INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION

A PROJECT ON

TEA PROCESS AUTOMATION

PREPARED BY
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REGISTRATION NO.
QA143941

29.8.14

International Institute for Advanced Training on Control & Automation
IIATCA

INTRODUCTION

The concerned project is based on Tea Process Automation. The purpose of this project is inclusion of stepwise automation in various operations that are performed in a tea plant, from Weathering of tea leaves, Rolling and CFM in respective chambers to Bio-Chemical Processing of tea leaves and finally drying, are logically designed ladder logic.

In this project the following software and hardware are used.

Software:

# Operating System	: Microsoft Windows 8 Developer Preview Edition
# PLC programming	: RSLogix 500 English 7.00.00 (CPR 7)
# SCADA programming	: RSView 32 7.20.00 (CPR 7)
# Emulator	: RSLogix Emulate 500
# Communication Software	: RSLinx Classic 2.51.00 (CPR 7)
# Communication Protocol	: DH-485; [DH-Data High Way]
# Communication Driver (with PLC)	: AB_DF1-1
# Communication Driver (without PLC)	: EMU-500
# Drawing	: AutoCAD 2008
# Documentation	: Microsoft Office 2010
# Others	: a) Rockwell Automation USB CIP driver package
	b) PDF Creator
	c) Adobe Reader 11.0.1

PLC DESCRIPTION

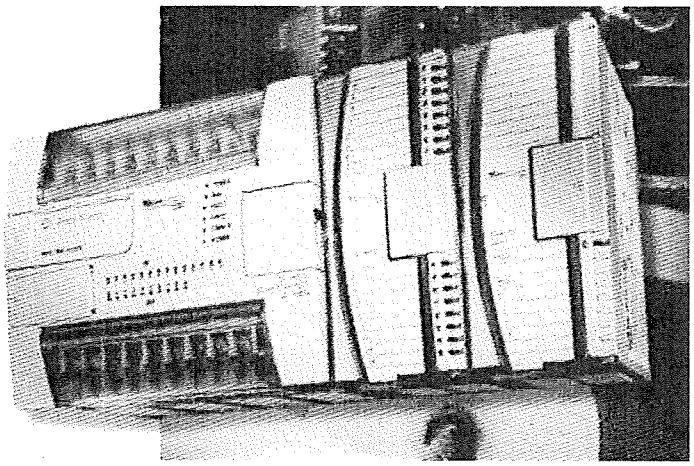
MicroLogix-1200; 1762-L24BWA

Input Power : 120/240V ac
Inputs : (10) 24V dc; (4) fast 24V dc
Outputs : (10) relay
Enhancement : The trim pots (trimming potentiometers) on the controller operated in reverse of the ladder logic.

MicroLogix 1200 controllers now offer:
- Full ASCII (read/write)
- PTO Controlled Stop
- PWM Ramping
- RTC and String Messaging
- Static Data File Protection
- Comms Reset Pushbutton Bit
- Floating Point (F) Data File for use with:
  compare instructions (EQU, GEQ, GRT, LEQ, LES, LIM, NEQ); math instructions (ABS, ADD, CLR, DIV, MUL, NEG, SQR, SUB); move instruction (MOV); file instructions (CPW, FLL); and the message (MSG) instruction
- Programmable Limit Switch (PLS) File for use with HSC
- RTA - Real Time Clock Adjust
- GCD - Gray Code
- CPW - Copy Word
- ABS- Absolute Value

For 1762-L24BWA controllers: The COM of the sensor supply is also connected to chassis ground internally. The 24V dc sensor power source should not be used to power output circuits. It should only be used to power input devices.

MicroLogix-1200 With Expansion I/O Module



2 Ch. Input/ 2 Ch. Output Analog Module; 1762-IF2OF2

2-channel analog voltage/current input
2-channel analog voltage/current output

Input Type Selection

Select the input type, current or voltage, using the switches located on the module's circuit board *and* the input type/range selection bits in the Configuration Data File. Refer to MicroLogix 1200 and 1500 Programmable Controllers Instruction Set Reference Manual, publication number 1762- RM001. You can access the switches through the ventilation slots on the top of the module. Switch 1 controls channel 0; switch 2 controls channel 1. The factory default setting for both switch 1 and switch 2 is Current. Switch positions are shown in pic.

SYSTEM DESCRIPTION

Weathering Chamber:

This is the first chamber of the process. Two proximity sensors are present in this closed chamber. One is located in front of this chamber and another is located in the other side of the chamber. First sensor sense the entering of the tea leaves and another sensor sense the exit of the tea leaves. Weathering process is done inside the chamber.

Rolling chamber:

This is the second chamber of the process. Like the weathering chamber this closed chamber also consists of two proximity sensors. First sensor senses the entering of the tea leaves and the second one senses the exit of the tea leaves. Rolling process is performed inside the chamber.

Continuous Fermenting Machine:

This is the third chamber of the process. This closed chamber consists of two proximity sensors for the purpose of sensing the entry and exit of tea leaves. Continuous fermentation process is performed.

Bio-Chemical Process Chamber:

This is the fourth chamber of the process. This closed chamber consists of two proximity sensors for the purpose of sensing the entry and exit of tea leaves. Bio-Chemical Process is performed here for a temperature specific duration.

Dryer Chamber:

This is the fifth and last chamber of the process. This closed chamber consists of two proximity sensors for the purpose of sensing the entry and exit of tea leaves. Bio-Chemical Process is performed here for a temperature specific duration.

Sensor Unit:

The sensor unit senses ambient temperature using RTD. For the process chambers proximity sensors are used as mentioned earlier.

Types of Proximity Sensors:

- Capacitive
- Capacitive displacement sensor
- Doppler effect (sensor based on effect)
- Eddy-current
- Inductive
- Laser rangefinder
- Magnetic, including magnetic proximity fuse
- Passive optical (such as charge coupled devices)
- Passive thermal infrared
- Photocell (reflective)
- Radar
- Reflection of ionizing radiation
- Sonar (typically active or passive)

Application:

- Parktronic, car bumpers that sense distance nearby cars for parking
- Ground proximity warning system for aviation safety
- Vibration measurements of rotating shafts in machinery [1]
- Top dead centre (TDC) / camshaft sensor in reciprocating engines
- Sheet break sensing in paper machine
- Anti-aircraft warfare
- Mobile phones
- Roller coasters
- Conveyor systems
- Touch screens on mobile devices that come in close proximity with the face

Transducer:

It receives signal from sensor unit and converts it into an equivalent electrical signal. This electrical signal is transmitted to the control room.

CONTROL PHILOSOPHY

In the Process Automation, tea leaves are pulled to weathering chamber to get total dry state. Tea leaves, just collected from tea gardens, consist of some amount of water moisture. To eliminate this small amount of moisture weathering process is required. Weathering Process takes some time to make the tea leaves dry from its dripping condition.

After finishing the weathering process, tea leaves go to rolling chamber rapidly for getting separate state one from another.

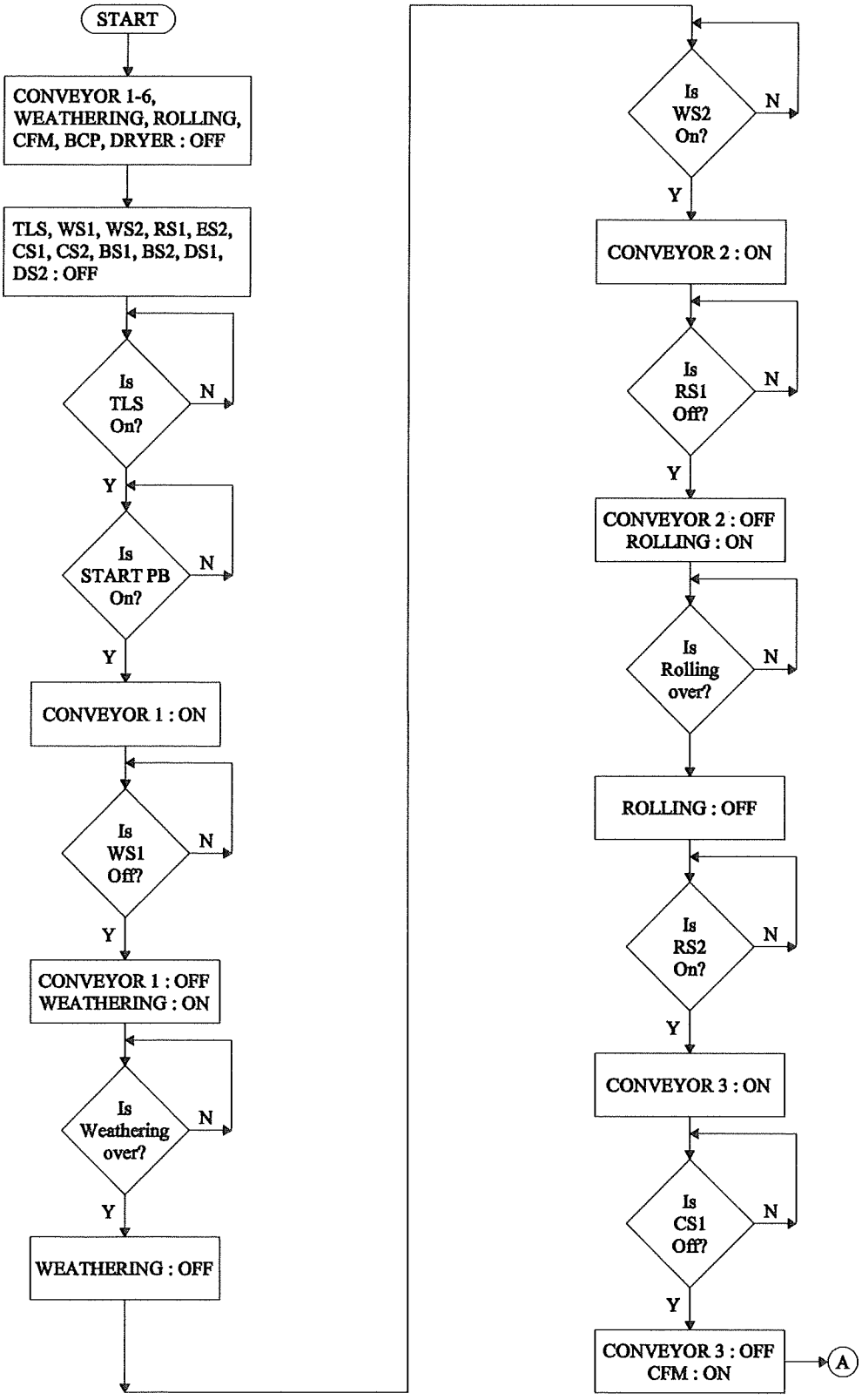
After finishing the rolling process, tea leaves go to CFM (Continuous Fermenting Machine). Fermentation of entire tea leaves is done here. After completion of fermenting process tea leaves get semi liquid form. This process also take some time same as others.

