

Summary Report for Individual Task
551-88L-3068
Troubleshoot a Refrigeration Unit
Status: Approved

Distribution Restriction: Approved for public release; distribution is unlimited.

Destruction Notice: None

Foreign Disclosure: FD5 - This product/publication has been reviewed by the product developers in coordination with the [installation/activity name] foreign disclosure authority. This product is releasable to students from all requesting foreign countries without restrictions.

Condition: Given a refrigeration unit aboard a vessel, at sea, at anchor or moored alongside a pier, day or night, under all sea and weather conditions, while wearing appropriate PPE, (i.e. hearing protection, Nitrile gloves, eye protection, etc.), a lock out tag out kit, Refrigeration Tool Kit and a marine rail tool box.

Standard: The Soldier correctly conducted troubleshooting procedures pertaining to a refrigeration unit aboard an Army vessel, IAW the appropriate Technical Manual and local SOPs, without injury to self or others and without damage to equipment.

Special Condition: None

Safety Risk: Medium

MOPP 4:

Task Statements

Cue: None

DANGER
None

WARNING
None

CAUTION
None

Remarks: None

Notes: None

Performance Steps

1. Demonstrate troubleshooting procedures for a reach-in refrigeration unit with a hermetic compressor.

a. Compressor will not start – no hum.

(1) Possible causes.

(a) Line disconnect switch open.

(b) Fuse removed or blown.

(c) Overload protector tripped.

(d) Control stuck in open position.

(e) Wiring improper or loose.

(2) Actions to take.

(a) Close start or disconnect switch.

(b) Replace fuse.

(c) Refer to electrical diagram.

(d) Check wiring against diagram.

b. Compressor will not start – hums.

(1) Possible causes.

(a) Improperly wired.

(b) Low voltage to unit.

(c) Starting capacitor defective.

(d) Relay failing to close.

(e) Compressor motor has winding open or shorted.

(f) Internal mechanical trouble in compressor.

(2) Actions to take.

(a) Check wiring against diagram.

(b) Determine reason and correct.

(c) Test capacitor, replace if necessary.

(d) Determine reason and correct, replace if necessary.

(e) Replace compressor.

(f) Replace compressor.

c. Compressor will not start – hums but trips on overload protector.

(1) Possible causes.

(a) Improperly wired.

(b) Low voltage to unit.

(c) Relay failing to open.

(d) Run capacitor defective.

(e) Excessively high discharge pressure.

(f) Compressor motor has a winding open or shorted.

(g) Internal mechanical trouble in compressor (tight).

(2) Actions to take.

(a) Check wiring against diagram.

(b) Determine reason and correct.

(c) Determine reason and correct, replace if necessary.

(d) Test capacitor, replace if necessary.

(e) Check discharge shutoff, possible overcharge or insufficient cooling on condenser.

(f) Replace compressor.

(g) Replace compressor.

d. Compressor starts and runs, but short cycles on overload protector.

(1) Possible causes.

(a) Additional current through overload protector.

(b) Low voltage to unit.

(c) Overload protector defective.

(d) Run capacitor defective.

- (e) Excessive discharge pressure.
- (f) Suction pressure too high.
- (g) Compressor too hot – return gas hot.
- (h) Compressor motor has a winding shorted.

(2) Actions to take.

- (a) Check wiring diagram, check for added fan motors, pumps, etc., connected to wrong side of protector.
- (b) Determine reason and correct.
- (c) Check current, replace protector.
- (d) Test capacitor, replace if necessary.
- (e) Check for restrictions in cooling medium or refrigeration system.
- (f) Check for possibility of misapplication. Use stronger unit.
- (g) Check refrigerant charge (fix leak), add if necessary.
- (h) Replace compressor.

e. Unit runs OK, but short cycles.

(1) Possible causes.

- (a) Overload protector.
- (b) Thermostat.
- (c) High pressure cut-out due to;

1 Insufficient air.

2 Overcharge.

3 Air in system.

- (d) Low pressure cut-out due to;

1 Undercharge.

2 Restriction in expansion device.

(2) Actions to take.

- (a) Refer to paragraph 1.d.
- (b) Differential set to close – widen differential setting.
- (c) High pressure cut-out;

1 Check air to condenser.

2 Reduce refrigerant charge.

3 Purge air from system.

- (d) Low pressure cut-out;

1 Find and fix leak, add refrigerant.

2 Replace cut-out device.

f. Unit operates long or continuously.

(1) Possible causes.

- (a) Shortage of refrigerant.
- (b) Control contacts stuck or frozen closed.
- (c) Refrigerated space has excessive load or poor insulation.
- (d) System inadequate to handle load.
- (e) Evaporator coil iced.
- (f) Restriction in refrigeration system.
- (g) Dirty condenser.

