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# AIR COOLED EXCHANGERS, INC.

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PHONE 918 251-7477  
FAX 918 251-7482  
P.O. BOX 577  
BROKEN ARROW, OK 74013

## OPERATING AND MAINTENANCE INSTRUCTIONS FOR ACE COOLERS

### IMPORTANT

Before start up, check set screws and bolts in the fan assembly and set screws in locking collars of all bearings and sheaves. These items should be checked again several days after start up.

### FAN & DRIVE

Although the fan and drive are inspected before shipment, clearance between the fan blades and the fan ring and guard, and alignment of the fan shaft should be checked to assure that rough handling during shipment has not loosened bearing mounting bolts or caused misalignment.

V-belt drives should be adjusted until tight enough to prevent excessive belt slippage. The belt is generally tight enough when it can be twisted one-quarter of a turn with the thumb and fore-finger.

### LUBRICATION

Bearings should be greased in accordance with normal maintenance practice. Over-lubrication is the most common cause of bearing failure. In general, about one cubic inch of grease in each bearing every 2 to 3 months is adequate. The operating temperature of the bearing may indicate how much lubrication is required.

Normal temperature may range from "cool to warm to touch" up to a point "too hot to touch for more than a few seconds" depending on bearing size and speed, and surrounding conditions. Unusually high temperature accompanied by excessive leakage of grease indicates too much grease. High temperature with no grease showing at the seals, particularly if the bearing seems noisy, usually indicates too little grease. Normal temperature and slight showing of grease at the seals indicates proper lubrication.

### TUBE CLEANING

Operating conditions sometimes cause an accumulation of dirt on the outside fin surface. This can be removed by directing compressed air, or a greaseless solvent followed by a water spray through the fins in a direction opposite the normal air flow. The inside of the tubes will require periodic inspection and cleaning as necessary. Removal of access plugs allows visual inspection, and if necessary, the use of mechanical tube cleaners.

### PLUG LEAKS

Should tapered plugs develop leaks, additional tightening is normally all that is required. Thread dope may be used if tightening alone is not sufficient. If shoulder type plugs develop leaks, the gaskets should be replaced. Tapered plugs that are removed for the tube inspection or cleaning should be replaced in the same hole.

### TUBE LEAKS

Tube leaks can be of two types: (1) leaks in the tubewall itself (usually corrosion ) and (2) leaks in the tube to tubesheet joint. In the first case, it is usually most practical to plug both ends of the tube with the resulting loss in heat transfer surface. When so many tubes have been plugged that performance is affected, retubing will be necessary. If leaks develop in the tube to tubesheet joints, re-rolling of the tube will be required. Care must be used in selection of the proper tube expander for the size and BWG of the tube being used. As with all rolled tube joints, over-rolling must be avoided.

### GENERAL

If it is ever necessary to contact our plant for service or replacement parts, it is essential that our serial number or other identifying data be obtained from the metal nameplate attached to the cooler. This is the only way to positively identify the correct parts that may be required.



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FAX 918-258-1833

FACSIMILE TRANSMITTAL SHEET

TO:	Jade Cable	FROM:	Doug Self
COMPANY:	Waterflood	DATE:	11/14/2002
FAX NUMBER:	306-634-7887	TOTAL NO. OF PAGES INCLUDING COVER:	1
PHONE NUMBER:		SENDER'S REFERENCE NUMBER:	
RE:	J2A	YOUR REFERENCE NUMBER:	

☐ URGENT    ☐ FOR REVIEW    ☐ PLEASE COMMENT    ☐ PLEASE REPLY    ☐ PLEASE RECYCLE

Jade,

Keep fan blades at a minimum pitch in winter, 15° @ clevis. Keep fan blades at 27° clevis during normal summer operation.

Regards,

Doug

E-MAIL: MAILHUB@ACE-COOLERS.COM



## **CLASS 1000 FANS INSTALLATION INSTRUCTIONS**

The clevises on the hubs are set at approximately the required angle for the specified fan performance. Install hubs without loosening the clevises. The bushing has been installed and lubricated at the factory. No further lubrication is required. Place the hub/bushing on the shaft with the key in place (preferably bolts will be towards free end of shaft). Using a 10 mm allen wrench, sequentially tighten the bolts to firmly engage the bushing in the hub and seat the bushing on the shaft. Once the bushing/hub is firmly seated on the shaft, continue tightening the bolts sequentially until the specified torque of 50 ft-lb (6.9 kg-m) is reached. Do not overtighten bolts as this could cause damage to the hub.

The bolts holding the clevis to the hub should be torqued to 50 ft-lb (6.9 kg-m). Install blades so they extend straight out from the hub and torque the clevis bolt/nut to 50 ft-lb (6.9 kg-m). The threads on the clevis bolt are supplied from the factory with a lubricant coating. Be sure the lubricant is still present before tightening.

Before starting the fan, manually check all bolts and nuts to see if they are tightened. Take care not exceed torque limits. Manually rotate the fan while checking each blade for proper clearance. Start the fan and watch it in operation. All blades should move to the same operating position, indicating that the blade angles are properly set and that all blades are equally loaded. After the fan has been operating for several minutes, stop the fan and observe the blades as the fan comes to rest. All of the blades should return to their original position at the same rate. Inspect the inner surface of the fan ring and the blade tips for any indication of scoring. The horsepower given on the fan specifications is the calculated horsepower that is required for the specified performance. Consult the factory before increasing the blade.



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## **AIR COOLED HEAT EXCHANGER SUGGESTED START UP PROCEDURE**

Before any start up procedure is begun, a thorough inspection of the Air Cooled Exchanger should be made.