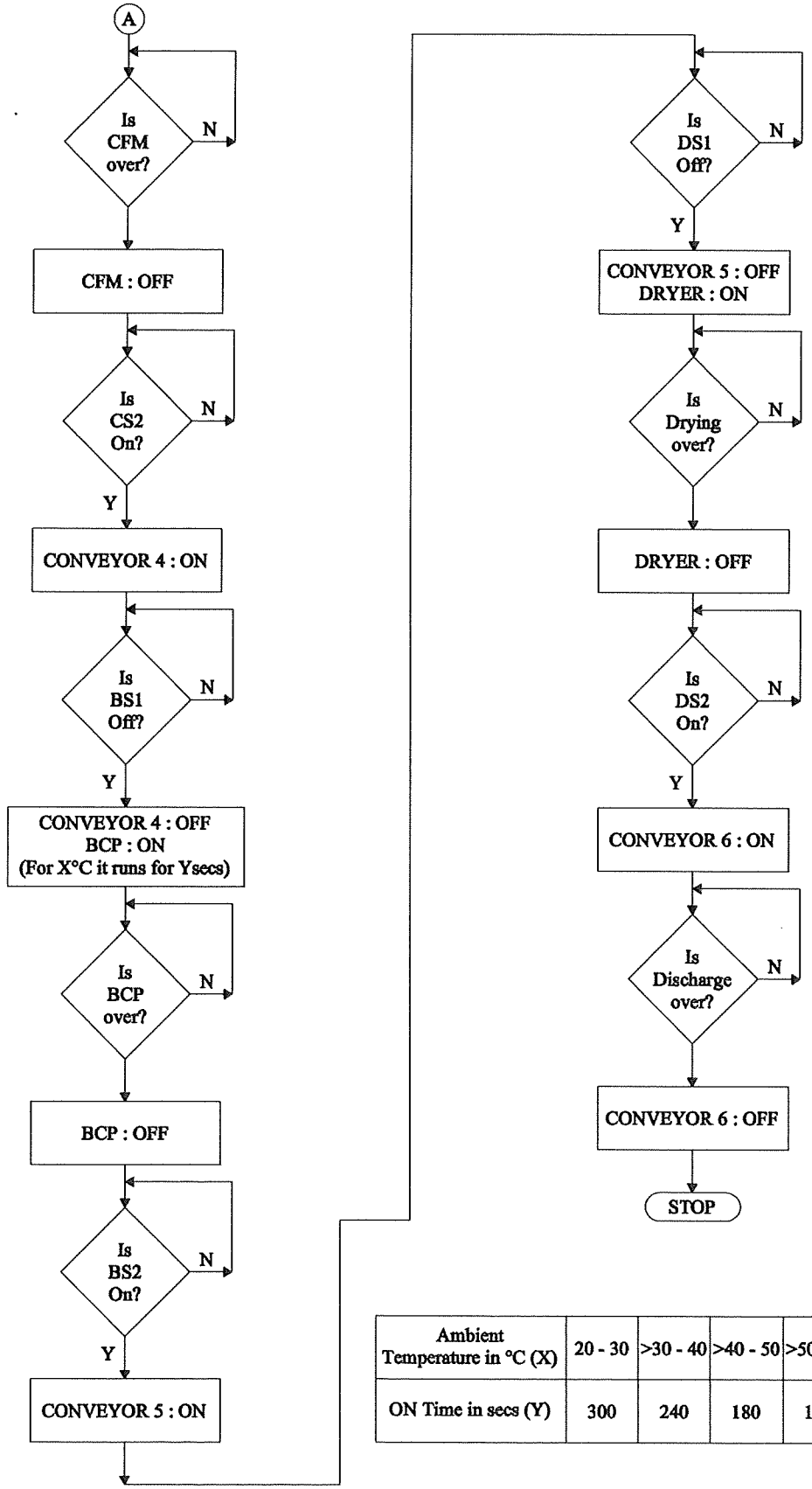
After completion of fermentation process semi liquid tea leaves are passed through MHC (Material Handling Conveyor). The feeding is done taking care of the time of exposure of the leaves of the conveyor to allow various bio chemical processing (TR/TF) of leaves. A chart indicating relevant time the tea leaves are exposed w.r.t. the ambient temperature is enclosed. Now, the end-user wants an open loop control system (since the feedback is not dependent on the output) where the feeding to the dryer will be done automatically depending on ambient temperature.Since the bio-chemical process is controlled based on the physical observation by the experienced operator, the end-user wants a provision to vary i.e. feed a desired speed to the conveyor speed control system at any particular temperature other than the difficult value (i.e. factory set values of the control system programmed in accordance with the enclosed chart provided by the end-user) of the control system, so that the exposure time of the leaves can be varied according to the ambient temperature.

- Following the part of material handling conveyor the leaves goes to dryer part to become totally dried and processed. After the dried processed tea leaves can be obtained.

Temperature (^{0}C)	≥20.0&< 30.0	≥30.0 &< 40.0	≥40.0 &< 50.0	≥50.0 &< 60.0	≥60.0 & ≤ 70.0
Time (sec.)	300	240	180	120	60

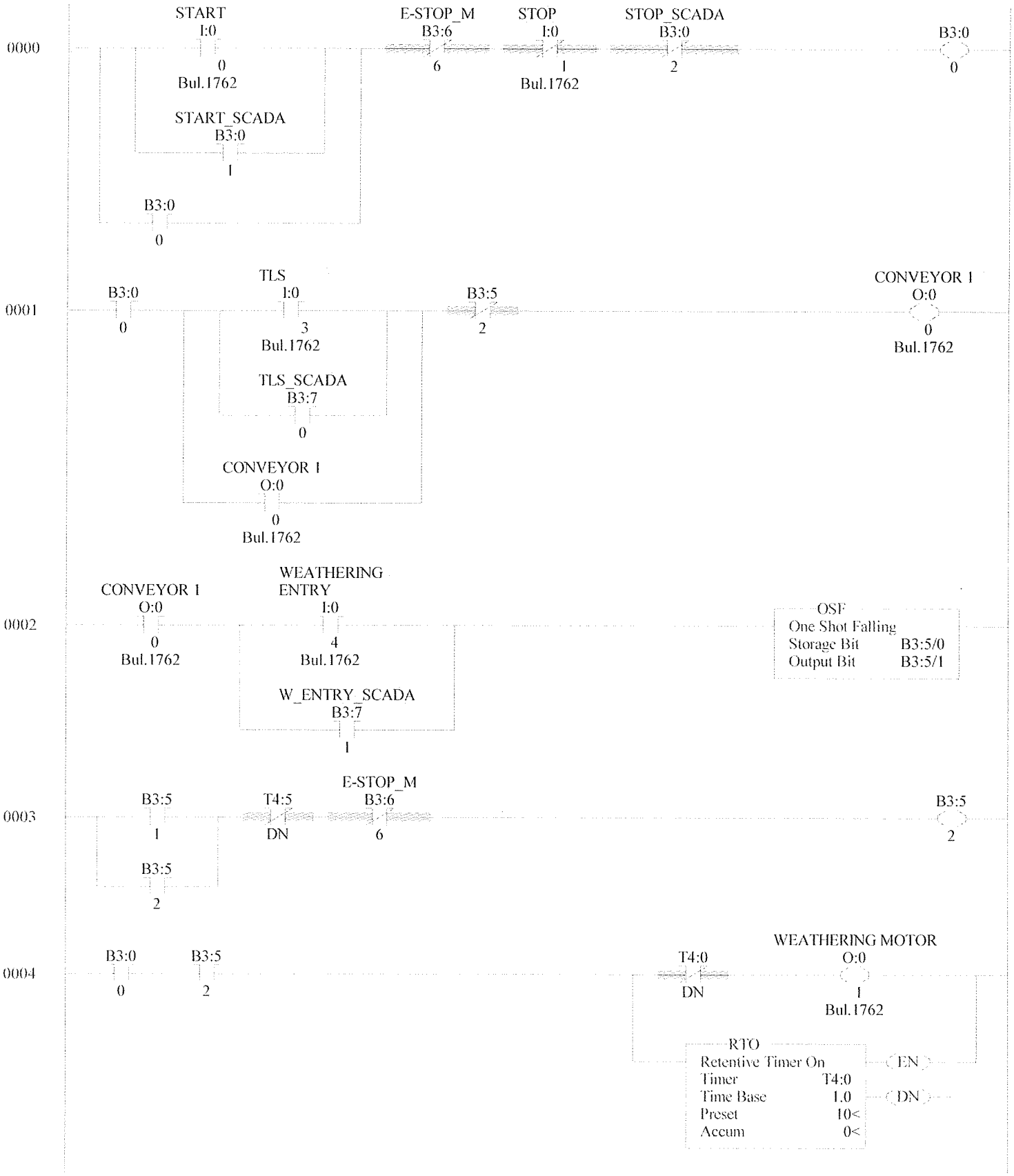
PROCESS FLOW CHART FOR TEA PROCESS AUTOMATIOM

