

Lesson: LTIII Operation

This lesson introduces you to the sequences of operation of the LTIII Automatic Transfer Switch. During this lesson, you will color prints which can be used to help you remember the sequences of operation, and the inputs and outputs to be checked in Start, Stop, Transfer and Retransfer modes.

Objectives

After completing this lesson, you should be able to:

- List the inputs and outputs to be checked during a Normal Source fail sequence of operation.
- List the inputs and outputs to be checked during a Normal Source return sequence of operation.
- List the inputs and outputs to be checked during a remote test, test, or exercise with load sequence of operation.
- List the inputs and outputs to be checked during a remote test, test, or exercise without load sequence of operation.

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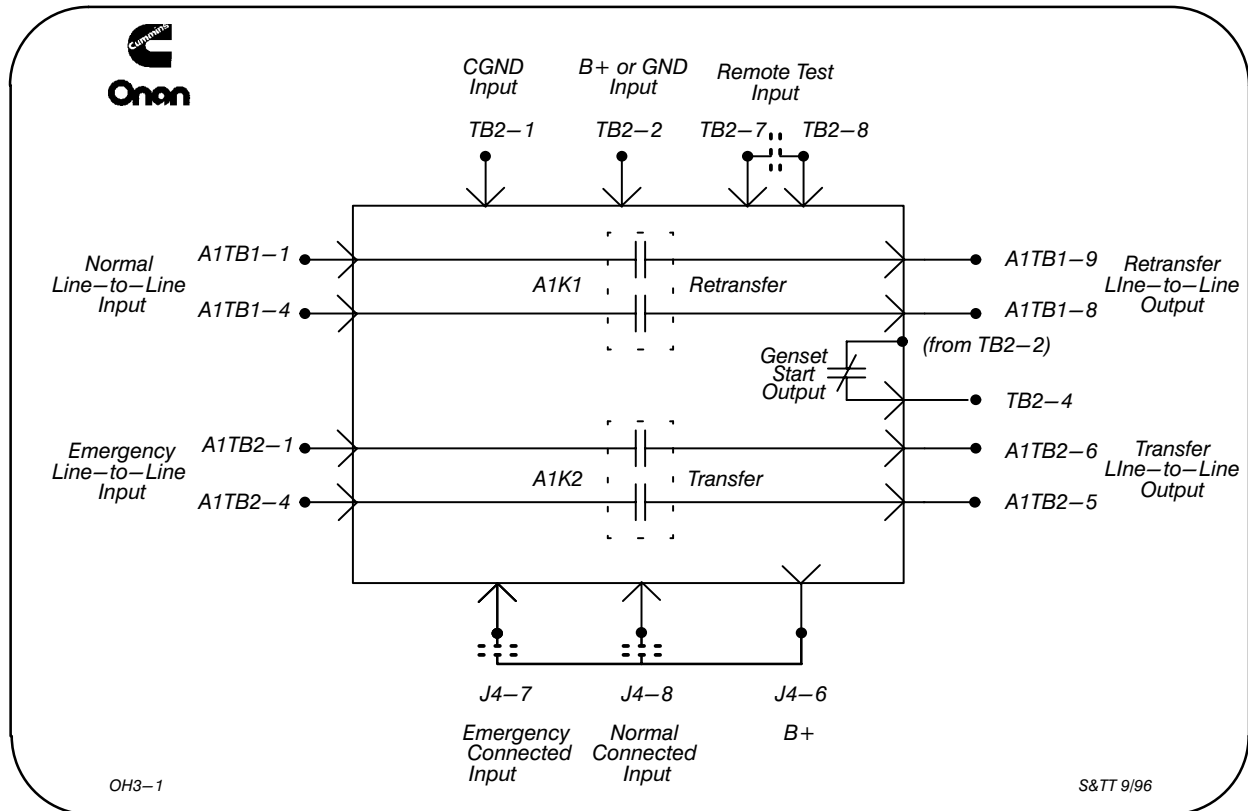
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OTIII/Power Sentry Sequence of Operation

1. Write the numbers 1 through 16 in the spaces provided in the order of operation for a Utility-to-Genset OTIII automatic transfer switch Normal Source Power Interruption.

- _____ Transfer time delay begins.
- _____ K11 contacts close sending a start signal to the genset.
- _____ Retransfer timing complete – load transfers from emergency to neutral, then neutral to normal.
- _____ Emergency source voltage sensor indicates that Emergency source is available.
- _____ Stop time delay begins.
- _____ Retransfer is complete.
- _____ Transfer is complete.
- _____ Emergency source is not available.
- _____ Genset starts.
- _____ Failure of the Normal source initiates start time delay.
- _____ Stop time delay is complete. K11 relay energizes removing the start signal to the genset.
- _____ Emergency source is not available.
- _____ Retransfer time delay begins.
- _____ Transfer time delay is complete – load transfers from normal to neutral, then neutral to emergency.
- _____ Normal power source returns.
- _____ Start time delay is complete. K11 relay de-energizes sending a start signal to the genset.



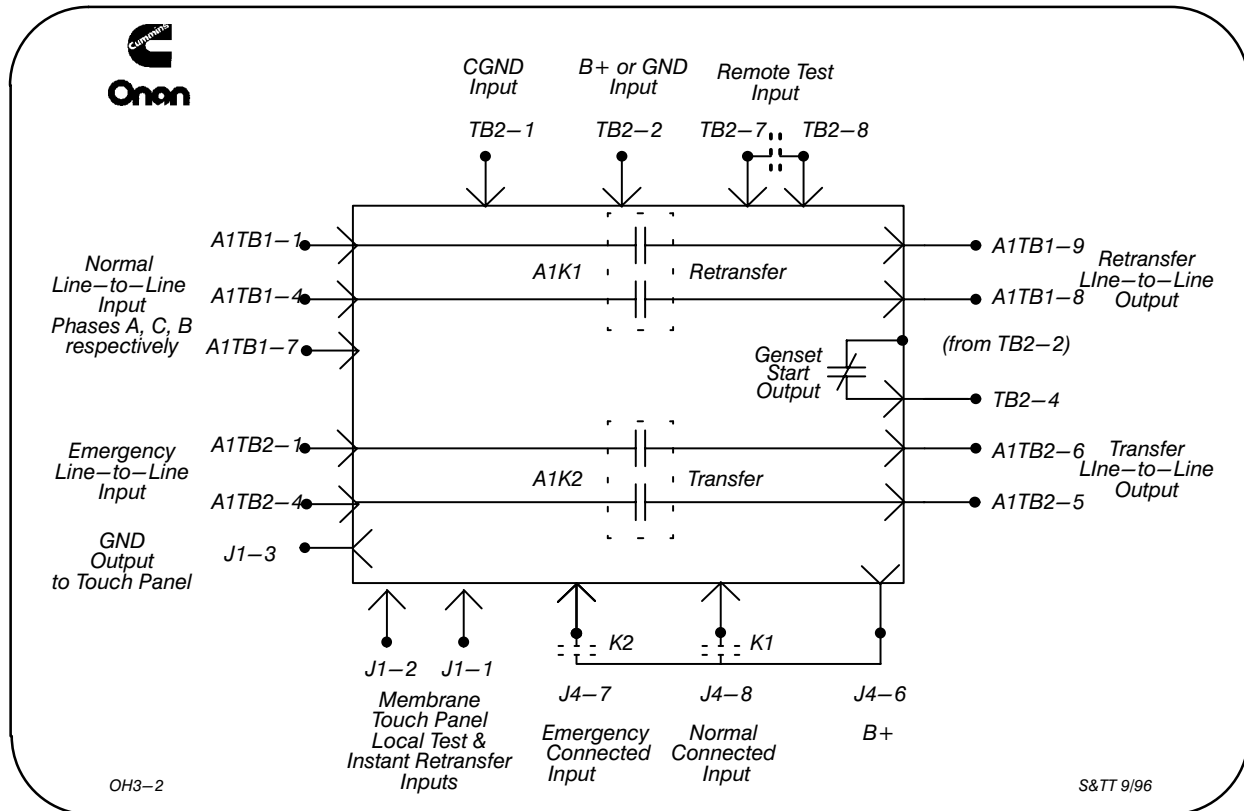
LTIII Control Package A Inputs/Outputs

Inputs

Normal Source Sensing – 1 phase
 Emergency Source Sensing – 1 phase
 CGND
 B+
 Remote Test
 Normal Connected
 Emergency Connected

Outputs

Transfer Signal
 Retransfer Signal
 Genset Start
 Control Status Indication
 24VDC for K1/K2 Connected Inputs