- 1.) Be sure all bolted connections are properly tightened.
- 2.) After tube bundle and piping hydrotest, remove hydrotest connections. Be sure tube bundle is properly drained, and if required, dried. Connect process piping and any auxiliary connections.
- 3.) Inspect all process connection, as well as, vent drain, temperature and pressure, or any other auxiliary connections to be sure they are plugged or connected properly.
- 4.) Check mechanical equipment before starting process through the tube bundle(s).
  - a.) Thoroughly check the plenum and fan drive area to be sure all tools and construction materials are removed.
  - b.) Rotate the fan by hand and check fan tip clearance and alignment of belts and sheaves.
  - c.) Check belt tension.
  - d.) Check all fan drive bolts to be sure they are properly tightened. This includes bearing bolts, fan and sheave bushing bolts, set screws, motor bolts and fan blades attachment bolts.
  - e.) If air operated auto-variable pitch fans are used, check for proper pitch with the air off. Fans may go to either minimum or maximum pitch at air failure. Check specifications for requirements. If fan pitch is not satisfactory, set pitch per manufacturer's instructions (see Operation and Maintenance Instructions). If fan pitch is satisfactory, cycle fan through it's range, using plant air and an air regulator.

- f.) If air operated louvers are provided, it is advisable to disconnect the air motor linkage and cycle the louvers by hand to assure there is no binding or obstruction of the louvers blades. If binding occurs, check to be sure louver frames are square. Attaching bolts may have to be loosened and frames shifted to ease binding. If louvers operate smoothly, reconnect air motor. Cycle the air motor, using plant air and an air regulator.
  - g.) If manually adjusted pitch fans are provided, check fan pitch and re-pitch per manufacturer's instructions if required.
  - h.) If manual operated louvers are provided, check for binding of the blades, as in instruction (f). Operate louvers to be sure there is no linkage obstruction or binding.
  - i.) Remove condensate drain plugs, if provided, in electric motors and other electrical components to drain any condensation that might have occurred during storage. If space heaters are furnished in electric motors, louver actuators, controls, etc., activate the space heaters and allow approximately 24 hours before starting equipment.
  - j.) After all the applicable steps previously stated are completed, the mechanical equipment may be cycled.
  - k.) Be sure all personnel and equipment are away from the fan and fan drive area. For safety reasons, equipment guards should be installed. Activate the drive motor and let it reach speed. Check for vibration and excessive noise. If vibration or excessive noise occurs, immediately shut motor down, and check for loose connections or insufficient clearance between moving parts. If the system is running smoothly, replace any guards removed and move to the next drive and repeat above steps.
- 5.) Start the process through the tube bundle(s). Open the inlet valves slowly and let the process "Warm" the bundles slowly. This will allow the components of the tube bundle to expand at the same rate and lessen the thermal shock.

## Air Cooled Exchangers, Inc.



**P.O. Box 577**

## Broken Arrow, Oklahoma 74013

**Phone: 918-251-7477**

**Fax: 918-251-7482**

**Date: 4/11/03**

**Customer:** Waterflood Services

**ACE Serial Number(s):** 03018, 03019

Cooler Model: J2A

[illegible]

FAN, SHAFT, BEARINGS & V-BELTS ARE RECOMMENDED SPARE PARTS.

ALL INQUIRES AND ORDERS MUST BE ACCOMPANIED BY COOLER SERIAL NUMBER.

E-Mail the Parts division of our Engineering Department at [mailhub@ace-coolers.com](mailto:mailhub@ace-coolers.com)

Visit Us on the World Wide Web at **[www.ace-coolers.com](http://www.ace-coolers.com)**





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Fax (918) 258-1833

E-MAIL: MAILHUB@ACE-COOLERS.COM

## COOLER PERFORMANCE SPECIFICATION

CUSTOMER	WATERFLOOD	PROPOSAL NUMBER	P000517F.1
REFERENCE		DATE	1/9/2003
MODEL	J2A	PAGE	1

### PERFORMANCE OF ONE UNIT

SERVICE	JW	OIL	AC
FLOW	48.0GPM	42.0GPM	1.00MMSCFD
FLUID	50%GLY	OIL	.65
TEMPERATURE IN, F	190.0	202.0	185.0
TEMPERATURE OUT, F	174.0	180.0	120.0
INLET PRESSURE, PSIA			164.0
PRESSURE DROP, PSI	8.5	6.8	1.5
DUTY, BTU/HOUR	340000	210000	75172
CORRECTED MTD	72.8	89.1	41.3
BARE TUBE RATE	112.8	57.0	58.7
FOULING	0.00050	0.00050	0.00200
BARE SURFACE, SQ. FT.	41	41	31
TOTAL SURFACE SQ. FT.	658	658	494

### CONSTRUCTION

NO. SECTIONS	1	1	1
NO. TUBES/SECTION	44	44	33
LENGTH	6	6	6
NO. ROWS	3	3	6
NO. PASSES	4	2	2
COUNTERFLOW			
TUBE O.D. AND BWG	5/8X16BWG	5/8X16BWG	5/8X16BWG
TUBE MATERIAL	SA214(WLD)	SA214(WLD)	SA214(WLD)
DESIGN PRESSURE, PSI	14	375	375
DESIGN TEMPERATURE, F	350	233	233
NOZZLES	2-150RF	2-300RF	2-300RF
HEADER TYPE	RECT TUBE	BOX W/PLUGS	BOX W/PLUGS
HEADER MATERIAL	STEEL	SA-516-70	SA-516-70
ASME CODE STAMP		YES	YES
GROOVED TUBE SHEET	YES	YES	YES
CORROSION ALLOWANCE			
PLUGS, TYPE	TAPER	SHOULDER	SHOULDER
PLUGS, MATERIAL	STEEL	STEEL	STEEL
TURBULATORS		YES	
ACCELERATORS			
LOUVERS	NO	NO	YES
STRESS RELIEVE	NO	NO	NO
NDE			
API-661			
VENTS AND DRAINS			
FINS			

