Troubleshooting and Repair of Liquid Detector
(Leak Detector Element and Liquid Level Element)

Tank Farm Maintenance Procedure

MAINTENANCE

USQ # GCX-2

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(Leak Detector Element and Liquid Level Element)

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for troubleshooting and repair for the majority of the problems encountered with leak detectors and Liquid Level Detectors in the 200 Areas.

1.2 Scope

This procedure involves the following types of troubleshooting and repairs to be made:

1.2.1 Troubleshooting of transfer and non-transfer leak detection system, including those that report to the Tank Farm Monitoring and Control System (TFMCS).

1.2.2 Troubleshooting and restart of TFMCS human machine interfaces (HMI).

1.2.3 Replacement of identical parts/equipment may be conducted within this procedure.

1.2.4 Before a component can be replaced, the Responsible Engineer must determine the safety classification and the suitability of a replacement component for the specific application. Additional commercial grade dedication (CDG/CGI) paperwork may be required prior to part installation.

1.2.5 All maintenance or repairs must be recorded on the Comment Page of the work package with appropriate Responsible Engineer for component verification.
1.2 Scope (Cont.)

1.2.6 This procedure does not cover more complex problems, other than items listed, which will require the craftsmen to refer to the appropriate H-2 or H-14 drawings and use logical troubleshooting techniques to make the necessary repairs.

- Induction Relays
- Variable Resistor
- Reset and Lamp test Buttons
- Rectifier
- Indicating Lamps/Strobe Light
- Transformers
- Potter & Brumfield Type Relays
- Interconnecting wires (when wire pulls are not required)
- Lugs and Terminal Strips
- B/W 5300 Intrinsically Safe Relay
- MTL Trip Amplifier
- Selector Switch
- Cleaning of connectors/terminals.
- Minor mechanical adjustments
- Push Button Switch
- Human Machine Interface (HMI).

2.0 INFORMATION

NONE
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 Follow DOE–0359, Hanford Site Electrical Safety Program for safe work practices. Troubleshooting on the Liquid Level Element and Liquid Detector Element systems may be performed with the systems energized. Voltages that are present range from 120V to 240V. The precautions for Work on or near Energized Parts found in, DOE-0359, Hanford Site Electrical Safety Program will be used, and an electrical energized work permit may be required. Use extreme caution.

3.1.2 Be aware of electrical hazards that may be caused by humid atmospheric conditions.

3.2 Radiation and Contamination Control

3.2.1 Work in radiological areas will be performed using a Radiological Work Permit following review by Radiological Control per the ALARA Work Planning procedure TFC-ESHQ-RP_RWP-C-03.
3.3 Limits

3.3.1 This procedure provides for Defense in Depth (DID) protection through maintaining transfer leak detection monitoring capabilities.

3.3.2 This troubleshooting procedure may be used as backup to Maintenance Procedure 3-LDD-042 and applicable Functional Test Procedures for Transfer Leak Detectors or it may be used at the direction of the Shift Manager on transfer and non-transfer leak detection components.

3.3.3 Troubleshooting may not be performed on a transfer leak detector while it is monitoring a waste transfer structure that is physically connected to an active waste transfer pump.

3.3.4 If wires are lifted or components replaced as part of this procedure, post installation testing must be performed prior to the leak detector being used to monitor transfer structures that are physically connected to an active waste transfer pump. Connectors that can only be re-connected in one configuration (due to tabs or special shapes) may be disconnected and re-connected without post installation testing.

3.3.5 TFMCS HMI being used to monitor leak detection equipment may not be re-started if a waste transfer or 242-A Evaporator campaign is in progress unless the Shift Manager has identified an alternate HMI is available for monitoring as shown on the TFMCS Network Status screens.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies are required to perform this procedure.
- Electrician's protective gloves and eye protection

The following supplies may be needed to perform this procedure.
- Adjustable power source (0-10 VDC)
- Volt Ohmmeter
- Use insulated test leads with approximately 2 watt 6-10 K ohms resistor.
- A parts kit that consists of an induction relay, variable resistor, reset button, rectifier, indicating lamps, transformer, Potter & Brumfield relay, B&W Intrinsically safe Relay, Lamp test Buttons and Selector Switch
- Other tools, equipment and supplies as identified by Shift Manager/OE/FWS/User.

