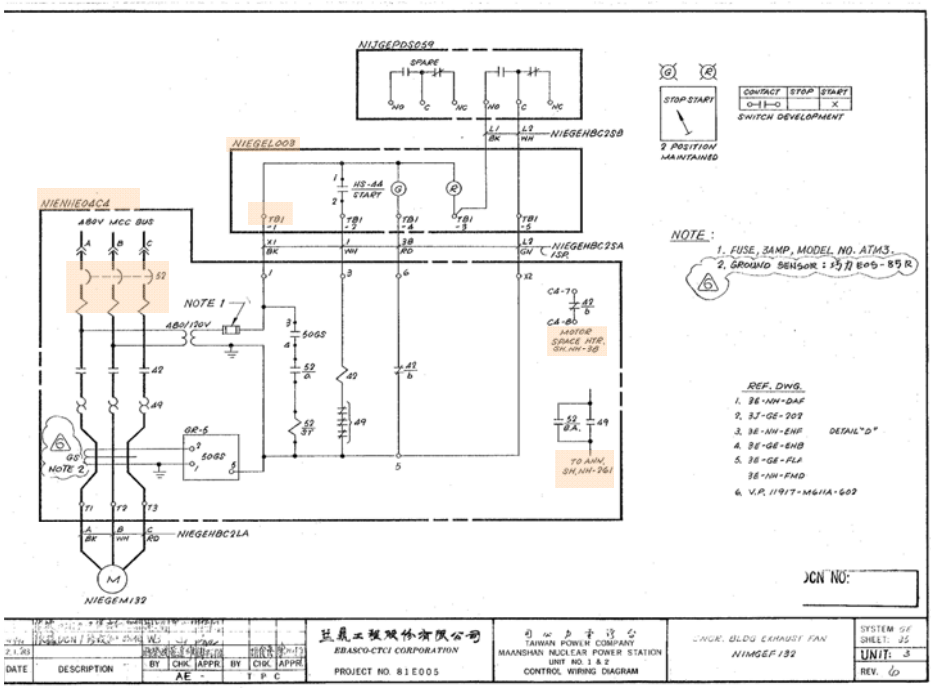


控制電路各部份元件介紹

（1）電源：480V、三相、60Hz

（2）斷路器：ACB，電源ON/OFF控制用

（3）控制用變壓器：變壓比480/120V，供給控制迴路電源

（4）42主接點：三組a接點，用來控制風扇馬達起停運轉。

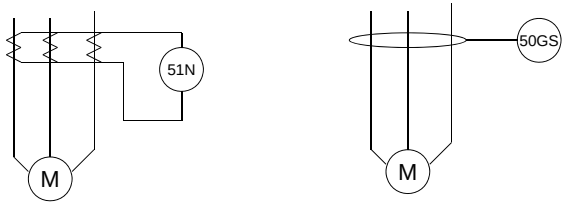
CWD

（5）49電驛之感熱元件（Heater Element）：
設於馬達電流迴路上，馬達電流愈大，熱就產生越多，將使得49電驛內之雙金屬片彎曲越厲害，進而頂開49電驛之接點，將控制迴路電源切除，保護MOV馬達不致因過載燒毀。
（ 49電驛為電氣過載保護元件 ）

CWD

(6) 50GS :馬達的接地故障保護

- 馬達起動電流大，尤其是像在本廠這種全壓起動的系統，各比流器的飽和程度不同，電驛迴路中會有殘餘的零相電流，所以如果用51N電驛容易誤動作。
- 在低電阻接地的系統，可以使用零相比流器加瞬間跳脫，就不必顧慮各比流器飽和程度不同的問題，這種方法簡單可靠、快速，而且很經濟，因此本廠的馬達保護大量使用這種方式，此電驛叫50GS