ALUMINUM L-TENSION HIGH PERFORMANCE

### AIR DATA

INLET AIR, F	90	ELEVATION, FT.	95
OUTLET AIR, F	118	TOTAL SCFM	20234

### MECHANICAL EQUIPMENT

NO FANS	1	HP/FAN	6.4	RPM	1025	DIA	48
FAN AEROVENT		FAN MATERIAL	ALUMINUM			NUMBER OF BLADES	6
DRIVE							
DRAFT TYPE	INDUCED						
EST SHIPPING WEIGHT	3391	WIDTH	7.0	LENGTH	5.4	HEIGHT	5.2
ACCESSORIES	HAILGUARD.	BUGSCREEN.					



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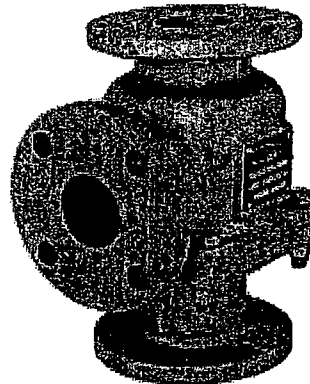
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# AMOT CONTROLS

## Model B

### Thermostatic Valves



#### FEATURES

- FLOW RATES OF 68 - 1200 USGPM
- TAMPER-PROOF TEMPERATURE SETTINGS OF 55°F - 240°F
- COMPLETELY SELF-CONTAINED
- ▲ POSITIVE 3-WAY VALVE ACTION
- AVAILABLE IN CAST IRON, DUCTILE IRON, BRONZE, STEEL, AND STAINLESS STEEL
- 1-1/2" - 6" PIPE SIZES: FLANGED, AND THREADED CONNECTION

#### APPLICATIONS

- ENGINE & COMPRESSOR COOLING SYSTEM
- LUBE OIL SYSTEMS
- COGENERATION HEAT RECOVERY LOOPS
- ▲ PROCESS CONTROL
- TEMPERATURE MIXING OR DIVERTING

AMOT Model B Thermostatic Valves are fully automatic, 3-way fluid temperature control valves for diverting or mixing applications. They provide reliable control of fluid temperatures in engine jacket water and lubrication oil cooling systems. These valves are suitable for process control and industrial applications where fluids must be mixed or diverted depending on their temperatures. They may also be applied to cogeneration systems to control temperatures in the heat recovery loop assuring proper engine cooling and maximizing heat recovery.

#### TAMPER-PROOF

As with other AMOT thermostatic valve the Model B utilizes fully enclosed, factory-set temperature element assemblies which provide tamper-proof operation. To change a valve setting it is necessary to exchange the temperature element assemblies inside the valve.

#### HIGH RESISTANCE TO SHOCK

Model B thermostatic valves display excellent reliability even under extreme shocks or vibration and many models have been qualified to MIL-S-901 and MIL-V-19772.

#### MANUAL OVERRIDE

If desired, AMOT Model B thermostatic valves can be supplied with a manual override which allows the user to direct flows through Ports A and C. On valves equipped with the manual override option, there is one manual override device for each of the temperature element assemblies. To engage the manual override function, flip the lever(s) 180° from "Auto" to "Manual" position.

FORM 936

## OPERATION

The valve is supplied with the temperature element assemblies factory-set to the nominal temperature setting. Temperature is sensed at Port A which remains open to Port B (bypass) until the fluid temperature reaches a point 5 - 10°F below the nominal setting. As the temperature continues to rise, the sliding valve moves to close off Port B and open Port C (connected to the cooler or heat exchanger) Port B is fully closed 8 - 10°F above the nominal setting. The valve continually modulates the fluid flow to maintain the nominal temperature. For optimum control, the system should be sized so about 1/2 the total fluid flow is passing through the cooler at full load.

For long life, AMOT Model B valves should not be exposed to continuous temperatures exceeding 25°F above their nominal temperature setting. For occasional short periods (1/2 hour or less), they can be exposed to temperatures of 50°F above their nominal temperature setting, but not to exceed 250°F maximum.

For higher over-temperatures, reduced stroke element assemblies (5566X) are available. They will withstand continuous temperatures of 60°F above their nominal temperature setting but add 30% to the valve pressure drop. Reduced stroke elements are not available in all temperatures.

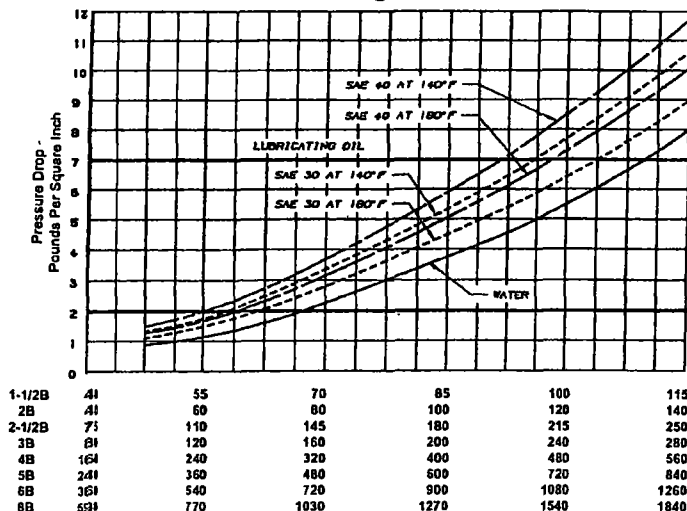
## INSTALLATION

AMOT thermostatic valves operate in any position and may be oriented at the convenience of the system designer. In the smaller sizes, the valve may be supported by the connecting pipe but should not be subjected to excessive bending. Line up the piping before tightening the connecting bolts. Larger sizes should not be used to support long and heavy lengths of pipe nor used to draw up lengths of pipe which have been fabricated too short.