LTIII Control Package B Inputs/Outputs

Inputs

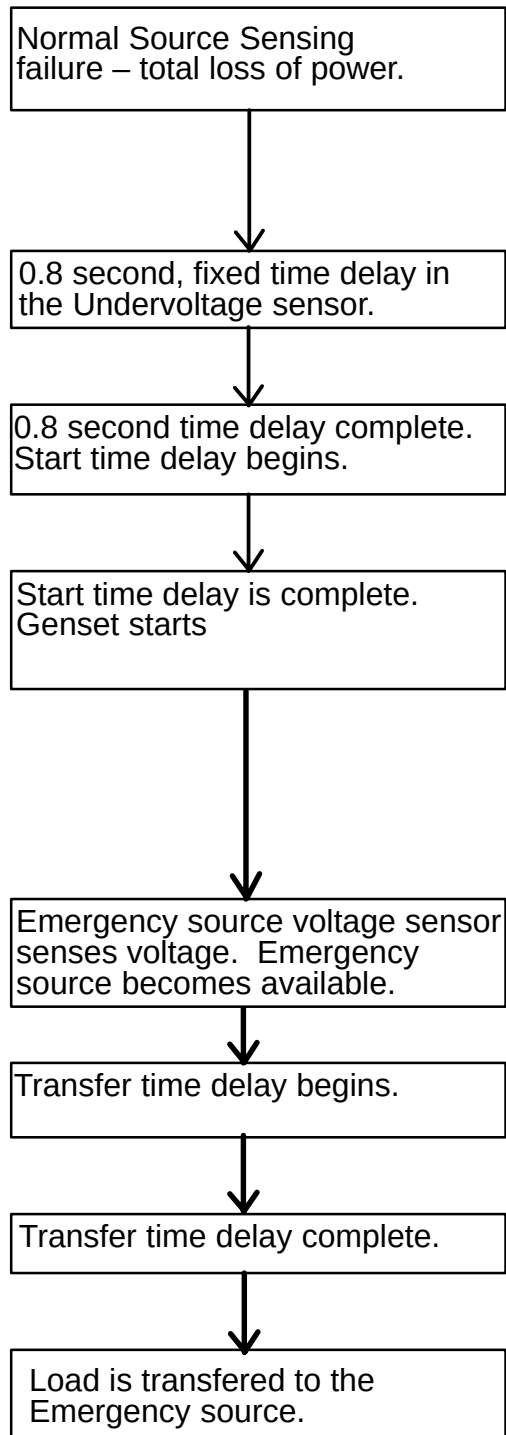
Normal Source Sensing – 1 or 3 phase
 Emergency Source Sensing – 1 phase
 CGND
 B+
 Remote Test
 Local Test
 Instant Retransfer
 Emergency Connected
 Normal Connected

Outputs

Transfer Signal
 Retransfer Signal
 Genset Start
 Control Status Indication
 GND for Touch Panel
 24VDC for K1/K2 Connected Inputs

LTIII Normal Source Power Interrupted

Control Flow Diagram



Indicators On

No lamps illuminated for total loss of power. If it is not a total loss of power, the Normal Available DS10 and Retransfer DS9 will be ON.

same as previous

same as previous

Start – DS12

Start – DS12
Emergency Available – DS11

Transfer Timing – DS6
Start – DS12
Emergency Available – DS11

Start – DS12
Emergency Available – DS11
Transfer – DS8

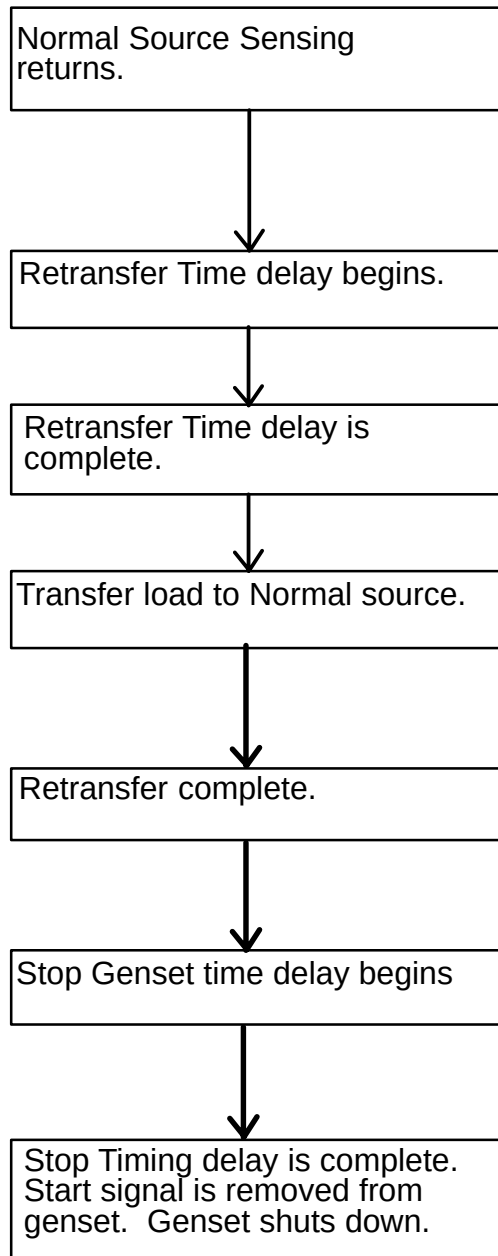
Start – DS12
Emergency Available – DS11
Transfer – DS8

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S&TT 9/96

LTIII Normal Source Power Returns

Control Flow Diagram



Indicators On

Normal Available – DS10
 Transfer – DS8
 Emergency Available – DS11
 Start – DS12

Normal Available – DS10
 Transfer – DS8
 Emergency Available – DS11
 Start – DS12
 Retransfer Timing – DS7

Normal Available – DS10
 Retransfer – DS9
 Emergency Available – DS11
 Start – DS12

Normal Available – DS10
 Retransfer – DS9
 Emergency Available – DS11
 Start – DS12

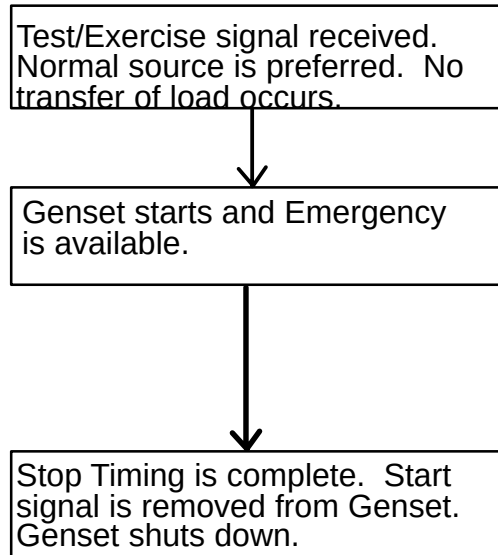
Normal Available – DS10
 Retransfer – DS9
 Emergency Available – DS11
 Start – DS12

Normal Available – DS10
 Retransfer – DS9
 Emergency Available – DS11
 Start – DS12
 Stop Timing – DS5

Normal Available – DS10
 Retransfer – DS9

LTIII Test/Exercise Without Load (S2 in the No Load position)

Control Flow Diagram



Indicators On

Normal Available – DS10
Retransfer – DS9

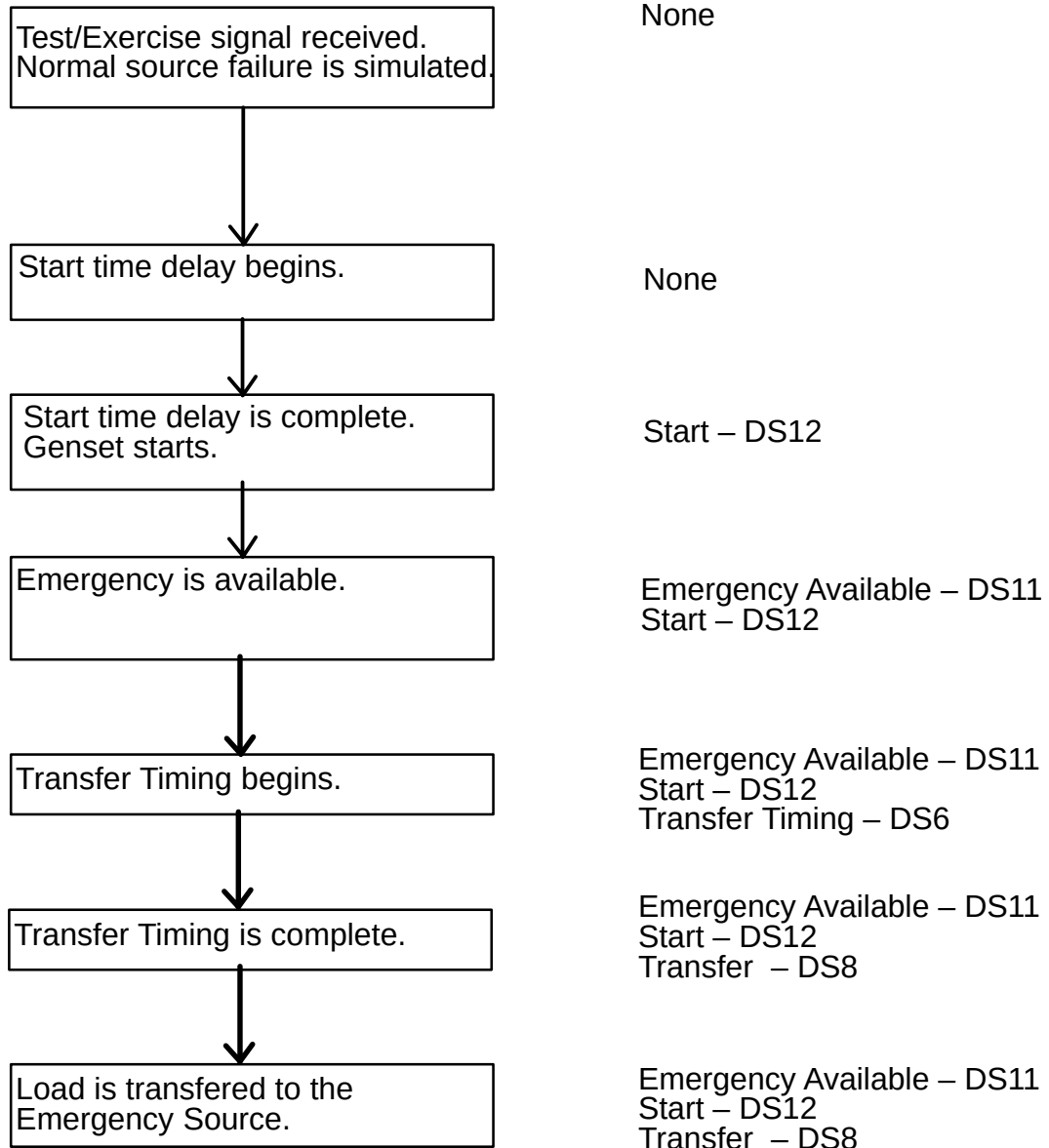
Normal Available – DS10
Retransfer – DS9
Emergency Available – DS11
Start – DS12

