

TEST PROJECT – DAY 1
PROJET D'ÉPREUVE – JOUR 1

AUTOMATION AND CONTROL

CONTRÔLE ET AUTOMATISATION

POST-SECONDARY
NIVEAU POSTSECONDAIRE

CONTINUOUS LEARNING



FORMATION CONTINUE

DIGITAL



COMPÉTENCES NUMÉRIQUES

DOCUMENT USE



UTILISATION DE DOCUMENTS

NUMERACY



CALCUL

ORAL COMMUNICATION



COMMUNICATION ORALE

READING TEXT



LECTURE

WORKING WITH OTHERS



TRAVAIL D'ÉQUIPE

WRITING



DÉRICTION

THINKING



CAPACITÉ DE RAISONNEMENT

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1.0 INTRODUCTION

1.1 – General

With this challenge, we will assess your abilities in the following criteria:

- a) Ability to analyze technical data.
- b) Quality of wiring.
- c) Capacity to implement an automatic process.
- d) Troubleshooting techniques.
- e) Abilities for error detection.

1.2 – Step A: Installation of Electrical Raceways and Components as per specifications

Part of all process type projects is the installation of the raceways and components that function as inputs and outputs. We will assess the quality of your installation, interpretation of site drawings, and precision of equipment placement.

1.3 – Step B: Wiring an automated process within a panel

As a technician, you should have the ability to completely wire a system and make the necessary modifications. We will assess the quality of your manual work, the organization of components, and the use of materials provided.

1.4 – Step C: Programming the automated process

You are provided with a function, and you must program the automated process with your PLC and the provided VFD. The system must be functional, and adhere to the instructions.

1.5 – Step D: Troubleshooting

Your ability to detect and solve problems will be assessed.

2.0 – Conductors

2.1 – Size and use

1. Power connections must be 14 AWG gauge.
2. Control conductors must be 16 AWG gauge.
3. Any exceptions to paragraphs 1 & 2 will be specifically mentioned on the drawings.

2.2 – Colour Code

The following colour code must be used to distinguish circuits:

1. Single phase	Identified Conductor	→ White
	Line	→ Black
2. Three phase	Identified Conductor	→ White
	Line	→ Red, Black, Blue
3. DC Control		→ Light Blue
4. AC Control	Identified Conductor	→ Yellow
	Line	→ Brown
5. Bonding/Grounding		→ Green
6. Input/output	18/3 Cable	→ Red
		→ Black
		→ Green
7. Motor Connections	12/4 Cable	→ Red
		→ Black
		→ White
		→ Green