If the valve is mounted at the high point of the system, the system should be properly vented to prevent trapping air at the temperature element assemblies.

For piping diagrams regarding specific applications, refer to Form 913, AMOT Thermostatic Valves General Information.

Figure 1



Flow in U.S. Gallons Per Minute  
Recommended pressure drop is 2 to 7 psi.

## SELECTION

AMOT thermostatic valves are selected by the anticipated flow rate through the valve. Refer to Fig. 1. Pressure drop across the valve is usually limited to approximately 2 psi to 7 psi to maintain good temperature regulation.

Threaded end connections are available on 1 1/2 and 2 inch sizes. Models with cast iron, ductile iron, or bronze housings have ANSI 125 lb flat face flanges. Steel or Stainless Steel housings feature ANSI Class 150 or 300 raised face flanges. Metric connections also available.

Models with steel housings have ANSI 150 lb/300 lb Class compatible raised face flanges.

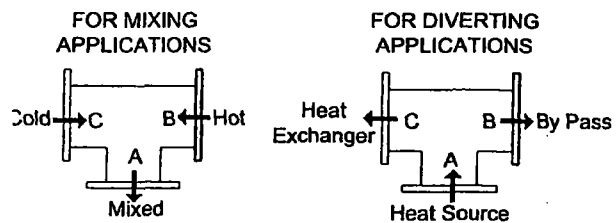
Versions available from USA factory.

Cast Iron	Ductile Iron	Bronze	Steel
1-1/2BOCT	2BMDE	1-1/2BOBT	2BCSJ
1-1/2BHCT	2BFDE	2BOBT	2BCSH
2BOCT	2-1/2BMDF	2BCBF	2BMSJ
2BHCT	3BODF	2BFBF	2BMSH
2BMCF	4BEDF	2-1/2BMBF	2-1/2BOSJ
2BCCF	4BODF	3BOBF	2-1/2BMSJ
2BFCF	4BMDE	3BMBF	3BOSJ
2-1/2BOCF	5BODF	4BEBF	3BMSJ
2-1/2BMCF	5BMDE	4BOBF	3BOSH
3BOCF	6BODF	4BMBF	
3BMCF	6BMDE	5BOBF	
4BECF		5BMBF	
4BOCF		6BOBF	
4BMCF		6BMBF	
5BOCF			
5BMCF			
6BOCF			
6BMCF			

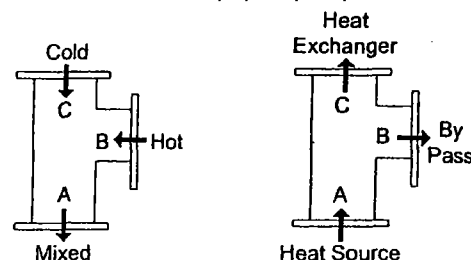
Indicates Non-Standard

## PIPING DIAGRAMS

### MODELS BO, BC, BM



### MODEL 1-1/2, 2, BO, BH, BF



## SPECIFICATIONS

Internal Trim Materials ..... Bronze and Stainless Steel  
 Standard Seal Material ..... Buna N  
 Max. Pressure Drop Across Valve ..... 20 psi (1.4 Bar)  
 Valve Pressure Ratings at 250°F  
 Cast Iron, Ductile Iron, Bronze ..... 150 psi (10 Bar)  
 Cast Iron, Model BH ..... 340 psi (23 Bar)  
 Steel, Class 150, ..... 245 psi (17 Bar)  
 Steel, Class 300, ..... 665 psi (46 Bar)  
 Stainless Steel Class 150, ..... 228 psi (15 Bar)  
 Stainless Steel Class 300, ..... 590 psi (41 Bar)

Shipping Weights:	Cast Iron	Ductile Iron	Bronze	Steel
1-1/2BO/2BO	25	--	--	--
1-1/2BH/2BH	32	--	--	--
1-1/2BM	--	--	25	--
2BC, BM	30	30	35	45
2BF	35	35	40	--
2-1/2B	55	55	75	75
3B	60	60	80	80
4B	135	135	150	--
5B	200	200	240	--
6B	270	270	300	--

## HOW TO ORDER

(Refer to Model Code System Below.)

When ordering please specify the following:

1. Valve size connection (see Table A).
2. Valve Type (see Table B).
3. Housing material (see Table C).
4. Type of End Connection (see Table D).
5. Nominal temperature setting (see Table E).
6. Any of the following special features if required:
  - a) Viton or neoprene seals (instead of Buna N).
  - b) Electroless Nickel plated temperature element assembly.
  - c) Element leak hole (see Table G).
  - d) Reduced stroke element assembly for high over-temperature.

This product may be ordered using the full description as shown above or by constructing a Model No. using the Model Code System below. For special requirements, contact the AMOT factory or your local representative.

