

Summary Report for Individual Task
551-88L-3066
Troubleshoot an Air Conditioning System
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 an air conditioning system 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.), with a lock out tag out kit and a marine rail tool box.

Standard: The Soldier correctly conducted troubleshooting procedures pertaining to an air conditioning system 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 abnormal operating pressures/temperatures.

a. High head pressure.

(1) Possible causes.

(a) No water flow to condenser:

1 Water pump not running.

2 Water regulating valve stuck closed or defective.

3 Hand valve closed.

(b) Condenser water inlet temperature too high.

(c) Insufficient water flow through condenser.

1 Obstruction in sea chest, water supply line, dirty strainer or closed valve.

2 Low water supply pressure pump.

3 Water regulating valve set to open at too high head pressure.

(d) Condenser tubes clogged or water baffles corroded.

(e) Refrigerant overcharge, condenser tubes submerged in liquid refrigerant.

(f) Compressor discharge stop valve partially closed.

(g) Air or non-condensable gas in system.

(2) Actions to take.

(a) Check water flow to condenser.

1 Start pump.

2 Replace valve.

3 Open all valves.

(b) Check to see if water intake is near hot water discharge.

(c) Check water flow through condenser.

1 Remove obstruction, clean strainer or open valve.

2 Prime pump, repair or replace.

3 Adjust valve.

- (d) Clean tubes.
- (e) Remove excess refrigerant.
- (f) Open valve fully.
- (g) Purge system.

b. Low head pressure.

(1) Possible causes.

- (a) Condenser water inlet temperature too low.
- (b) Liquid refrigerant flooding back from evaporator.
- (c) Liquid refrigerant flooding back from evaporator.
- (d) Compressor suction stop valve partially closed.
- (e) Leaky compressor discharge valve.
- (f) Leaky compressor suction valve.
- (g) Worn piston rings.
- (h) Wrong refrigerant added to the system.

(2) Actions to take.

- (a) Reduce water flow by adjusting water regulating valve.
- (b) Adjust water regulating valve.
- (c) Examine fastening of thermal bulb or defective expansion valve.
- (d) Open valve fully.
- (e) Test for leaks. Replace valve plate.
- (f) Test for leaks. Replace valve plate.
- (g) Replace compressor.
- (h) Make certain R-22 only was added, if not:

1 Recover system charge.

2 Evacuate system.

3 Recharge with R-22.

c. High suction pressure.

(1) Possible causes.

- (a) Over feeding of expansion valve.
- (b) Leaky compressor suction valves.
- (c) Capacity control system unloading at too high suction pressure.
- (d) Clogged screen strainer in compressor suction manifold.

(2) Actions to take.

- (a) Check installation of expansion valve bulb, if valve is stuck open replace valve.
- (b) Replace valve plate.
- (c) Adjust capacity control valve to begin unloading at a lower control point.
- (d) Remove and clean strainer.

d. Low suction pressure.

(1) Possible causes.

- (a) Insufficient refrigerant.
- (b) Excessive expansion valve restriction.
- (c) Restricted liquid line or compressor suction strainer.
- (d) Improper operation of solenoid valve.
- (e) Capacity control set to unload at too low suction pressure.

(2) Actions to take.

- (a) Add refrigerant.
- (b) Replace expansion valve.
- (c) Isolate drier or strainer, remove and clean or replace.
- (d) Check power supply to valve.

1 Examine coil for burnt spots.

2 Check thermostat setting.

3 Repair or replace valve.

(e) Adjust capacity control valve to unload at a higher suction pressure.

e. Compressor crankcase cold (sweating or frosting).

(1) Possible causes.

(a) Liquid refrigerant returning to compressor.

(b) Refrigerant overcharge.

(c) Defective expansion valve.

(d) Insufficient chilled water flow through chiller barrel pump.

(e) Sludge build up in chiller.

(f) Too much oil in circulation.

(g) Operating thermostat set to low.

(2) Actions to take.

(a) Stop liquid refrigerant flooding.

(b) Remove excess refrigerant.

(c) Check bulb, replace valve.

(d) Check system fill tank, purge air from system, repair or replace pump.

(e) Drain chiller barrel and flush.

(f) Remove excess oil. Oil level to be no higher than half-way up on bull's eye sight glass.

(g) Readjust thermostat setting and replace if defective.

f. High crankcase temperature.