(2) Actions to take.

- (a) Find and fix leak, add refrigerant.
- (b) Clean contacts or replace control.
- (c) Determine fault and correct.
- (d) Replace with larger system.
- (e) Defrost coil, ensure air flow to coil is not restricted.
- (f) Determine location and remove.
- (g) Clean condenser.

g. Start capacitor open, shorted, or blown.

(1) Possible causes.

(a) Relay contacts not operating properly.

(b) Prolonged operation on start cycle due to;

1 Low voltage to unit.

2 Improper relay.

3 Starting load too high.

(c) Excessive short cycling.

(d) Improper capacitor.

(2) Actions to take.

(a) Check and replace.

(b) Prolonged start cycle operation;

1 Determine reason and correct.

2 Replace.

3 Correct by using pup down arrangement if necessary.

(c) Determine reason for short cycling (refer to paragraph 1.e.) and correct.

(d) Determine correct size and replace.

h. Relay defective or burned out.

(1) Possible causes.

(a) Incorrect relay.

(b) Incorrect mounting angle.

(c) Line voltage too high or too low.

(d) Excessive short cycling.

(e) Relay being influenced by loose vibrating mounting.

(f) Incorrect run capacitor.

(2) Actions to take.

- (a) Check and replace.
- (b) Remount relay in correct position.
- (c) Determine reason and correct.
- (d) Determine reason (refer to paragraph 1.e.) and correct.
- (e) Remount rigidly.
- (f) Replace with proper capacitor.

i. Space temperature too high.

(1) Possible causes.

- (a) Control setting too high.
- (b) Inadequate air circulation.
- (c) Expansion valve too small.
- (d) Evaporator coils dirty.

(2) Actions to take.

- (a) Reset control.
- (b) Improve air movement.
- (c) Use larger valve.
- (d) Clean evaporator coils.

j. Suction line frosted or sweating.

(1) Possible causes.

- (a) Expansion valve passing excess refrigerant or is oversized.
- (b) Expansion valve stuck open.
- (c) Evaporator fan not running.
- (d) Overcharge of refrigerant.

(2) Actions to take.

- (a) Readjust valve or replace with small valve.

(b) Clean valve of foreign particles, replace if necessary.

(c) Determine reason and correct.

(d) Correct charge.

k. Liquid line frosted or sweating.

(1) Possible causes.

(a) Restriction in dehydrator or strainer.

(b) Liquid shut-off (king valve) partially closed.

(2) Actions to take.

(a) Replace dehydrator or strainer.

(b) Open valve fully.

l. Unit noisy.

(1) Possible causes.

(a) Loose parts or mounting.

(b) Tubing rattle.

(c) Bent fan blade causing vibration.

(d) Fan motor bearings worn.

(2) Actions to take.

(a) Find and tighten.

(b) Reform to be free of contact.

(c) Replace blade or fan.

(d) Replace motor.

2. Demonstrate troubleshooting procedures for a walk-in refrigeration unit with an external drive compressor.

a. Compressor will not start.

(1) Possible causes.

(a) No power to motor.

(b) Control circuit is open.

(2) Actions to take.

(a) No power;

1 Check power to and from fuses; replace fuses if necessary.

2 Check starter contacts, connections, overloads and timer. Reset or replace as necessary.

3 Check power at motor terminals.

4 Repair wiring if damaged.

(b) Open control circuit;

1 Safety switches are holding circuit open. Check high pressure, oil pressure, and low pressure switches. Also check oil filter pressure differential switch if supplied.

2 Thermostat is satisfied.

3 Check control circuit fuses if blown, replace.

4 Check wiring for open circuit.

b. Motor “hums” but does not start.

(1) Possible causes.

(a) Low voltage to motor.

(b) Motor shorted.

(c) Compressor is seized due to damage or liquid.

(2) Actions to take.

(a) Check incoming power for correct voltage.

(b) Check at motor terminals. Repair or replace as necessary.

(c) Remove belts or coupling. Manually turn crankshaft to check compressor.

c. Compressor starts, but motor cycles off on overloads.

(1) Possible causes.

(a) Compressor has liquid or oil in cylinders.

(b) Suction pressure is too high.

(c) Bearings are “tight”.

(2) Actions to take.

(a) Check compressor crankcase temperature.

(b) Unload compressor when starting. Use internal unloaders if present.

(c) Check motor and compressor bearings for temperature. Lubricate motor bearings.

d. Compressor starts but short cycles automatically.

(1) Possible causes.

(a) Low refrigerant charge.

(b) Driers plugged or saturated with moisture.

(c) Refrigerant feed control is defective.

(d) No load.

(e) Suction strainer blocked or restricted.