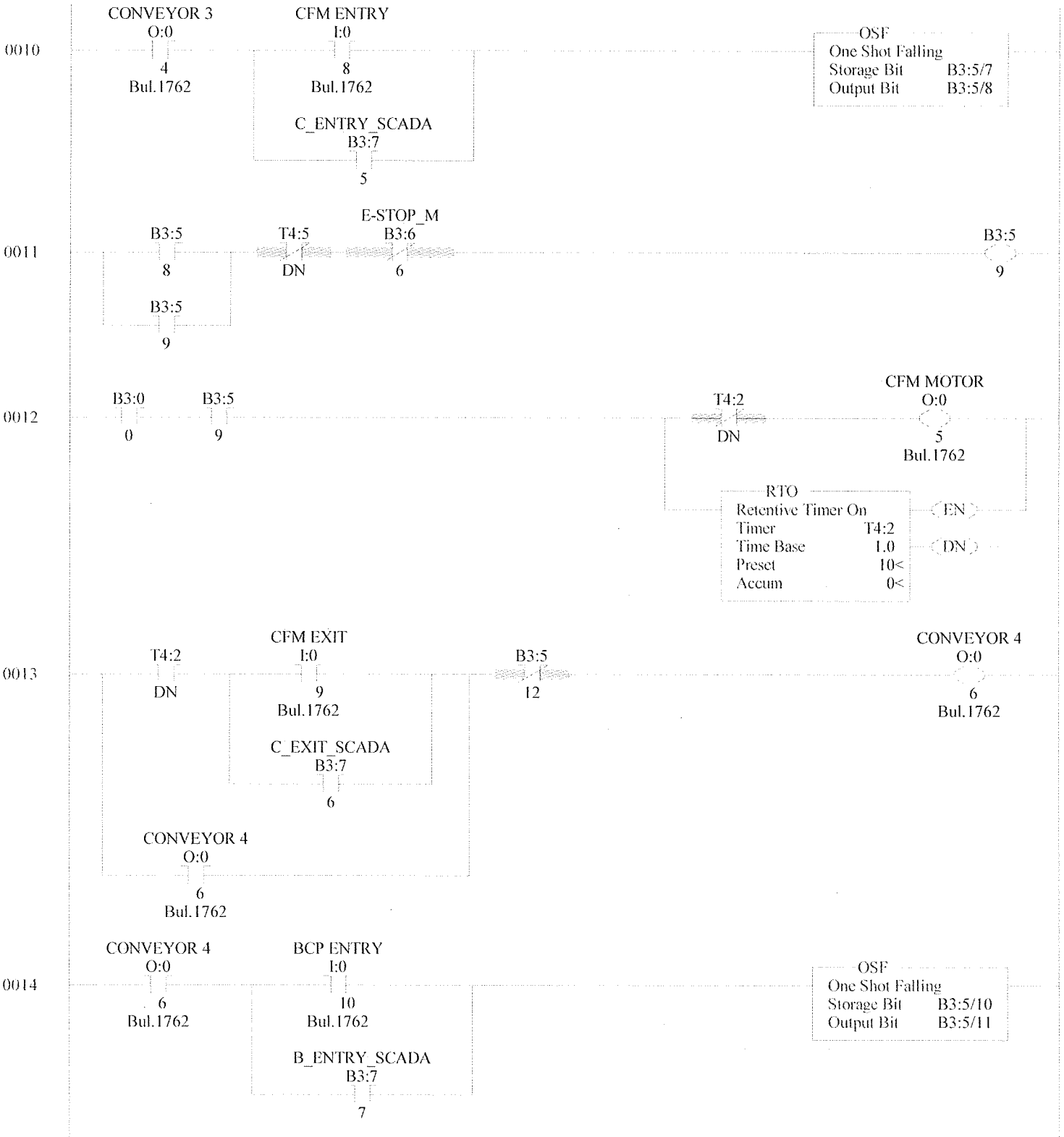


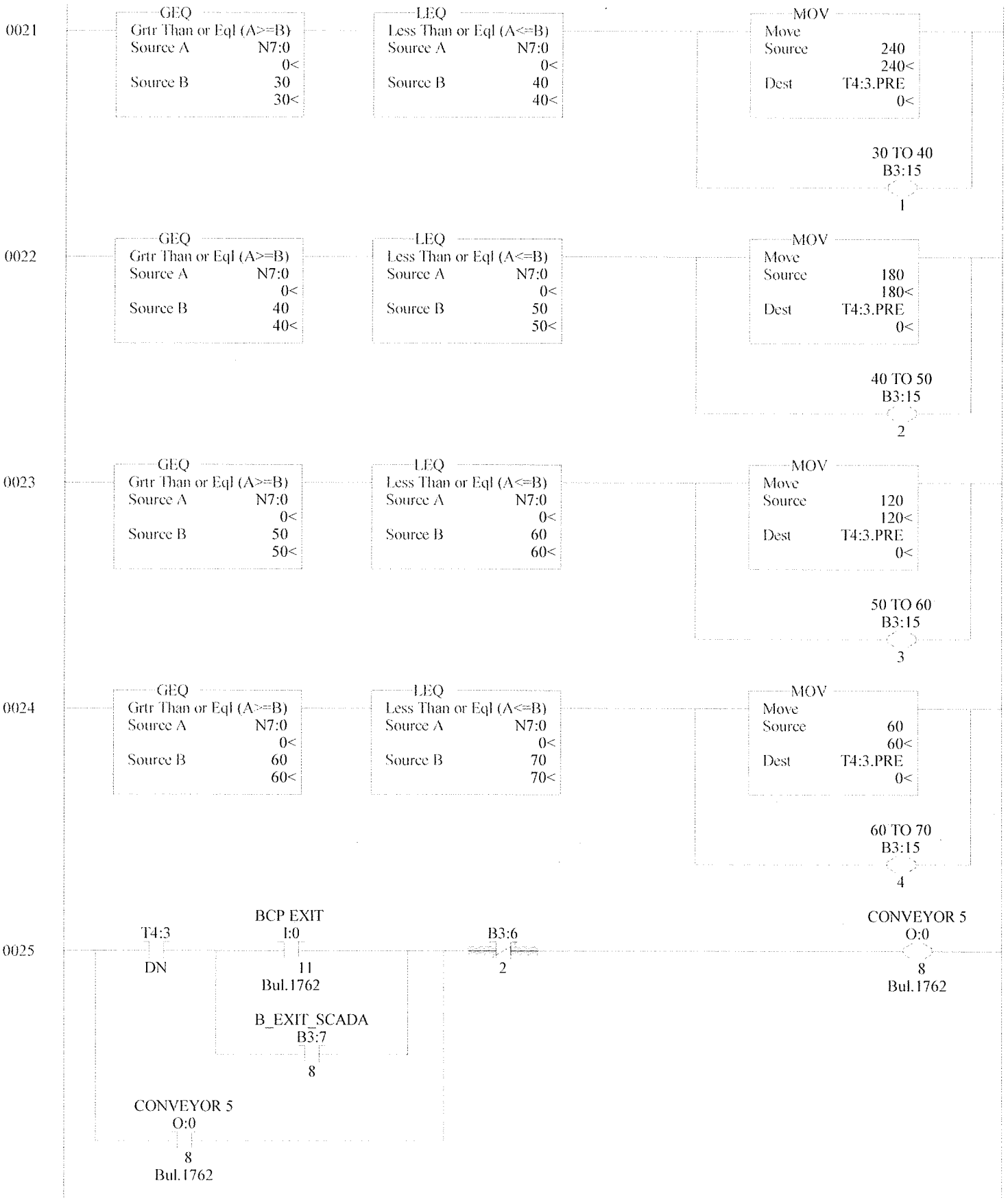


Ambient Temperature in °C (X)	20 - 30	>30 - 40	>40 - 50	>50 - 60	>60 - 70
ON Time in secs (Y)	300	240	180	120	60

