring return normally open
5	R - Push button	schneider	Push button spring return normally open
6	STOP Push button	schneider	Push button spring return normally close
7	INTERlock	TeSys	mechanical interlock

10-3 connect a three phase motor circuit with dynamic breaking

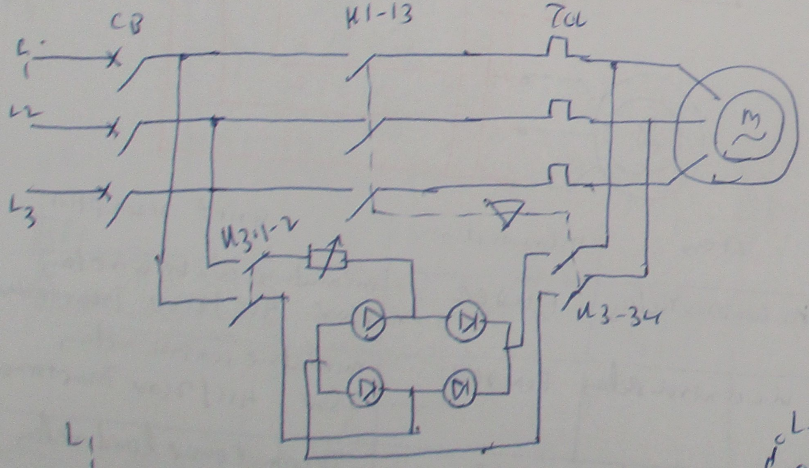
Exposed terminal DIH Enclose terminal body, motor body earth fault DIH measure motor/ voltage Falling of motor on foot DIH use safety shoe

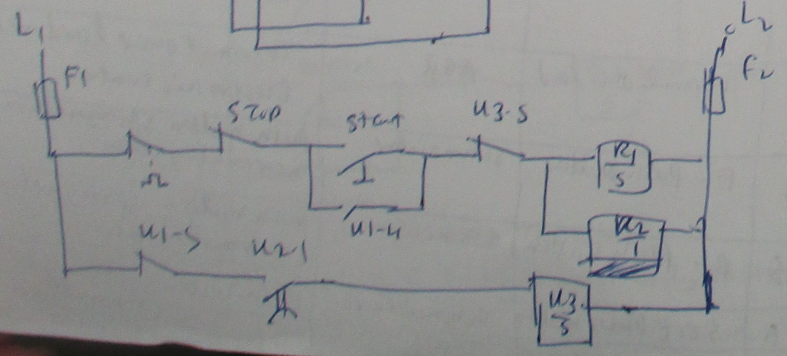
Name Plate Details

Line voltage = 415 Phase 3 output power 44 watt
Power factor 0.67, frequency 50 Rated full load current = 1.6A
Rated Speed 1365 rpm connection Y/Δ
~~Ins~~ Insulation class - F.

$$P_{out} = \frac{2\pi NT}{60} \qquad T = \frac{P_{out} \times 60}{2\pi N} = \frac{44 \times 60}{2 \times 3.1416 \times 1365}$$

$$= 0.3 N\text{-}m$$





Dynamic braking	Starting current (A)	Braking time	Braking current (A)
minimum current setting	0.31	3sec	1.71
maximum current setting	1.36	5sec	2.14

Effect of increasing the dc current on braking in dynamic breaking.

Dynamic braking is achieved by disconnecting the ac supply and connecting a dc supply across the stator winding. The dc supply sets up a stationary magnetic field in the stator, slowing the rotor

11-3 connect a variable frequency drive

ZENER MODEL - ZM0004 SS
PART NO ZM-ZM0004SS
INPUT 34.6 TO 423 VAC 3φ 47-62 Hz
OUTPUT 0 TO 41.5V AC 3φ 0 TO 200Hz
40°C, 3.0A General Purpose Rating
3.1A Extended duty rating
4.7A Inst
maximum Terminal fastening torque 1.7N-m 15.6 lbf-in
AC Drive