(2) Actions to take.

(a) Check and add if necessary.

(b) Replace cores.

(c) Repair or replace.

(d) To prevent short cycling, if objectionable, install pump-down circuit, anti-recycle timer or false load system.

(e) Check and clean or replace as necessary.

e. Motor is noisy or erratic.

(1) Possible causes.

(a) Motor bearing failure or winding failure.

(b) If electronic starter check calibration on control elements.

(2) Actions to take.

(a) Check and repair as needed.

(b) Adjust as necessary.

f. Compressor runs continuously but does not keep up with the load.

(1) Possible causes.

- (a) Load is too high.
- (b) Refrigerant metering device is underfeeding, causing the compressor to run at too low a suction pressure.
- (c) Faulty control circuit, may be low pressure control or capacity controls.
- (d) Compressor may have broken valve plates.
- (e) Thermostat control is defective and keeps unit running.
- (f) Defrost system on evaporator not working properly.
- (g) Suction strainer dirty and restricting gas flow.
- (h) Hot gas bypass or false load valve stuck (if equipped).

(2) Actions to take.

- (a) Decrease load.
- (b) Check and repair liquid feed problems.
- (c) Check and repair.
- (d) Check compressor for condition of parts. This condition can usually be detected by checking compressor discharge temperature.
- (e) Check temperatures of product or space and compare with thermostat control. Replace or readjust thermostat.
- (f) Check and repair as needed.
- (g) Clean or replace.
- (h) Check and repair or replace.

g. Noisy compressor operation.

(1) Possible causes.

- (a) Loose flywheel or coupling.
- (b) Coupling not properly aligned.
- (c) Loose belts.
- (d) Poor foundation or mounting.
- (e) Check compressor with stethoscope if noise is internal.

(f) Check for liquid or oil slugging.

(2) Actions to take.

(a) Tighten set screws.

(b) Check and align if required.

(c) Align and tighten per specs. Check sheeve grooves.

(d) Tighten mounting bolts.

(e) Replace compressor.

(f) Eliminate liquid from suction mains, check crankcase oil level.

h. Low evaporator capacity

(1) Possible causes.

(a) Inadequate refrigerant feed to evaporators.

(b) Expansion valve bulb in a trap.

(c) Oil in evaporator.

(d) Evaporator surface fouled.

(e) Air or product velocity is too low.

(2) Actions to take.

(a) Inadequate refrigerant feed;

1 Clean strainers and driers.

2 Check expansion valve superheat setting.

3 Check expansion valve size.

(b) Change piping or bulb location to correct.

(c) Warm the evaporator, drain oil, and install an oil trap to collect oil.

(d) Clean.

(e) Increase to rated velocity, coils not properly defrosting, check defrost time, check method of defrost.

i. Discharge pressure too high.

(1) Possible causes.

- (a) Air or noncondensibles in condenser.
- (b) Condenser tubes fouled.
- (c) Water flow inadequate.
- (d) Air flow is restricted.
- (e) Liquid refrigerant backed up in condenser.

(2) Actions to take.

- (a) Purge noncondensibles.
- (b) Clean condenser tubes.
- (c) Inadequate water flow;
 - _1_ Check water supply pump.
 - _2_ Check water regulating valve.
 - _3_ Check water temperature.
- (d) Check and clean coils.
- (e) Liquid refrigerant backup;
 - _1_ Find source of restriction and clear.
 - _2_ If system is overcharged, remove refrigerant as required.
 - _3_ Check to make sure equalizer/vent line (if equipped) is properly installed and sized.

j. Discharge pressure too low.

(1) Possible causes.

- (a) Water quantity not being regulated properly through condenser.
- (b) Refrigerant level low.
- (c) Evaporator/condenser fan and water switches are improperly set.

(2) Actions to take.

- (a) Flush, readjust or replace water regulating valve.
- (b) Add refrigerant if necessary.

(c) Reset condenser controls.

k. Suction pressure too low.

(1) Possible causes.

(a) Light load condition.

(b) Refrigerant level low.

(c) Evaporators not getting enough refrigerant.

(d) Refrigerant metering controls are set too low.

(2) Actions to take.

(a) Shut off some compressors if equipped with more than one.

(b) Add refrigerant if necessary.

(c) Not enough refrigerant to evaporators.

1 Discharge pressure too low. Increase to maintain adequate refrigerant flow.

2 Check liquid feed lines for adequate refrigerant supply.

3 Check for clogged liquid line driers, replace if necessary.

(d) Check superheat or liquid level and correct as indicated.

l. Suction pressure too high.

(1) Possible causes.

(a) Low compressor capacity.

(b) Evaporator full of liquid refrigerant.

(2) Actions to take.