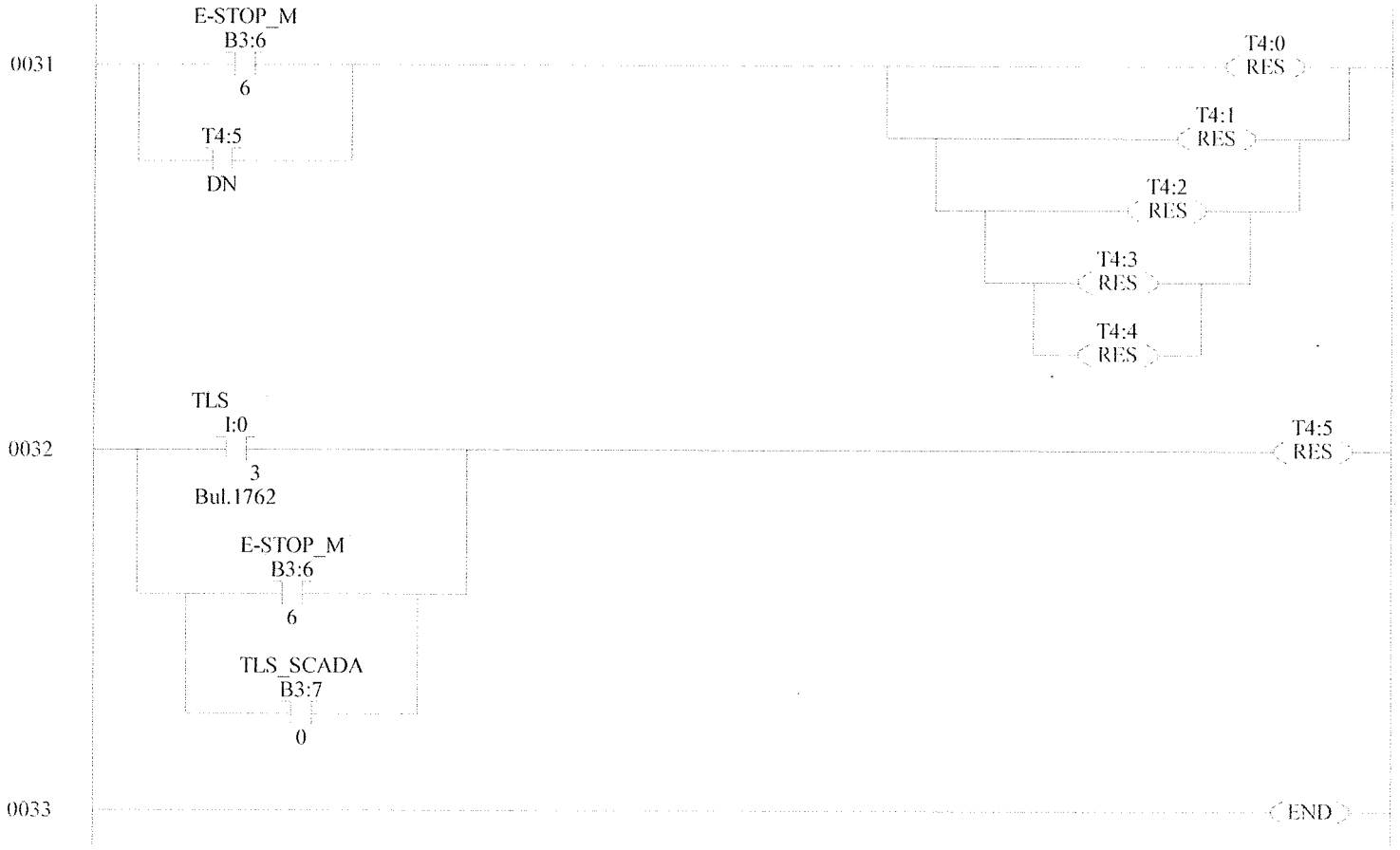
LAD 2 - --- Total Rungs in File = 34

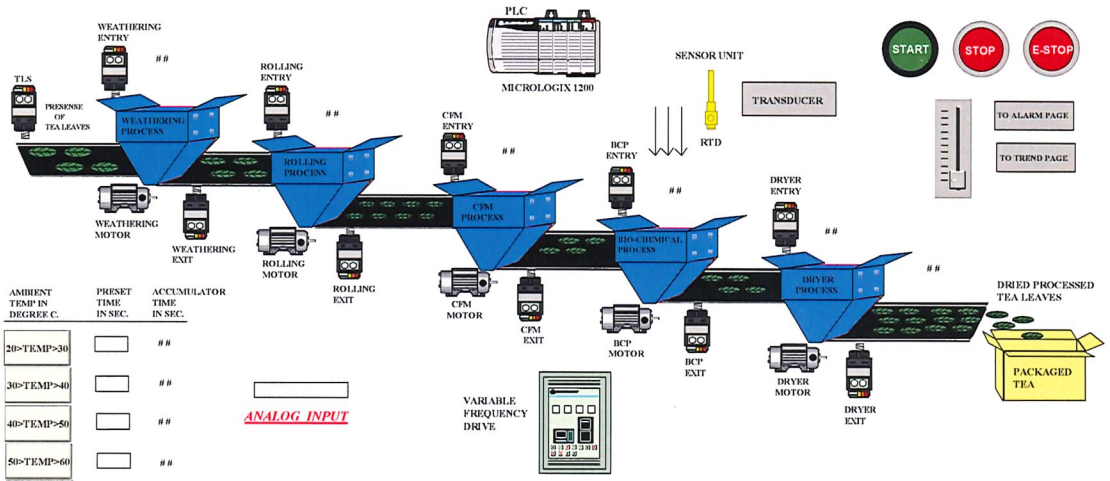



0010
CONVEYOR 3
O:0
4
Bul.1762
CFM ENTRY
I:0
8
Bul.1762
C_ENTRY_SCADA
B3:7
5
OSF
One Shot Falling
Storage Bit B3:5/7
Output Bit B3:5/8
0011
B3:5
8
B3:5
9
T4:5
DN
E-STOP_M
B3:6
6
B3:5
9
0012
B3:0
0
B3:5
9
T4:2
DN
CFM MOTOR
O:0
5
Bul.1762
RTO
Retentive Timer On
Timer T4:2
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
0013
T4:2
DN
CFM EXIT
I:0
9
Bul.1762
C_EXIT_SCADA
B3:7
6
B3:5
12
CONVEYOR 4
O:0
6
Bul.1762
CONVEYOR 4
O:0
6
Bul.1762
0014
CONVEYOR 4
O:0
6
Bul.1762
BCP ENTRY
I:0
10
Bul.1762
B_ENTRY_SCADA
B3:7
7
OSF
One Shot Falling
Storage Bit B3:5/10
Output Bit B3:5/11

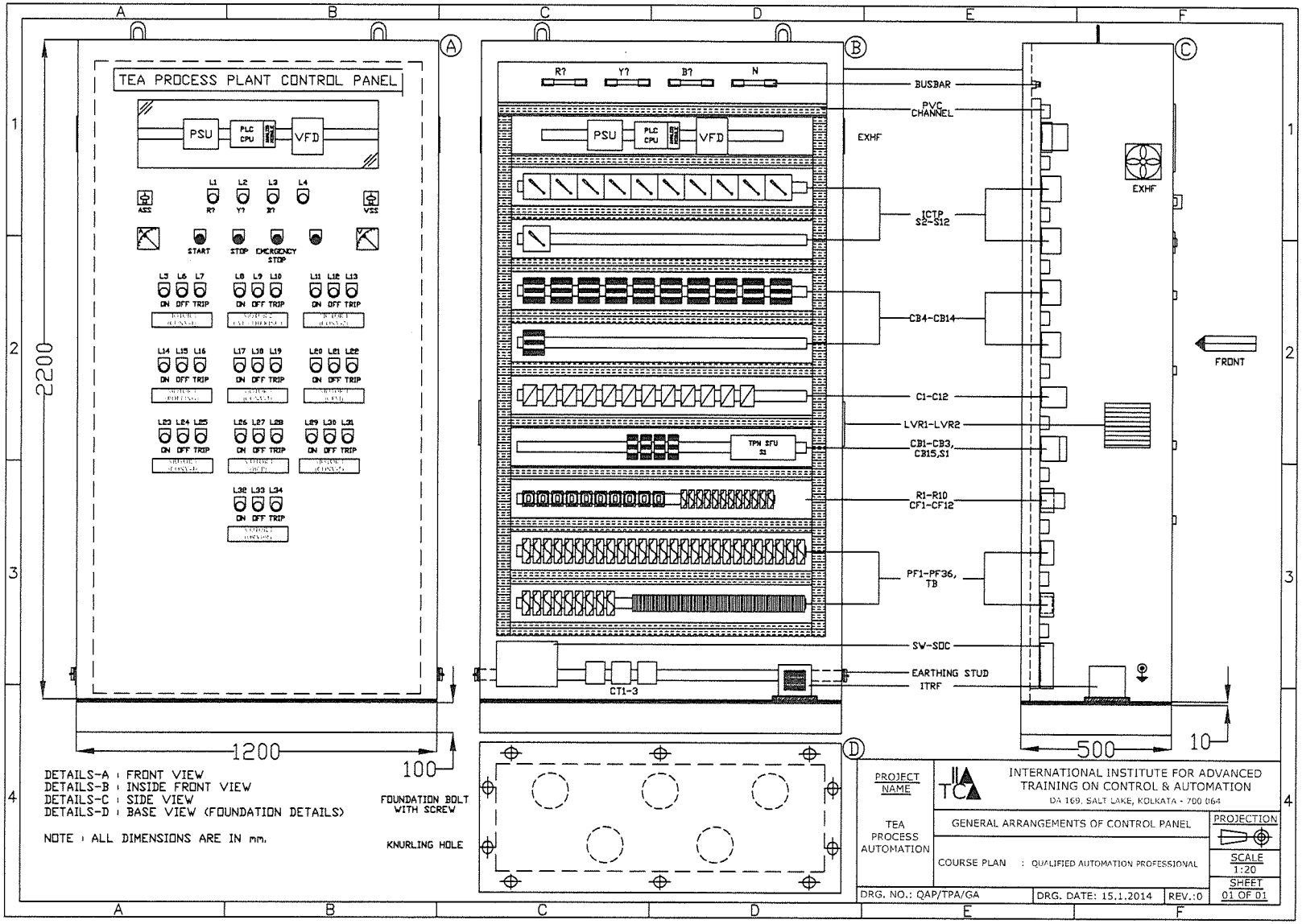

0021
GEQ
Grtr Than or Eql (A>=B)
Source A N7:0
0<
Source B 30
30<
LEQ
Less Than or Eql (A<=B)
Source A N7:0
0<
Source B 40
40<
MOV
Move
Source 240
240<
Dest T4:3.PRE
0<
30 TO 40
B3:15
1
0022
GEQ
Grtr Than or Eql (A>=B)
Source A N7:0
0<
Source B 40
40<
LEQ
Less Than or Eql (A<=B)
Source A N7:0
0<
Source B 50
50<
MOV
Move
Source 180
180<
Dest T4:3.PRE
0<
40 TO 50
B3:15
2
0023
GEQ
Grtr Than or Eql (A>=B)
Source A N7:0
0<
Source B 50
50<
LEQ
Less Than or Eql (A<=B)
Source A N7:0
0<
Source B 60
60<
MOV
Move
Source 120
120<
Dest T4:3.PRE
0<
50 TO 60
B3:15
3
0024
GEQ
Grtr Than or Eql (A>=B)
Source A N7:0
0<
Source B 60
60<
LEQ
Less Than or Eql (A<=B)
Source A N7:0
0<
Source B 70
70<
MOV
Move
Source 60
60<
Dest T4:3.PRE
0<
60 TO 70
B3:15
4
0025
T4:3
DN
BCP EXIT
I:0
11
Bul.1762
B_EXIT_SCADA
B3:7
8
CONVEYOR 5
O:0
8
Bul.1762
B3:6
2
CONVEYOR 5
O:0
8
Bul.1762

LAD 2 - --- Total Rungs in File = 34





SCADA DESIGN OF TEA PROCESS AUTOMATION USING RS VIEW 32 WORKS SCADA SOFTWARE (ROCKWELL AUTOMATION)

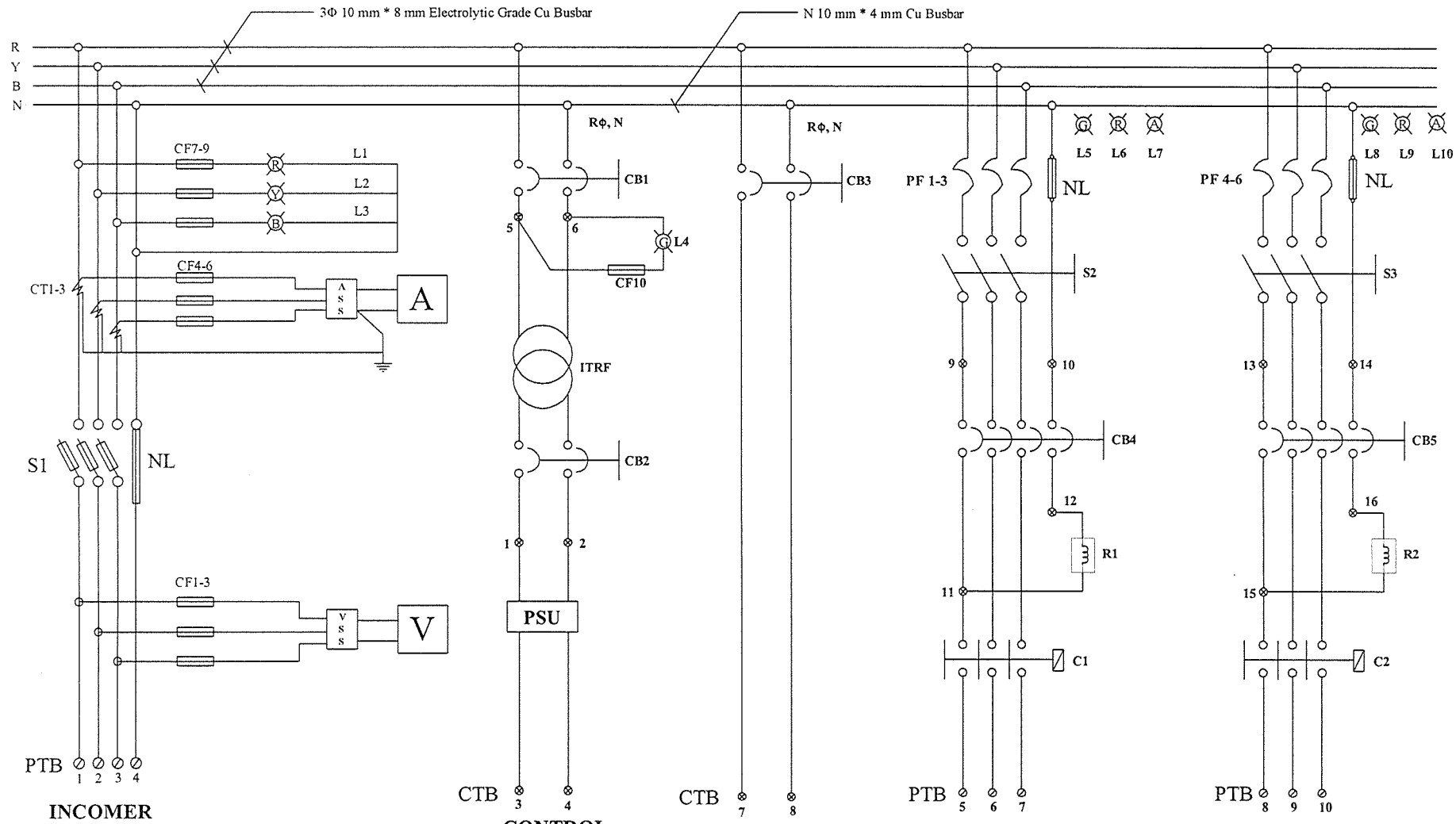


DETAILS-A : FRONT VIEW
DETAILS-B : INSIDE FRONT VIEW
DETAILS-C : SIDE VIEW
DETAILS-D : BASE VIEW (FOUNDATION DETAILS)