## MODEL CODE SYSTEM

3 BO C F 160 01 - - ( )

Special Requirements, (MTO) Made-To-Order

Element Assembly Leak Hole, See Table G

Element Assembly Type, See Table F

Temperature Setting, See Table E

TABLE A Valve Size Inches (mm)
1-1/2 (40)
2 (50)
2-1/2 (65)
3 (80)
4 (100)
5 (125)
6 (150)
8 (200)

TABLE B Valve Type Code No.
BO Standard
BM Manual Override
BC Tee config, Flanged
1-1/2, 2" only
BF Flanged, 2" only
BH 1-1/2, 2" only
BR Manual override (UK)

TABLE C Body Material Code No. Material
C Cast Iron
S Steel
B Bronze
D Ductile Iron
R Stainless Steel

TABLE D* Connections Code No. End Type
F ANSI B16.1 Class 125 FF Flange
J ANSI B16.5 Class 150 RF Flange
H ANSI B16.34 Class 300 RF Flange
A NPS (Metric) Flange
B NPS (Metric) Flange
C NPS (Metric) Flange
N NPS Flange
P JIS 5K RF Flange
T NPT Threaded
V BSP-TR / JIS Threaded
W SAE Threaded (straight thread) (O ring seal)

TABLE E Temperature Setting Code No. Nominal Temp °F (°C)
*055 55 (13)
075 75 (24)
090 90 (32)
095 95 (35)
100 100 (38)
105 105 (41)
110 110 (43)
115 115 (46)
120 120 (49)
*130 130 (54)
135 135 (57)
140 140 (60)
145 145 (63)
*150 150 (66)
155 155 (69)

TABLE E (Continued)		
Temperature Setting		
Code No.	Nominal Temp °F (°C)	
160	160	(71)
165	165	(74)
170	170	(77)
175	175	(79)
180	180	(83)
185	185	(85)
195	195	(91)
205	205	(96)
215	215	(102)
225	225	(107)
230	230	(110)
235	235	(113)
240	240	(116)
Temperatures apply only to 1096 and 2433 Element Assemblies.		

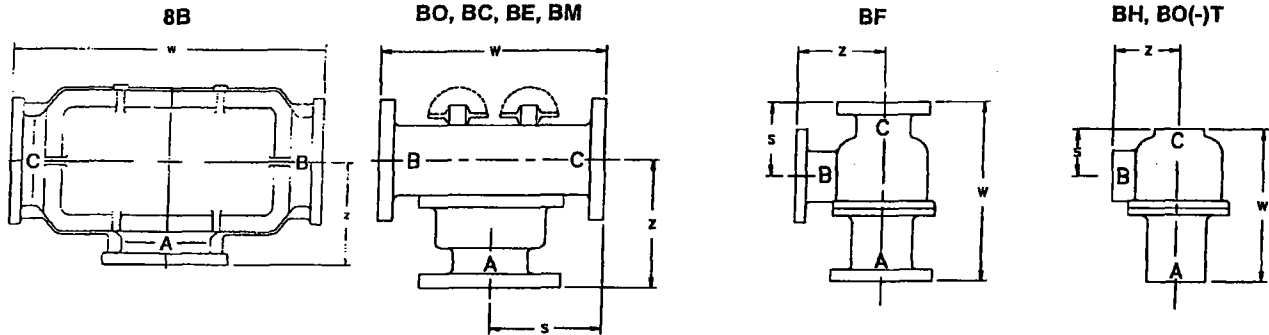
TABLE F Element Assembly Code No. Type
01 1096X Standard
02 1096P Plated with Viton
03 1096X with Viton seals
07 2433X Manual Override
11 5566X Reduced stroke
105 6836S Saltwater
44 1096X with Neoprene
45 1096P with Neoprene
20 5566X with Viton
12 5566P Plated
53 2433X with Viton
50 6836K Electroless Nickel with Neoprene

TABLE G Element Assembly Leak Hole Code No. Size Inches (mm)
none (standard)
A 1/2 (12.5)
B 1/4 (6.3)
C 3/8 (9.5)
AB 1/8 (3.2)
LE 1/16 (1.6)
E 3/32 (2.4)
G 5/16 (7.9)
H 5/16 (7.9)

\* = Also avail. as reduced stroke. Contact factory for other temps.  
 [Symbol] Indicates Non-Standard, MTO

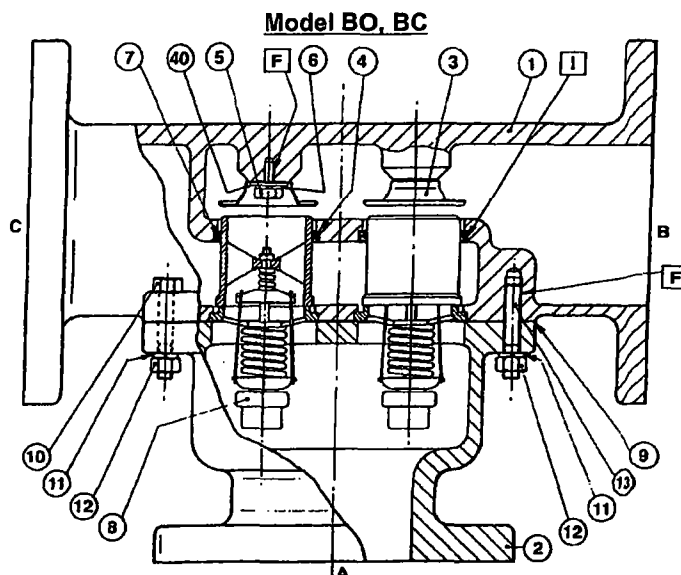
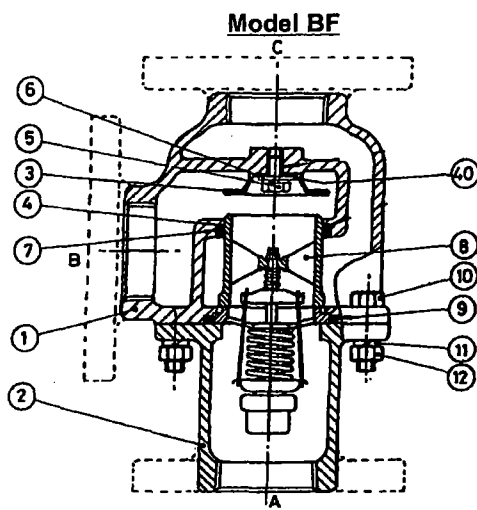