(a) Low compressor capacity;

1 Check compressor for possible internal damage.

2 Check system load.

3 Start more compressors if equipped with more than one.

(b) Check superheat or liquid level and correct as indicated.

(Asterisks indicates a leader performance step.)

Evaluation Guidance: None

Evaluation Preparation: None

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Demonstrated troubleshooting procedures for a reach-in refrigeration unit with a hermetic compressor.			
a. Compressor will not start – no hum.			
b. Compressor will not start – hums.			
c. Compressor will not start – hums but trips on overload protector.			
d. Compressor starts and runs, but short cycles on overload protector.			
e. Unit runs OK, but short cycles.			
f. Unit operates long or continuously.			
g. Start capacitor open, shorted, or blown.			
h. Relay defective or burned out.			
i. Space temperature too high.			
j. Suction line frosted or sweating.			
k. Liquid line frosted or sweating.			
l. Unit noisy.			
2. Demonstrated troubleshooting procedures for a walk-in refrigeration unit with an external drive compressor.			
a. Compressor will not start.			
b. Motor “hums” but does not start.			
c. Compressor starts, but motor cycles off on overloads.			
d. Compressor starts but short cycles automatically.			
e. Motor is noisy or erratic.			
f. Compressor runs continuously but does not keep up with the load.			
g. Noisy compressor operation.			
h. Low evaporator capacity.			
i. Discharge pressure too high.			
j. Discharge pressure too low.			
k. Suction pressure too low.			
l. Suction pressure too high.			

Supporting Reference(s):

Step Number	Reference ID	Reference Name	Required	Primary
	TM 55-1905-223-24-17	UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR ENVIRONMENTAL CONTROL SUBSYSTEM FOR LANDING CRAFT UTILITY (LCU) (NSN 1905-01-154-1191) (REPRINTED W/BASIC IN	No	No
	TM 55-1915-208-24&P	UNIT INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR ENVIRONMENTAL CONTROL SYSTEM P/N LM2-WC30-65, 39BA-050, 42CG, 42VF,	No	No
	TM 55-1915-218-24&P	UNIT INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR SHIP STORES REFRIGERATION P/N 3RK1-030TAD, HAC-034, 6LP2-95E, LMR (No	No
	TM 55-1915-254-10-1	OPERATOR'S MANUAL FOR LOGISTICS SUPPORT VESSEL (LSV-7 & -8)	No	No
	TM 55-1915-254-10-2	OPERATOR'S MANUAL FOR LOGISTICS SUPPORT VESSEL (LSV-7 & -8)	No	No
	TM 55-1925-224-24&P	UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR ENVIRONMENTAL CONTROL SUBSYSTEM FOR LARGE TUG (LT) (NSN 1925-01-24	No	No
	TM 55-1925-231-24&P	UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR REFRIGERATION MACHINERY FOR LARGE TUG (LT) (NSN 1925-01-247-7110) (T	No	No

Environment: Environmental protection is not just the law but the right thing to do. It is a continual process and starts with deliberate planning. Always be alert to ways to protect our environment during training and missions. In doing so, you will contribute to the sustainment of our training resources while protecting people and the environment from harmful effects. Refer to FM 3-34.5 Environmental Considerations and GTA 05-08-002 ENVIRONMENTAL-RELATED RISK ASSESSMENT.

Safety: In a training environment, leaders must perform a risk assessment in accordance with ATP 5-19, Risk Management. Leaders will complete the current Deliberate Risk Assessment Worksheet in accordance with the TRADOC Safety Officer during the planning and completion of each task and sub-task by assessing mission, enemy, terrain and weather, troops and support available-time available and civil considerations, (METT-TC). Note: During MOPP training, leaders must ensure personnel are monitored for potential heat injury. Local policies and procedures must be followed during times of increased heat category in order to avoid heat related injury. Consider the MOPP work/rest cycles and water replacement guidelines IAW FM 3-11.4, Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection, FM 3-11.5, Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination.

Prerequisite Individual Tasks : None

Supporting Individual Tasks :

Task Number	Title	Proponent	Status
551-88L-2061	Maintain a Refrigeration Unit	551 - Transportation (Individual)	Approved

Supported Individual Tasks :

Task Number	Title	Proponent	Status
551-88L-2061	Maintain a Refrigeration Unit	551 - Transportation (Individual)	Approved
551-881-8084	Conduct Field Maintenance on a Refrigeration System	551 - Transportation (Individual)	Approved

Supported Collective Tasks : None

ICTL Data :

ICTL Title	Personnel Type	MOS Data
88L30 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL3, Duty Pos: TFR, LIC: EN
88L40 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL4, Duty Pos: TGB, LIC: EN, SQI: O