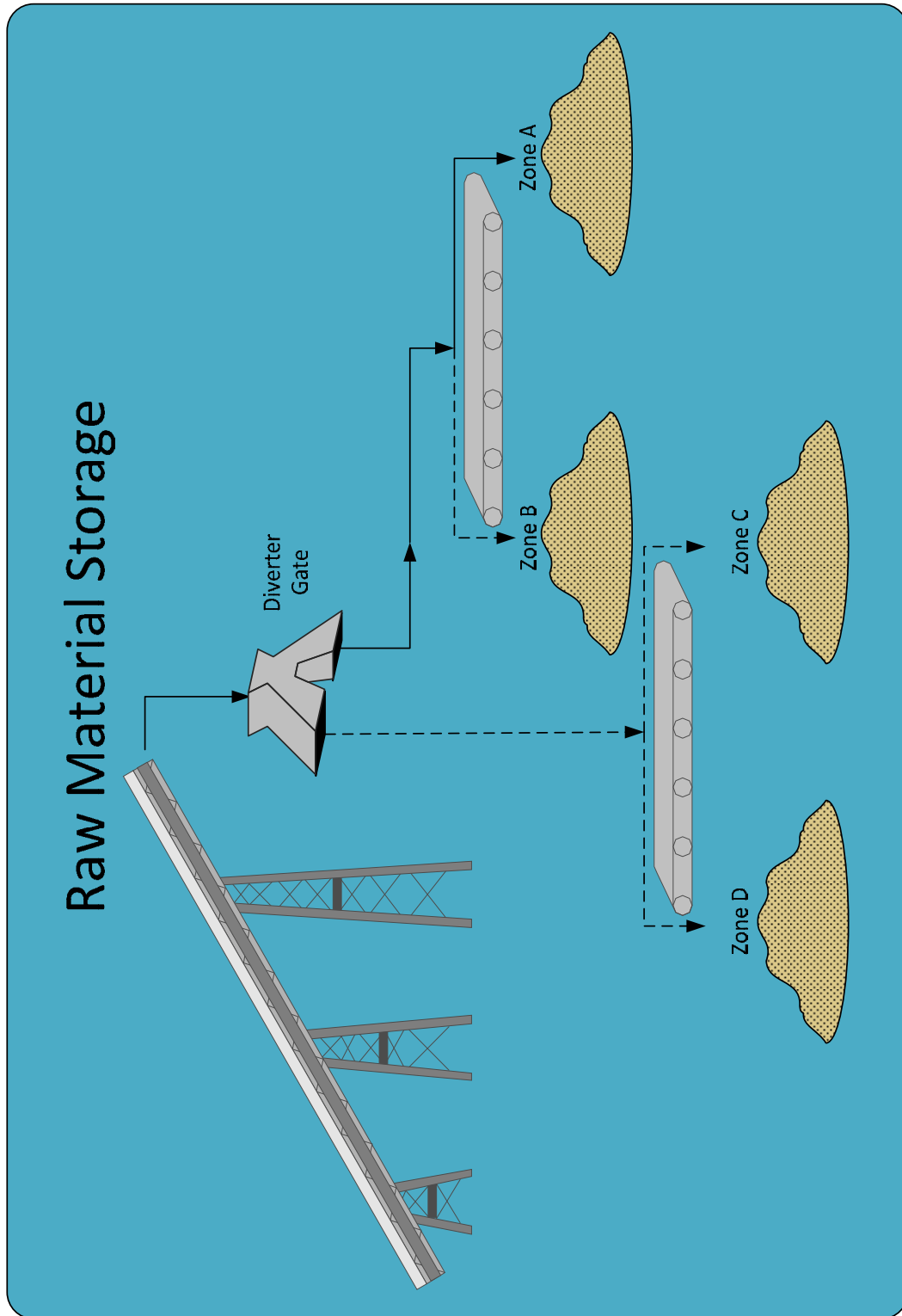
3.0 – General Description

3.1 – Process Description

Particleboard is an engineered wood product that is widely used in the manufacturing of kitchen cabinets, household furniture and other ready-to-assemble wood products. The process of making the particleboard uses a mix of various wood species and resins in order to obtain the desired density and structural properties of the board.

The scope of this project is to design a process that will allow an operator to select a separate pile location for the different species of wood using conveyors. The piles are located in a building that is divided into 4 zones, with each zone being a separate pile.

3.1 – Process Diagram



4.0 - Input and Outputs

4.1 Technical Details:

Inputs

Emergency Stop

The system is equipped with a general Emergency Stop button.

The Emergency Stop button mounted on the Control Panel Door will be used in conjunction with a 120VAC relay (non-PLC) to create a Master Control Relay (MCR)/Emergency Stop Circuit. The 120VAC relay will be equipped with both normally-open and normally-closed contacts, as required.

When the Emergency Stop button is depressed, The Master Control Relay/Emergency Stop Circuit will de-energize all of the PLC's outputs.

All of the PLC's outputs shall remain de-energized until the Emergency Stop button is reset.

The automatic process is not reinitialized after an emergency stop; machine operator intervention is necessary to manually reset the system by selecting Manual Mode (SS1_1) and then return to Automatic Mode on the selector switch (SS1_2) and then pressing Start/Jog (PB3). Only then can the process resume operation with the normal starting process for Automatic mode.

If the Emergency Stop button is pressed when the system is in manual mode, on reset, the manual mode will resume where it left off.

See Input Table for Input designations

Outputs

For details of the location of the outputs, see the attached drawings.

See Output Table for Output designations.