Normal Available – DS10
Retransfer – DS9

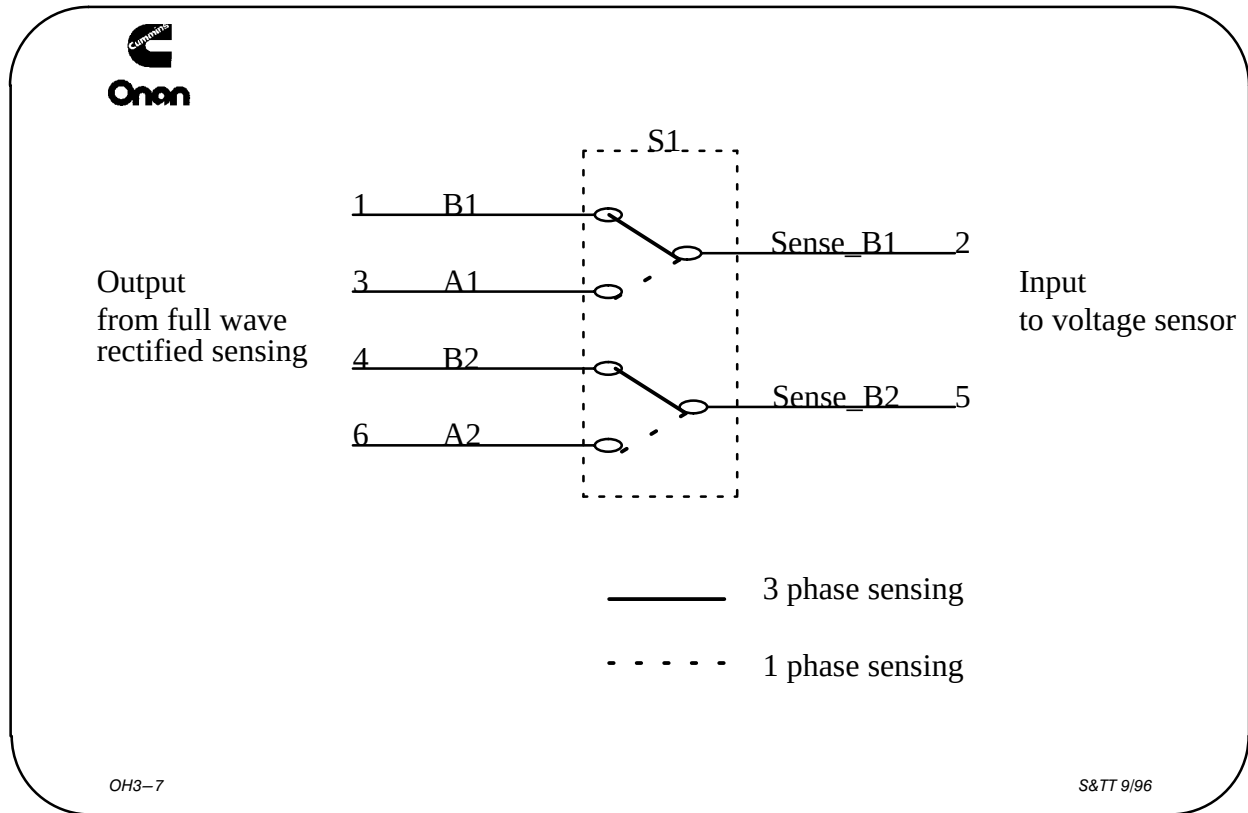
LTIII Test/Exercise With Load (S2 in the Load position)

Control Flow Diagram

Indicators On

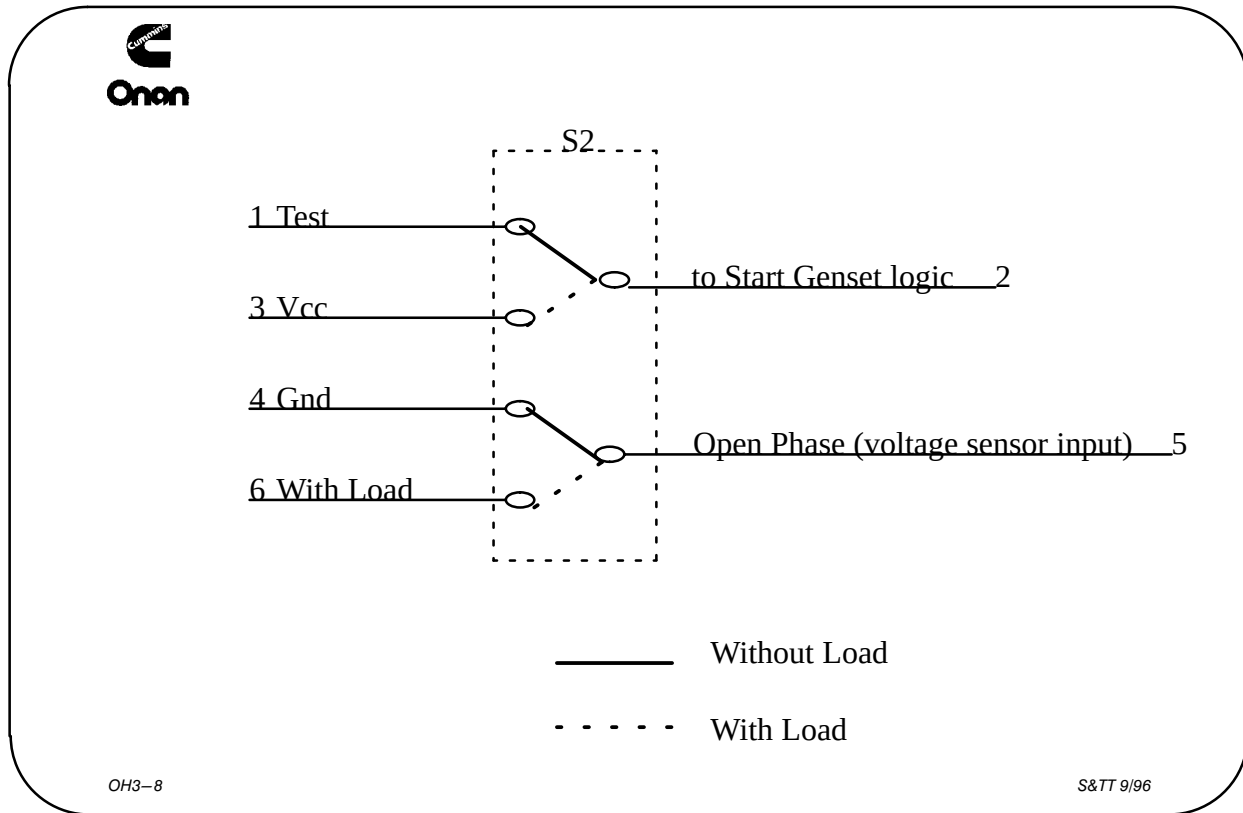


Retransfer sequence is the same as that of the Normal Source Power Return sequence of operation.



