



*National Skill Competition*



# *Industrial Maintenance*

*Test Project*



*Skill Area: Commercial wiring*

**National Skills Competition Date: March 30 and 31, 2005**

## Skills Jamaica Competition March 30-31, 2005

### General Instructions

- (1) Each competitor will be required to carry out the test project as specified on the schedule to be handed out two days before the competition.
- (2) The time will be specified according to the test project.
- (3) Minor adjustments may be made to the test project on the day of the competition where a new test project will be issued to the competitor.
- (4) Competitors are expected to identify all equipment/ materials/ingredients needed and submit list to the competitions committee no later than January 28, 2004.
- (5) **Please note that all competitors should provide their own small tools and utensils.**
- (6) Competitors will be given a schedule two days before the competition. Debriefings will also be conducted for all competitors on March 28, 2004.
- (7) All competitors will get an opportunity to arrange work areas the day before the competition. Where applicable competitors for the second day will arrange their work areas on the evening of day one. Competitors who fall in the second shift will get an opportunity to do their preparation at offsite locations (to be decided) where necessary.
- (8) All competitors should be present for the opening ceremony along with their instructors/coaches.
- (9) Rehearsal for the opening ceremony will be held on the evening of March 28, 2005 (National Indoor Sport Center at 6 pm).

## Competitor procedures

- Project will be worked on over the Two days of the competition
- Each module/task will be completed on the assigned day so that progressive marking can take place.
- Prior to the start of the competition, each competitor will be given a detailed timetable reflecting the time for completion of each module
- Competitors will have a maximum of 30 minutes to become familiar with material, equipment and processes
- The competitor will be given all competition documents including marking criteria 1 hour prior to the commencement of the Competition so that they can study the requirements
- **At no time during the competition may the coach of the competitor be involved in any discussion with his/her competitor without the permission of the judge.**
- Competitors and coaches who continually fail to abide by the Technical Description and Competition Rules may be temporarily or permanently removed from the competition.
- Competitors will not be allowed to communicate on their cell phone during the competition procedures
- **Competitors are required to bring their own tools for the competition ( See list of tools required)**

## **Skill specific safety requirements**

- All competitors must use safety glasses when using any hand, power or machine tools or equipment likely to cause or create chips or fragments that may injure the eyes.
- A first-aid kit must be available throughout the competition
- All competitors must use safety glasses when Live testing the installation
- All competitors must obtain permission to apply power to any part of the installation
- No form of jewellery must be worn during competition procedures.
- Competitors must wear fully enclosed working shoes during the competition procedures.

### **Note**

***Any competitor, who in the opinion of the expert/judge fails to abide by the correct safety procedures, will be stopped and may be allowed to continue.***

The test project consists of only practical work. The competitors must independently carry out the requirement for the following modules using commercially available material and equipment. Wiring and installation must be in accordance with the document provided

Competitors must use the necessary and appropriate working techniques to complete the tasks given. Competitors will be judge on the following:

- Measuring and marking of layout for electrical fixtures
- Installing fixtures
- Manual bending of conduit
- Sawing, drilling and de-burring
- Conduit installation
- Wiring and connecting switches and control devices

- Electrical fixtures are arranged in accordance to layout diagram
- Circuit connected in accordance to schematic diagram
- Circuit function according to specification.
- Work is completed within given time.
- Work area is clean and tidy after completion of module.
- Safety practices throughout the duration on the competition.

# **MODULE A**

## **FORWARD & REVERSE MOTOR CONTROL CIRCUIT**

### **MODULES DESCRIPTIONS AND SUGGESTED WORKING TIME**

This module is limited to the installation of a Forward-Reverse motor control system. The competitor must be able to demonstrate a range of skills in the installation of electrical equipment and wiring systems. There will be a minimum of two (2) different wiring systems use in section

The following systems will be used in Project Module A

- PVC conduit
- Flexible conduit – metal

### **DURATION**

The duration for this module is **three (3)** hours

#### **1.0 PLANS AND PREPARE FOR INSTALLATION WORK:**

- 1.1 Preparation and planning requirements are identified from electrical diagram and wiring specifications.
- 1.2 Electrical materials and apparatus are identified for job specifications
- 1.3 Use the appropriate tools for the tasks out lined.
- 1.4 Appropriate personal protective gear is selected and correctly fitted.