4.2 Performance Documents

The following documents may be needed to perform this procedure:
- H-2-34965, Sheets 1 through 10 (Tripod Style and pre-TFMCS circuits)
- H-2-71092, Electrical Diagrams and Details
- H-14-100981 (Generic TFMCS Pit Leak Detector drawings)
- H-14-100982 (Generic TFMCS Encasement Leak Detector drawings)
- H-14-100983 (Generic TFMCS Leak Detector Station drawing)
- A-6003-876, Tank Operations Contractor Lifted/Landed Lead Record
- See Table 1 – Loop Diagram Drawings
- TFC-ENG-DESIGN-C-15, Commercial Grade Dedication
- ERA (Electrical Risk Assessment).

4.3 Field Preparation

4.3.1 PRIOR to working on leak detector listed on the work authorization,
NOTIFY Affected Operator where alarm is received, of the work to be performed.

4.3.2 PERFORM a contamination survey prior to breaking of system lines.

4.3.3 CONFIRM an ERA has been prepared that covers the troubleshooting activity.
5.0 PROCEDURE

NOTE - Sections 5.1 through 5.6 of this procedure may be worked in any logical order, or not at all.

- Sections 5.1 and 5.2 are set up in Activity levels that may be performed in any logical order to help determine resolution to the problem.

5.1 Troubleshoot and Repair Liquid Detector

NOTE - The steps in this section of the procedure will list basic parts and troubleshooting methods for determining resolution to repair malfunctioning leak detectors.

5.1.1 DON PPE per the ERA.

5.1.2 DISCONNECT probe leads from source.

5.1.3 CHECK continuity across leak detection probes.

5.1.3.1 IF continuity exists between probe leads, STOP WORK AND NOTIFY Shift Manager.

5.1.3.2 IF probe leads checked OK (no continuity), REPLACE probe leads removed in Step 5.1.2.
5.1 Troubleshoot and Repair Liquid Detector (Cont.)

Induction Relays Troubleshooting

5.1.4 TEST for incoming voltage at primary side of induction relay.

5.1.4.1 IF primary voltage is correct, GO TO Step 5.1.5.

5.1.4.2 IF primary voltage is incorrect, TROUBLESHOOT back to source.

5.1.5 TEST for voltage at secondary side of induction relay.

5.1.5.1 IF secondary voltage is correct, GO TO Step 5.1.6.

5.1.5.2 IF secondary voltage is incorrect, REPLACE relay.

5.1.6 VISUALLY INSPECT alignment and status of auxiliary contacts.

5.1.6.1 IF minor adjustments are required, MAKE adjustments, OR

REPLACE relay.

5.1.6.2 IF alignment and status of auxiliary contacts are correct, CONTINUE.

NOTE - In the alarm state, the contacts should change positions.

5.1.7 PLACE 6-10 K ohms test lead across probe terminals AND

OBSERVE results.

5.1.7.1 IF results are satisfactory, REMOVE test leads AND)

GO TO Step 5.1.8.


5.1.7.2 IF results are not satisfactory, PERFORM Step 5.1.5.

a. IF still not satisfactory, REPLACE Induction Relay.
5.1 Troubleshoot and Repair Liquid Detector (Cont.)

Variable Resistor Troubleshooting

5.1.8 REMOVE leads to variable resistor from appropriate terminals.

5.1.8.1 WITH Volt Ohmmeter, CHECK to see if there is approximately 0-10 K Ohms variance.

5.1.8.2 IF readings are satisfactory, REPLACE leads AND GO TO Step 5.1.9.


5.1.8.3 IF readings are not satisfactory, REPLACE 10 K Ohm variable resistor.

Reset Button Troubleshooting

5.1.9 PRESS Reset push button.

5.1.9.1 WITH Voltmeter, TEST for voltage on the line side of push button switch contact.

5.1.9.2 IF contact does not have voltage, TROUBLESHOOT back to source.

5.1.10 REMOVE meter lead from line side of contacts AND PLACE it on the other side of contacts. (There should be no voltage on that side.)