Fwd △ Rev ▽ Enter ↵ Exit Esc STOP ○

L_1 L_2 L_3	GUW
○ ○○	○○○
INPUT FROM SUPPLY	OUTPUT TO MOTOR

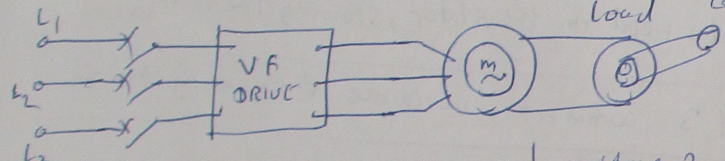
EME, Electric motor Education
www.electricmotoreducation.com.au
model SS-3-2003, Serno 1406-3855
415VAC 3.0A 3φ 50Hz

Exposed terminal D/H Enclose terminal
motor body earth fault D/H measure motor body voltage
Failing of motor on fault D/H Use safety shoe.

Phase = 3, Line voltage 415, output power = 44W
Power factor 0.67, Frequency 50, Rated full load
current 1.6A, Rated speed 1365 rpm connection Δ/Y
Insulation class F.

$P_{out} = \frac{2\pi NT}{60}$

$T = \frac{P_{out} \times 60}{2\pi N} = \frac{44 \times 60}{2 \times 3.1416 \times 1365} = 0.3 N-m$

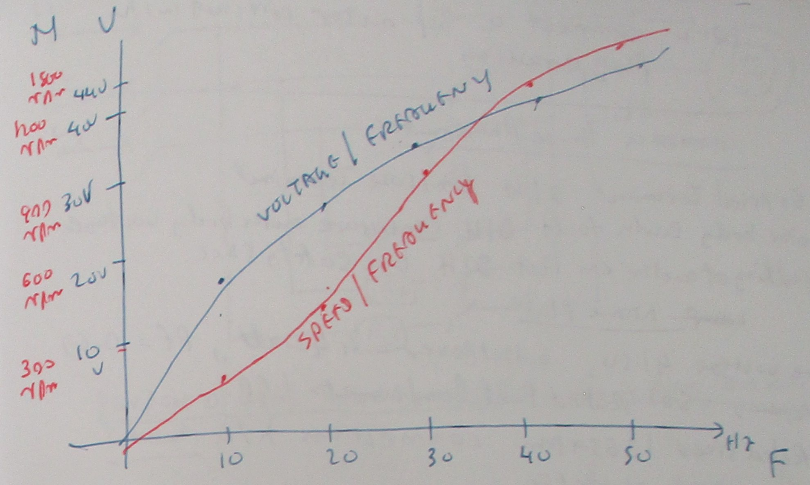


minimum frequency = 0 Hz
maximum frequency = 200 Hz
Current = 3.6A
Torque = 1.7 N-m

voltage Boost	
I/P	34.6 → 480 AC
O/P	0 → 415 AC

VF Drive speed, voltage & Frequency

Frequency Hz	motor speed rpm	motor Line voltage(V)	Line voltage to Frequency ratio
10	145	16.32	1.632
20	350	25.9	1.295
30	892	33.3	1.11
40	1144	39.1	0.9775
50	1481	44.2	0.884



50Hz ⇒ 1500 rpm

$N = \frac{120f}{P} = \frac{120 \times 50}{4} = 1500$ rpm

VF Drive speed regulation

VF Drive Speed setting RPM	No load motor Speed (rpm)	Full load motor speed RPM
1500	1492	1365

Q) Why the VF Drive must adjust the output voltage for each change in output frequency

A) The VFD voltage to frequency ratio remains constant throughout the speed range of the motor to ensure that the current drawn by the motor is kept constant airgap flux and a constant torque in the motor.

Q) What effect did the load have on motor as why

It will increase the torque and slow down the speed. because motor can not produce more than rated output according to $P = \frac{2\pi NT}{60}$

$T \propto \frac{1}{N}$ or $N \propto \frac{1}{T}$ when torque will be
speed will be down