(1) Possible causes.

(a) Clogged liquid line strainer.

(b) Defective expansion valve.

(c) Leaking compressor valves.

(d) Shortage of refrigerant.

(e) Low voltage or dirty contact points.

(f) Clogged compressor suction strainer.

(2) Actions to take.

(a) Clean or replace strainer.

(b) Replace expansion valve.

(c) Change valve plate.

(d) Check refrigerant charge.

(e) Check voltage and contactor. Repair or replace contactor.

(f) Remove and clean strainer.

g. Chiller freeze-up.

(1) Possible causes.

(a) Excessive air in system.

(b) Improper circulation of chilled water.

(c) Compressor contacts stuck closed.

(d) Improperly set safety thermostat.

(e) Safety thermostat by-passed.

(f) System solution low of ethylene glycol.

(2) Actions to take.

(a) Purge air from system.

(b) Ensure system is full, check for and replace defective pump, check for closed valves.

(c) Replace contactor.

(d) Check safety thermostat for proper operation and setting.

(e) Remove by-pass, replace thermostat if defective.

(f) Check system with hydrometer.

1 Should be 35% ethylene glycol, protection to 0°.

2 If required, add to fill tank.

h. Cold or frosted liquid line.

(1) Possible causes.

(a) Restriction in liquid line at point of frost or temperature difference.

(b) Non-condensables in system.

(2) Actions to take.

(a) Remove restriction or replace defective component.

(b) Purge refrigerant charge, evacuate and recharge.

2. Demonstrate troubleshooting procedures for erratic system operation.

a. Compressor will not start.

(1) Possible causes.

(a) Power off.

(b) Control circuit breaker off.

(c) Loose electrical connections or faulty wiring.

(d) Dirty control switch contacts.

(e) Low voltage, overload tripping.

(f) High pressure control switch contacts open.

(g) Low pressure control switch contacts open.

(h) Control switch stuck open.

(i) Compressor motor defective.

(j) Motor compressor hums:

1 Single phase wire broken, contactor points burned and pitted, or circuit breaker or fuse defective.

2 Compressor motor defective.

(k) Water flow switch open:

1 Switch defective.

2 Chilled water pump not running.

3 Chilled water pump cavitating.

4 Hand valve closed or obstructed.

(l) Freeze control open.

(m) Manual "CON_OFF" switch, located on side of control box in "OFF" position, or defective.

(n) Operating thermostat set too high.

(2) Actions to take.

(a) Check main switch and circuit breakers.

(b) Reset control breaker, if it keeps tripping check control circuit for short.

(c) Tighten connections. Check wiring and correct trouble.

(d) Clean contacts.

(e) Tighten connections. Check wiring and correct trouble.

(f) Reset overload, correct cause of low voltage.

(g) Low on refrigerant, find and fix leak recharge system.

(h) Locate defective control and replace.

(i) Check compressor for short or open overload or winding.

(j) Check motor:

1 Repair any broken wires or replace defective contactor, circuit breaker or fuse.

2 Replace compressor.

(k) Check water flow switch:

1 Replace switch.

2 Start pump, check breaker.

3 Purge air from system.

4 Open hand valve or clear obstruction.

(l) Reset switch, find cause of opening, check ethylene glycol mixture.

(m) Turn switch to "ON" position.

(n) Reset or replace if defective.

b. Compressor short cycles on high pressure cut-out.

(1) Possible causes.

(a) Insufficient water flow through condenser or clogged condenser.

(b) Head pressure control defective.

(c) Refrigerant over charge, liquid line is cool.

(d) Air or non-condensables.

(e) Compressor discharge stop service valve partially closed.

(f) Condenser water pump not running or defective.

(g) Water regulating valve out of adjustment or defective.

(h) Overboard water strainer clogged.

(i) Intake overboard water too warm.

(2) Actions to take.

(a) Open any valve in water supply line or adjust water regulating valve, check:

1 Water strainer.

2 Condenser tubes.

3 Water pump.

4 Sea chest.

(b) Replace defective control.

(c) Remove excess refrigerant.

(d) Purge, evacuate and recharge system.

(e) Open valve fully.

(f) Restart pump or replace if defective.

(g) Adjust water regulating valve or replace.

(h) Clean strainer.

(i) Check to see if water intake is near hot water discharge.

c. Compressor short cycles on low pressure cut-out.