5.1.10.1 DE-ACTIVATE push button, voltage should appear.

5.1.10.2 IF improper test results occur for contacts, REPLACE the switch or contacts.


5.1.10.3 IF mechanical position of push button is damaged, REPLACE push button switch.
5.1 Troubleshoot and Repair Liquid Detector (Cont.)

Rectifier Troubleshooting

5.1.11 REMOVE rectifier from leak detector circuits.

5.1.12 WITH Volt Ohmmeter, TEST for proper polarity flow through rectifier.

5.1.12.1 IF rectifier is determined to be within specifications, PLACE it back into circuit.

NOTE - Rectifier Replacement Part Reference Drawing H-2-34965, Part #22, Single-Phase Bridge Rectifier, 400 VAC, 6 Amp, 120 VAC. International Rectifier Model Number KBPC604.

5.1.12.2 IF rectifier test is not within specifications, REPLACE with new rectifier.

NOTE - Voltage to the lamp will only be present in the alarm state.

5.1.13 IF lamp is not illuminated, CHECK for voltage to lamp.

5.1.14 IF there is no voltage, TROUBLESHOOT back to source.

NOTE - Indicating Lamps Replacement Parts:

- Reference Drawing H-2-34965, Part #18. Light - flat base surface mounting, clear lens, 12 VDC, Perkins Marine Lamp and Hardware Corp. Cat. Figure #371 with 12 VDC bulb #1004.


Indicating Lamps Troubleshooting

5.1.15 IF proper voltage is present to lamp, REPLACE lamp with the proper replacement.
5.1 Troubleshoot and Repair Liquid Detector (Cont.)

Transformer Troubleshooting

NOTE - Voltage will only be present in the alarm state.

5.1.16 TEST for primary voltage.

5.1.16.1 IF not correct, TROUBLESHOOT back to source.

NOTE - Voltage will only be present in the alarm state.

5.1.17 TEST for proper secondary voltage.


5.1.17.1 IF not correct, REPLACE transformer.

General Purpose Relays (Potter & Brumfield Type) LD2 Troubleshooting

NOTE - LD2 should test energized in the NORMAL (UNALARMED) state.

5.1.18 TEST for proper incoming voltage to relay coil.

5.1.18.1 ADJUST pot to approximately 110 VDC.

5.1.18.2 IF voltage is not correct, TROUBLESHOOT back to source.

5.1.18.3 PLACE leak detector into alarm using 10k ohm resistor to test.

5.1.18.4 CONFIRM that contacts on LD2 change positions.

5.1.18.5 WITH Volt Ohmmeter, TEST relay contacts opening and closing operation.


5.1.18.6 IF contacts do not operate properly, REPLACE relay.
5.1 Troubleshoot and Repair Liquid Detector (Cont.)

Interconnecting Wires and Terminal Strips Troubleshoot

NOTE - Replacement Parts:
- Reference Drawing H-2-34965, Part #15. Terminal block - 300V, 6 points, screw type both sides for #12 wire direct mounted.

5.1.19 USE visual inspection and Volt Ohmmeter reading to determine operability of wiring and terminal strips.

AY/AZ Fail Safe Low Level Alarm

5.1.20 MARK AND DISCONNECT the two probe leads from auxiliary terminal strip and terminal 14 on the SSR-1 relay. (See Figure 2)

5.1.21 MEASURE the resistance between the two probe leads lifted in Step 5.1.20.

5.1.21.1 IF resistance indicates an open circuit, NOTIFY the Shift Manager that liquid is below the low level probe which is the expected alarm condition.

5.1.21.2 IF the resistance measures 20k Ω s or less, REPLACE relay with a B/W 5200-HF2 high sensitivity relay.

5.1.22 CONFIRM the continuity of the probe lead removed from the auxiliary terminal strip goes to ground.

5.1.22.1 IF the probe lead removed from the auxiliary terminal strip is not grounded, TROUBLESHOOT the continuity of the wire out to the grounding location.
5.1 Troubleshoot and Repair Liquid Detector (Cont.)