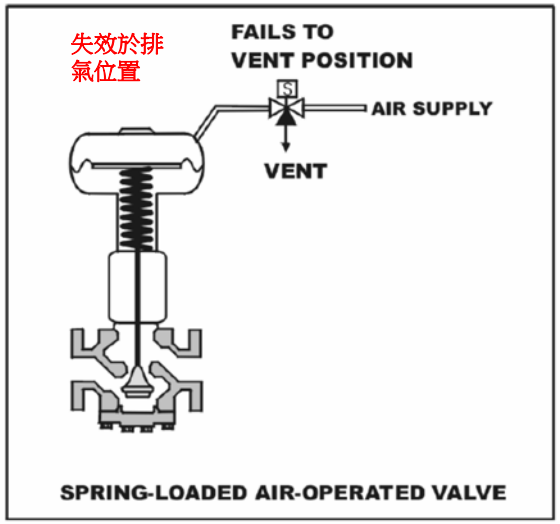


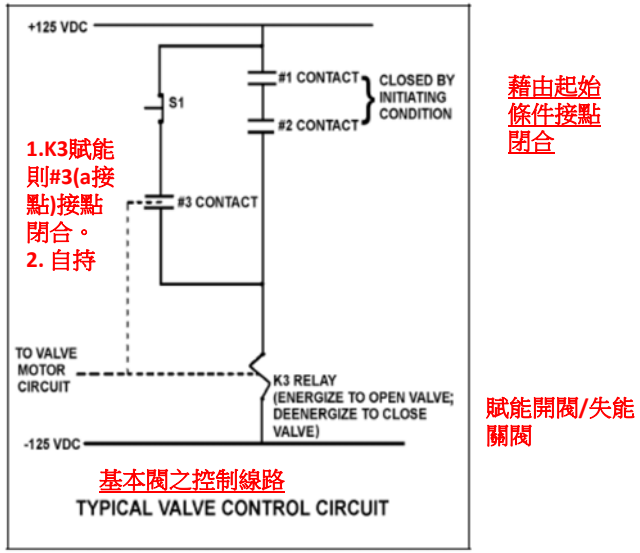
CWD

（7）熔絲：控制迴路限流保護用。
（一般為接地保護）

（8）42：控制風扇起停運轉之「電磁接觸器」（Magnetic Contacts，MC）。包括「線圈」（Coil）及數組「a、b接點」。當「線圈」未通電時，「a接點」不接通，但「b接點」閉合；反之，當「線圈」通電時，「a接點」閉合，而「b接點」不接通。『註：「線圈」通電的動作稱為「激磁」(Energized)，「a接點」稱為「常開接點」(Normal Open Contact)，「b接點」稱為「常閉接點」(Normal Close Contact)。』

CWD





1.K3賦能則#3(a接點)接點閉合。
2. 自持

藉由起始條件接點閉合

至閥馬達(操作器)線路

賦能開閥/失能關閥

基本閥之控制線路

Refer to the drawing of a typical valve control circuit (see figure below). What is the purpose of depressing the S1 pushbutton?(壓下S1的功用何在?)
A. To deenergize the K3 relay after the initiating condition has cleared.(在起始條件消失後使K3電驛失能)
B. To prevent energizing the K3 relay when the initiating condition occurs.
C. To manually energize the K3 relay in the absence of the initiating condition.
D. To maintain the K3 relay energized after the initiating condition has cleared.
ANSWER: A.

Refer to the drawing of a typical valve control circuit (see figure below). One purpose of the
K3 relay is to...(**K3 relay 功能之一為何?)**
A. hold the valve open after one or both of the initiating conditions have cleared, even if the
reset pushbutton (S1) is depressed.
B. hold the valve open even if one or both of the initiating conditions have cleared**.(縱然在起始條件消失後保持閥開啟)**
C. close the valve as soon as either initiating condition has cleared.
D. close the valve as soon as both initiating conditions have cleared.
ANSWER: B.