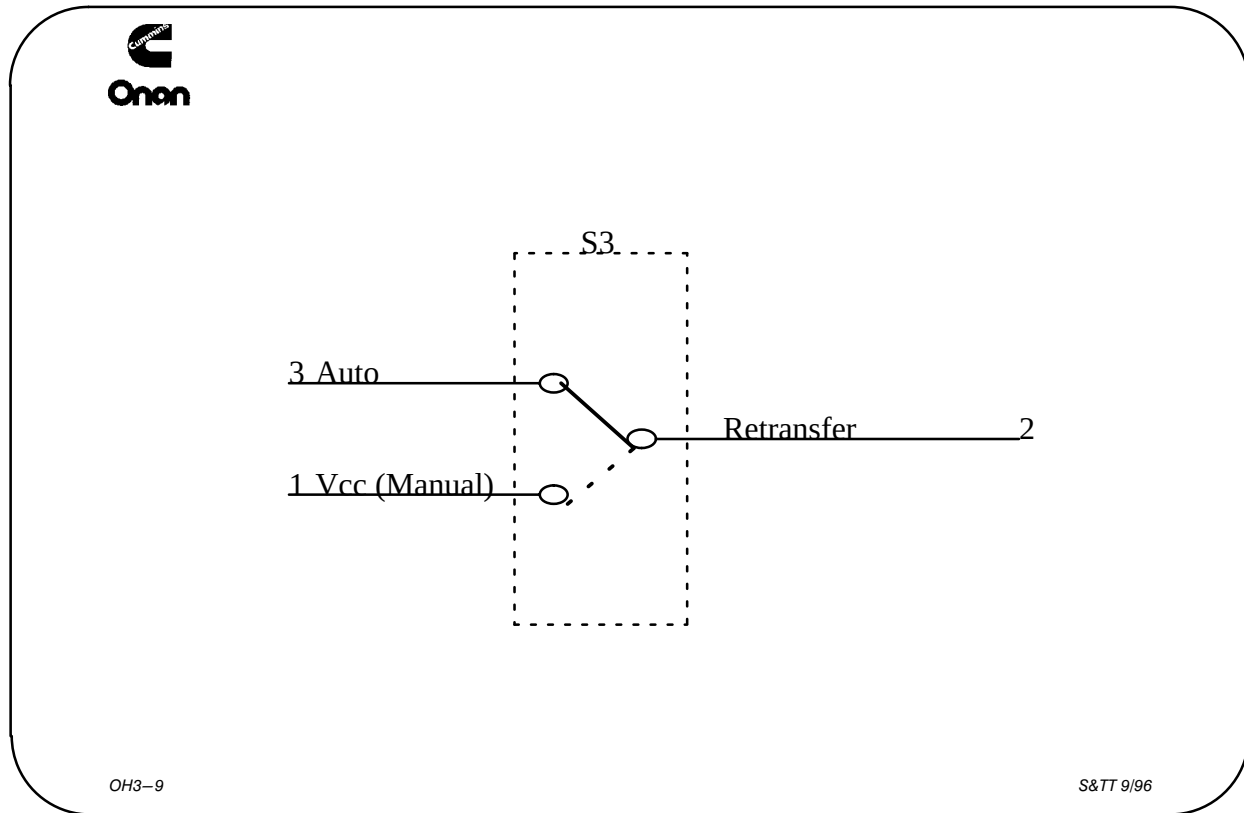
LTIII S1 – Single or Three Phase Sensing

2. S1 is a feature of Control Package B only.
3. Three phase sensing is available for the Normal Power source only.



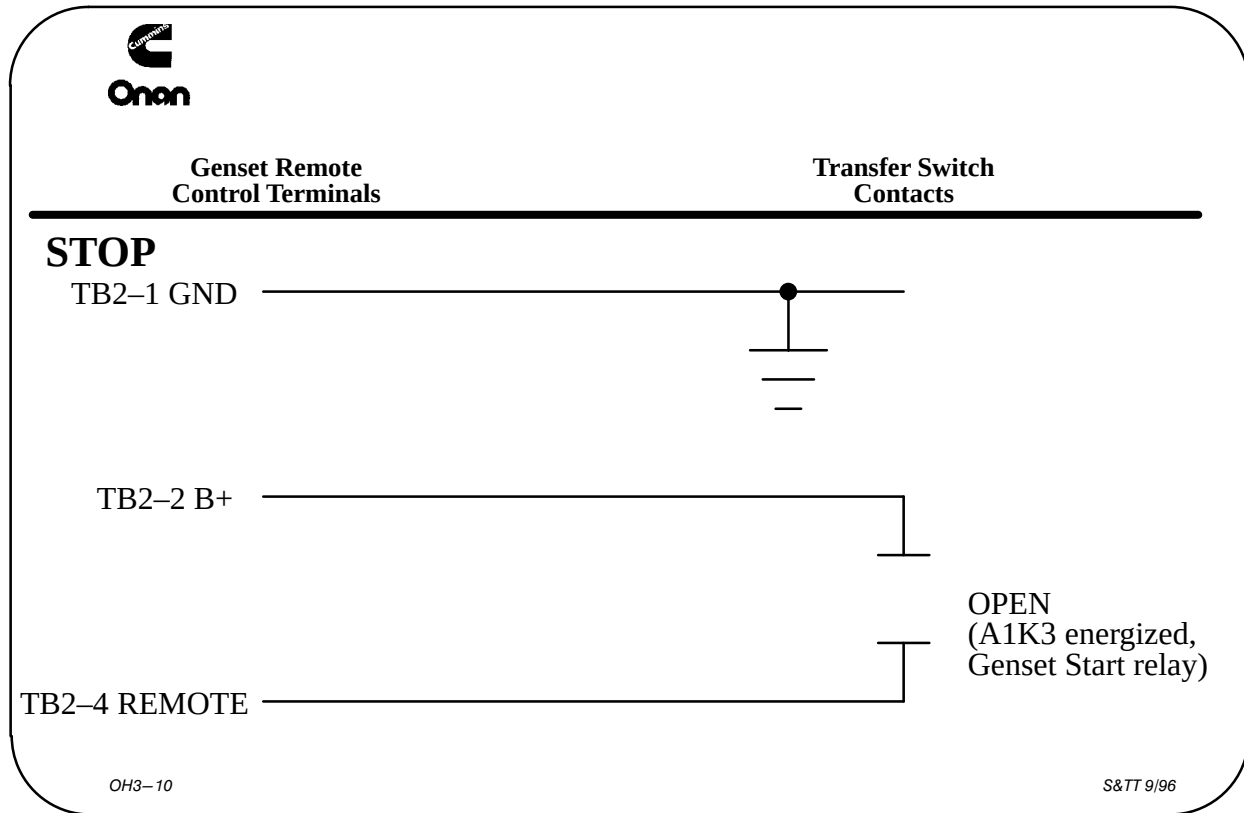
LTIII S2 – With or Without Load Test/Exercise

4. S1 is a feature of Control Packages A and B.
5. Switch in the Without Load position bypasses the Time Delay logic and applies a start signal directly to the Start_Genset logic. The electronic control senses that the Normal Source is available, therefore does not initiate a transfer sequence.
6. Switch in the With Load position simulates a power failure by creating an open phase detection signal. This open phase detection is applied to the voltage sensor. Open phase simulation allows transfer of load to take place. This test provides a full functional test on the start/stop circuit, the electronic control, and the contactor assembly.
7. Test or Exercise without load sequence of operation does not include timing to transfer, transfer active, timing to retransfer, or timing to stop. This test simply starts and stops the generator set.



LTIII S3 – Auto/Manual Retransfer

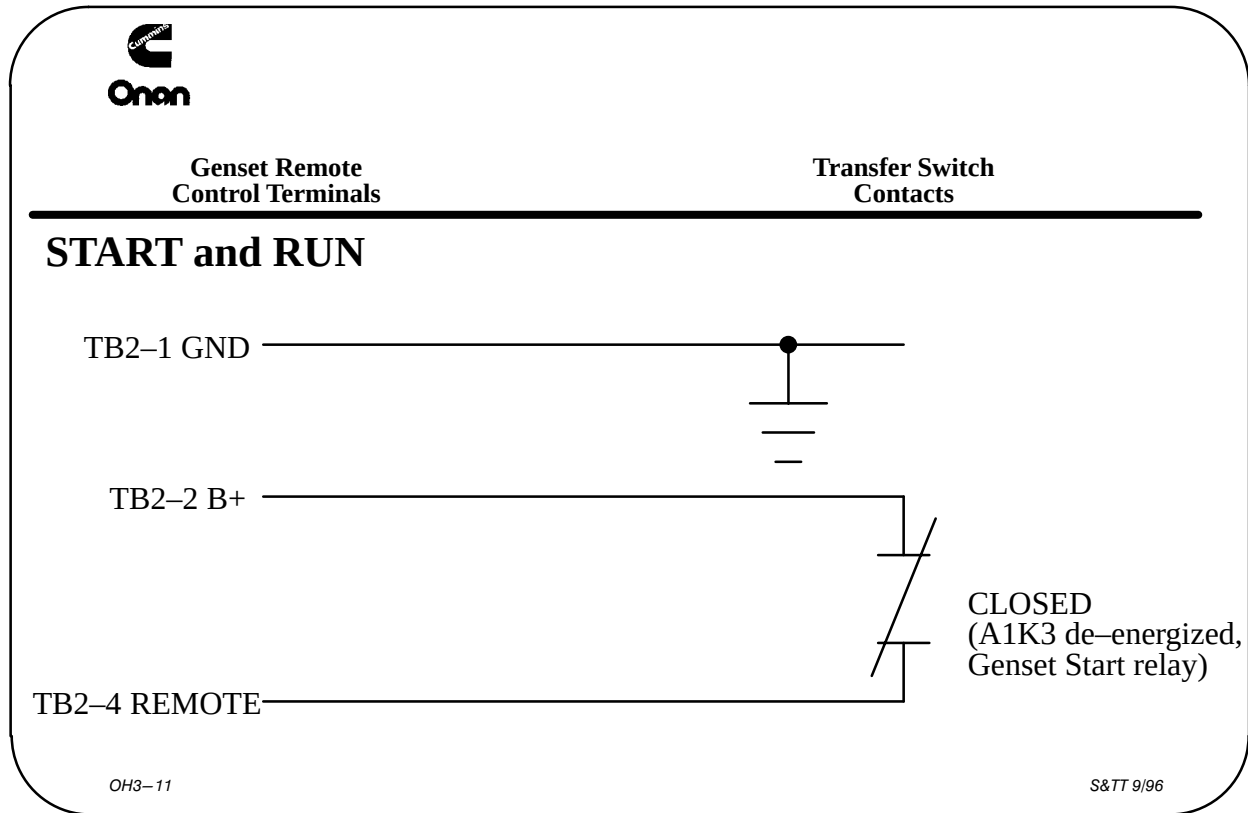
8. S3 is a feature of Control Package B only.
9. If S3 is in the Auto position, the control completes the retransfer timing sequence before initiating the retransfer of load from emergency to normal.
10. If S3 is in the Manual position, Vcc is applied to the retransfer circuit which disables the retransfer timing and in turn the retransfer activate signal. The load will not be retransferred to the normal source until S3 is returned to the Auto position or the Manual Override, if applicable, switch is turned to the Close Normal position.