**AY/AZ Fail Safe High Level Alarm**

5.1.23 **MARK AND DISCONNECT** the three probe leads from auxiliary terminal strip, terminal 14, and terminal 15 on the SSR-1 relay. (See Figure 3)

5.1.24 **MEASURE** the resistance between the two probe leads lifted from terminals 14 and 15.

5.1.24.1 **IF** resistance measurement does not indicate an open circuit, **NOTIFY** the Shift Manager of the presence of liquid at the high level alarm probe which is the expected alarm condition.

5.1.24.2 **IF** resistance measurement indicates an open circuit, **REPLACE** relay with a B/W 5200-HF2 high sensitivity relay.

5.1.25 **MEASURE** the resistance between the lead lifted from terminal 15 and the lead lifted from the auxiliary terminal strip.

5.1.25.1 **IF** measured resistance does not indicate continuity between the lead lifted from terminal 14 and the lead lifted from the auxiliary terminal strip, **TROUBLESHOOT** the leads out to the leak detection probe.

5.1.26 **CONFIRM** the continuity of the probe lead removed from terminal 15 goes to ground.

5.1.26.1 **IF** the probe lead removed from terminal 15 is not grounded, **TROUBLESHOOT** the continuity of the wire out to the grounding location.
Troubleshooting and Repair of Liquid Detector
(Leak Detector Element and Liquid Level Element)

5.2 Troubleshoot and Repair Intrinsically Safe Leak Detector

NOTE - The steps in this section of the procedure will list basic parts and troubleshooting methods for determining resolution to repair malfunctioning intrinsically safe leak detectors.

- Leak detectors installed by Project W-314 do not have a latching relay, RESET button, or a light transformer and some do not have an LD2 relay (see Table 1 for specific configuration drawings). The PLC/HMI software will keep the alarm locked in while it is active and clear it when it resets.

Leak Detector Relays B&W(LD1) and TRIP Amplifier MTL(LD3) Troubleshooting

5.2.1 DON PPE per the ERA.

5.2.2 Per the Loop Diagram shown in Table 1, DISCONNECT either the Amphenol type or Phoenix contact type connectors at the pit AND CONFIRM a leak detector FAIL alarm occurs.

5.2.2.1 IF the FAIL alarm does not occur, CONTINUE with Step 5.2.6.

5.2.3 INSTALL a set of simulated probes (See Figure 1) for the leak detector circuit to be tested AND CONFIRM the FAIL alarm clears.

5.2.3.1 IF the FAIL alarm does not clear, CONTINUE with Step 5.2.6.

5.2.4 Using a voltmeter, MEASURE the resistance between the probes going into the pit.

5.2.4.1 IF the meter shows an open connection, continue with Step 5.2.5.

5.2.4.2 IF the meter reading does not show an open connection, NOTIFY the Shift Manager of the presence of liquid in the pit and suggest the pit drain be opened while monitoring the resistance reading.
5.2 Troubleshoot and Repair Intrinsically Safe Leak Detector (Cont.)

5.2.5 SHORT the simulated probes together AND

CONFIRM a LEAK alarm occurs.

5.2.5.1 IF a LEAK alarm does not occur, CONTINUE with Step 5.2.6.

5.2.6 TEST for incoming voltage at the line side of the B&W or MTL relay.

5.2.6.1 IF incoming voltage at the line side of the B&W or MTL relay is within specifications, GO TO Step 5.2.7.

NOTE - For troubleshooting the AP-Farm Leak Detectors or at a Co-Located Panel, the Multi-Pole Selector Switch must be in the position for detector system to be tested.

5.2.6.2 IF primary voltage is incorrect, TROUBLESHOOT back to source.

5.2.7 TEST probe voltage (9-11 VDC) at points 1 and 4 on the MTL relay with test switch in the "OPERATE" position.

5.2.7.1 IF probe voltage (9-11 VDC) at points 1 and 4 on the MTL is within specifications, TURN switch to "FAIL" position AND

CONFIRM (0 VDC) probe voltage.