# DIMENSIONS



Model No.	Nominal Pipe Size	Principal Dimensions			Width in the Other Plane	Flange Drilling			No. of Element Assemblies
		"S"	"W"	"Z"		No. of Holes	Dia. of Holes	Bolt Circle	
1-1/2BO(-)T	1-1/2 (40)	3-13/16 (97)	9-11/16 (246)	3-9/16 (90)	5-1/2 (140)	—	—	—	1
1-1/2BHCT	1-1/2 (40)	4-1/16 (103)	10-11/16 (271)	4 (102)	5-3/4 (146)	—	—	—	1
2BC(-)F 2BM(-)F	2 (50)	4-7/16 (113)	8-7/8 (225)	5-7/8 (149)	6 (152)	4	3/4 (19)	4-3/4 (121)	1
2BF(-)F	2 (50)	4-3/4 (121)	10-5/8 (270)	4-7/16 (113)	6 (152)	4	3/4 (19)	4-3/4 (121)	1
2BCSJ 2BMSJ	2 (50)	4-7/16 (112)	8-7/8 (225)	5-7/8 (149)	6 (152)	4	3/4 (19)	4-3/4 (121)	1
2BCSH 2BMSH	2 (50)	4-7/16 (112)	8-7/8 (225)	5-7/8 (149)	6 (152)	8	3/4 (19)	5 (127)	1
2BO(-)T	2 (50)	3-13/16 (97)	9-11/16 (246)	3-9/16 (90)	5-1/2 (140)	—	—	—	1
2BHCT	2 (50)	4-1/16 (103)	10-11/16 (271)	4 (102)	5-3/4 (146)	—	—	—	1
2-1/2BO(-)F 2-1/2BM(-)F	2-1/2 (65)	5 (127)	10 (254)	6-1/2 (165)	8-1/4 (210)	4	3/4 (19)	5-1/2 (140)	2
2-1/2BOSJ 2-1/2BMSJ	2-1/2 (65)	5 (127)	10 (254)	6-1/2 (165)	8-1/4 (210)	4	3/4 (19)	5-1/2 (140)	2
3BO(-)F 3BM(-)F	3 (80)	5-1/4 (133)	10-1/2 (267)	6-3/4 (172)	8-1/4 (210)	4	3/4 (19)	6 (152)	2
3BOSJ 3BMSJ	3 (80)	5-1/4 (133)	10-1/2 (267)	6-3/4 (172)	8-1/4 (210)	4	3/4 (19)	6 (152)	2
3BOSH 3BMSH	3 (80)	5-1/4 (133)	10-1/2 (267)	6-3/4 (172)	8-1/4 (210)	8	3/4 (19)	6-5/8 (168)	2
4BO(-)F 4BM(-)F	4 (100)	7-15/16 (201)	15-7/8 (403)	8-9/16 (218)	12-1/8 (308)	8	3/4 (19)	7-1/2 (190)	4
5BO(-)F 5BM(-)F	5 (125)	9-5/8 (249)	19-1/4 (489)	9-1/2 (241)	13-3/4 (349)	8	7/8 (22)	8-1/2 (216)	6
6BO(-)F 6BM(-)F	6 (150)	9-5/8 (244)	19-1/4 (489)	10 (254)	19 (483)	8	7/8 (22)	9-1/2 (241)	9
8BO(-)F 8BR(-)F	8 (200)	16-1/2 (420)	33 (840)	11 (280)	19-11/16(500) 26-3/4(680)	8	7/8 (22)	11-3/4 (298)	18

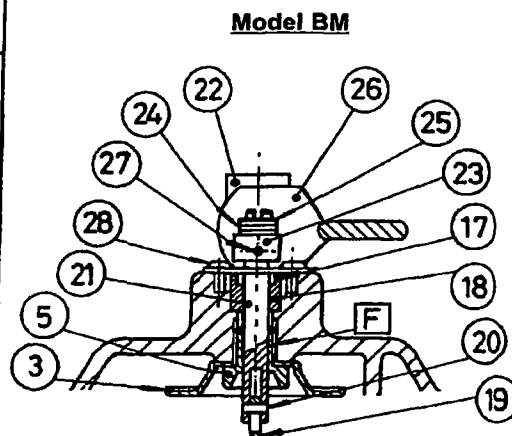
Dimensions in inches. Millimeters in ( ).



### SERVICE PARTS FOR MODELS BO, BC, BF, BH, BM

Ref No.	Part No.	Description
3	9585L001	Seat, Bolted-In (Except BM)
3	9585L002	Seat (BM only)
4	1182	Sleeve
5	11132L050	Capscrew
6	11133	Lockwasher
7	1183	Element O-ring, Buna N (Standard)
7	1183L002	Element O-ring Seal, Viton
8	1096X(temp)	Element Assembly (Standard)
8	1096P(temp)	Element Assembly, plated
8	2433X(temp)	Element Assembly, manual override
9	761	O-ring 1-1/2 - 3B, Buna N
9	761L001	O-ring 1-1/2 - 3B, Viton
9	1094	Gasket 2-1/2 B, 3B, (Old Versions)
9	1123	Gasket 4B
9	1117	Gasket 5B
9	1149	Gasket 6B
17	358	O-ring, Buna N (BM only)
17	358L001	O-ring, Viton (BM only)

This Parts List effective with Valve Serial No. B941.



## MAINTENANCE

Properly applied and installed, AMOT Thermostatic Valves require practically no maintenance.