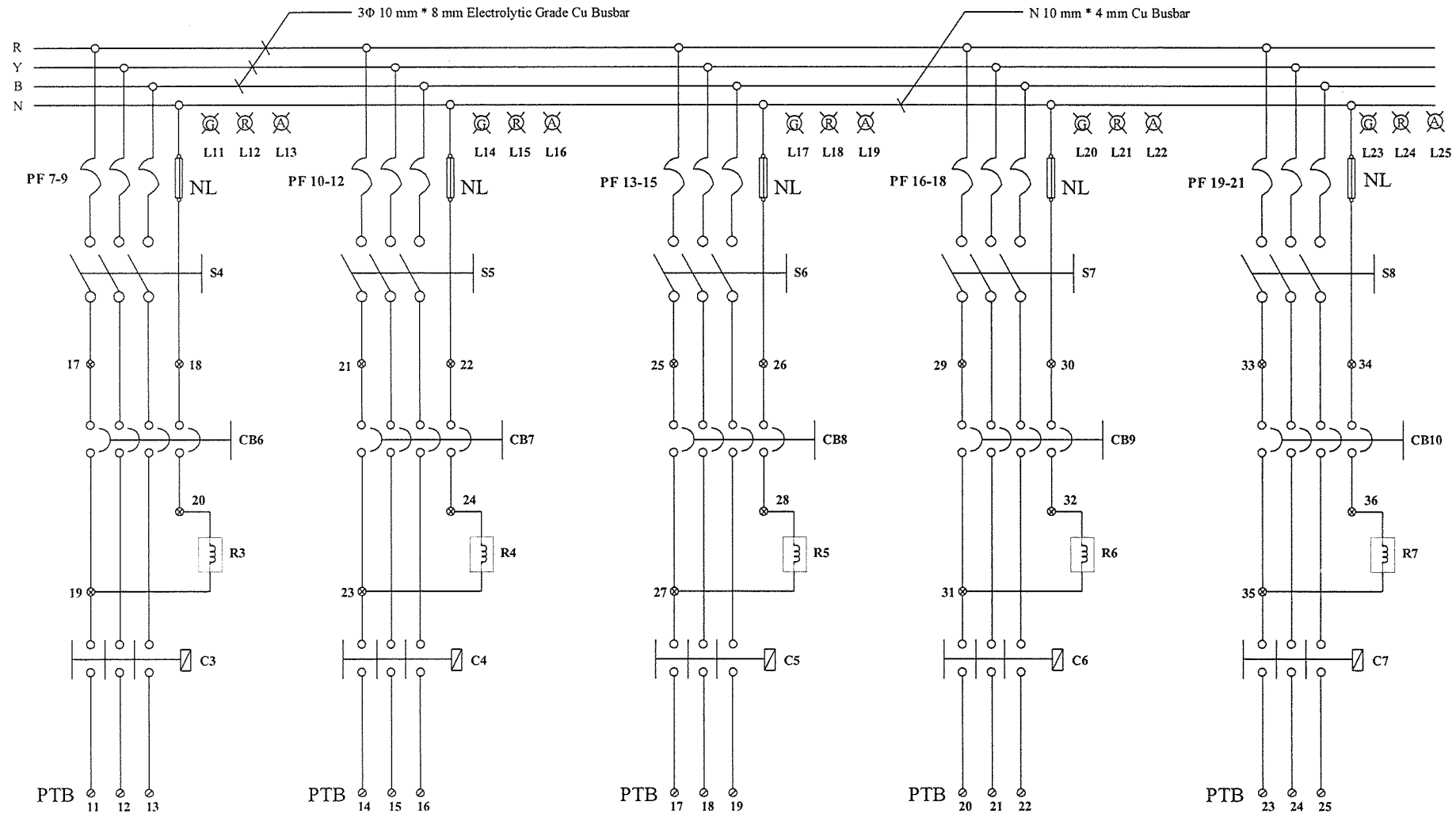
NOTE : ALL DIMENSIONS ARE IN mm.

PROJECT NAME: TEA PROCESS AUTOMATION	INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION, DA 169, SALT LAKE, KOLKATA - 700 064	
	GENERAL ARRANGEMENTS OF CONTROL PANEL	PROJECTION
	COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL	SCALE 1:20
DRG. NO.: QAP/TPA/GA	DRG. DATE: 15.1.2014 REV.:0	SHEET 01 OF 01

LEGEND					
SL. NO.	TAG	MATERIAL DESCRIPTION	RANGE, RATING &TYPE	MAKE	QTY
1	PLC	PROGRAMMABLE LOGIC CONTROLLER	MicroLogix 1200, 1762-L24BWA, I/P: 14 pts, 24V DC, O/P: 10 pts RELAY TYPE.	ALLEN-BRADLEY	1
2		EXTERNAL ANALOG I/0 MODULE	1762-IF2OF2 (2 CH Analog I/P & 2 CH Analog O/P)	ALLEN-BRADLEY	1
3		PC-PLC COMM. HARDWARE	1761-CBL-PM02, Series C	ALLEN-BRADLEY	1
4	VFD	AC DRIVE	ALTIVAR 71, ATV71H075N4, 0.75W - 3/4 HP, 380-480 V AC	TELEMECHANIQUE	1
5	PSU	POWER SUPPLY UNIT	I/P: 110V/220V AC, O/P: 24V DC, 5A	MEANWELL	1
6	S1	TPN SFU	100A	L&T	1
7	S2-S14	ICTP SWITCH	16A	L&T	13
8	CB1-CB3, CB17	DP MCB	10A, C CURVE	L&T	4
9	CB4-CB16	TPN MCB	16A, C CURVE	L&T	13
10	C1-C12	POWER CONTACTOR	12A, AC3 DUTY WITH (1NO+1NC) AUX CONTACT	TELEMECHANIQUE	12
11	R1-R14	CONTROL RELAY	230V AC, 2C/O, (2NO+2NC) AUX CONTACT	PLA	14
12	L1-L34	INDICATING LAMP	230V AC, 24V DC, (RED, GREEN, YELLOW, BLUE, AMBER) FILAMENT TYPE	SIEMENS	34
13	a,b,c,d	PUSHBUTTONS WITH ELEMENT	2 NO, 2 NC (GREEN & RED)	SIEMENS	4
14	PF1-PF36	POWER FUSE	16A, HRC WITH MTG BASE	GEC	36
15	CF1-CF12	CONTROL FUSE	2A, WITH MTG BASE	GEC	12
16	CT1-3	CURRENT TRANSFORMER	CTR: 100:1, CLASS 1, 5VA	KAPPA	3
17	A	AMMETER	0-500A, ANALOG TYPE, 76mm^2, 5A	MECO	1
18	ASS	AMMETER SELECTOR SWITCH	6A, 4 POSITION WITH OFF	KAYCEE	1
19	V	VOLTMETER	0-500A, ANALOG TYPE, 76mm^2, 5A	MECO	1

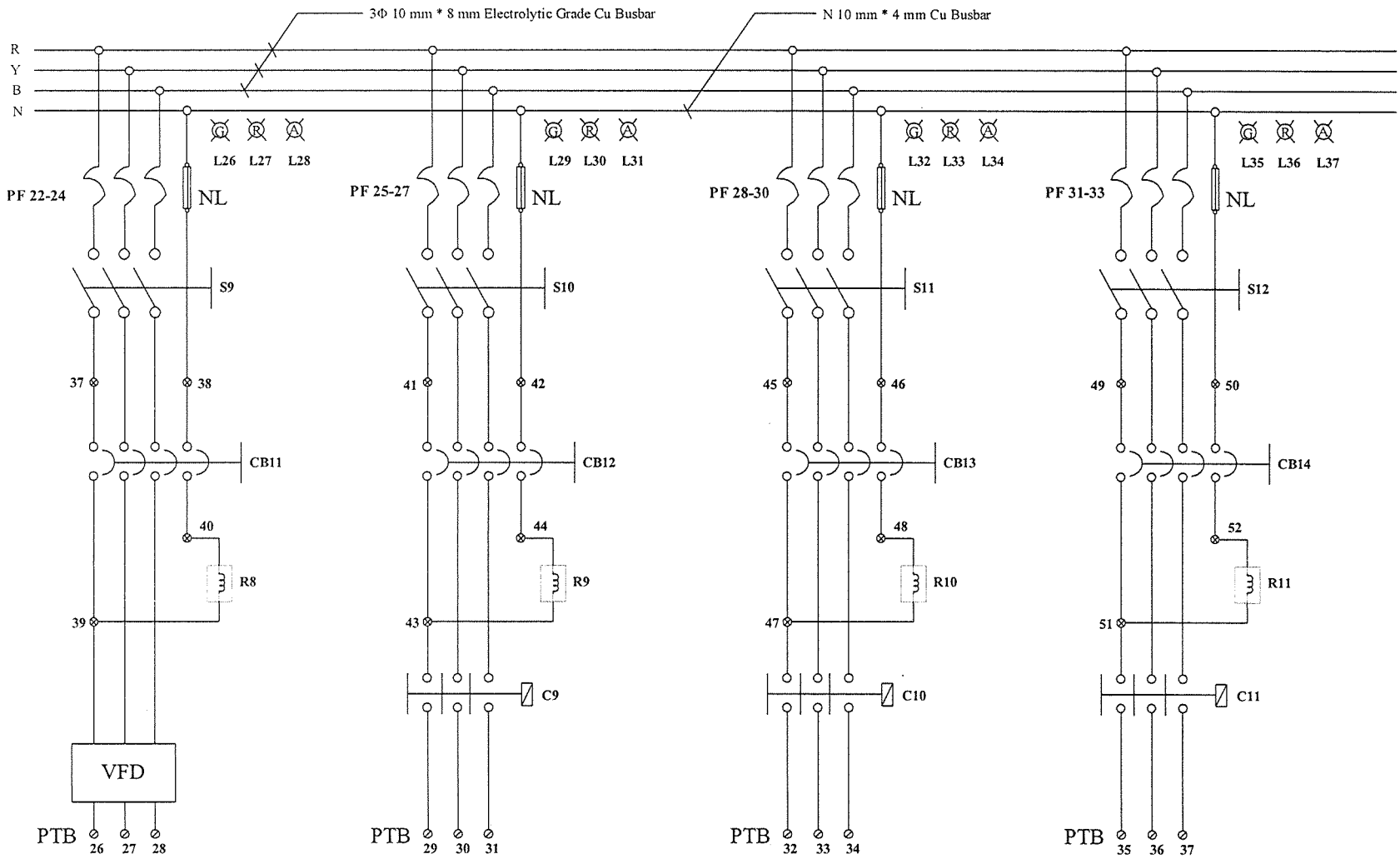


PROJECT NAME: TEA PROCESS AUTOMATION	INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION, DA 169, SALT LAKE, KOLKATA - 700 064	PROJECTION
	POWER CIRCUIT OF MOTOR	
	NAME : MD. SALMAN AZIM COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL REG. No. : QA143941	SCALE N.T.S
DRG. NO.: QAP/TPA/PC_M	DRG. DATE: 21.08.2014 REV.:0	SHEET 01 OF 01