5.2.7.2 WITH RESET button pressed, TURN switch to "PROBE TEST" position AND

CONFIRM that voltage has dropped (approximately 4-5 VDC) with the potentiometer on the B&W relay set at 0 (if potentiometer is present).

5.2.7.3 IF testing is on an AP-Farm Leak Detector or a Co-Located Panel and voltage did not drop in Step 5.2.7.2, TEST Multi-Pole Selector Switch for continuity.
5.2 Troubleshoot and Repair Intrinsically Safe Leak Detector (Cont.)

NOTE - B&W and MTL Relay Replacement Parts:
- Reference Drawing H-2-34965, Part #38. Intrinsically Safe Control Relay, 120 VAC Primary coil, with double throw contacts. B/W Controls Model 5300-S-FI-OC or 5300-S-V-OC.
- Reference Drawing H-2-34965, Part #42. Trip Amplifier, General Purpose Intrinsically Safe Output, Single Alarm, Dual Form C Output Contacts with SNC2 Surface Mounting Clip. MTL Incorporated Model # MTL2313A.

5.2.7.4 CHECK test resistor is within tolerance and securely wired.

5.2.7.5 IF any of the above tests did not give the desired result or if the voltages measured varied, REPLACE test switch/contact block(s).

Reset and Beacon push test Buttons Troubleshooting

5.2.8 PERFORM the following steps to troubleshoot for either button.

5.2.8.1 PRESS push button, then with Voltmeter, TEST line side of push button contact for voltage.

5.2.8.2 IF contact does not have voltage, TROUBLESHOOT back to source.

NOTE - There should be no voltage on that side for the Reset button and there should be voltage for the Beacon Button.

5.2.8.3 REMOVE meter lead from line side of contacts AND

PLACE it on the other side of the contacts

5.2.8.4 DE-ACTIVATE push button. (Voltage should appear at this time for RESET TEST and no voltage for BEACON TEST.)
5.2  Troubleshoot and Repair Intrinsically Safe Leak Detector (Cont.)

NOTE -  Reset and Beacon Push Button Replacement Parts:
- Reference Drawing H-2-34965, Part #43. Reset Push button, with contact block, 600 VAC, 10 Amp, 1 N.C. General Electric or Square D. Model Numbers G.E. CR104PBG01B1 or Square D class 9001, type KR2B with type KA1G contact block.

5.2.8.5  IF improper test results occur for contacts, REPLACE the switch or contacts.

5.2.8.6  IF mechanical position of push button is damaged, REPLACE push button switch.
5.2 Troubleshoot and Repair Intrinsically Safe Leak Detector (Cont.)

Indicating Lamps Troubleshooting

5.2.9 IF lamp is not strobing or lit, CHECK for voltage to lamp. (Voltage will only be present in the alarm state)

5.2.9.1 IF there is no voltage, TROUBLESHOOT back to source.

NOTE - Indicating Lamps Replacement Parts:
- Reference Drawing H-14-100983, Sht. 1, Item #5, Strobe Light, Clear 120V Operation, Edwards, Model #94DV2C-N5.

5.2.9.2 IF proper voltage is present to lamp, REPLACE lamp with the proper replacement.

Transformer Troubleshooting

NOTE - Voltage will only be present in the alarm state.

5.2.10 TEST for primary voltage.

5.2.10.1 IF primary voltage is not within specifications, TROUBLESHOOT back to source.

NOTE - Voltage will only be present in the alarm state

5.2.11 TEST for proper secondary voltage.

NOTE - Transformer Replacement Part Reference Drawing H-2-34965, Part #21. Transformer - signaling, primary voltage 120V-60 Hz, secondary 12 V. (See * note) Graybar Cat. #998 Edwards Model #592/596.

5.2.11.1 IF secondary voltage is not within specifications, REPLACE transformer.
5.2 Troubleshoot and Repair Intrinsically Safe Leak Detector (Cont.)

General Purpose Relays (Potter & Brumfield Type) LD2 Troubleshooting

NOTE - LD2 should test energized in Step 5.2.12.

5.2.12 TEST for proper incoming voltage to relay coil.

5.2.12.1 IF incoming voltage to relay coil is not within specifications, TROUBLESHOOT back to source.

NOTE - For troubleshooting the AP-Farm Leak Detectors, the Multi-Pole Selector Switch must be in the position for detector system to be tested.