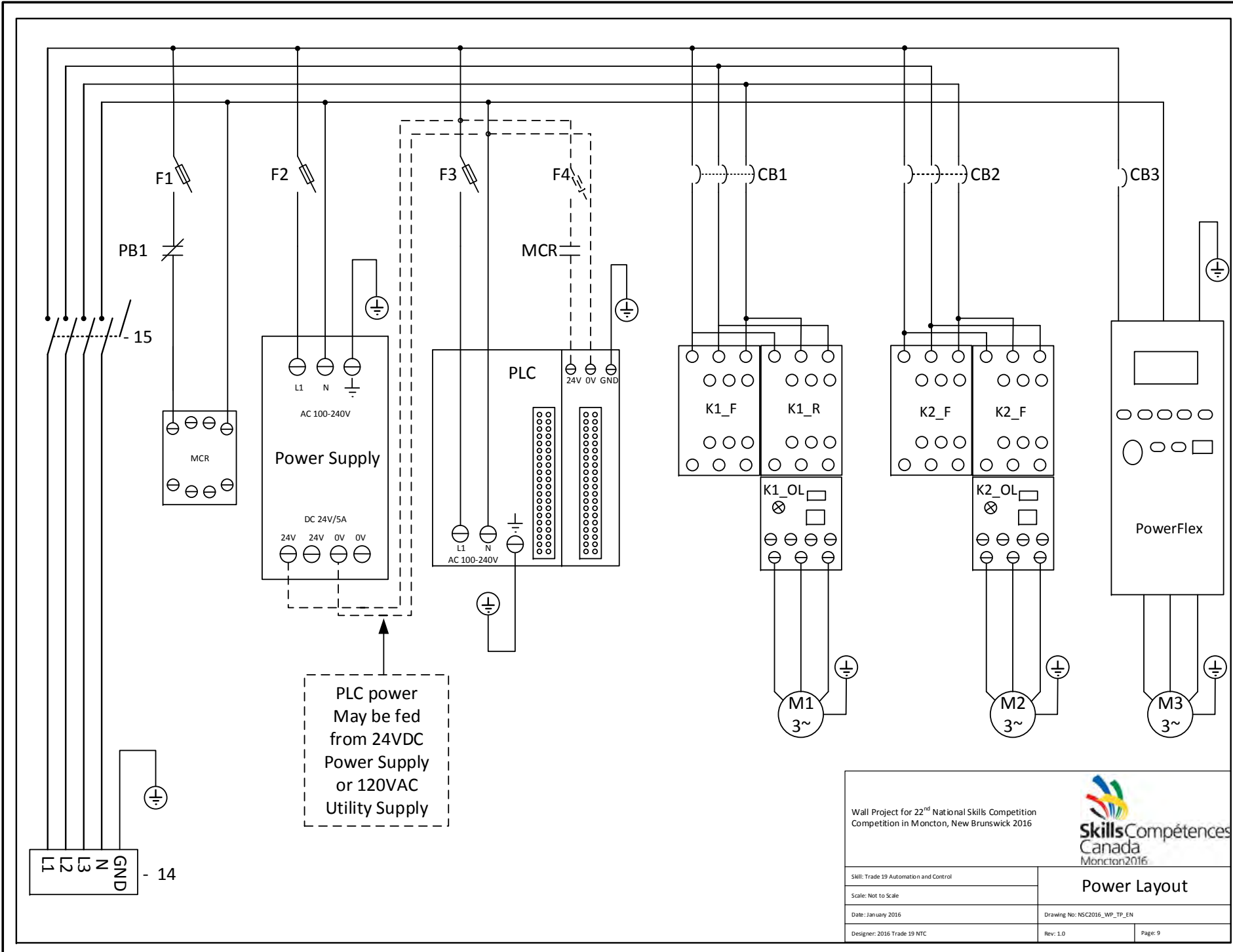
4.2 - Inputs

The following tables are a recommended assignment of the inputs and outputs for your programmable control. As controllers vary in how they are connected and function, you must check your particular PLC to see if these assignments are suitable.