## **2.0 INSTALL ELECTRICAL COMPONENTS AND APPARATUS:**

- 2.1 All electrical apparatus are installed in accordance with layout diagram.
- 2.2 Conduits bend and installed in accordance with JS21 requirements.
- 2.3 All cables are installed in accordance to layout and schematic diagrams.

## **3.0 PROCEDURES:**

- 3.1 Measure and markout the positions for the fixtures (see layout diagram for dimensions)
- 3.2 Secure fixtures to work-board
- 3.3 Cut, bend (where necessary) and install conduit to workboard.
- 3.4 Pull through cables using the appropriate technique
- 3.5 Connect forward and reverse contactors (power circuit) as shown in schematic diagram.
- 3.6 Connect forward control push button circuit as shown in schematic diagram.
- 3.7 Connect reverse coil and forward interlock as shown in schematic diagram.
- 3.8 Connect reverse control push button circuit as shown in schematic diagram.
- 3.9 Connect reverse coil and forward interlock as shown in schematic diagram.
- 3.10 Connect overload contacts as shown in schematic diagram
- 3.11 Check motor specifications and note voltage rating
- 3.12 Conduct Continuity test on Power Circuit
- 3.13 Conduct Insulation Resistance test on motor
- 3.14 Use correct measuring instrument to check 3-phase supply.
- 3.15 Connect the supply lines  $L_1, L_2$  and  $L_3$  to Terminals  $T_1, T_2, T_3$  of the motor

3.16 Recheck schematic diagram to ensure that corrections correct

3.17 Turn on power and start motor

## **MODULE B**

### **LIGHTING AND POWER CIRCUIT**

#### **1.0 MODULES DESCRIPTIONS AND SUGGESTED WORKING TIME**

This module is limited to a domestic or commercial type installation, consisting of lighting circuits, power outlet circuits and fixed appliances circuits. The installation of consumer units and protective equipment is also included. It will take the format stated below

- Fluorescent Lighting controlled by a double Pole Mem Switch, Powered by a 220V supply
- The Tungsten Halogen Lamp is controlled by a Photo Electric Cell and powered by 110V supply
- Two 110V Sockets Outlet
- One 220V Socket Outlet

Competitor must be able to demonstrate a range of skills in the installation of electrical equipment and wiring systems. There will be a minimum of three (3) different wiring systems this module.

The following systems will be used in Project Module B

- PVC conduit
- Multi-core cable

## **DURATION**

The duration for this module is **three (3)** hours

### **2.0 PLANS AND PREPARE FOR INSTALLATION WORK:**

- 2.1 Preparation and planning requirements are identified from electrical diagram and wiring specifications.
- 2.2 Electrical materials and apparatus are identified for job specifications
- 2.3 Use the appropriate tools for the tasks out lined.
- 2.4 Appropriate personal protective gear is selected and correctly fitted.

### **3.0 INSTALL ELECTRICAL COMPONENTS AND APPARATUS:**

- 3.1 All electrical apparatus are installed in accordance with layout diagram.
- 3.2 Conduits bend and installed in accordance with JS21 requirements.
- 3.3 All cables are installed in accordance to layout and schematic diagrams.

### **4.0 PROCEDURES:**

- 4.1 Measure and markout the positions for the fixtures (see layout diagram for dimensions)
- 4.2 Secure fixtures to work-board
- 4.3 Cut, bend (where necessary) and install conduit to workboard.
- 4.4 Pull through cables using the appropriate technique
- 4.5 Terminate lighting circuits
- 4.6 Terminate plug circuits
- 4.7 Perform continuity test on the Installation
- 4.8 Perform Verification of polarity test on Installation

## Material Listing

### 5.0 Module A

Below is an approximation of the quantity and type of materials and accessories required for Module A.