LO-2 connect a 3ϕ motor circuit with plug braking

connect a three Phase motor

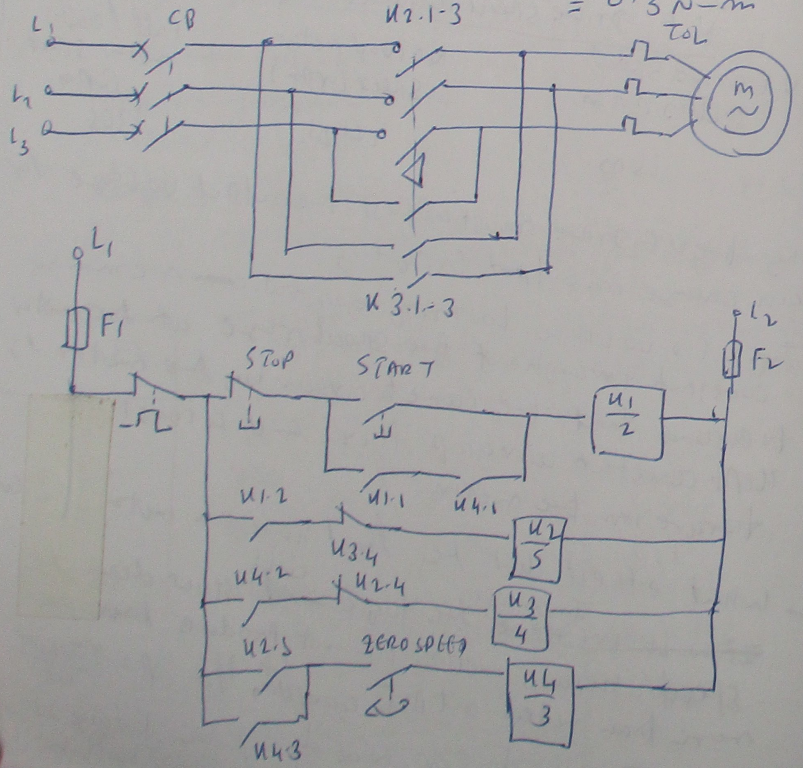
Exposed Terminal DIH Enclose Terminal
motor body earth fault DIH measure motor body voltage
Falling of motor on feet DIH use safety shoe.

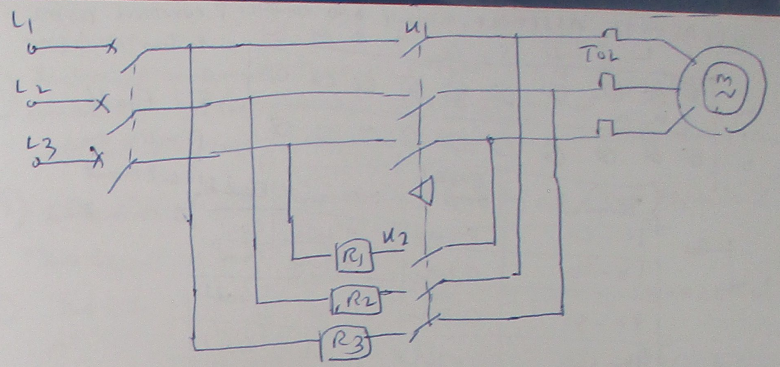
~~Nemp~~ Name Plate

Line voltage 415V, output power = 44 watt, Pf = 0.69
Frequency = 50 Rated full load current = 1.6A
Rated speed 1365 rpm connection Δ/Δ
Insulation class (F

$P_{out} = \frac{2\pi NT}{60}$, $T = \frac{P_{out} \times 60}{2\pi N} = \frac{44 \times 60}{2 \times 3.1416 \times 1365}$

$= 0.3\ N-m$





Purpose of using braking resistors in a plug braking circuit

Braking resistors are useful for large loads. The drive units can take advantage of these devices for more rapid slow down cycles

They dissipate the energy which a motor generates during deceleration. As the braking resistors dissipate the energy, it helps to prevent damage to the drive which could happen due to over voltage.