Input Detail	Symbol	Contact Type	PLC inputs Assignment
Emergency Stop	PB1	NC	In0
Stop	PB2	NC	In1
Start/Jog (Manual)	PB3	NO	In2
Jog Cycle Select	PB4	NO	In3
Manual mode	SS1_1	NO	In4
Automatic Mode	SS1_2	NO	In5
Zone Selection Switch 1 (LSB)	SS2_1	NO	In6
Zone Selection Switch 1 (MSB)	SS3_1	NO	In7
Limit A (Diverter Position)	LS1	NO	In8
Limit B (Diverter Position)	LS2	NO	In9
Proximity Sensor (Material Present)	PS1	NO	In10
K1 Overload	K1_OL	NO	In11
K2 Overload	K2_OL	NO	In12

4.3 – Outputs

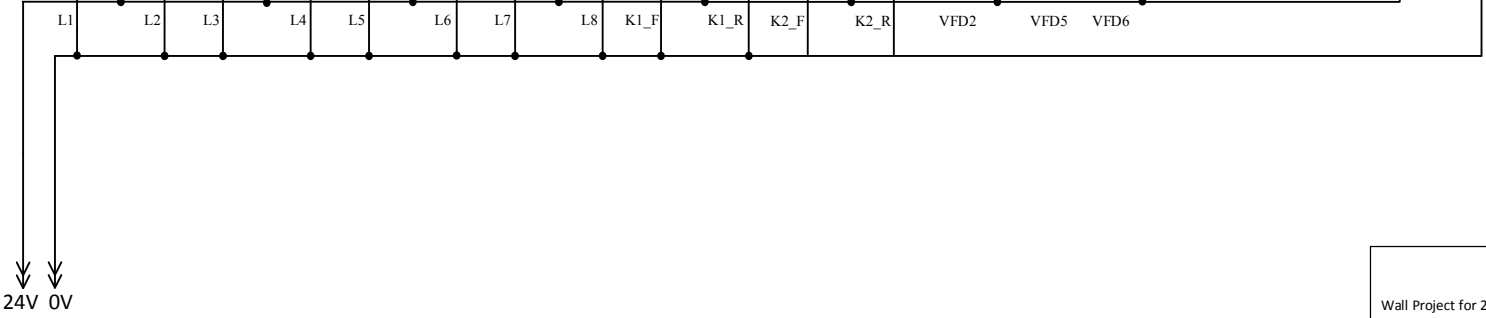
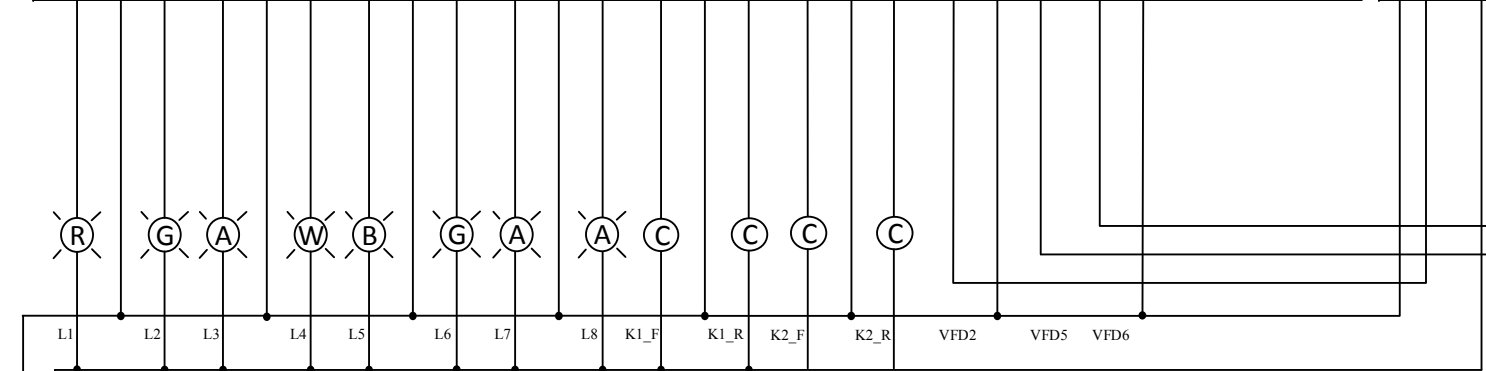
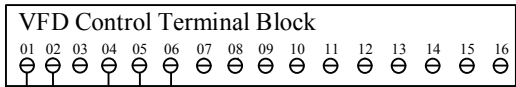
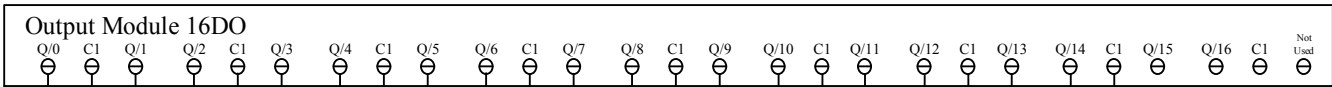