MOTOR 3 (CONV 2) | **MOTOR 4 (ROLLING)** | **MOTOR 5 (CONV 3)** | **MOTOR 6 (CFM)** | **MOTOR 7 (CONV 4)**

PROJECT NAME: TEA PROCESS AUTOMATION	INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION, DA 169, SALT LAKE, KOLKATA - 700 064	PROJECTION
	POWER CIRCUIT OF MOTOR	
	NAME : MD. SALMAN AZIM COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL REG. No. : QA143941	SCALE N.T.S
DRG. NO.: QAP/TPA/PC_M	DRG. DATE: 21.08.2014 REV.:0	SHEET 01 OF 01



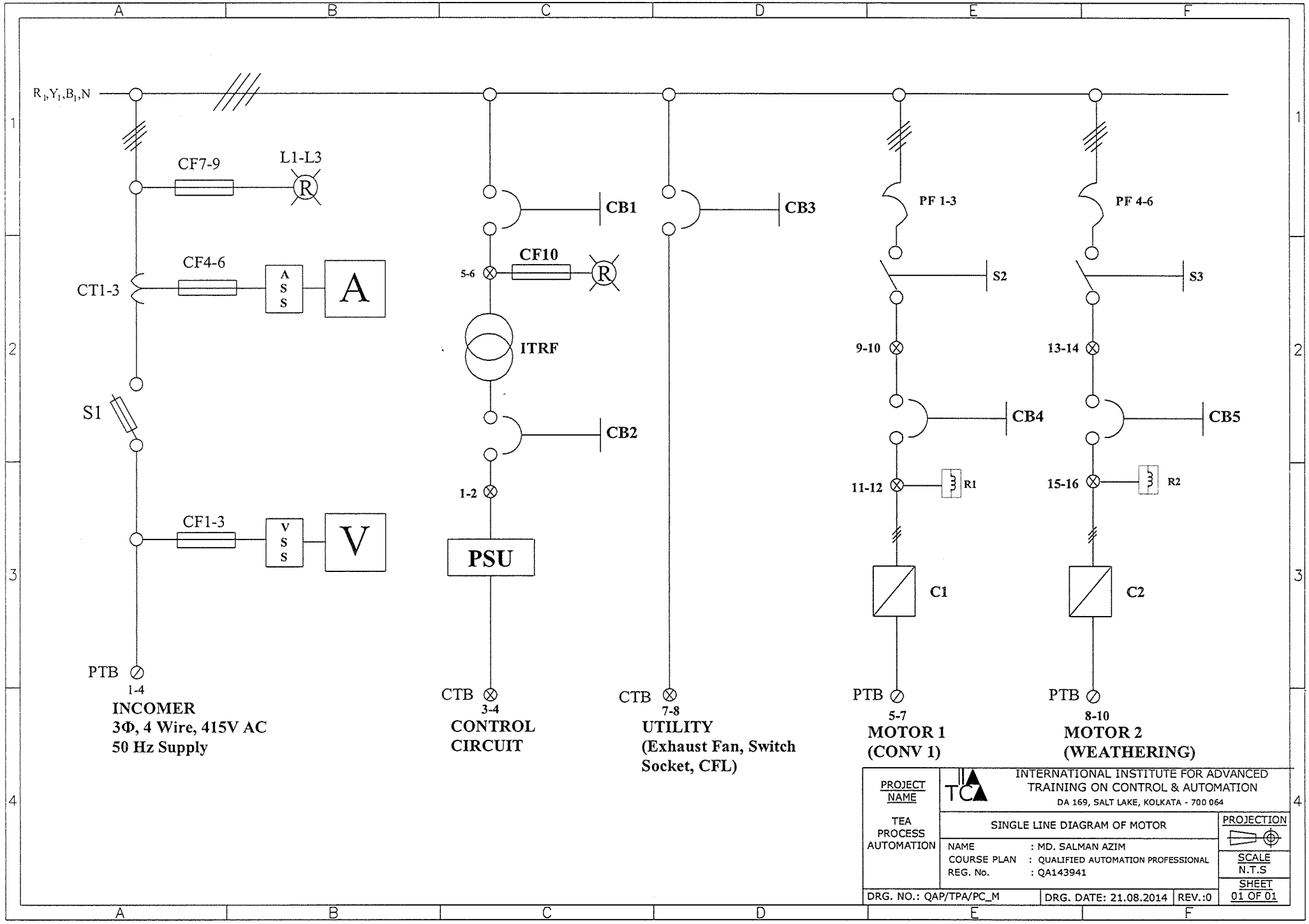
MOTOR 8 (BCP)

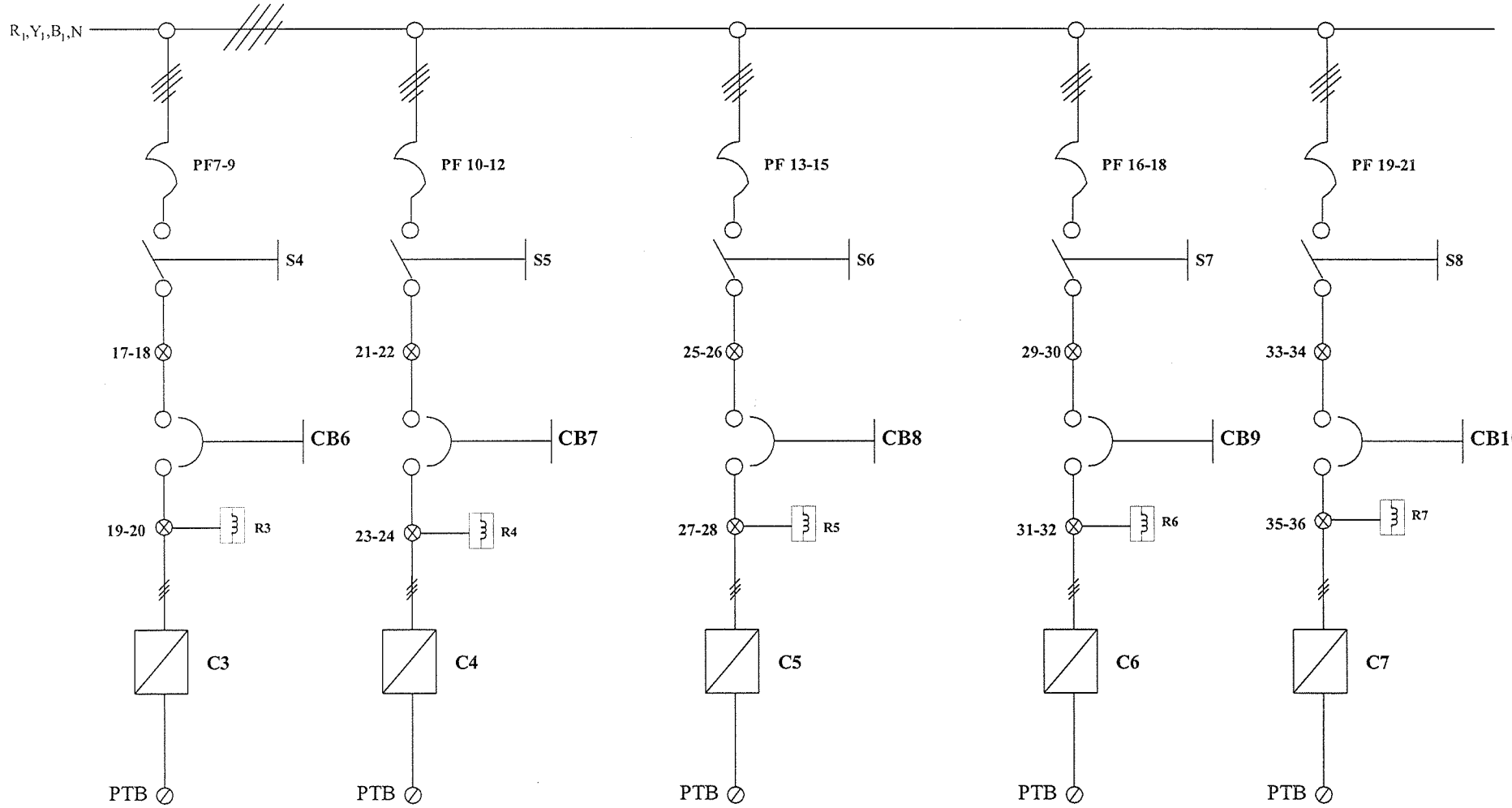
MOTOR 9 (CONV 5)

MOTOR 10 (DRYER)