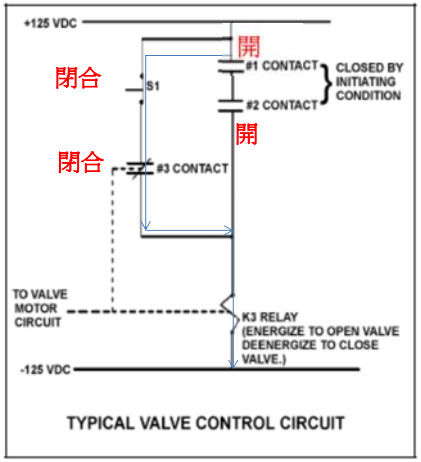
Refer to the drawing of a typical valve control circuit (see figure below).
Which one of the following describes the function of the #3 contact**?(...#3接點之功能之一為何?)**

A. To keep the K-3 relay energized after the initiating condition clears(**.(在起始條件消失後使K3電驛繼續賦能)**
)
B. To provide a method for manually energizing the K-3 relay
C. To increase circuit reliability because any one of three contacts can energize the K-3 relay
D. To ensure the K-3 relay can always be deenergized even with the initiating condition
present
ANSWER: A.

The initiating condition occurs and closes the #1 and #2 contacts to energize the K-3 relay and
open the valve. Which one of the following will close the valve?
(起始條件發生且閉合**#1和#2接點去賦能K3**電驛來開啟閥**,**下列何者會關閉閥**?**)
A. Loss of 125 Vdc
B. Both #1 and #2 contacts open
C. Either #1 or #2 contact opens
D. Depressing the S1 pushbutton with the initiating condition
present
ANSWER: A.

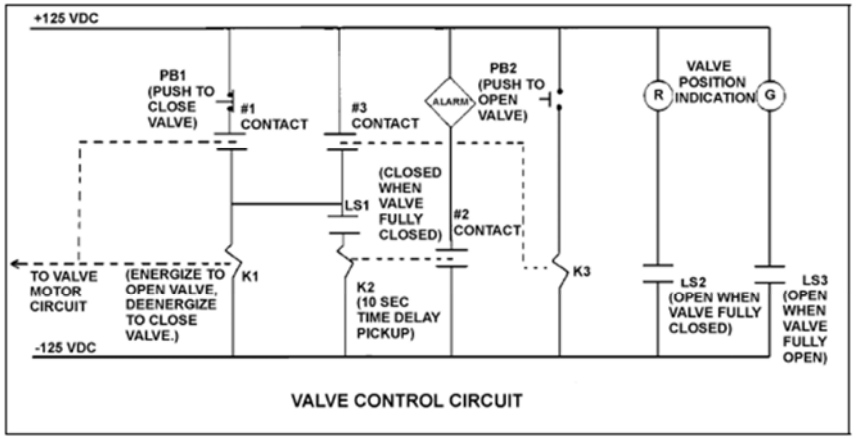
Refer to the drawing of a typical valve control circuit for a 480 Vac motor-operated valve (see
figure below).
The valve is currently open with the contact configuration as shown. If the S1 pushbutton is depressed, the valve will _____ and when the S1 pushbutton is subsequently released, the valve will
_____.

A. remain open; remain open
B. close; remain closed
C. remain open; close
D. close; open
ANSWER: B.



PPT18:在10秒內只要閥有從全關往開方向一些,則LS1開啟,K2將失能。

PPT 15:閥全關時,壓下PB2, K3賦能,#3接點閉合,使K1賦能,#1接點閉合。同時#K3閉合下且閥全關LS1閉合接通使k2賦能,如果連續10秒賦能,則開始使k2閉合,送出警報。



PPT17:LS1,LS3閉合指示閥關閉, #2接點閉合指示K2 R'Y持續賦能大於 10 SECS ,#1接點閉合指示K1 R'Y持續賦能。

Refer to the drawing of a valve control circuit. Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.
If the valve is presently closed, when will the alarm actuate**?(如果目前閥是關閉,何時動作警報?)**

A. As soon as PB2 is pushed
B. 10 seconds after PB2 is pushed if the valve is still closed
C. Immediately upon pushing PB2 and for the next 10 seconds if the valve remains closed
D. 10 seconds after PB2 is pushed if the valve is still stroking open
ANSWER: B.