S&TT1/95

Standard 2-Wire Start Circuit – Stop Sequence

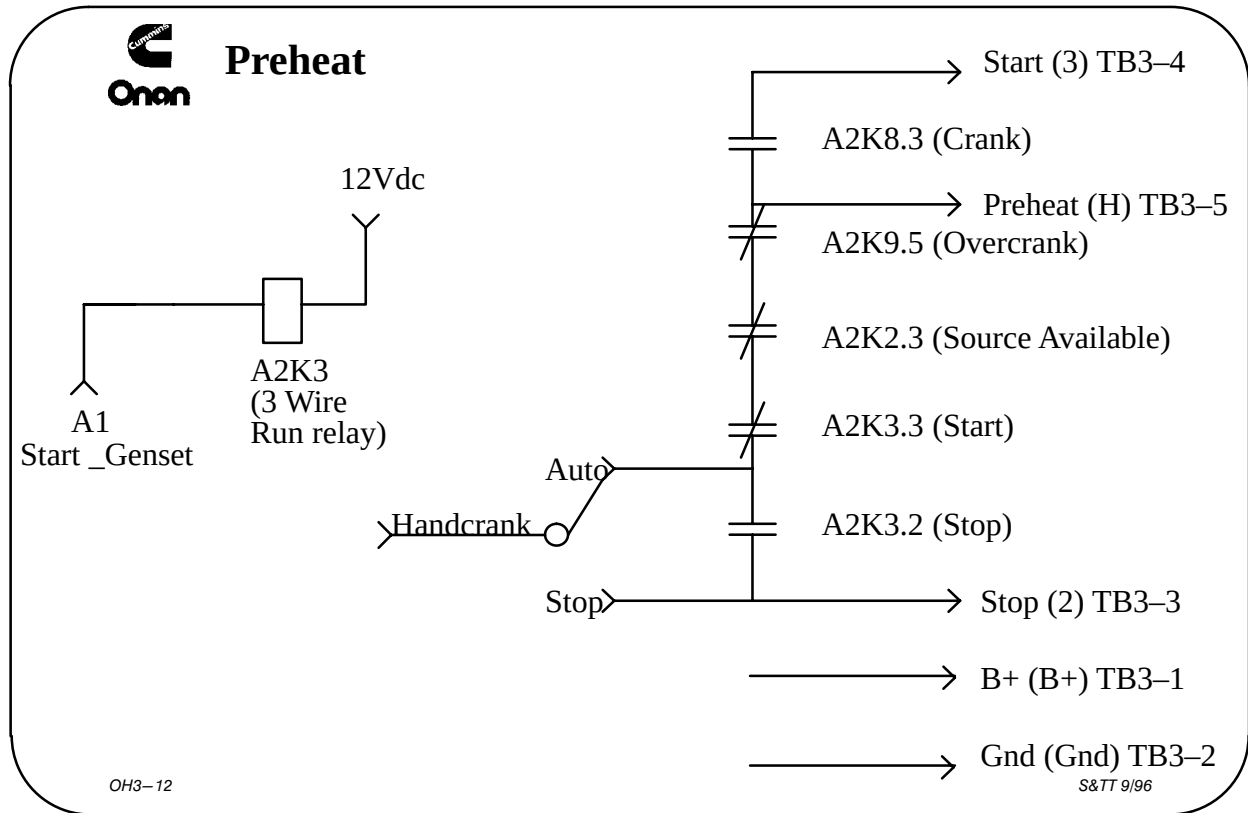
11. A1 – LTIII electronic control board.
12. K3 – board mount, genset start relay.
13. The 2-Wire start circuit consists of three wires – GND, B+ and RMT.
14. Opening the transfer switch contacts between B+ and RMT automatically shuts down the genset.



S&TT1/95

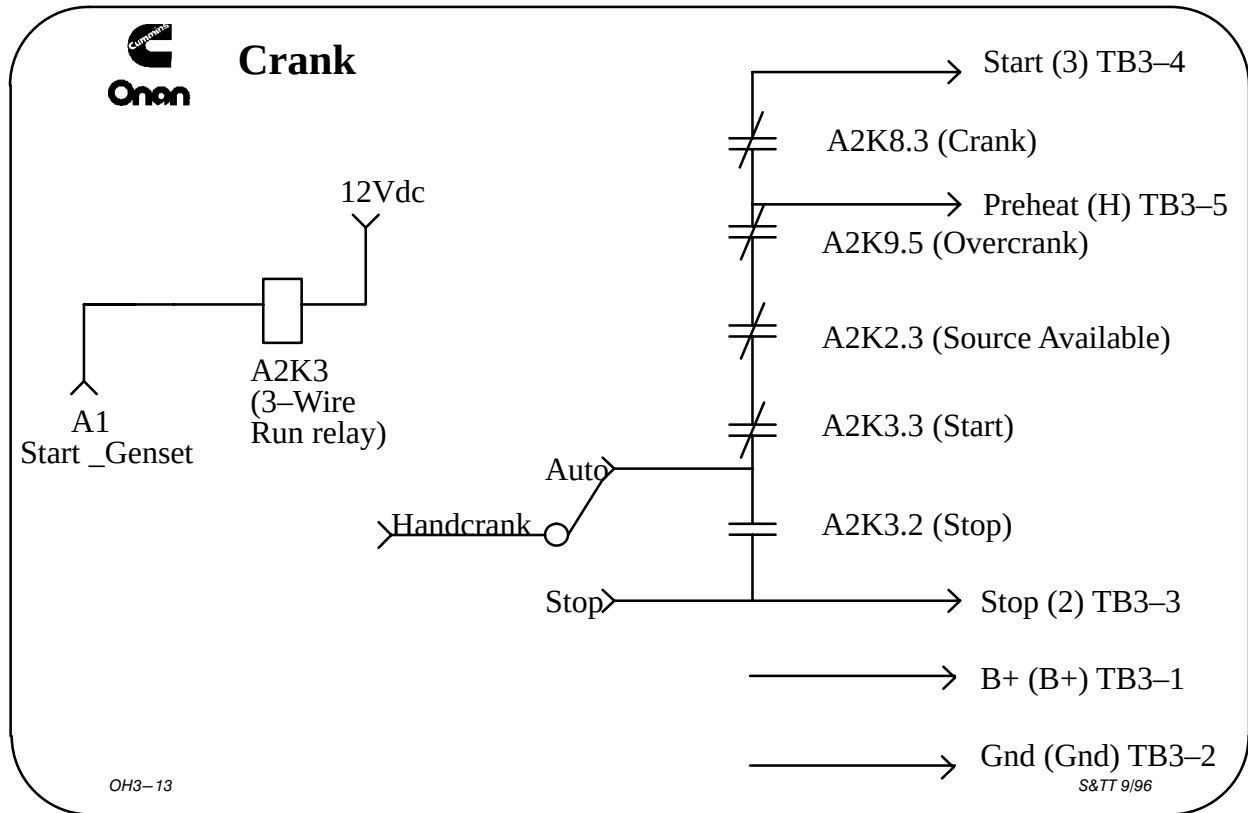
Standard 2-Wire Start Circuit – Start and Run Sequence

15. Closing contacts between B+ and RMT sends a start signal to the generator set.
16. Maintained contact closure is required for the generator set to continue to operate.