* From the provided Link, find braking resistor value

Brake power = 0.0044 kw
minimum resistance value = 6.3Ω [motor winding resistance
Braking Time t_{br} = 1sec Toycle Time = 120sec
Duty cycle = 0.83% Recommended value R = 7.5Ω

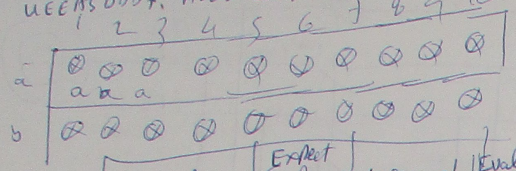
X view the video

Plug braking characteristics

Plug braking	Braking resistance (Ω)	Starting current (A)	Braking Time (sec)	Braking current (A)
without braking resister	∞	0.31	3sec	1.11
with braking resister	7.5Ω	1.136	1 sec	2.14 A

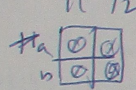
From data sheet of Practical video

UEEA50007, ASSEMBLE, MOUNT AND CONNECT CONTROL GEAR & SWITCH GEAR



3.3 Fault finding on Rail mount terminal

Terminal	Expected	measured	Evaluation
1a-2a	0.2Ω	0.2Ω	Good
1b-2b	0.2Ω	0.2Ω	Good
4a-5a	0.2Ω	0.2Ω	Good
4b-5b	0.2Ω	0.2Ω	Good
1a-4a	1.5189	1.5189	Good
1b-4b	1.5189	1.5189	Good
1a-5a	1.519	1.519	Good
1b-5b	1.519	1.519	Good
11a-11b	1.519	1.519	Good
12a-12b	1.519	1.519	Good



Terminal Number	State of field wire connection
1a/b	X
2a/b	X
3a/b	
4a/b	X
5a/b	X
6a/b	
7a/b	
8a/b	
9a/b	
10a/b	

X connected

Hazard:

Exposed terminal

DIY - Test before touch

wrong voltage damage the equipment

DIY Test the voltage & check the equipment before energizing

(1) Information about type of circuit or equipment connected at the control panel terminal
circuit diagram, schematic diagram connection diagram

(2) ~~Eff~~ Effect of open circuit wiring at field terminal
The equipment will not operate

(3) The effect of short circuit ~~at~~ in wiring connected at field terminal
The equipment will not operate as well as the high current can damage the equipment

(4) Load resistance ~~has~~ connected at terminal is less than expected value
— The control system will not properly work because it will use some short circuits at its ~~to~~ components and it will draw the higher current that can damage the control equipment

1.2 Conduct a Risk Assessment

Basic description of job

utilize proximity switch to control the motor
motor 1 & motor 2 can be selected by Selector switch,

material equipment list

Item no	
1	Programmable relay switch (PLC) S12-A8-RC -1
2	DIN RAIL — 2
3.	Terminal connector — 10 connection — 1
4	Terminal connector 2 connection — 1
5	magnetic ~~contactor~~ contactor (4 terminals) — 4 TECO CN-16
6.	miniature control relay 250VAC with TOL circuit Breaker DTNL40 C-16 2400 -1
7	circuitbreaker Hager MSN310 C-10 — 3
8	Normally open Push button Schneider spring return Red 4 close green 4
9	
10	40HP PILOT Light 415V Yellow 2 Red 2 Green 2

11 - Proximity switch — 2 sensor

(1) Is it practical to remove all hazards from work environment)

It is not practical to remove all hazards from a work environment, appropriate engineering substitution isolation need to use as well as utilize personel protective equipment to provide the protection.

(2) PPE to carryout voltage testing on Live switchgear
Insulated glove, insulated plier, test equipment

(3) Why is it necessary to isolate a control panel before carrying out any work on that panel?
To avoid accidentially energizing the panel, it needs to isolate, Locking ~~or~~ and tagging