Refer to the drawing **(PPT 14)of** a valve control circuit for a valve that is initially fully closed (see figure below). (Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.)
Which one of the following describes when the motor-operated valve will begin to stroke open**?(下列何者描述MOV開始打開?)**

A. At the same time the alarm actuates
B. 10 seconds after PB2 is depressed
C. Immediately after PB2 is depressed
D. Immediately after PB1 is depressed if contact #1 is closed
ANSWER: C.

Refer to the drawing((PPT 14) of a valve control circuit (see figure below). Pushbutton PB2 was depressed to open the valve, and the current contact/pushbutton status is as shown with the following exceptions: LS1 is closed. LS3 is closed. #1 contact is closed. #2 contact is closed.

Which one of the following describes the condition of the valve and its control circuit?
A. The valve is closed and the valve motor circuit has just been energized to open the valve.
B. The valve is closed and an open demand signal has existed for at least 10 seconds.
C. The valve is partially open and the valve motor circuit is deenergized as PB2 was
prematurely released.
D. The valve is partially open and an open demand signal has existed for at least 10 seconds.
ANSWER: B.

Refer to the drawing((PPT 14) of a valve control circuit (see figure below). Note: Limit switch (LS)
contacts are shown open regardless of valve position, but relay contacts follow the standard
convention for control circuit drawings.
Which one of the following describes the purpose of the alarm in the control circuit shown in the accompanying drawing?
A. Alert the operator when the valve motor circuit has been energized for 10 seconds after pushbutton PB2 is depressed
B. Alert the operator when the valve has not moved off its closed seat(離開全關) within 10 seconds of depressing pushbutton PB2

C. Alert the operator that the valve is opening by sounding the alarm for 10 seconds after PB2 is depressed
D. Alert the operator if the valve has not reached full open within 10 seconds of depressing pushbutton PB2

ANSWER: B.

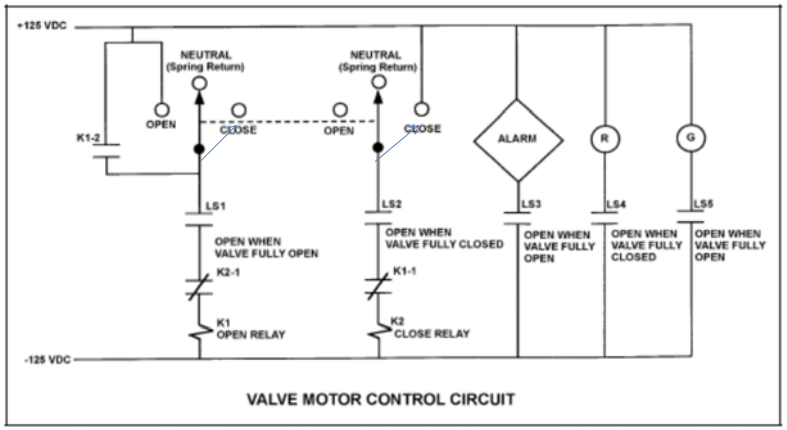
Refer to the drawing (PPT 14)of a valve control circuit (see figure below). Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings. The valve is half open and moving to the open position(半開往全開). Which one of the following describes the current condition of the valve position indicating lights?(閥位指示將如何?)

A. Red light on, green light off
B. Red light off, green light on
C. Red light off, green light off
D. Red light on, green light on
ANSWER: D.

PPT 14:瞬間按壓下PB2後放開,閥當下形成一半,此狀況下, #1, #2, and #3狀態為何?

Pushbutton PB2 has been momentarily depressed and then released, and the valve is currently at mid-stroke and moving to the open position. Under these conditions, which one of the following describes the position of contacts #1, #2, and #3?
A. #1 closed; #2 open; #3 open
B. #1 open; #2 closed; #3 closed
C. #1 open; #2 open; #3 open
D. #1 closed; #2 closed; #3 closed
ANSWER: A.