(1) Possible causes.

(a) Restricted water flow through chiller.

1 Low water level in system.

2 Defective pump.

3 Water pump not running.

4 Hand valve closed or obstructed.

(b) Suction strainer or expansion valve strainer plugged.

(c) Liquid line drier plugged.

(d) Shortage of refrigerant.

(e) Thermal bulb on expansion valve lost its charge.

(f) Capacity control system set to unload at too low a suction pressure.

(g) Low pressure control defective.

(h) Suction stop service valve partially closed.

(2) Actions to take.

(a) Check water flow:

1 Check system fill tank.

2 Repair or replace pump.

3 Check circuit breaker or starter.

4 Open valve or clear obstruction.

(b) Remove and clean strainers.

(c) Pump down system and change drier.

(d) Repair leak and recharge system.

(e) Test thermal bulb:

1 Detach bulb from suction line and hold in palm of one hand.

2 Grip suction line with other hand.

3 If flooding through is observed, bulb has not lost its charge.

4 If there is no flooding through, replace expansion valve.

(f) Adjust capacity control valve to begin unloading at a higher control point.

(g) Replace control.

(h) Open valve.

d. Compressor runs continuously.

(1) Possible causes.

(a) Shortage of refrigerant.

(b) Compressor discharge valve leaks.

(c) Control contacts fused.

(d) Leaking piston rings or worn cylinder sleeve.

(e) Check to see if thermostat is stuck.

(2) Actions to take.

(a) Repair leak and recharge.

(b) Replace valve plate.

(c) Replace control.

(d) Replace compressor.

(e) Replace thermostat.

3. Demonstrate troubleshooting procedures for system noises.

a. Compressor noises.

(1) Possible causes.

(a) Loose hold down bolts.

(b) Slugging due to refrigerant floodback:

1 Expansion valve defective.

2 Expansion valve bulb loose.

3 Incorrect location of bulb.

(c) Hydraulic knock due to excess oil circulation.

(d) Noise level varies with unloading.

(e) Wear of parts such as piston, connecting rods and bearings.

(2) Actions to take.

(a) Tighten bolts.

(b) Eliminate floodback:

1 Change expansion valve.

2 Tighten bulb clamp.

3 Relocate bulb in accordance with technical manual.

(c) Remove excess oil.

(d) Check for capacity control malfunction.

(e) Replace compressor.

b. Pipes rattle.

(1) Possible causes.

(a) Improper support or isolation.

(b) Loose pipe connections.

(2) Actions to take.

(a) Check piping supports.

(b) Check pipe connections.

c. Hissing.

(1) Possible causes.

(a) Insufficient refrigerant flow through expansion valve.

(b) Clogged liquid line drier.

(2) Actions to take.

(a) Replace expansion valve or add refrigerant.

(b) Replace drier.

4. Demonstrate troubleshooting procedures for capacity control malfunction.

a. Compressor will not unload.

(1) Possible causes.

(a) Capacity control valve out of adjustment.

(b) Suction pressure too high.

(c) Capacity control valve defective.

(2) Actions to take.

(a) Adjust capacity control valve.

(b) Refer to paragraph 1.c.

(c) Replace valve.

b. Compressor will not load.

(1) Possible causes.

(a) Capacity control valve out of adjustment.

(b) Suction pressure too low.

(c) Capacity control valve defective.

(2) Actions to take.

(a) Adjust capacity control valve.

(b) Refer to paragraph 1.d.

(c) Replace valve.

c. Rapid unloader cycling.

(1) Possible causes.

(a) Suction pressure fluctuating rapidly due to partial load conditions.

(b) Capacity control valve defective.

(2) Actions to take.

(a) Increase differential setting on capacity control valve.

(b) Replace valve.

5. Demonstrate troubleshooting procedures for cooling coil trouble.

a. No cooling – blower does not run.

(1) Possible causes.

(a) Circuit breaker tripped off or bad fuse.

(b) Fan switch in “OFF” position.

(c) Fan switch defective.

(d) Fan motor defective.

(e) Thermostat set on fan “ON” but selector switch set on “OFF” or thermostat set to high.

(f) Thermostat defective.

(g) Three way water valve not open.

(h) Chiller package not running.

(i) Air in system.

(j) Chilled water not circulating.

(k) Hand valve closed.

(2) Actions to take.