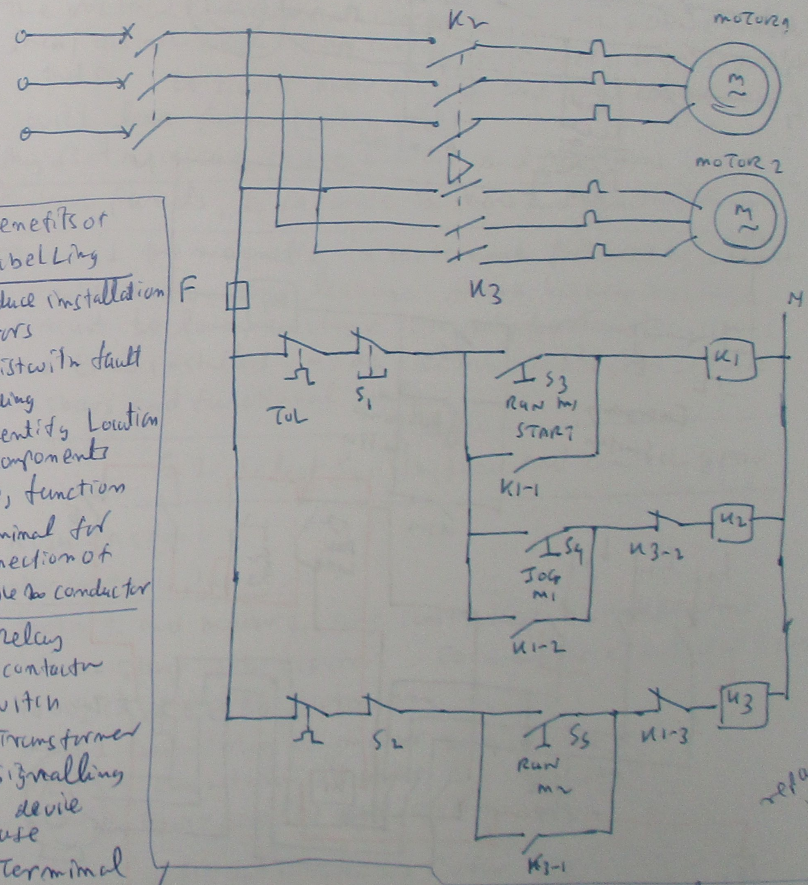
Hazard	Associated Risk	Risk Level	control measure	control
Electrical Leakage from Power circuit to ELV	Blow out of ELV equipment	2	Appropriate segregation ~~Segregation~~ between Power & control circuit	✓ Eliminate substitute Isolate Engg Admin PPE
Live terminal Electrocution	Death / Disability	1	Enclosing the Live terminal	Isolate
Accidentially switching on while the other person is working	Death / Disability	1	Tag n Lock process	Eliminate
overload n over current of motor	Trip off the circuit breaker	3	use appropriate reduced current starting	Engg
Slip / Trip / fall while working on panel equipment	Injury	3	use Appropriate Ladder	PPE
Touching of Live Panel while testing	Electrocution	1	use Insulated glove	PPE

3.2 Identify and label components

Risk - as per 1.2

K - Relay contactor S - Switch T - Transformer X Terminal
Plug B - Transducer C capacitor F Protective device
H - Signalling device. L Inductor / reactor, P signalling device
R - Resistor S - switching device

motor 1 & motor 2 are controlled by Independant Start Stop starters
motor 1 can not run if motor 2 is running
motor 2 can not run if motor 1 is running
motor 1 also has a jogging control circuit.



3 benefits of Labelling
- Reduce installation errors
- Assist with fault finding
- Identify Location of component type, function terminal for connection of cable & conductor

K - Relay contactor
S - Switch
T - Transformer
P - Signalling device
F - Fuse
X - Terminal

Function of component / Terminal Number
- Indicate how terminals relate to the arrangement of internal parts
- Relate component connection to circuit

function, location of electrical wiring
- Allow easy identification conductor / termination during installation, fault