If necessary, temperature element assemblies may be easily replaced. Remove Nuts (12) or Bolts (6) and separate the Upper (1) and Lower (2) Housing. Remove Element Assembly (8) and Element O-ring Seal (7). Remove Housing O-ring (9) or Gasket and clean any foreign material from sealing surfaces. Lubricate new Element O-ring Seal (7) with a good grade of petroleum grease and re-insert in the groove in Upper Housing (1). Insert Element Assembly (8) through Element O-ring Seal (7) with a twisting motion. Install Housing O-ring (9) or Gasket around the Element Assembly Flange and bolt on Lower Housing (2).

AMOT designs and tests all its products to ensure that high quality standards are met. For good product life, carefully follow AMOT's installation and maintenance instruction; failure to do so could result in damage to the equipment being protected or controlled.

When communicating with AMOT regarding operation of a control, always give the Model No. and Serial No. If ordering service parts, also include description, part no., and quantity desired. If any parts are ordered by Reference No. only, please include the Form No., Revision No., and date of this brochure.

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# Installation Instructions for L150, EL150K1, and EL150 EX Level SWICHGAGE®s for Engine Liquids

L-7758N  
Revised 06-00  
Section 15  
(00-02-0171)



Please read the following instructions before installing. A visual inspection for damage during shipping is recommended before mounting. It is your responsibility to have a qualified person install the unit.

## GENERAL INFORMATION

### WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.



**CAUTION:** Certain danger to human and to equipment such as applied in a mobile or marine application may occur if some equipment is stopped without pre-warning. It is therefore, recommended that monitored functions be limited to alarm only or to alarm before shutdown in such applications.

### Description

The L150, EL150K1 and EL150EX Level SWICHGAGE® instruments are a combination liquid level gauge and low limit switch. Each unit includes a float chamber, an indicating pointer, a dial, and a low level contact. When properly installed and maintained, the float operates the pointer which, in turn, both indicates level during normal operation, and closes a switching circuit if the level falls to the low-limit set point.

### Applications

The primary use of these level SWICHGAGE® instruments is for engine cooling systems, surge or expansion tanks, condenser radiator or vapor phase systems, whether pressurized or atmospheric. These instruments can also be used to monitor lube oil, hydraulic fluid or diesel fuel reservoirs and activate alarms and/or shutdown at a predetermined minimum level.

These instruments are built for low pressure systems.

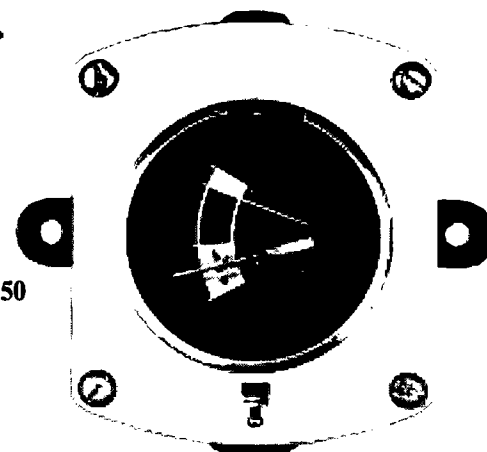
### Cold Weather Warning



BEFORE FREEZING WEATHER COMES, CHECK TO BE SURE YOUR L150 OR EL150 SERIES COOLANT LEVEL SWICHGAGE® IS FILLED WITH ANTIFREEZE SOLUTION THE SAME AS YOUR ENGINE BLOCK AND RADIATOR. On many engines, such as condenser radiator systems, the coolant in your level SWICHGAGE® remains static until the level falls to drain point. When 'winterizing' it's a good idea to make certain all water drains from your level SWICHGAGE®, to check against clogged connections, and then BE SURE IT REFILLS WITH ANTIFREEZE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN EQUIPMENT DAMAGE.

CE\*\*

L150

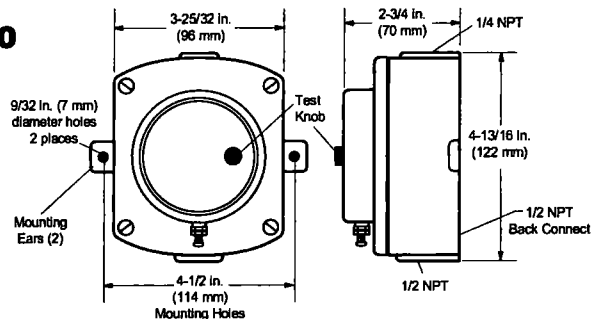


Specifications	L150	EL150K1	EL150EX
<b>Case</b>			
• Die cast aluminum, polyurethane coated	•	•	
• Sand cast aluminum, painted.			•
<b>Float</b>			
• Brass	•	•	
• Stainless Steel (AISI 304)			•
<b>Lens</b>			
• Polycarbonate	•	•	
• Tempered glass			•
<b>O-Rings:</b> Saturated Nitrile, suitable for coolant or hydrocarbons. Maximum temperature 250°F (120°C)	•	•	•
<b>Cover Gasket</b>			
• Neo-cork	•	•	
• Buna			•
<b>Contact Rating</b>			
• Pilot duty 2 A @ 30 VAC/DC resistive SPST	•		
• SPDT rated 10 A @ 125 VAC; 0.5 A @ 125 VDC; 10 A @ 30 VDC		•	•
<b>Vent Tube:</b> 1/4 x 5 in. (6 x 127 mm) with fittings.	•	•	•
<b>Maximum Working Pressure:</b> 25 psi (172 kPa) [1.72 bar]	•	•	•
<b>Electrical Connection</b>			
• (1) 16 AWG x 24 in. (1.5 mm² x 610 mm) with terminals.	•		
• (3) 18 AWG x 14 in. (1.0 mm² x 356 mm)		•	
• Terminal Block			•
<b>CSA Listed for Hazardous Location:</b> Class I, Division 1, Groups C & D.			•