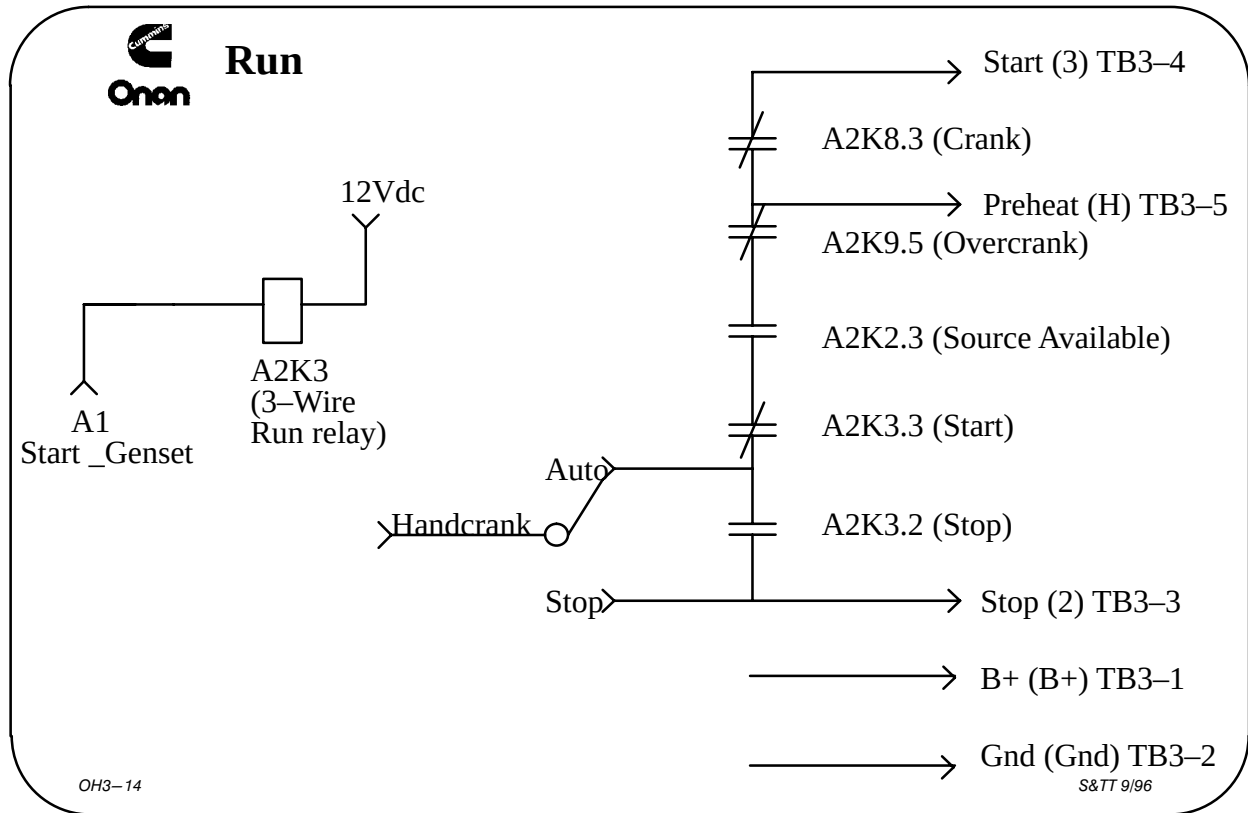
Standard 3-Wire Start Circuit – Preheat

17. Start_Genset output is applied to the 3-Wire start module de-energizing A2K3 genset start relay.
18. A2K3.3 normally closed contacts close and A2K3.2 normally open contacts open.
19. A2K2.3 (source available relay) normally closed contacts remain closed.
20. A2K9.5 (overcrank relay) normally closed contacts remain closed.
21. Preheat signal is applied the terminal H of the genset.



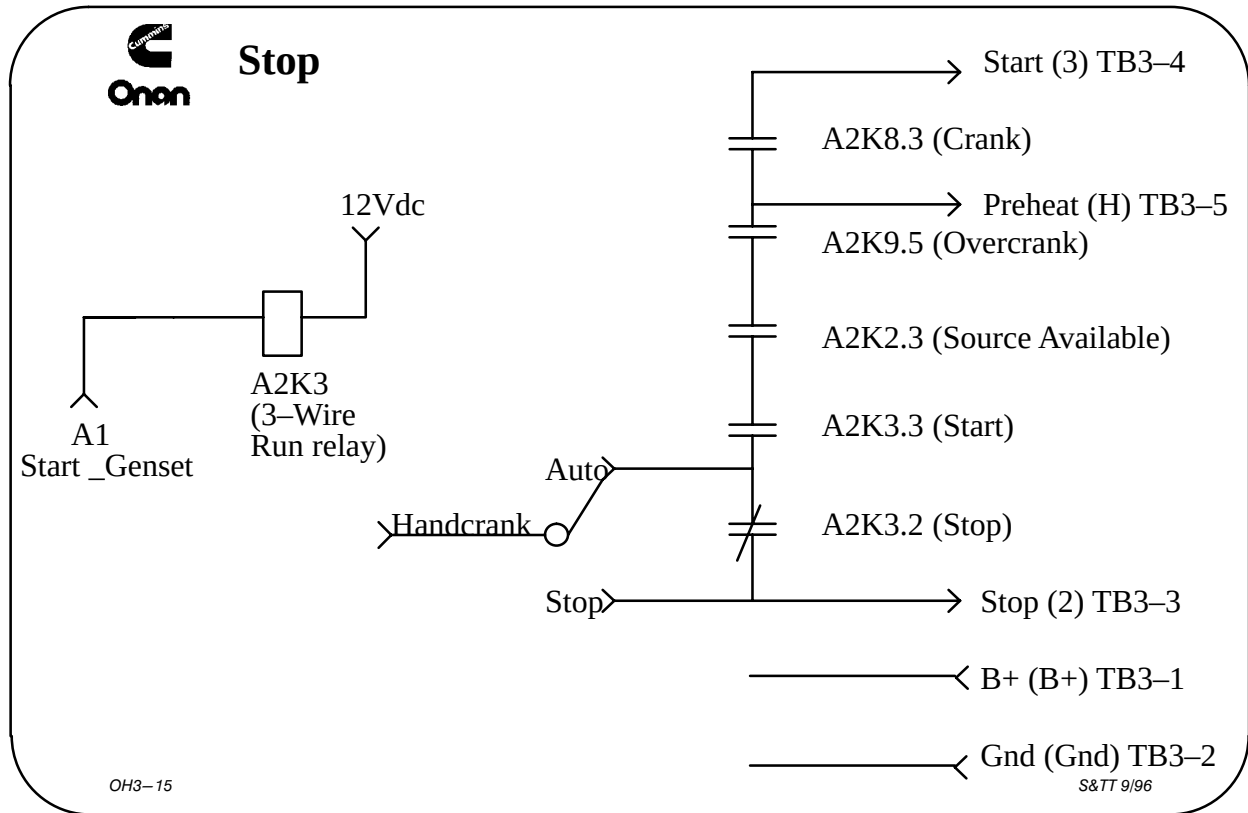
Standard 3-Wire Start Circuit – Crank

22. After preheat time delay is complete, A2K8 (crank relay) energizes.
23. A2K8.3 normally open contacts close and a start signal is applied to terminal 3 of the genset.
24. The genset cranks.



Standard 3-Wire Start Circuit – Run

25. Once the 3-wire start module senses that emergency source is available A2K2 (source available) relay energizes.
26. A2K2.3 normally closed contacts open. This removes power from the crank circuit.



Standard 3-Wire Start Circuit – Stop

27. After control receives a signal to stop, either from handcrank switch or A1 Start_Genset signal is removed, A2K3 relay energizes. The crank relay A2K8 resets.
28. A2K3.2 normally open contacts close and A2K3.3 normally closed contacts open.
29. Stop signal is applied to terminal 2 of the genset...the genset shuts down.

Activity: LTIII Electronic Control Operation Quiz

Take approximately five minutes to answer the following questions.