(a) Reset circuit breaker or replace fuse.

(b) Turn switch “ON”.

(c) Replace switch.

(d) Replace motor.

(e) Set “HEAT-OFF-COOL” switch to “COOL”, check thermostat setting.

(f) Replace thermostat.

(g) Be sure valve is energized.

(h) Restart chiller package.

(i) Purge system and check system fill tank.

(j) Check chilled water pump.

(k) Open all valves.

b. Partial or insufficient cooling – blower running.

(1) Possible causes.

(a) Low refrigerant charge.

(b) Three way valve partially closed.

(c) Air in system.

(d) Thermostat set too high.

(e) Electric heat element on.

(f) Check to see if wrong refrigerant was added to the system.

(2) Actions to take.

(a) Check refrigerant charge.

(b) Open valve manually. Replace valve if defective.

(c) Purge system and check system fill tank.

(d) Reset thermostat.

(e) Check heat contactor.

(f) Make certain R-22 only was added, if not:

1 Recover system charge.

2 Evacuate system.

3 Recharge with R-22.

(Asterisks indicates a leader performance step.)

Evaluation Guidance: None

Evaluation Preparation: None

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Demonstrated troubleshooting procedures for abnormal operating pressures/temperatures.			
a. High head pressure.			
b. Low head pressure.			
c. High suction pressure.			
d. Low suction pressure.			
e. Compressor crankcase cold (sweating or frosting).			
f. High crankcase temperature.			
g. Chiller freeze-up.			
h. Cold or frosted liquid line.			
2. Demonstrated troubleshooting procedures for erratic system operation.			
a. Compressor will not start.			
b. Compressor short cycles on high pressure cut-out.			
c. Compressor short cycles on low pressure cut-out.			
d. Compressor runs continuously.			
3. Demonstrated troubleshooting procedures for system noises.			
a. Compressor noises.			
b. Pipes rattle.			
c. Hissing.			
4. Demonstrated troubleshooting procedures for capacity control malfunction.			
a. Compressor will not unload.			
b. Compressor will not load.			
c. Rapid unloader cycling.			
5. Demonstrated troubleshooting procedures for cooling coil trouble.			
a. No cooling – blower does not run.			
b. Partial or insufficient cooling – blower running.			

Supporting Reference(s):

Step Number	Reference ID	Reference Name	Required	Primary
	TC 55-509	MARINE ENGINEMAN's HANDBOOK	No	No
	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 55-1915-254-10-1	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

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-2064	Maintain a Ventilation System	551 - Transportation (Individual)	Approved
551-88L-1043	Identify Basic Components of a Heating Ventilation and Air Conditioning (HVAC) System	551 - Transportation (Individual)	Analysis
551-881-8082	Conduct Field Maintenance on an Air Conditioning System	551 - Transportation (Individual)	Approved
551-88L-2060	Maintain a Heating System	551 - Transportation (Individual)	Approved
551-88L-2059	Maintain an Air Conditioning System	551 - Transportation (Individual)	Approved

551-88L-1039	Demonstrate Basic Knowledge of a Ventilation System	551 - Transportation (Individual)	Analysis
551-88L-2056	Maintain an Electric Motor	551 - Transportation (Individual)	Approved

Supported Individual Tasks :

Task Number	Title	Proponent	Status
551-88L-1043	Identify Basic Components of a Heating Ventilation and Air Conditioning (HVAC) System	551 - Transportation (Individual)	Proposed
551-88L-1039	Demonstrate Basic Knowledge of a Ventilation System	551 - Transportation (Individual)	Approved
551-88L-1043	Identify Basic Components of a Heating Ventilation and Air Conditioning (HVAC) System	551 - Transportation (Individual)	Analysis
551-88L-2056	Maintain an Electric Motor	551 - Transportation (Individual)	Approved
551-88L-1039	Demonstrate Basic Knowledge of a Ventilation System	551 - Transportation (Individual)	Analysis
551-88L-2060	Maintain a Heating System	551 - Transportation (Individual)	Approved
551-88L-1043	Identify Basic Components of a HVAC System	551 - Transportation (Individual)	Approved
551-88L-4033	Review HVAC Theory	551 - Transportation (Individual)	Approved
551-88L-2064	Maintain a Ventilation System	551 - Transportation (Individual)	Approved
551-88L-2059	Maintain an Air Conditioning 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