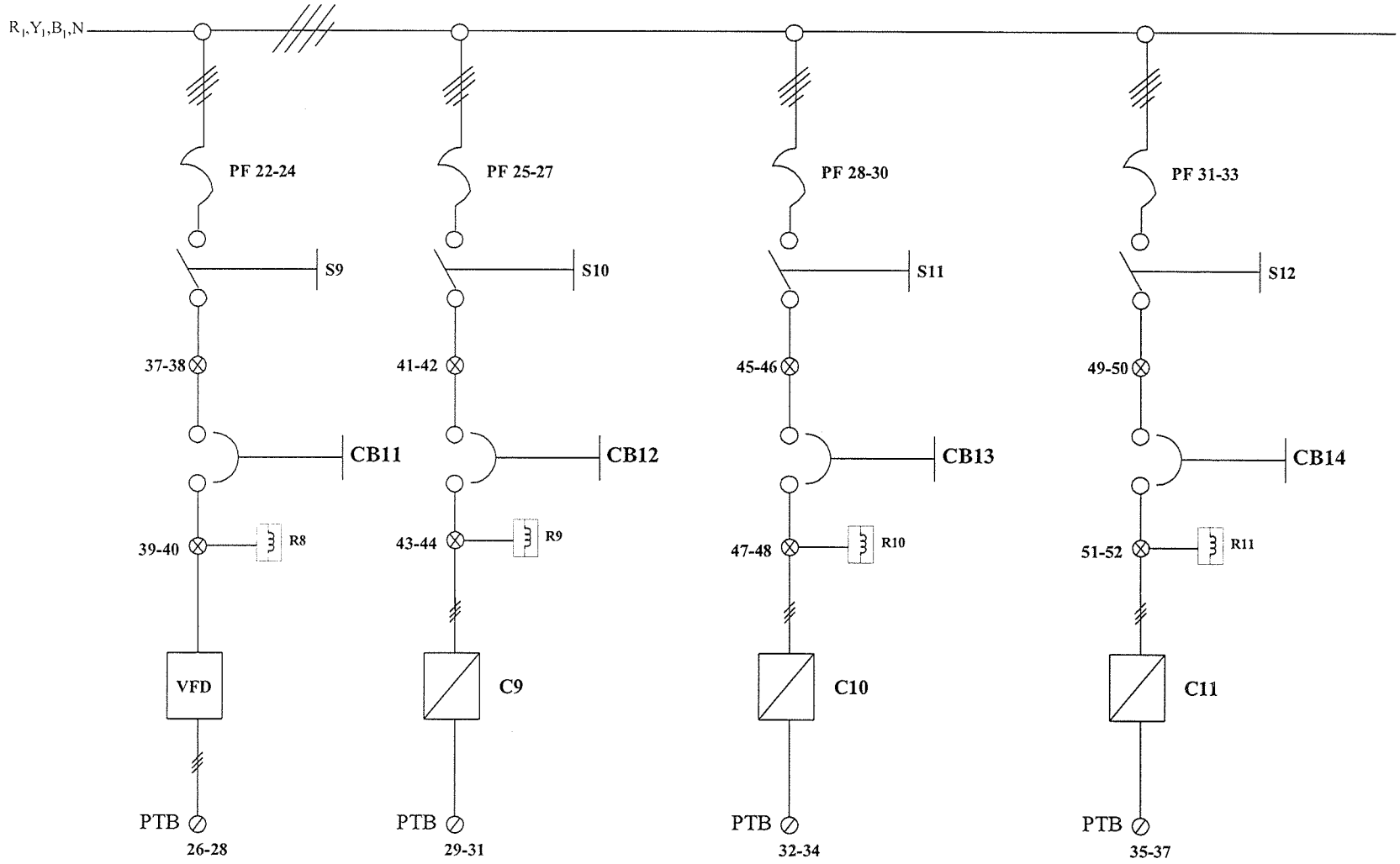
MOTOR 11 (M16)

PROJECT NAME: TEA PROCESS AUTOMATION	INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION, DA 169, SALT LAKE, KOLKATA - 700 064	PROJECTION
	POWER CIRCUIT OF MOTOR	
	NAME : MD. SALMAN AZIM COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL REG. No. : QA143941	SCALE N.T.S
DRG. NO.: QAP/TPA/PC_M	DRG. DATE: 21.08.2014 REV.:0	SHEET 01 OF 01

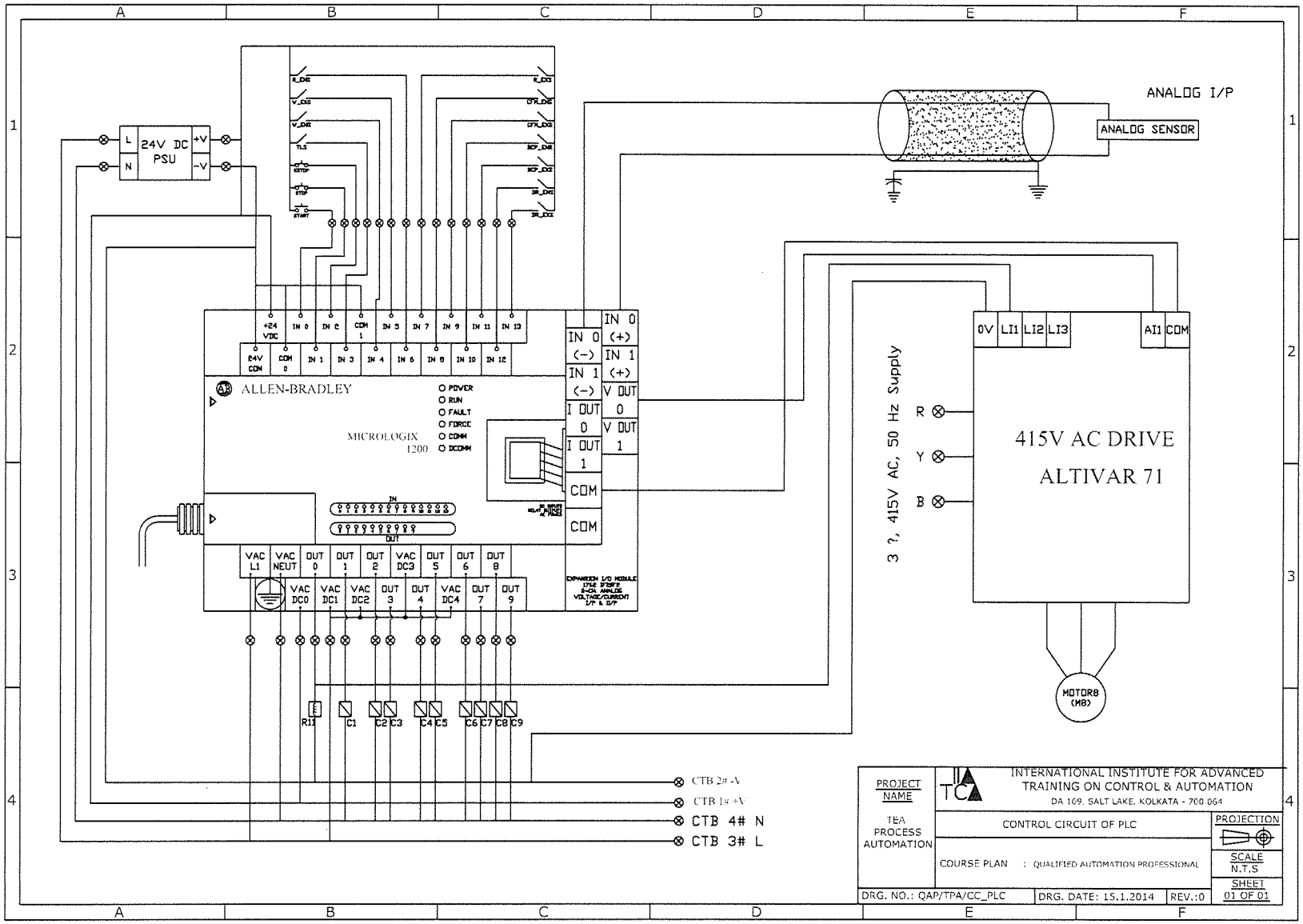

R1,Y1,B1,N
CF7-9
L1-L3
R
CF4-6
CT1-3
A S S
A
S1
CF1-3
V S S
V
PTB
1-4
INCOMER
3Φ, 4 Wire, 415V AC
50 Hz Supply
CB1
CF10
5-6
R
ITRF
CB2
1-2
PSU
CTB
3-4
CONTROL
CIRCUIT
CB3
CTB
7-8
UTILITY
(Exhaust Fan, Switch
Socket, CFL)
PF 1-3
S2
9-10
CB4
11-12
R1
C1
PTB
5-7
MOTOR 1
(CONV 1)
PF 4-6
S3
13-14
CB5
15-16
R2
C2
PTB
8-10
MOTOR 2
(WEATHERING)
PROJECT NAME
TEA PROCESS AUTOMATION
INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION
DA 169, SALT LAKE, KOLKATA - 700 064
SINGLE LINE DIAGRAM OF MOTOR
PROJECTION
NAME : MD. SALMAN AZIM
COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL
REG. No. : QA143941
SCALE N.T.S
SHEET 01 OF 01
DRG. NO.: QAP/TPA/PC_M
DRG. DATE: 21.08.2014
REV.:0

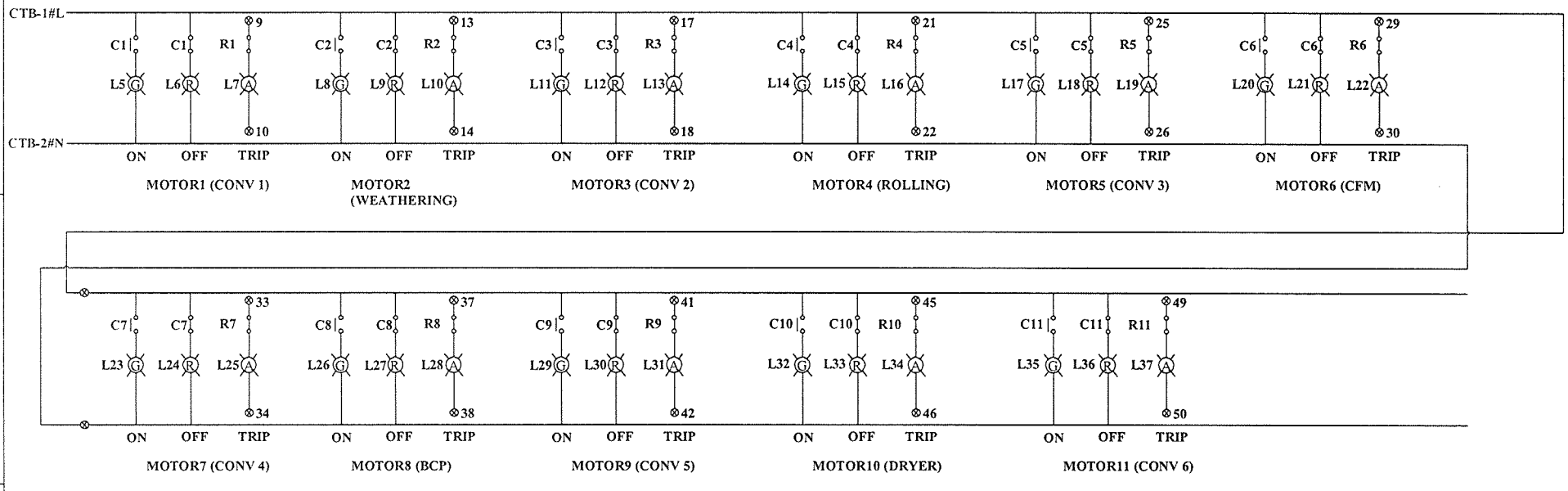


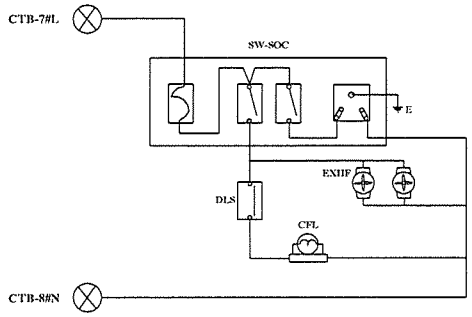
PROJECT NAME: TEA PROCESS AUTOMATION	INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION, DA 169, SALT LAKE, KOLKATA - 700 064	
	SINGLE LINE DIAGRAM OF MOTOR	PROJECTION
	NAME : MD. SALMAN AZIM COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL REG. No. : QA143941	SCALE N.T.S
DRG. NO.: QAP/TPA/PC_M	DRG. DATE: 21.08.2014 REV.:0	SHEET 01 OF 01