Item #	Quantity	Description	Specification
1	1	Motor	3 $\Phi$ / 220V, 50Hz, 1/2hp, 1425 rpm
2	1	Control Panel (enclosure)	12 x 12 x 6
3	2	3-Pole Contactor	size 0
4	4	Auxiliary Contact	2- Normally open 2- Normally closed
5	3	Switch	1-Normally closed 2-Normally open
6	3	Overload	220V/5A
7	1	Isolator	20A/triple pole
8	1	Distribution Panel	12-way

9	2 Length	PVC Conduit	20 mm
<b>Item #</b>	<b>Quantity</b>	<b>Description</b>	<b>Specification</b>
11	3	Conduit ends	32 mm
12	10	Conduit ends	20 mm
13	3'	Flexible conduit	½"
15	1	Triple-pole breaker	40 Amps
16	1	Triple-pole breaker	20 Amps
17	1	3 pin plug (mail)	220V/15A

## 6.0 Module B

Below is an approximation of the quantity and type of materials and accessories required for Module B

Item #	Quantity	Description	Specification
1	1	Octagonal box	
2	2	Handy box	
3	1	4 x4 Metal box	
4	2	Double-pole breaker	20A
5	2	Single-pole breaker	20A
6	1	Flush socket outlet (Round pin)	220V/15A
7	2	Flush socket outlet	110V/15A
8	2 Length	PVC Conduit	20 mm
9	10	Conduit ends	20 mm
10	1	Tungsten Halogen lamp	110V
11	1	Photo cell	110V
12	2	Fluorescent lamp	220V, 40W, 4' (double tube)
13	1	Double-pole switch	20A
15	10	Conduit Straps	20mm