PPT 22 :初始狀況:閥全開LS1開啟,k1失能,k1-1接點閉合(b接點) ,LS2閉合。開關如藍色箭頭轉至close,k2賦能,閥往關閉方向動作2secs,手離開開關後,return to Neutral,k2失能,動作停止。



VALVE MOTOR CONTROL CIRCUIT

PPT 23 :初始狀況:閥全關LS1閉合, k2-1接點閉合(b接點) ,開關如轉至OPEN,k1賦能k1-2閉合接通,即使開關return to Neutral, 因k1-2繼續閉合使k1持續賦能直到全開,LS1開啟才會失能。

Refer to the drawing **(PPT 21)** of a valve motor control circuit (see figure below) for a valve that is currently fully open and has a 10-second stroke time. (Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.)

Which one of the following describes the valve response if the control switch is taken to the“Close” position for two seconds and then released?

A. The valve will not move.
B. The valve will close fully.
C. The valve will begin to close and then stop moving.
D. The valve will begin to close and then open fully.
ANSWER: C.

Refer to the drawing (**(PPT 21)**)of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time. (Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.)
Which one of the following describes the valve response if the control switch is taken to the “Open” position for two seconds and then released?
A. The valve will not move.
B. The valve will open fully.
C. The valve will begin to open and then stop moving.
D. The valve will begin to open and then close fully.
ANSWER: B.

Refer to the drawing (**(PPT 21)** of a valve motor control circuit (see figure below) for a valve that is currently fully open and has a 10-second stroke time**. Limit switch LS2 has failed open(故障/失效在開啟/不通=誤判閥以全關).** (Note:Limit switch (LS) contacts are shown open regardless of valve position, but relay contactsfollow the standard convention for control circuit drawings.)

Which one of the following describes the valve response if the control switch is taken to the “Close” position for 2 seconds and then released?
A. The valve will not move.**(因為LS2開啟不通使關閉電驛K2不能賦能)**
B. The valve will close fully.
C. The valve will begin to close and then stop moving.
D. The valve will begin to close and then open fully.
ANSWER: A.

Refer to the drawing ((**(PPT 21)**)of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time. (Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.)
The operator takes the control switch to “Open” momentarily and the valve begins to open. Five seconds later, the operator takes the switch to “Close” momentarily and then releases the switch. Which one of the following describes the valve response after the switch is released?
A. The valve will stop opening and remain partially open.
B. The valve will stop opening and then go fully closed.
C. The valve will open fully and remain fully open.**(說明見ppt 26)**
D. The valve will open fully and then go fully closed.
ANSWER: C.

起始狀況:LS2開啟;失能,Ls1閉合,k2-1(b接點)閉合;k1失能, k1-2失能。閥轉到OPEN,k1賦能k1-2閉合接通,即使開關return to Neutral, 因k1-2繼續閉合使k1持續賦能。
5 secs後閥開度50%將開關瞬間轉到CLOSE,期間K1不曾失能直到閥全開,k2則因k1-1(b接點持續不通)無法賦能。