1. Normal Source, 3 phase sensing is available with Control Package ?

2. K1/K2 contacts inputs to the electronic control, which indicate Normal or Emergency connected, are... ?

3. The seven primary types of inputs to Control Package A are... ?

4. The six primary types of outputs from Control Package B are... ?

5. Which of the following indicators is "ON" during the Timing for Transfer delay?

_____ DS5 Stop
timing

_____ DS6 Transfer Timing

_____ DS7 Retransfer Timing

_____ DS8 Transfer

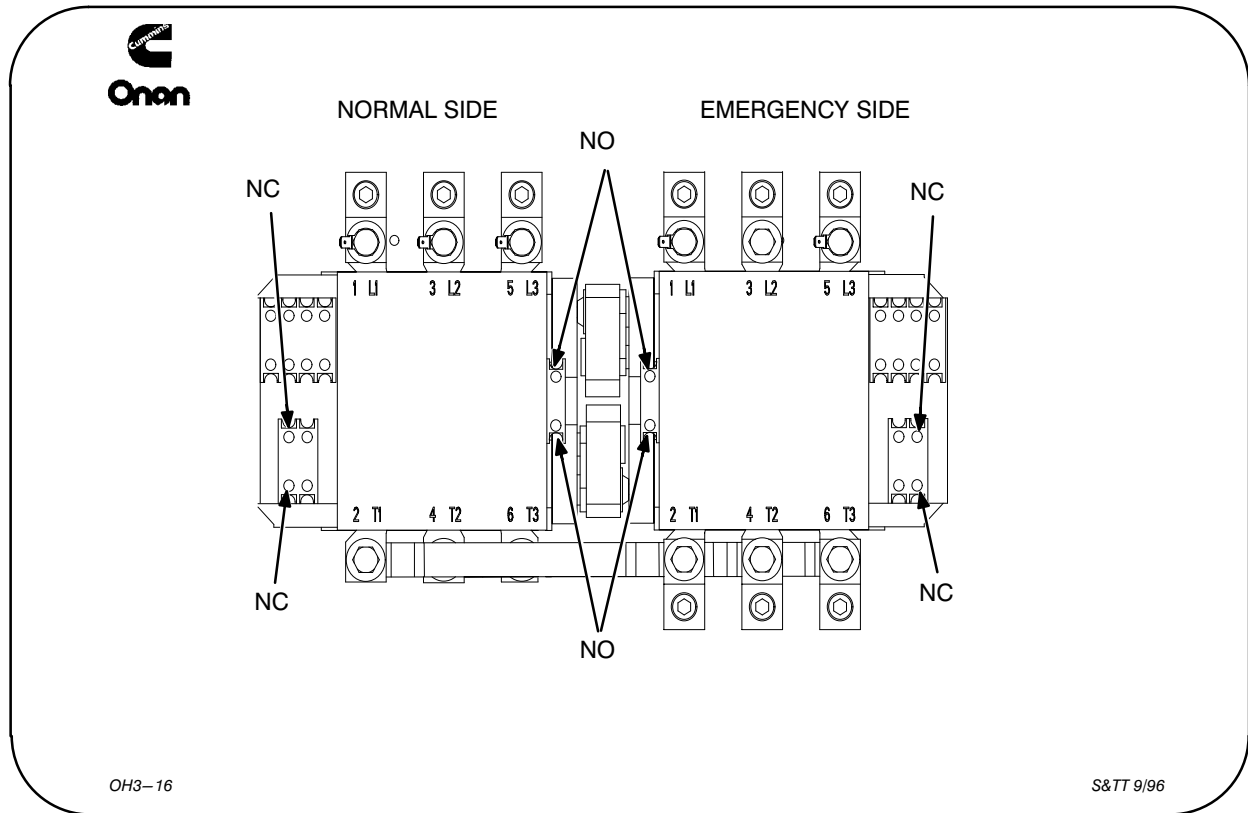
_____ DS9 Retransfer

_____ DS10 Normal Available

_____ DS11 Emergency Available

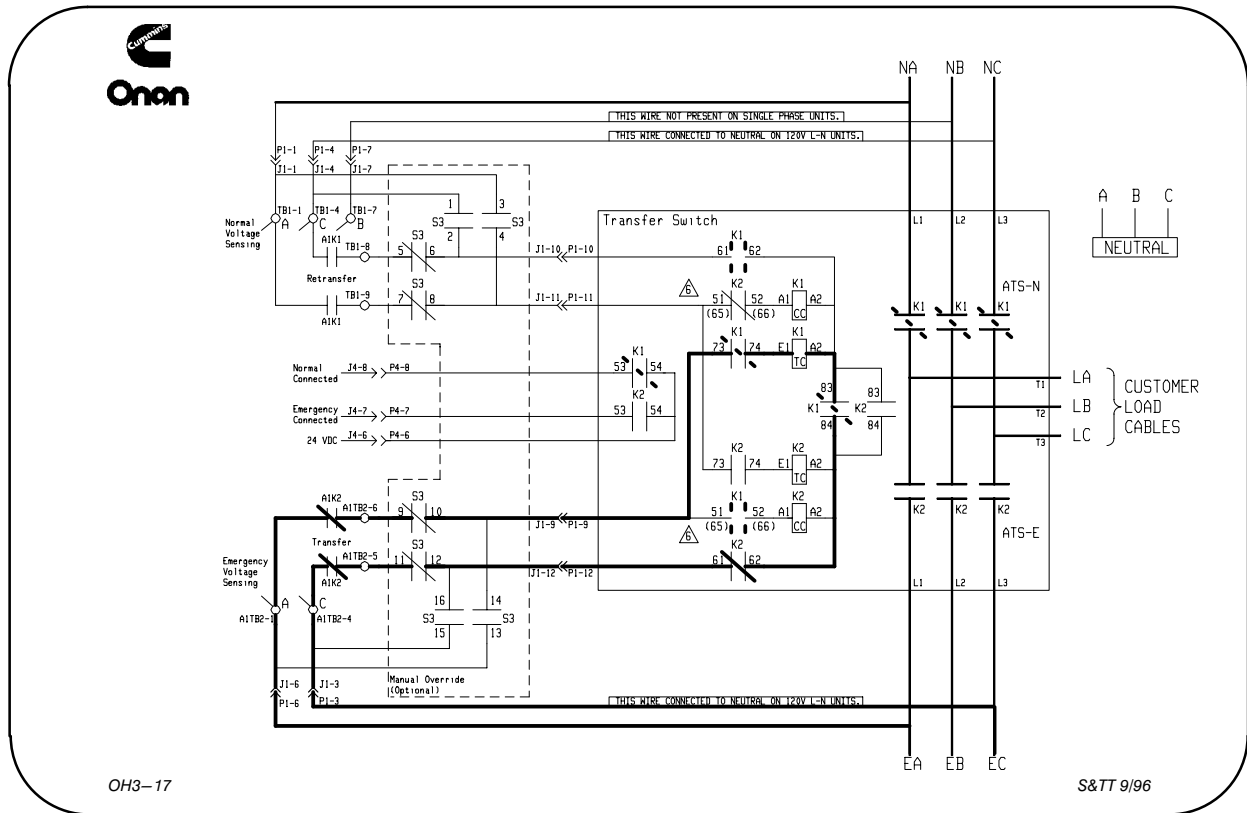
_____ DS12 Start

6. Which of the following indicators is "ON" during the Stop time delay after retransferring to the Normal Power Source ?
- _____ DS5 Stop Timing
- _____ DS6 Transfer Timing
- _____ DS7 Retransfer Timing
- _____ DS8 Transfer
- _____ DS9 Retransfer
- _____ DS10 Normal Available
- _____ DS11 Emergency Available
- _____ DS12 Start
7. During a Test 'Without' Load, which of the eight Control Indicators never turn on?
- _____
- _____
8. Relay A1K3 performs what function and is located where?
- _____
9. Relay A2K3 performs what function and is located where?
- _____
10. During the crank cycle of a 3-Wire start genset, which of the following contacts are closed?
- _____ A2K2.3
- _____ A2K3.2
- _____ A2K3.3
- _____ A2K8.3
- _____ A2K9.5