5.2.13 PLACE leak detector selector switch in fail position to test that contacts on LD2 change positions with Volt Ohmmeter.

5.2.13.1 TEST relay contacts open and closed as relay coil de-energizes.

NOTE - General Purpose Relays (Potter & Brumfield Type) LD2 Replacement Part Reference Drawing H-2-34965, Part #41. Relay general purpose, Potter & Brumfield Model Number KRPA-14AG-120V.

5.2.13.2 IF contacts do not operate properly, REPLACE relay.

Interconnecting Wires and Terminal Strips Troubleshoot

NOTE - Replacement Parts:

5.2.14 USE visual inspection and Volt Ohmmeter reading to determine operability of wiring and terminal strips.
5.2 Troubleshoot and Repair Intrinsically Safe Leak Detector (Cont.)

**Leak Detector Test Relays MTL (LD4) and (LD5) Troubleshooting**

5.2.15 IF testing at the co-located panel, **USE** the selector switch to select the leak detector to be tested.

5.2.16 IF performing a remote test, **LEAVE** the selector switch in the OPERATE position.

**NOTE** - The local PROBE TEST / FAIL switch activates the remote testing relays (LD4 and LD5) in all farms except AP FARM. In AP FARM, there is a separate resistor for the remote test function and the local test switch. See Table 1 for Loop Diagram drawings.

5.2.17 **CHECK** the 160 mA fuse located under the cover on the front of the MTL 2215 relay to verify continuity across the fuse.

5.2.17.1 IF the fuse is bad, **REPLACE** the fuse.

**NOTE** - For AP FARM, only the remote test will actuate LD4 or LD5.

5.2.18 **SELECT** PROBE TEST or FAIL TEST for the leak detector to be tested, **OR**

**PERFORM** the remote Component Verification test per the approved functional test procedure.

5.2.19 **VERIFY** a 24 VDC signal is received at points 15 and 16 on the MTL 2215 relay.

5.2.19.1 IF the signal is not received, **CHECK** the selector switch contacts if performing a local test or use the Loop Diagram from Table 1 to test back to the source.

5.2.19.2 IF assistance with software troubleshooting is required, **CONTACT** the Software Engineer.
5.2 Troubleshoot and Repair Intrinsically Safe Leak Detector (Cont.)

5.2.20 IF the 24 VDC signal is present, CONFIRM the light on the front of the MTL 2215 relay comes on.

5.2.20.1 IF the relay light does not come, REPLACE the MTL 2215 relay.

5.2.20.2 IF the 24 VDC signal is present and the light changes state, CONFIRM the output contacts change state when the signal is received.

a. IF the output contacts do not change state, REPLACE the MTL 2215 relay.

Power Supply Troubleshooting

NOTE - Power supply for leak detection circuits are located in the programmable logic controller (PLC) cabinets. See the Loop Diagram list in Table 1 for the appropriate enclosure and terminal strip number.

5.2.21 CHECK primary voltage is 114 VAC to 126 VAC.

5.2.22 IF primary voltage is not within specifications, TROUBLESHOOT back to source.

5.2.23 CHECK secondary voltage is 24 VDC.


5.2.24 IF secondary voltage is not within specifications, REPLACE power supply.
5.3 Adjustment of Trip Amplifier (LD3)

5.3.1 DON PPE per the ERA.

5.3.2 SET relay LD3 by disconnecting the LD1 probe output voltage to LD3 (terminals 1, 4 on LD3).

5.3.3 CONNECT (+) lead from DC power supply to terminal 1, and (-) lead to terminal 4.

5.3.4 ADJUST DC power supply to 1.5 volts.

5.3.5 CONNECT ohm meter to terminals 10 and 11.

NOTE - For the most accurate setting, adjustments should not be started with contacts open between terminals 10 and 11, or with LED off.

5.3.6 ADJUST the alarm set screw so contacts between terminals 10 and 11 are closed and LED is ON.

5.3.7 SLOWLY ADJUST alarm set screw clockwise AND STOP the instant ohm meter shows contacts are open between terminals 10 and 11 and LED is OFF.