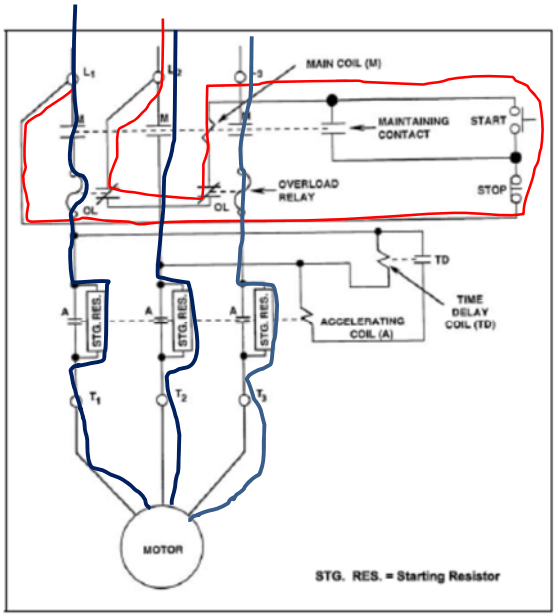
Refer to the drawing ((**(PPT 21)**)of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time. (Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.) An operator takes the control switch to “Open” momentarily and the valve begins to open.
(閥受指令開啟至一半, 開關轉至關閉且保持在關閉)
Five seconds later, the operator places **and holds the switch** in the “Close” position. Which one of the following describes the valve response with the switch held in the “Close” position?
A. The valve will stop opening and remain partially open.
B. The valve will stop opening and then go fully closed.
C. The valve will open fully and remain fully open.
D. The valve will open fully and then go fully closed.
ANSWER: D.

Refer to the drawing((**(PPT 21)**) of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time. (Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.)
The operator takes the control switch to “Open”. Two seconds later, after verifying the valve is opening, the operator releases the control switch. Which one of the following describes the valve motor control circuit alarm response after the switch is released?
A. The alarm will continue to actuate for approximately 8 seconds.
B. The alarm will continue to actuate until additional operator action is taken.
C. The alarm will actuate after approximately 8 seconds.
D. The alarm will not actuate until additional operator action is taken.
ANSWER: A.

初始狀態:Alarm ON,要到全開才會消失, 還待餘程8秒。

Refer to the drawing (**(PPT 21)** of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time. (Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts follow the standard convention for control circuit drawings.)
The operator takes the control switch to “Open” for 5 seconds and then releases the switch.
After one minute the operator takes the control switch to “Close” for 5 seconds and then releases the switch. Which one of the following describes the valve position immediately after the control switch is released the second time?
A. Approximately fully open.
B. Approximately fully closed.(.??)
C. Approximately 50% openD. Cannot be determined without additional information.
ANSWER: B.

藍:POWER
紅:CONTROL



START按下後,MAIN COIL賦能,三相電力經接點M,啟動電阻啟動馬達。同時賦能TD開始計時,經過設定時間後,接點TD閉合,賦能加速線圈A,接點閉合旁通啟動電阻。
按下STOP後MAIN COIL失能,M接點開啟,加速線圈A立刻失能,其接點開啟,準備下回啟動。

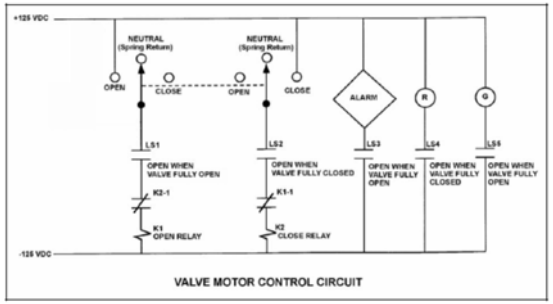
Refer to the drawing of a motor controller circuit (see figure below). (Note: Relay contacts
follow the standard convention for control circuit drawings.)
What is the purpose of the Time Delay Coil (TD) in the motor controller circuit?
A. Ensures the motor cannot be started until the overload relays are reset.
B. Ensures the motor cannot be started until the accelerating coil is energized.
C. Allows the motor to come up to speed before bypassing the starting resistors.
D. Allows the motor to come up to speed before placing the starting resistors in the circuit.
ANSWER: C.

Refer to the drawing of a motor controller circuit for a three-phase ac motor (see figure
below).
The motor receives overload protection from _____ overload (OL) relays, and
_____ OL relay(s) must actuate to deenergize the motor.
A. two; one
B. two; two
C. three; one
D. three; two
ANSWER: A.