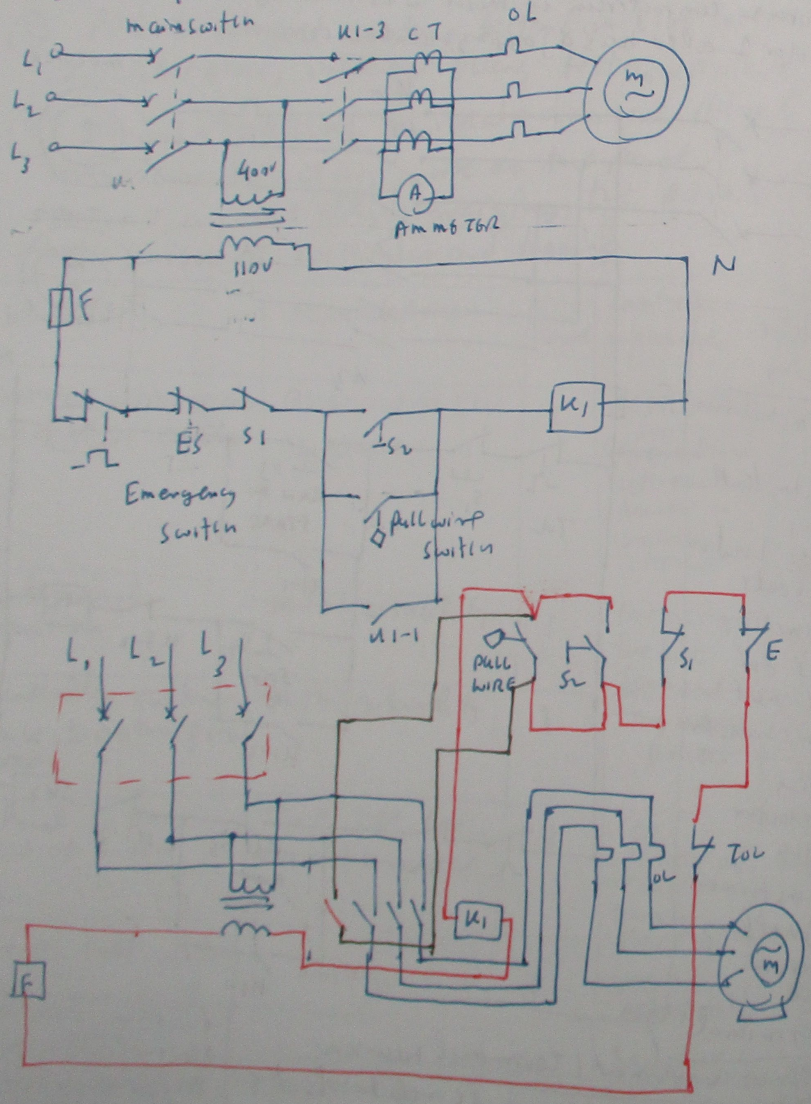
4.2 Develop circuit and wiring diagrams

Risk – As per 1.2

Operation specifications

Local control station (LCS)

- control & power circuit wirings
- Emergency stop
- main switch
- Local and remote stop/start push buttons
- combination fuse switch
- contactor - overload
- ammeter
- CT
- conveyor pull wire switch
- 400V/110V control transformer.



4 Advantages of circuit diagram compared to wiring diagram

- To easily express the function of the circuit
- To identify the control equipments
- To indicate the relation between control equipments
- To identify power and control circuit

Purpose of a wiring diagram

- To provide the guide and assistance to wire up the components.

Why must switch gear and control gear to be separated

The voltage and current carried by switch gear is greater than control gear. The control gear needs to be separated that of to avoid over voltage and over current which will leak from switch gear.

Why is it necessary to use barriers and partitions inside control panels, to separate busbars and functional units

To avoid the magnetic interference produced by different circuits and voltage leakage from higher voltage circuit to lower voltage circuit, barriers, partitions need to be installed inside control panels to separate busbars and functional units