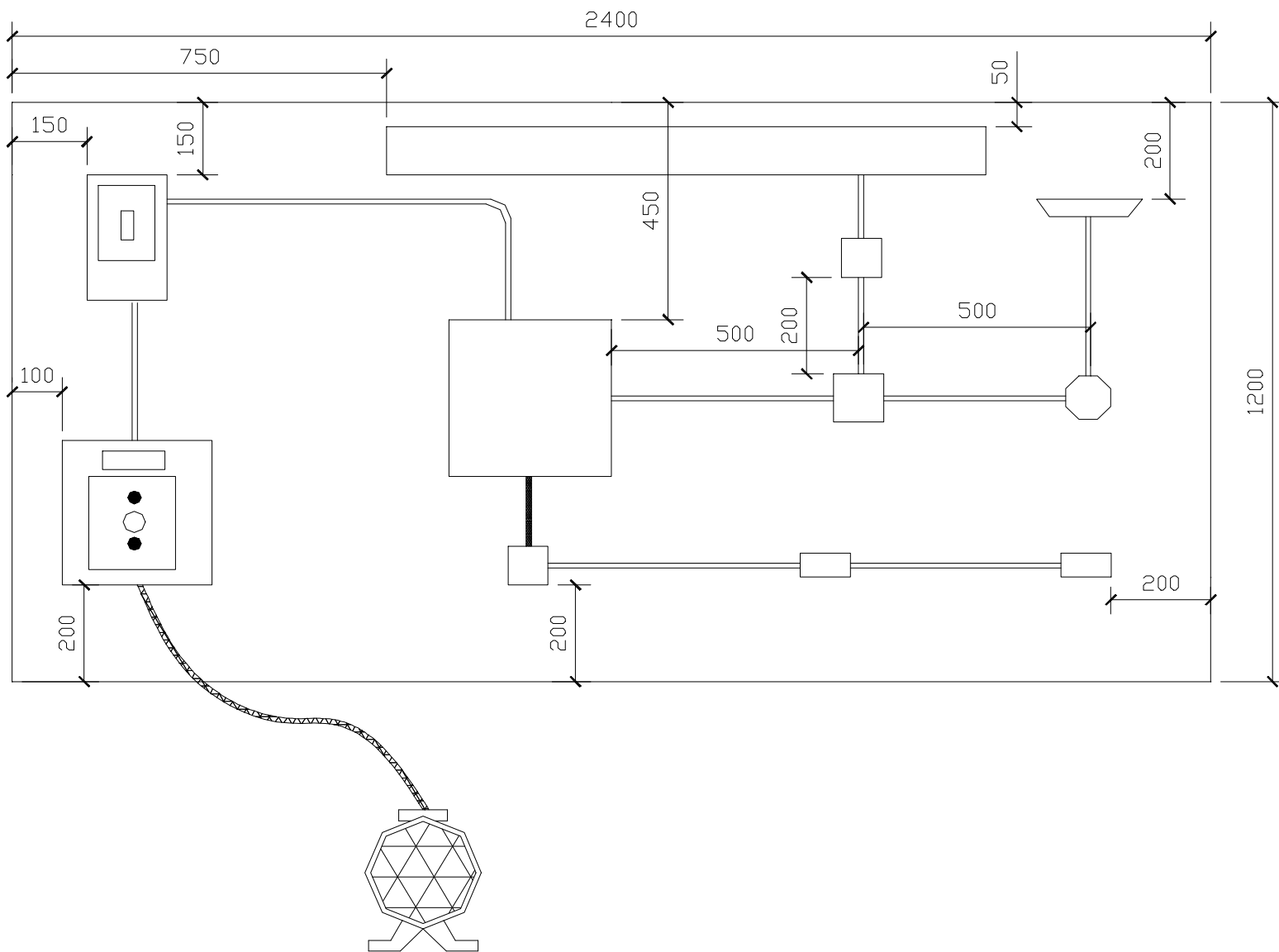
## **7.0 Additional Materials**

These materials will be used for both Modules A and B

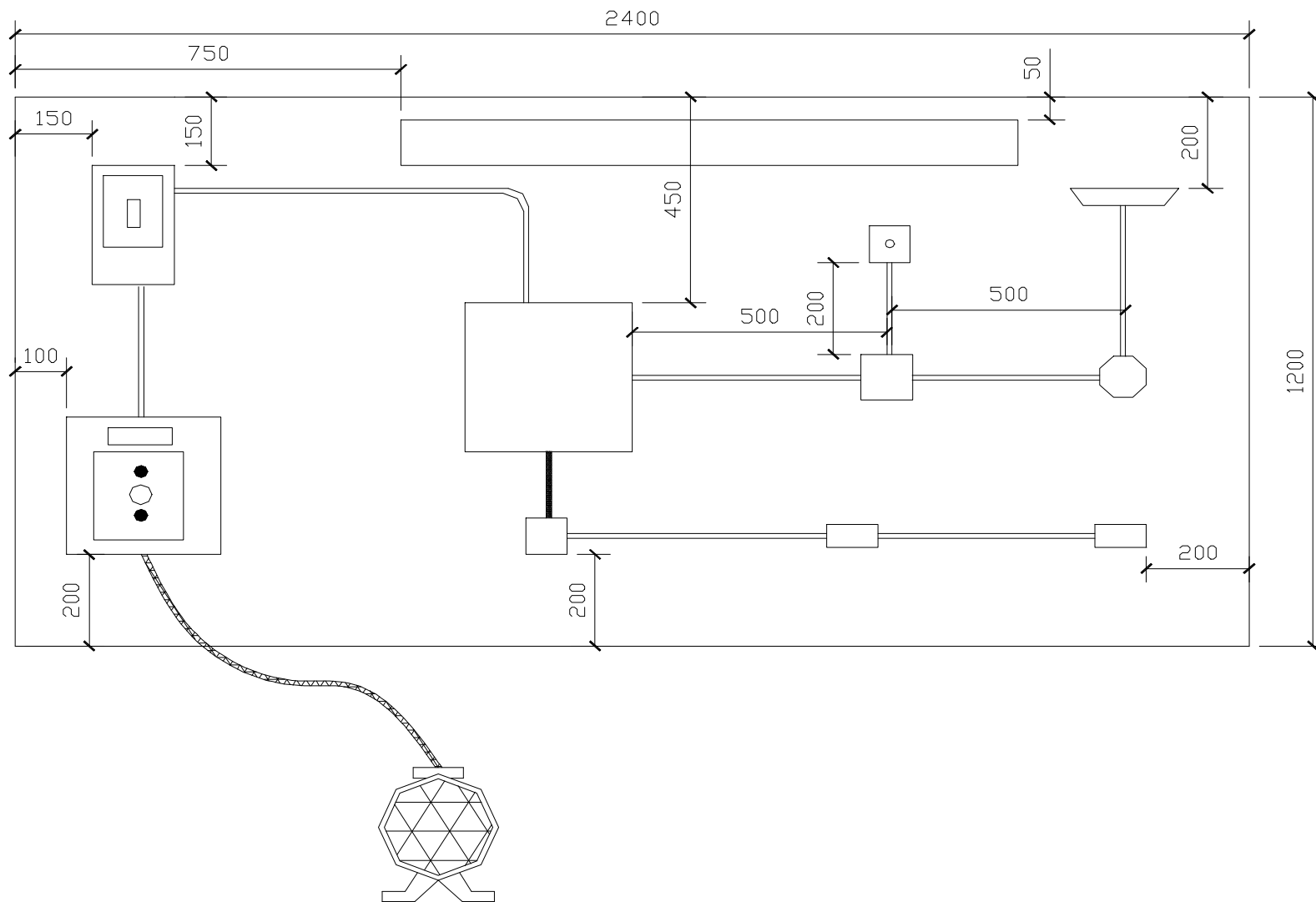
- Cable 2.5 mm<sup>2</sup> (Red)
- Cable 2.5 mm<sup>2</sup> (yellow)
- Cable 2.5 mm<sup>2</sup> (Blue)
- Cable 2.5mm<sup>2</sup> (green & yellow)
- Cable 2.5 mm<sup>2</sup> (Black)
- Earth wire 2.5 mm<sup>2</sup> (bare wire)
- Twin& earth sheathed cable 2.5 mm<sup>2</sup>
- Drywall Screws
- Connector connectors (15A)
- Cable Clips 2.5 mm<sup>2</sup>
- 3" Nail
- flexible cord 4-core