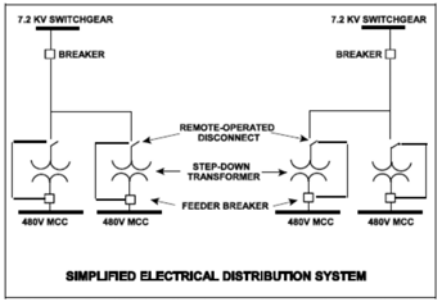
Refer to the drawing of a motor and its control circuit (see figure below). (Note: The relay
contacts shown follow the standard convention for control circuit drawings.)
How are the starting resistors employed before and after the motor is energized?
A. Inserted before the motor is energized; simultaneously bypassed after the motor gains
speed.
B. Inserted before the motor is energized; sequentially bypassed as the motor gains speed.
C. Bypassed before the motor is energized; simultaneously inserted after the motor gains
speed.
D. Bypassed before the motor is energized; sequentially inserted as the motor gains speed.
ANSWER: A.

Refer to the drawing of a motor and its control circuit (see figure below). (Note: The relay
contacts shown follow the standard convention for control circuit drawings.)
The motor has been operating for several hours when it is decided to stop the motor. What is
the status of the starting resistors before and after the motor STOP button is depressed?
A. Initially inserted in the motor circuit; bypassed immediately after the STOP button is
depressed.
B. Initially inserted in the motor circuit; bypassed following a preset time delay after the
STOP button is depressed.
C. Initially bypassed; bypass is removed immediately after the STOP button is depressed.
D. Initially bypassed; bypass is removed following a preset time delay after the STOP button
is depressed.
ANSWER: C.

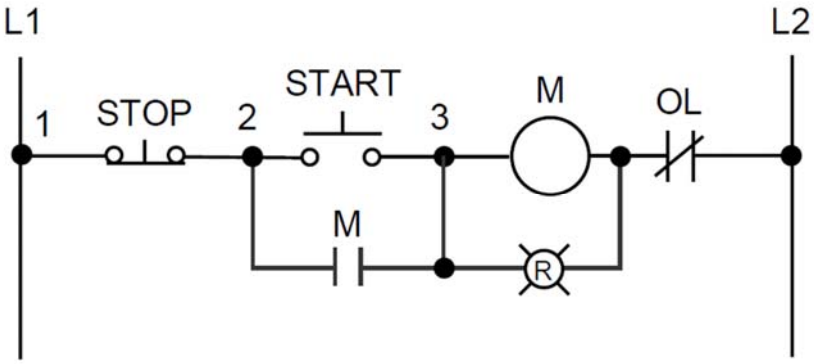
Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is
currently fully closed and has a 10-second stroke time. (Note: Limit switch (LS) contacts are
shown open regardless of valve position, but relay contacts follow the standard convention for
control circuit drawings.)
Which one of the following describes the valve response if the control switch is taken to the
“Open” position for two seconds and then released?
A. The valve will not move.
B. The valve will open fully.
C. The valve will begin to open and then close fully.
D. The valve will begin to open and then stop moving.
ANSWER: D.
請參照下圖的閥門馬達