5.2 Select switch gear and control gear

Risk – As per 1.2

-motor control panel

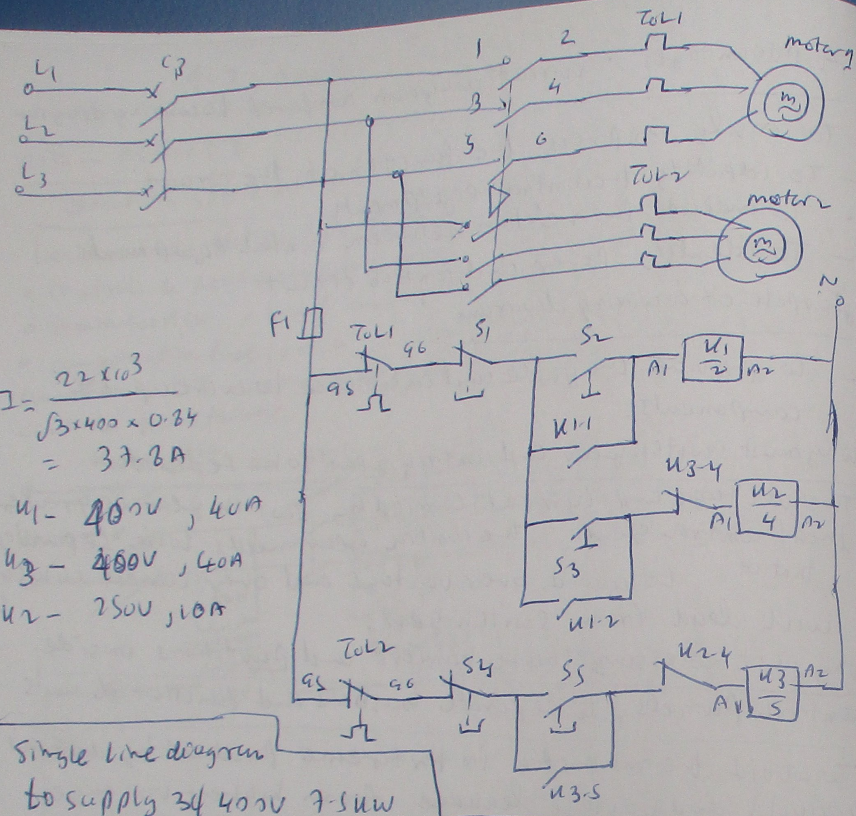
motor 1 and motor 2 are controlled by independent Stop-Start DOL starters. Each motor is rated at 22kw 400V, $\cos\phi = 0.84$, 1490 rpm.

motor 1 cannot run if motor 2 is running

motor 2 cannot run if motor 1 is running

motor 1 incorporated ~~for~~ jogging control.

Circuit diagram – Refer 3.2



$$I = \frac{22 \times 10^3}{\sqrt{3} \times 400 \times 0.84} = 37.8A$$

U_1 – 400V, 40A

U_3 – 400V, 40A

U_2 – 250V, 10A

Single line diagram to supply 3ϕ 400V 7.5kW X Δ Starter motor circuit

See 9.1.1

15kA Prospective fault capacity

Table 2

Protection device	kA rating	utilisation category	over load setting
Fault current Limiter	15kA	Positive Temperature coefficient device. (main pole)	
Isolator	15kA	Type D circuit breaker (main pole)	12.5 Time, Nominal current
contactor	15kA	CA 7-4(NAP), 32A (main pole)	
Thermal over load	15kA	Automatic set mode. (main pole)	110%

I_{fault} = 15000 Amp (15kA) Pf 0.84 Pf 0.5

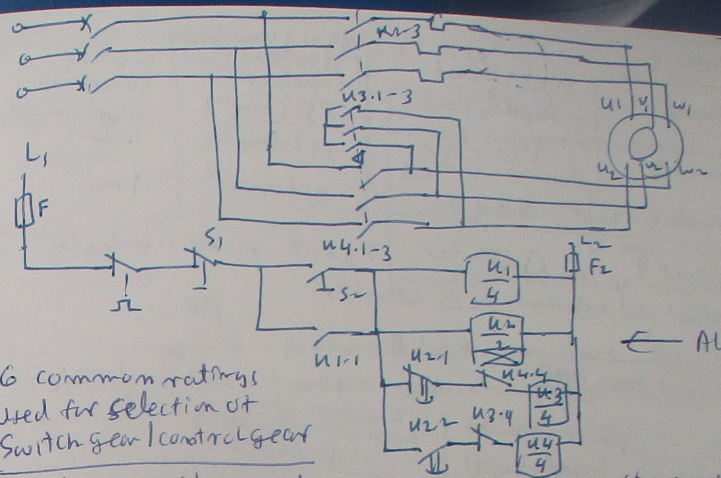
$$I = \frac{7.5 \times 10^3}{1.7321 \times 400 \times 0.84^2} = 12.8A$$

If Pf 0.5 ⟶ I = 21.6A //

Table 3 Protective Relay

Protection Device	OTL current
overload relay	12.5 Time Nominal

Table 4 HRC Fuse Settings



← Also for 6.3

6 common ratings used for selection of Switchgear / control gear

1/ maximum voltage rating (kV) 2/ Short Time with stand current (kA) 3/ Short circuit current rating (kA), 4/ continuous current rating 5/ Insulation Level dielectric strength 6/ Temperature rating Utilisation ~~of~~ category of switchgear

Characteristics operating conditions for switchgears such as contactors, CB, CB fuse unit, contactor relays.