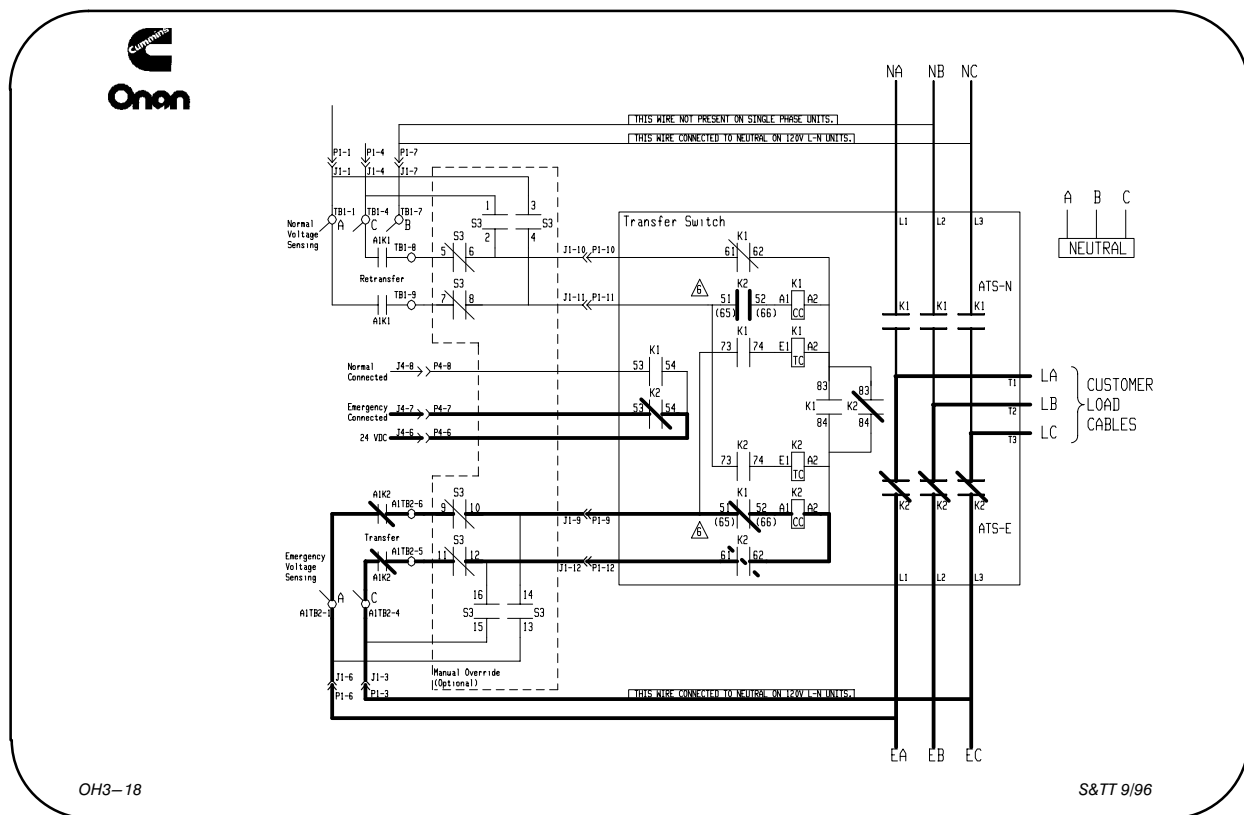
Contactor Operation

- 30 The automatic transfer switch contactors come in three pole configuration only.
- 31. Each contactor contains a closing coil and auxiliary contacts.
- 32. The assembly includes a mechanical interlock.
- 33. The normal source contactor has a mechanical latch for 30 and 60 amp frames. It has a permanent magnet latch for 100 through 260 amp frames. This is a standard feature.
- 34. As an option, the emergency source may include a mechanical latch for 30 and 60 amp frames or permanent magnet latch for 100 through 260 amp frames. **THIS IS OPTIONAL!**



LTIII Normal Trip Coil Energized (Normal Power Outage)

35. K1 contacts are pulled in and connected to the load.
36. Time delay start is complete and A1K3 genset start contacts are closed.
37. Genset starts and Emergency source is available. Transfer contacts A1K2 close.
38. Contacts S3 9 to 10 are closed in the auto mode completing the circuit to K1 contacts 73 to 74. K1 is still latched so K1 normally open contacts are still closed.
39. This completes the path to K1E1 trip coil.
40. Contacts S3 11 to 12 are closed in the auto mode completing the path to normally closed K2 contacts 61 to 62. K1 normally open contacts 83 to 84 are still closed. The circuit is complete to K1A2 trip coil
41. K1TC energizes and opens the K1 contacts.
42. K1 normally open contacts 53 to 54 are now open.
43. The load is not connected to either source.

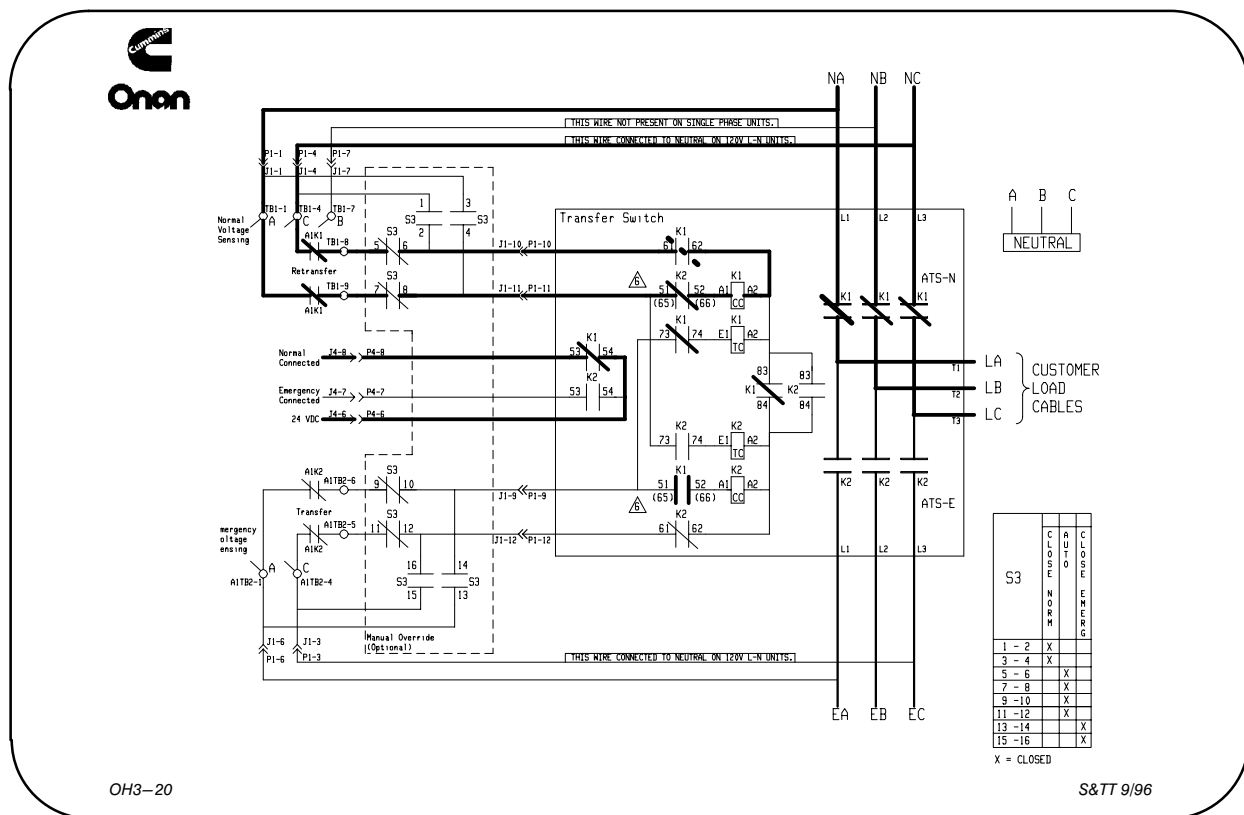


LTIII Emergency Closing Coil Energized (Emergency Connected)

44. A1K2 contacts are closed. S3 contacts 9 to 10 and 11 to 12 are closed.
45. K1 normally closed contacts 51 to 52 are closed completing the circuit to K2 A1 closing coil.
46. K2 normally closed contacts 61 to 62 are closed completing the circuit to K2A2 closing coil.
47. K2CC closing coil energizes pulling in the contacts.
48. Once K2 contacts are pulled in the K2 contacts 61 to 62 open removing power from the K2 closing coil.
49. K2 normally closed contacts 51 to 52 open preventing the inadvertent energization of the K1 closing coil. (electrical interlock)
50. K2 normally open contacts 53 to 54 close to provide indication to the electronic control that the K2 contacts are connected to the load.



51. K2 contacts are pulled in and connected to the load.
52. Normal source is available
53. Transfer contacts A1K1 close.
54. Contacts S3 7 to 8 are closed in the auto mode completing the circuit to K2 contacts 73 to 74. K2 is still latched so K2 normally open contacts are still closed.
55. This completes the path to K2E1 trip coil.
56. Contacts S3 5 to 6 are closed in the auto mode completing the path to normally closed K1 contacts 61 to 62. K2 normally open contacts 83 to 84 are still closed. The circuit is complete to K2A2 trip coil
57. K2TC energizes and opens the K2 contacts.
58. K2 normally open contacts 53 to 54 are now open.
59. The load is not connected to either source.



LTIII Normal Closing Coil Energized (Normal Connected)

60. A1K1 contacts are closed. S3 contacts 5 to 6 and 7 to 8 are closed.
61. K2 normally closed contacts 51 to 52 are closed completing the circuit to K1A1 closing coil.
62. K1 normally closed contacts 61 to 62 are closed completing the circuit to K1A2 closing coil.
63. K1CC closing coil energizes pulling in the contacts.
64. Once K1 contacts are pulled in, the K1 contacts 61 to 62 open removing power from the K1 closing coil. (cutout switch)
65. K1 normally closed contacts 51 to 52 open preventing the inadvertent energization of the K2 closing coil. (electrical interlock)
66. K1 normally open contacts 53 to 54 close to provide indication to the electronic control that the K1 contacts are connected to the load.

Activity: LTIII Contactor Operation Quiz

Take approximately five minutes to answer the following questions.

1. *The maximum voltage that can be measured on the electronic control board is ?*

2. *The maximum voltage on the electronic control is measured between ?*

3. *What single, most important thing must happen before the K2 closing coil is energized?*

4. *The S3 switch provides what feature?*

5. *K1 contacts 61 to 62, shown on drawing 626–2242 page 2 of 5, provide what type of protection?*

6. *K2 contacts 51 to 52, shown on drawing 626–2242 page 2 of 5, provide what type of protection?*

7. *K1 and K2 contacts 53 to 54 provide what feature?*

8. *If the K2 contactor is not mechanically or magnetically latched, what contacts are not included in the schematics shown on pages 3–21,22,23,24 of the Participant's Guide?*

9. *If the Emergency source is available and S3 contacts 13 to 14 and 15 to 16 are closed, what will happen to the load?*