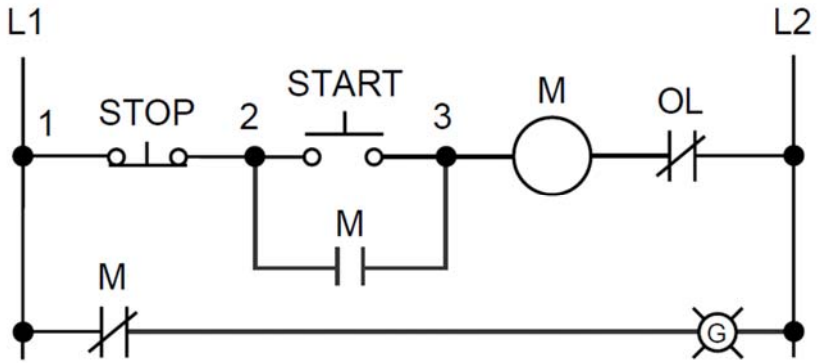


VALVE MOTOR CONTROL CIRCUIT

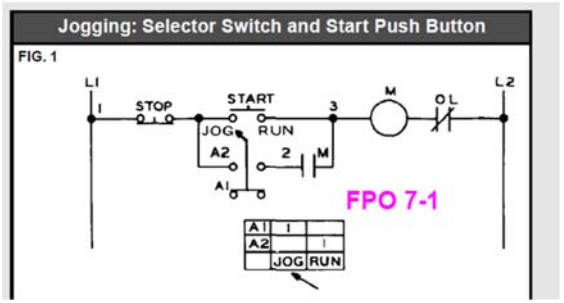


SIMPLIFIED ELECTRICAL DISTRIBUTION SYSTEM





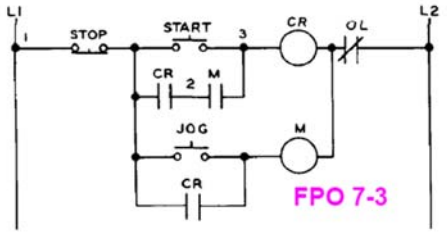
吋動=jogging=inching



吋動=jogging=inching

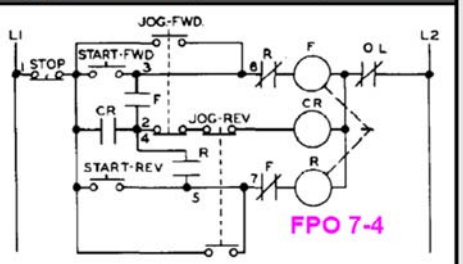
Jogging: Control Relay

FIG. 3



Jogging: Control Relay for Reversing Starter

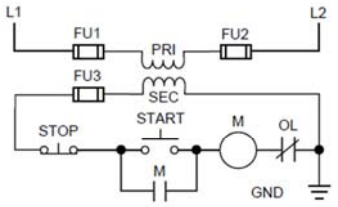
FIG. 4



This control scheme permits jogging the motor either in the forward or reverse direction, whether the motor is at standstill or rotating. Pressing the Start-Forward or Start-Reverse push button energizes the corresponding starter coil, which closes the circuit to the control relay.The relay picks up and completes the holding circuit around the Start button. As long as the relay is energized, either the forward or reverse contactor remains energized. Pressing either Jog push button will deenergize the relay, releasing the closed contactor. Further pressing of the Jog button permits jogging in the desired direction.

3-Wire Control:
Fusing in Both Primary Lines and 1 Secondary Line

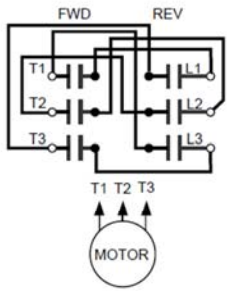
FIG. 5



Control circuit transformer with fusing in one secondary line and both primary lines, with one line grounded.

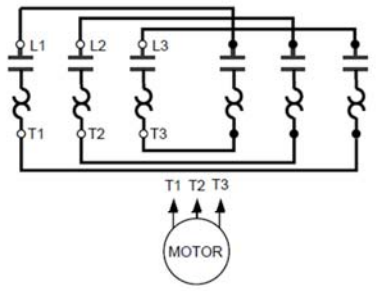
AC Reversing Manual Starters and Manual Motor Starting Switches:
Class 2511

FIG. 1



Reversing Manual Motor Starting Switch
Type K, 3-Pole, 3-Phase

FIG. 2



Reversing Manual Starter
Sizes M0 and M1, 3-Pole, 3-Phase

假設M#1&M#2皆未RUN,流程有產生一訊號,例如泵出口低壓力,因為CR失能下,M1賦能使M#1啟動,而M#2則不會啟動。CR賦能而且自持。

如果M#1因OL跳脫,則M2經CR(a接點),M1(b接點)賦能,M#2啟動。而在M2(a接點)閉合自持前,M2(b接點)可以用time delay 讓它言實在開啟。(M#1是並聯使用的LEAD)