5.3.8 DISCONNECT ohm meter from terminals 10 and 11.

5.3.9 DISCONNECT DC power supply leads from terminals 1 and 4.

5.3.10 RECONNECT the LD1 probe to terminals 1 and 4 (on LD3).
5.4 Troubleshooting With Pit Leak Detector In Alarm

5.4.1 DISCONNECT the Amphenol connector located on top of the pit for the leak detector to be tested.

NOTE - B and D (or 2 and 4) may also be used in the following step.

5.4.2 MEASURE the resistance between connector points A and C (or 1 and 3) on the side where the wires going down into the pit.

5.4.3 FOR any reading other than an OPEN circuit, NOTIFY Shift Manager that liquid may be in the pit and recommend the pit drain be opened.

5.4.3.1 WHEN pit drain is opened, MONITOR resistance, which should increase as liquid drains out of the pit.

5.4.3.2 IF resistance does not indicate an open circuit, TIGHTEN all connections and look for areas of degradation around connectors.

   a. IF resistance still does not indicate an open circuit, CONTACT Engineering for assistance.

5.4.4 ONCE pit drain is closed, RE-CONNECT Amphenol connectors AND CHECK leak detector alarm has cleared.
5.5 Troubleshoot TFMCS ABB System Status

5.5.1 FROM the top taskbar, SELECT the System Status Viewer icon (for icon name, place mouse over icon).

5.5.2 CHECK all icons are GREEN.

5.5.2.1 IF icons are YELLOW (indicating the system is running in a degraded condition without backup capability) and the degraded condition has an unknown cause, CONTACT Engineering for support.

5.5.2.2 IF icons are RED (indicating the system and its backup have failed) and the degraded condition has an unknown cause, CONTACT Engineering for support.

Check Farm System Status

5.5.3 FROM the TFMCS Overview Screen, SELECT the Farm to investigate.

5.5.4 SELECT the “System Status” button in the upper right taskbar.

5.5.5 CHECK all icons are GREEN.

5.5.5.1 IF icons are YELLOW (indicating the system is running in a degraded condition without backup capability) and the degraded condition has an unknown cause, CONTACT Engineering for support.

5.5.5.2 IF icons are RED (indicating the system and its backup have failed) and the degraded condition has an unknown cause, CONTACT Engineering for support.

Check Network Status

5.5.6 FROM the bottom taskbar, SELECT the RNRP icon (for icon name, place mouse over icon).

5.5.7 CHECK the primary and secondary network connection is active to all components by observing the status for each controller, server, or HMI (If working properly it will show “up, up”).
5.5 Troubleshoot TFMCS ABB System Status (Cont.)

5.5.8 IF one of the “up” indications is missing, the primary (left up) or secondary (right up) connection has been lost indicating a degraded condition AND IF the cause is not known, CONTACT Engineering for support.

5.5.8.1 USE the H-14-042660 drawing set to assist in troubleshooting system for proper operation.

Reset Human Machine Interface

5.5.9 PRIOR to performing Steps 5.5.10 through 5.5.13 on an ABB Server, CONFIRM Engineering support is available.

5.5.10 FROM the Windows START menu, SELECT “Restart”,

OR

IF “Restart” is not available, PUSH power button on front of HMI computer until HMI shuts down.

5.5.11 PUSH power button again until HMI begins to restart.

5.5.12 LOGIN at Windows login screen using password provided by Shift Manager or Administrator.

5.5.13 IF Windows login screen does not appear, CONTACT Engineering for support.
5.6 Rosemount 702 Troubleshooting

5.6.1 IF Wireless Leak Detectors are not detecting a leak do the following:

5.6.1.1 IF battery voltage is indicating 6.8V or less, REPLACE 702 battery

5.6.1.2 CHECK 702 transmitter 4 wiring (Red, Green, Yellow, Black)

5.6.1.3 OPEN enclosure case AND

CHECK for disconnected or damage wires between enclosure and probes.