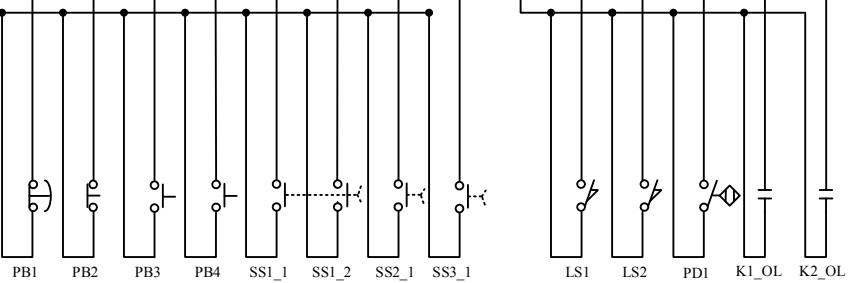
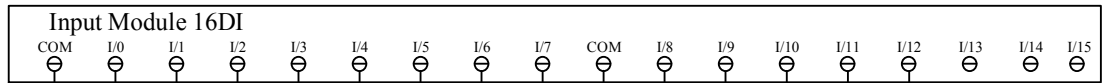
Output Detail	Symbol	PLC outputs Assignments
Tower Lamp Red	L1	Q0
Tower Lamp Green	L2	Q1
Tower Lamp Amber	L3	Q2
Indicating Lamp White	L4	Q3
Indicating Lamp Blue	L5	Q4
Indicating Lamp Green	L6	Q5
Indicating Lamp Amber	L7	Q6
Indicating Lamp Amber	L8	Q7
Motor Contactor M1 Forward Conveyor AB	K1_F	Q8
Motor Contactor M1 Reverse Conveyor AB	K1_R	Q9
Motor Contactor M2 Forward Conveyor CD	K2_F	Q10
Motor Contactor M2 Reverse Conveyor CD	K2_R	Q11
VFD Digital Input 02	VFD_02	Q12
VFD Digital Input 05	VFD_05	Q13
VFD Digital Input 06	VFD_06	Q14