### **Tools and Instruments required**

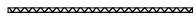
- Pliers
- Screw driver (Flathead and Phillips)
- Junction driver
- Spring bender
- Junior Saw
- Tape measure
- Level
- Wire stripper/Utility Knife
- Multimeter
- Megger



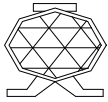
**DIMENSION: Measurements are in mm (1" = 25 mm)**



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Flex conduit



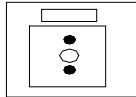
Motor



Distribution  
Panel



Isolator



Control Panel



Sheathed cable



Mem box



Halogen Lamp



Octagonal box



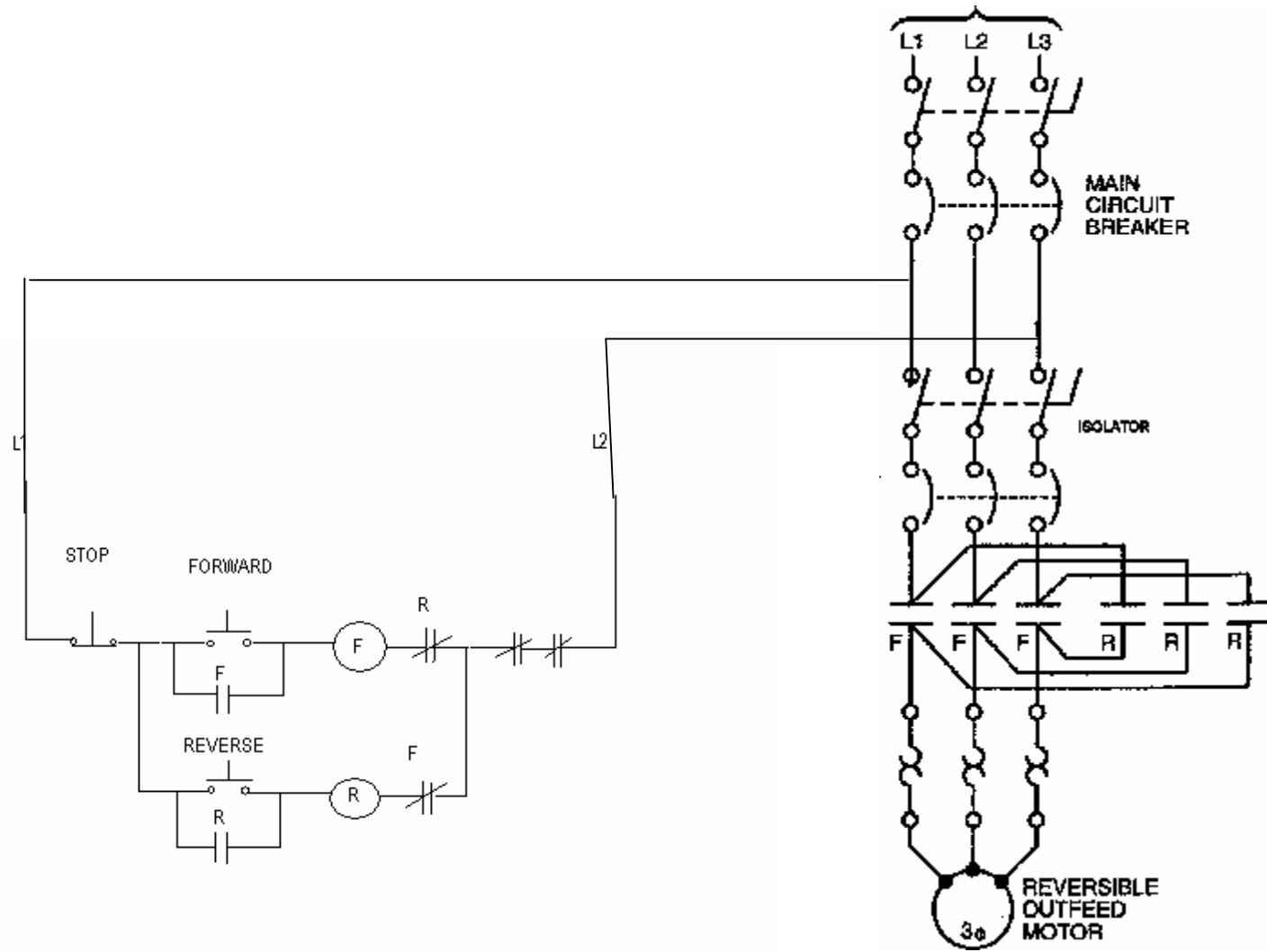
Handy box

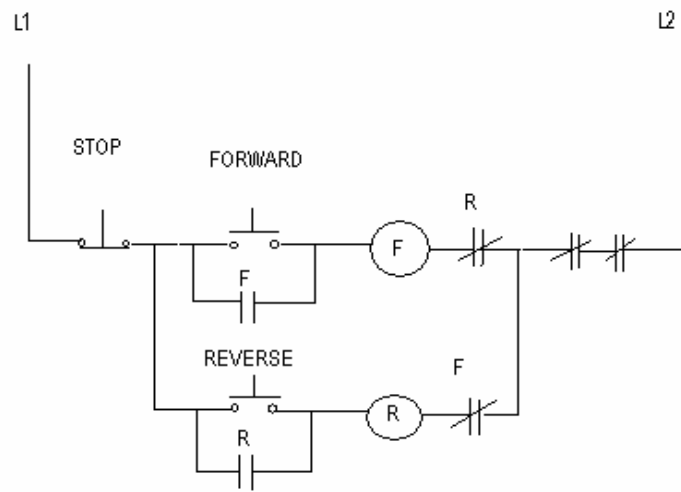


Fluorescent  
lamp (DP)

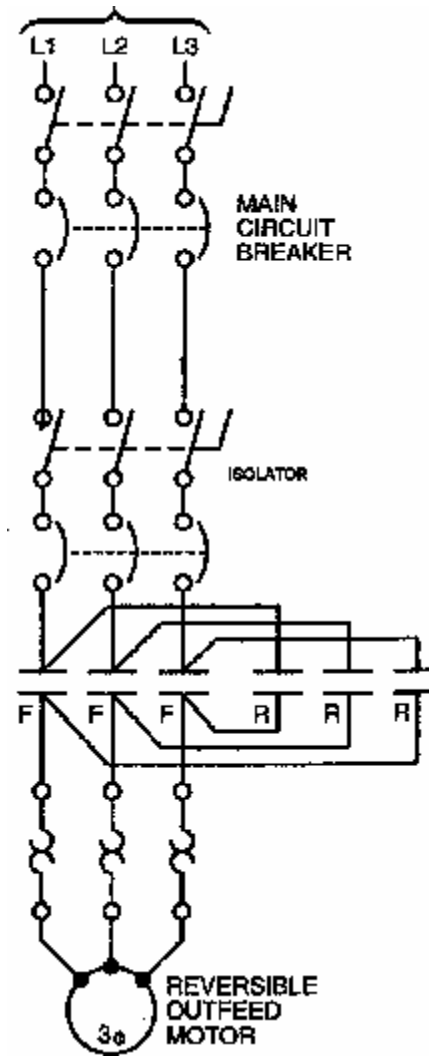
### Keys

# FORWARD-REVERSE MOTOR CONTROL SCHEMATIC





**CONTROL CIRCUIT**



**POWER CIRCUIT**