~~Inverse~~ Inverse Time characteristics of fuse

Due to excessive current, the greater the current, the smaller is the time taken by the fuse to blow out

Function / purpose of fault current Limiter

To Limit the prospective fault current at any downstream equipment.

6.3 Assemble a switch board or control panel

Hazards. As in 1.2

1/ Two Identical control panels each contain: 20 three pole contactors switching lower heating elements, lower heating elements are rated at 400V AC ✗.

control panel 1 use 230V AC control circuit supply

2 ——— 24V DC

Power & control conductor size for each panel,

$\sqrt{3} C I \cos\theta$ = Power

$1.7321 \times 400 \times I \times 1 = 10 \times 10^3$

$$I = \frac{10 \times 10^3}{1.7321 \times 400} = 14.43A$$

Table 3.1 Items ⟶ Table 7/8

$$3I^2R = 10 \times 10^3 \therefore R = \frac{10000}{3 \times 14.43^2} = 27.72\Omega$$

for 230V ⟶ $I = \frac{V}{R} = \frac{230}{27.72} = 8.29A$

AS3008 – Table 7 ⟶ 1 mm²

VA = 230 × 8.29 = 1.9 kVA

24V DC ⟶ $I = \frac{V}{R} = \frac{24}{27.72} = 0.86A$

Table 1

Control Panel	control ckt supply (volt)	Power conductor size (mm²)	control conductor size (mm²)
control Panel 1	230V AC	1-5mm²	1mm²
control Panel 2	240 dc	1-5mm²	1mm²

Ph control Panel 3, Y Δ starter, size of power conductor for 400V AC, 22kw Y Δ starter

$I = \frac{22 \times 10^3}{1.732 \times 400 \times 0.8} = 63.5A$ pf 0.8

size - 10mm² AS3008 / Table 7

Table 2

control Panel	Power Circuit Supply (volt)	Power conductor size (mm²)
control Panel 3	400V AC	10 mm²

Ph control Panel 4, 200A, 3Φ 4B pole busbar with 175A Load.

175A Load → 40 poles

Each pole - 175/40 = 3.64SA

3Φ → 40 pole

Each Phase - 40/3 = 16 pole → 175A

Each pole - 175/16 = 10.9A

size 1-5mm²

Switch board components - Din Rail Terminal, microcontactor miniature circuit breakers, Push button Terminal block, Surge Protection Relays, various Relays emfservices.com.au

Switchboard Enclosure Schneider Electric

Prisma SeT, L.V Power distribution switch board upto 4000A

component	Rated voltage/ue	Rated current, ic	kA Rating
1/ L.V Power distribution Switch board system	1000 V	4000A upto	85 kA
2/ Din RAIL	750V	24A	10 kA
3/ miniature circuit breaker	440V	upto 63A	6 kA
4/ Terminal blocks	Insul volt. 2000V UL-300V AC	10A	0.63 kA
5/ Relays	250V AC	10A	
6/ contactor LC1F 780 Tesys	415V	17.6A → 60A	42 kA
7 Push button	240V	10A	

Pilot Light | 415V/240V | 10A(AC) / 2.5A DC. 600V AC/DC mgt

Polarity - Power conductor correct

Polarity - control conductor correct

EL0014 EL0018 EL0039

TABLE (5)

visual Inspection good	Yes
Earth continuity ok	Yes
Insulation Resistance - Power Conductor 0 min	Yes
Insulation Resistance - control conductor 0 min	Yes

correct connection - Power conductor - correct - Yes

correct connection - control conductor - correct - Yes

Earth Fault Loop Impedance 0-5Ω Yes

optional Test - operate the switches - As Planned compliance - Yes

① 3 Types of connected load equipment that determine the sizeof power conductor

1/ HWS 2/ RANGE 3/ socket outlet

② Factor determines the voltage rating of Power & control cable

Insulation

Properties of insulating materials, materials thickness, environment in which the cable operates

③ 1 min { min Insulation resistance acceptable between Live Power & control cable.

④ methods to reduce electromagnetic interference between High current power cable & low current control cable, connected electronic device.

- Shielding, Filtering, Grounding