PLC power
May be fed
from 24VDC
Power Supply
or 120VAC
Utility Supply

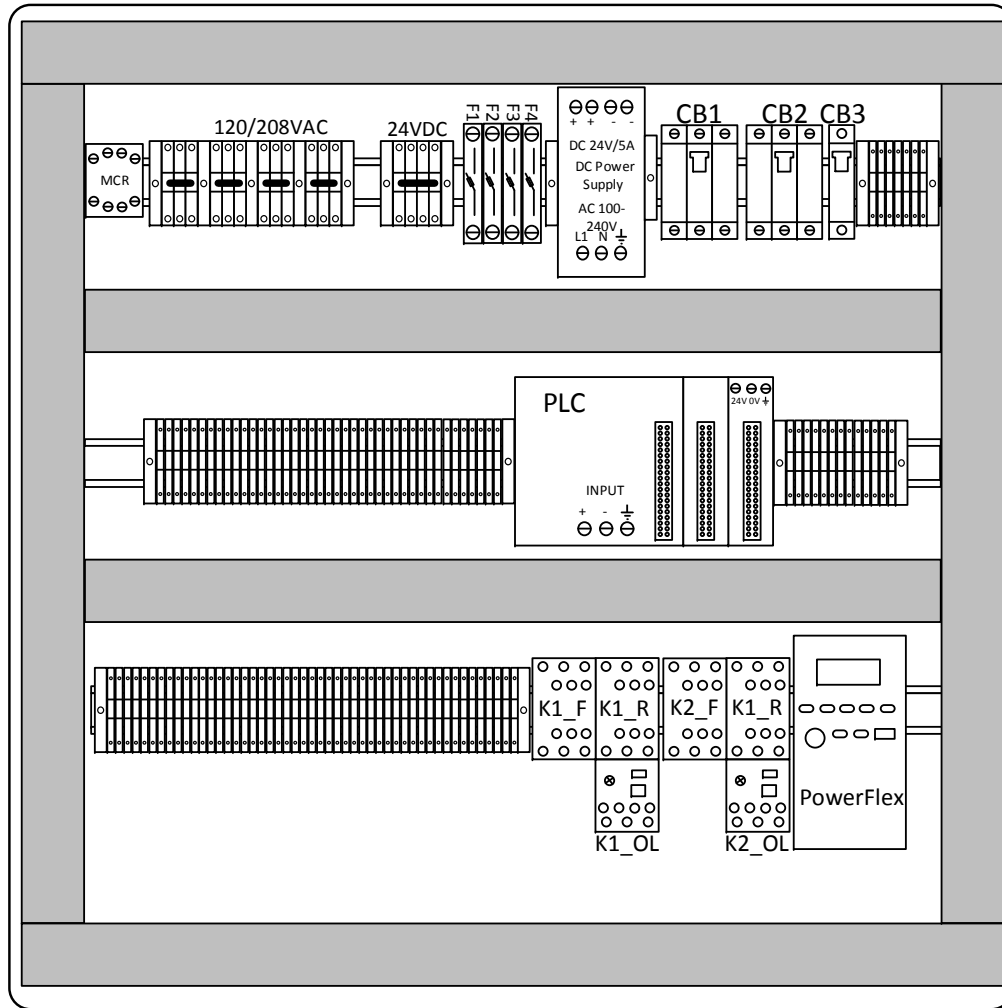
Wall Project for 22nd National Skills Competition
Competition in Moncton, New Brunswick 2016

Skill: Trade 19 Automation and Control	Power Layout	
Scale: Not to Scale		
Date: January 2016	Drawing No: NSC2016_WP_TP_EN	
Designer: 2016 Trade 19 NTC	Rev: 1.0	Page: 9



! From: NSC2016_PL_EN !

Wall Project for 22 nd National Skills Competition Competition in Moncton, New Brunswick 2016		
Control Layout		
Skill: Trade 19 Automation and Control	Date: January 2016	
Scale: Not to Scale	Designer: 2016 Trade 19 NTC	
Drawing No: NSC2016_PL_TP_EN		Page: 10



Wall Project for 22nd National Skills Competition
 Competition in Moncton, New Brunswick