PROJECT NAME: TEA PROCESS AUTOMATION	INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION, DA 169, SALT LAKE, KOLKATA - 700 064	PROJECTION
	SINGLE LINE DIAGRAM OF MOTOR	
	NAME : MD. SALMAN AZIM COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL REG. No. : QA143941	SCALE N.T.S
DRG. NO.: QAP/TPA/PC_M	DRG. DATE: 21.08.2014 REV.:0	SHEET 01 OF 01


ANALOG I/P
ANALOG SENSOR
24V DC PSU
L
N
+V
-V
ALLEN-BRADLEY
MICROLOGIX 1200
POWER
RUN
FAULT
FORCE
COMM
DCOMM
IN 0 (+)
IN 0 (-)
IN 1 (+)
IN 1 (-)
V OUT 0
I OUT 0
V OUT 1
I OUT 1
COM
COM
0V LI1 LI2 LI3
AI1 COM
3 ?, 415V AC, 50 Hz Supply
R
Y
B
415V AC DRIVE
ALTIVAR 71
MOTOR8 (M8)
R11
C1
C2 C3
C4 C5
C6 C7 C8 C9
CTB 2# -V
CTB 1# +V
CTB 4# N
CTB 3# L
PROJECT NAME
TEA PROCESS AUTOMATION
INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION
DA 169, SALT LAKE, KOLKATA - 700 064
CONTROL CIRCUIT OF PLC
PROJECTION
COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL
SCALE N.T.S
SHEET 01 OF 01
DRG. NO.: QAP/TPA/CC_PLC
DRG. DATE: 15.1.2014
REV.:0





PROJECT NAME: TEA PROCESS AUTOMATION	INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION, DA 169, SALT LAKE, KOLKATA - 700 064	PROJECTION
	TYPICAL CONTROL CIRCUIT OF LED's	
	NAME : MD. SALMAN AZIM COURSE PLAN : QUALIFIED AUTOMATION PROFESSIONAL REG. No. : QA143941	SCALE N.T.S
DRG. NO.: QAP/TPA/PC_M	DRG. DATE: 21.08.2014 REV.:0	SHEET 01 OF 01

BILL OF MATERIALS

SL. NO.	MATERIAL DESCRIPTION	RANGE, RATING &TYPE	MAKE	QTY
1	PROGRAMMABLE LOGIC CONTROLLER	MicroLogix 1200, 1762-L24BWA, I/P: 14 pts, 24V DC, O/P: 10 pts RELAY TYPE.	ALLEN-BRADLEY	1
2	EXTERNAL ANALOG I/0 MODULE	1762-IF2OF2 (2 CH Analog I/P & 2 CH Analog O/P)	ALLEN-BRADLEY	1
3	PC-PLC COMM. HARDWARE	1761-CBL-PM02, Series C	ALLEN-BRADLEY	1
4	AC DRIVE	ALTIVAR 71, ATV71H075N4, 0.75W - 3/4 HP, 380-480 V AC	TELEMECHANIQUE	1
5	POWER SUPPLY UNIT	I/P: 110V/220V AC, O/P: 24V DC, 5A	MEANWELL	1
6	TPN SFU	100A	L&T	1
7	ICTP SWITCH	16A	L&T	13
8	DP MCB	10A, C CURVE	L&T	4
9	TPN MCB	16A, C CURVE	L&T	13
10	POWER CONTACTOR	12A, AC3 DUTY WITH (1NO+1NC) AUX CONTACT	TELEMECHANIQUE	12
11	CONTROL RELAY	230V AC, 2C/O, (2NO+2NC) AUX CONTACT	PLA	14
12	INDICATING LAMP	230V AC, 24V DC, (RED, GREEN, YELLOW, BLUE, AMBER) FILAMENT TYPE	SIEMENS	34
13	PUSHBUTTONS WITH ELEMENT	2 NO, 2 NC (GREEN & RED)	SIEMENS	4
14	POWER FUSE	16A, HRC WITH MTG BASE	GEC	36
15	CONTROL FUSE	2A, WITH MTG BASE	GEC	12
16	CURRENT TRANSFORMER	CTR: 100:1, CLASS 1, 5VA	KAPPA	3
17	AMMETER	0-500A, ANALOG TYPE, 76mm^2, 5A	MECO	1
18	AMMETER SELECTOR SWITCH	6A, 4 POSITION WITH OFF	KAYCEE	1
19	VOLTMETER	0-500A, ANALOG TYPE, 76mm^2, 5A	MECO	1

COST ANALYSIS

SL. NO.	MATERIAL DESCRIPTION	RANGE, RATING &TYPE	MAKE	QTY	COST/UNIT	TOTAL COST
1	PROGRAMMABLE LOGIC CONTROLLER	MicroLogix 1200, 1762-L24BWA, I/P: 14 pts, 24V DC, O/P: 10 pts RELAY TYPE.	ALLEN-BRADLEY	1	25,000.00	25,000.00
2	EXTERNAL ANALOG I/0 MODULE	1762-IF2OF2 (2 CH Analog I/P & 2 CH Analog O/P)	ALLEN-BRADLEY	1	15,000.00	15,000.00
3	PC-PLC COMM. HARDWARE	1761-CBL-PM02, Series C	ALLEN-BRADLEY	1	22,000.00	22,000.00
4	AC DRIVE	ALTIVAR 71, ATV71H075N4, 0.75W - 3/4 HP, 380-480 V AC	TELEMECHANIQUE	1	36,000.00	36,000.00
5	POWER SUPPLY UNIT	I/P: 110V/220V AC, O/P: 24V DC, 5A	MEANWELL	1	1,500.00	1,500.00
6	TPN SFU	100A	L&T	1	2,500.00	2,500.00
7	ICTP SWITCH	16A	L&T	13	600.00	7,800.00
8	DP MCB	10A, C CURVE	L&T	4	350.00	1,400.00
9	TPN MCB	16A, C CURVE	L&T	13	450.00	5,850.00
10	POWER CONTACTOR	12A, AC3 DUTY WITH (1NO+1NC) AUX CONTACT	TELEMECHANIQUE	12	650.00	7,800.00
11	CONTROL RELAY	230V AC, 2C/O, (2NO+2NC) AUX CONTACT	PLA	14	150.00	2,100.00
12	INDICATING LAMP	230V AC, 24V DC, (RED, GREEN, YELLOW, BLUE, AMBER) FILAMENT TYPE	SIEMENS	34	100.00	3,400.00
13	PUSHBUTTONS WITH ELEMENT	2 NO, 2 NC (GREEN & RED)	SIEMENS	4	100.00	400.00
14	POWER FUSE	16A, HRC WITH MTG BASE	GEC	36	200.00	7,200.00
15	CONTROL FUSE	2A, WITH MTG BASE	GEC	12	25.00	300.00
16	CURRENT TRANSFORMER	CTR: 100:1, CLASS 1, 5VA	KAPPA	3	300.00	900.00
17	AMMETER	0-500A, ANALOG TYPE, 76mm^2, 5A	MECO	1	650.00	650.00
18	AMMETER SELECTOR SWITCH	6A, 4 POSITION WITH OFF	KAYCEE	1	150.00	150.00
19	VOLTMETER	0-500A, ANALOG TYPE, 76mm^2, 5A	MECO	1	650.00	650.00

SHEET METAL CALCULATION

Dimensions of the Control Panel Body:

Height = 2.15m, Width = 1m, Depth = 0.4m.

Dimensions of the Mounting Plate:

Height = 2m, Width = 0.95m.

Dimensions of the Channel Base:

Height = 0.1m, Width = 0.1m, Depth = 0.06m

Material of Construction: CRCA Sheet, TISCO.

Sheet metal required for the outside body of the control panel

$= 2\ [2.15 \times 1 + 1 \times 0.4 + 0.4 \times 2.15]\ m^2$

$= 2\ [2.15 + 0.4 + 0.86]\ m^2 = 6.82\ m^2$

Sheet metal required for the mounting plate

$= (2 \times 0.95)\ m^2 = 1.9\ m^2$

Sheet metal required for the channel base

Length of the channel base required = 2 (1m + 0.5m) = 3m

Breadth of the channel base is = 0.2m

Thus, area of the sheet metal required = $3m \times 0.2m = 0.6m^2$

Thus, the total weight of sheet metal used

$= (6.82 \times 16 + 1.9 \times 20 + 0.6 \times 48)\ kg = 175.92\ kg$

[Since weight of the sheet metal for:

- Body of the Control Panel (2mm thickness) = $16\ kg/m^2$
- Mounting Plate (2.5mm thickness) = $20\ kg/m^2$
- Channel Base (6mm thickness) = $48\ kg/m^2$]

Price of sheet metal = Rs.120/kg

Cost of sheet metal required

= Rs. (175.92 x 120) = Rs. 21110.40/-

Total Cost required

= **Rs. 35000/-** (Including Fabrication & Transportation charge)

CONCLUSION

Completing this project I have got a clear picture about Automated processes for Tea Processing Plant.

An overview of this project is in my knowledge now; Functions of various components and different steps involved in processing of Tea Leaves are very clear to me. I have learned several topics with this project; for example selection of particular PLC module, I/O requirements, external I/O module etc. In PLC programming part use of NO or NC contacts, pulse generation, use of timers, counters, timer or counter reset become very clear than before. Not only that I am now conceptually strong than earlier with the idea of associated control components selection based on the needs of the application (contactors, relays, cables, fuses, circuit breakers etc.), evaluation the project costing including Bill of Material(B.O.M) by collecting the market prices of the selected items used in the total process etc. I have cultured AutoCAD 2008 to design general arrangement of panel, schematic wiring diagram. This very software was totally unknown to me. But at present I am little bit familiar with AutoCAD. I got this superb opportunity with this project.

My greetings to the IIATCA authorities who structured the Qualified Automation Professional course plan with this project. It gave me great pleasure to introduce with Tea Process Automation process.