5.6.1.4 CHECK if circuit is OPEN

5.6.1.5 INSPECT probe by retracting probe and doing a visual inspection of probes.

5.6.1.6 CHECK continuity between each probe.
5.7 Restoration

5.7.1 REMOVE all test equipment AND

RESTORE equipment to original configuration.

5.7.2 PERFORM functional test per applicable data sheet(s).

5.8 Acceptance Criteria

Acceptance Criteria has been met when steps in this procedure have been satisfactorily performed and As-Left values meet the specifications and tolerance(s) per the Data Sheet.

5.9 Review

5.9.1 NOTIFY affected operator, testing is complete.

5.9.2 FWS REVIEW AND CHECK the following:

- Completed Data Sheets meet the acceptance criteria.
- Comments sections are filled out appropriately.
- Work requests needed as a result of this procedure are identified and generated.
- Work request number(s) of any work documents generated as a result of this procedure, are recorded in the Comments/Remarks section of the Data Sheet, as applicable.

NOTE - The Responsible Engineer signature signifies the Responsible Engineer is aware that the dedication for the subject item has been satisfactorily completed, that the dedication package is complete, and that related procedural requirements were met.

- Step 5.9.3 is only required when the COMMERCIAL GRADE ITEM UPGRADE DEDICATION (CGI) is used per TFC-ENG-DESIGN-C-15. General service parts may be replaced without a CGI upgrade.

5.9.3 CONFIRM Responsible Engineer has reviewed and signed the completed COMMERCIAL GRADE ITEM UPGRADE DEDICATION (CGI) form.

5.10 Records

The performance of this procedure generates no records. However PMIDs associated with the procedure, identified for the activity, are record material and are maintained in the work package as record material.

The identified record custodian is responsible for record management in accordance with TFC-BSM-IRM_DC-C-02 or other applicable requirements.
# Troubleshooting and Repair of Liquid Detector
(Leak Detector Element and Liquid Level Element)

## Table 1 – Loop Diagram Drawings

<table>
<thead>
<tr>
<th>EIN</th>
<th>DRAWING NUMBER</th>
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### Table 1 – Loop Diagram Drawings (Cont.)

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# Troubleshooting and Repair of Liquid Detector (Leak Detector Element and Liquid Level Element)

## Table 1 – Loop Diagram Drawings (Cont.)

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Troubleshooting and Repair of Liquid Detector (Leak Detector Element and Liquid Level Element)

Figure 1 - Leak Detector Test Connectors

Top of Pit Test Connectors

Two wire loops with the insulation removed from the center.
1. Connect A to B with one wire loop.
2. Connect C to D with other wire loop.

NOTE - Configuration shown above is used to investigate on top of the pit near electrode holder.
- Use Male part number to simulate probes in the pit and to simulate a leak back to the PLC. To simulate a leak, touch bare center of two wire loops together.
- Use Female part number to check resistance between the two wire loops. A low resistance would be an indication of liquid in the pit between the probes.

Edge of Pit Coverblock Test Connectors

Two wire loops with the insulation removed from the center.
1. Connect 1 to 2 with one wire loop.
2. Connect 3 to 4 with other wire loop.

NOTE - Configuration shown above is used to investigate at edge of pit coverblock.
- Use Male part number to simulate probes in the pit and to simulate a leak back to the PLC. To simulate a leak, touch bare center of two wire loops together.
- Use Female part number to check resistance between the two wire loops. A low resistance would be an indication of liquid in the pit between the probes.
Low Level Alarm Circuit

1. Low level in tank.
2. Open control circuit.
3. Relay failure.
4. Test push button operation.

Figure 2 – AY/AZ Fail Safe Low Level Alarm Circuit
Troubleshooting and Repair of Liquid Detector
(Leak Detector Element and Liquid Level Element)

Figure 3 – AY/AZ Fail Safe High Level Alarm Circuit

High Level Alarm Circuit

Auxiliary Terminal Strip

120 VAC, 60 Hz in

SSR-1

SSR-1 Inside Enclosure

To remote alarms

Door to Enclosure

High Level Alarm

Alarm will sound for:
1. High level in tank.
2. Open control circuit.
3. Relay failure.
4. Test push button operation.

High Level Alarm Circuit