Skill: Trade 19 Automation and Control

Scale: Not to Scale

Date: January, 2016

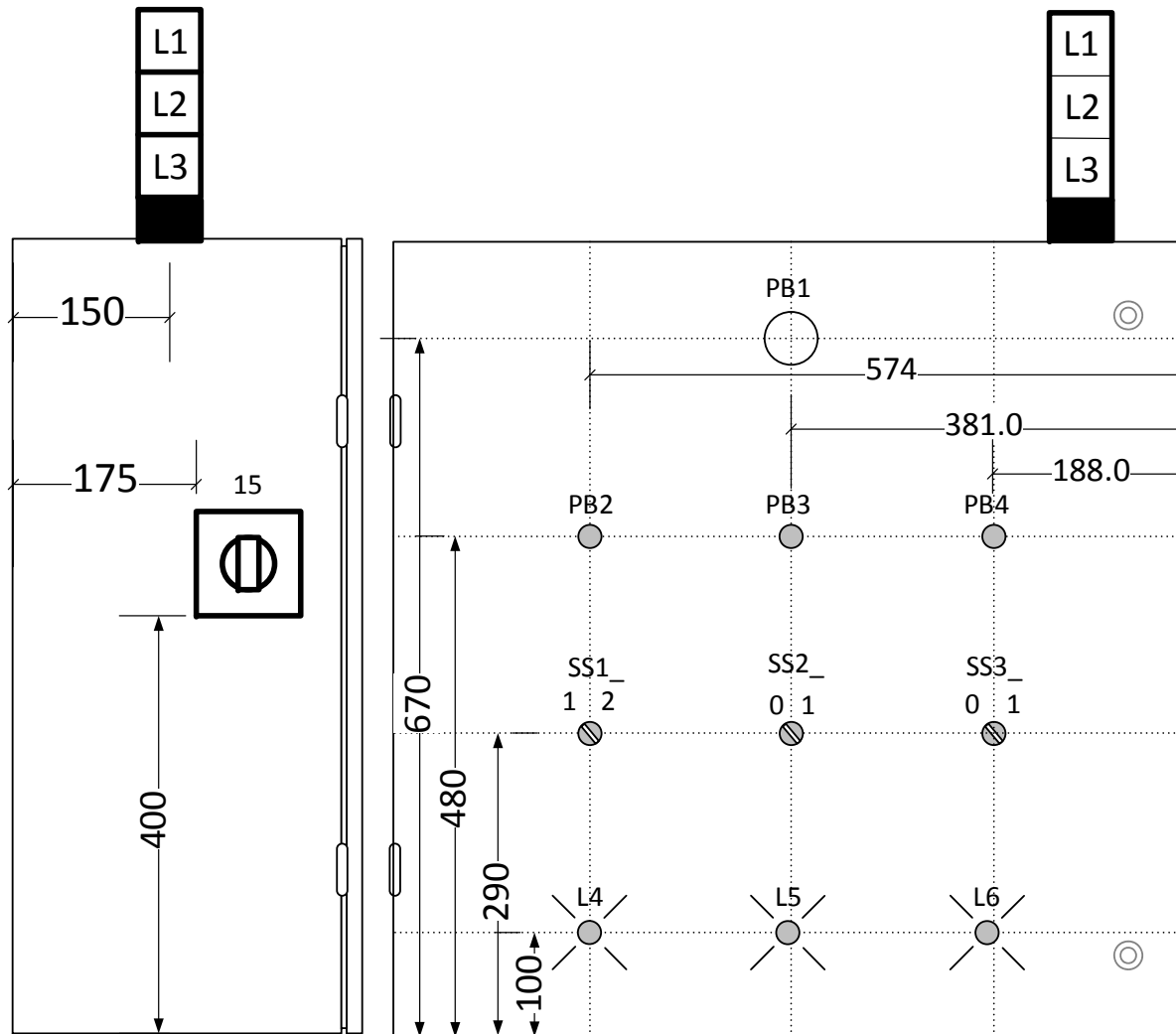
Designer: 2016 Trade 19 NTC

Back Panel Layout

Drawing No: NSC2016_BPL_TP_EN

Rev: 1.0

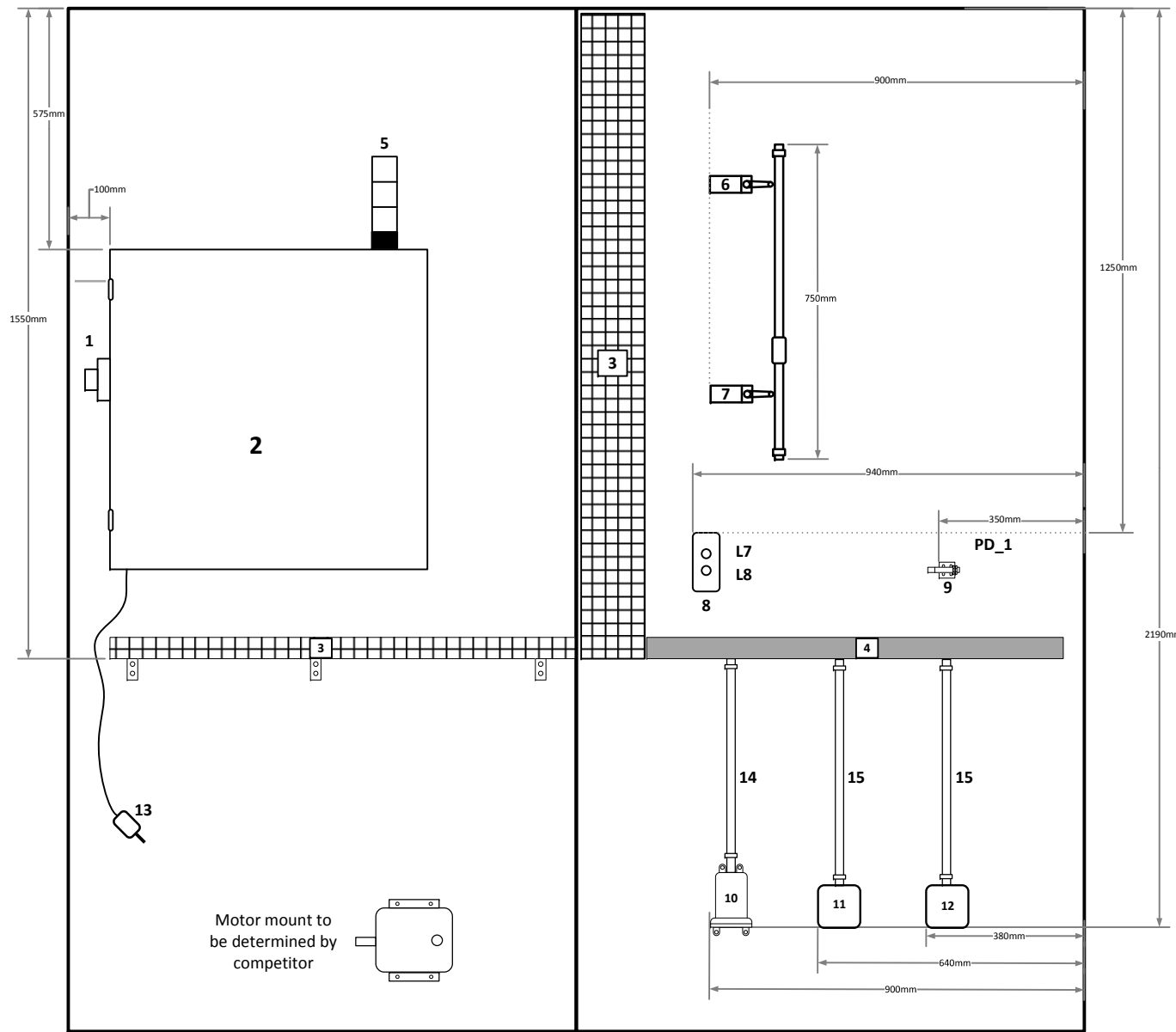
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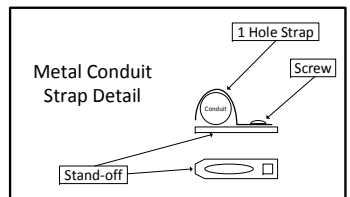
Wall Project for 22nd National Skills Competition
Competition in Moncton, New Brunswick 2016



Skill: Trade 19 Automation and Control	Door Layout	
Scale: Not to Scale		
Date: January 2016	Drawing No: NSC2016_DL_TP_EN	
Designer: 2016 Trade 19 NTC	Rev: 1.0	Page: 12



1. Panel Mounted Disconnect
2. Control Box
3. 6" Wire Cable Tray
4. 2"x2" solid wall PVC Duct
5. Stack Light
6. Limit Switch A
7. Limit Switch B
8. 2 Hole Station
9. Proximity Sensor
10. Pin and Sleeve Receptacle
11. Junction Box
12. Junction Box
13. 120/208V 20A TL Plug
14. 1/2" PVC
15. 1/2" EMT



All measurements will be taken from where it is shown on the drawing on the flat portion of device