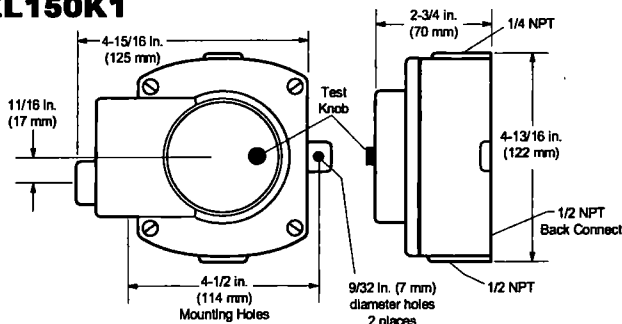
\*\*Products covered by this literature comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted.

## DIMENSIONS

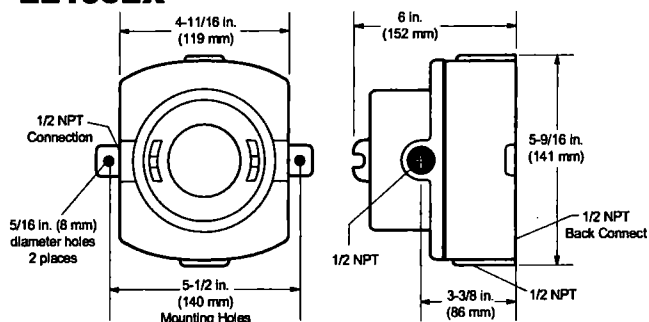
### L150



### EL150K1



### EL150EX



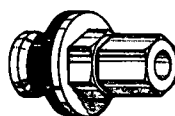
## PS FITTINGS INSTALLATION

A Murphy PS fitting is used when there is no threaded fitting in the top tank of the radiator to attach tubing for the L150/EL150 series level SWICHGAGE®.

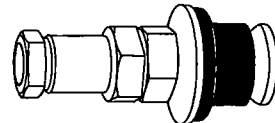
- P/N 15-00-0107 (PS) Accepts 1/4 in. (6 mm) O.D. copper tubing.
- P/N 15-01-0167 (PS Barbed) Barbed fitting accepts 1/4 in. (6 mm) I.D. flexible tubing and hose clamp.
- P/N 15-01-0202 (PS-D) Accepts 1/2 in. (13 mm) I.D. hose; 1/4 in. (6 mm) copper tube.

1. Determine the entry point into the radiator top tank. See *Level SWICHGAGE® Installation* for proper location. Drill 5/8 in. (16 mm) diameter hole in top tank of radiator. Be sure chips do not fall inside the tank. Remove any burrs on the hole wall.
2. Insert the rubber grommet of the PS Blind Hole Fitting. Tighten the jam nut while holding the fitting from turning in the hole. The jam nut will pull the tapered grommet into the hole from the inside of the top tank causing the grommet to expand and seal the hole.
3. Attach the appropriate tubing or hose for the PS Fitting.

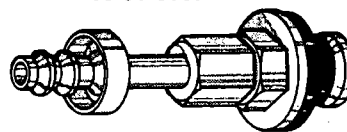
15-00-0107



15-01-0202



15-01-0167



## LEVEL SWICHGAGE® INSTALLATION



**WARNING:** Perform all installations with the power source "OFF". Be sure engine and radiator have cooled and coolant pressure has been relieved. SEVERE BURNS can result. Never remove radiator cap on a hot engine.

**IMPORTANT:** Operation of the L150/EL150K1 is different for a pressurized cooling system than for an atmospheric (non-pressurized) system. Installation of the L150/EL150K1 is only slightly different for each system. Connection of the top tube connection is the major difference. Differences will be noted in the installation instructions.

### Installation Notes

1. All top radiator connections must be away from the return hose turbulence.
2. All bottom radiator connections must be away from the suction hose.
3. The L150/EL150K1 must be attached to a mounting plate on the radiator or other framework.

**CAUTION:** If the L150/EL150K1 is NOT attached to the radiator, use high temperature quality flexible hose for the top and bottom connections to maintain the shock mounting protection for the radiator.

### Pressurized and Atmospheric Systems

1. Drain the cooling system.

2. For a **PRESSURIZED COOLING SYSTEM** (Figure 1) the shutdown point is determined by the entry point A of the tube connection into the top tank. The engine will shutdown when coolant level drops below this connection (see step 4).

If the radiator has a **SHALLOW UPPER TANK**, you can make entry from the top as illustrated in Figure 2. Insert the copper tube until it is slightly above the core. Secure the fitting.

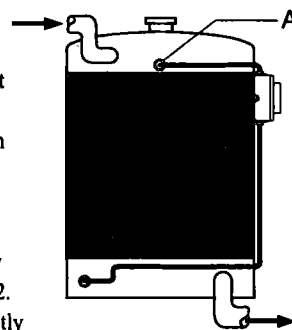
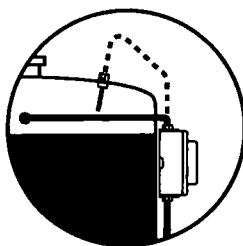


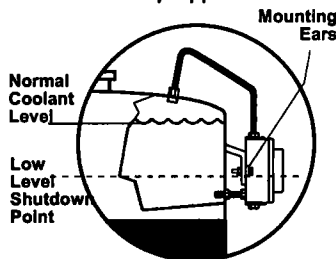
Figure 1: Pressurized System

**Figure 2:**  
Shallow Upper Tank



For a **PRESSURIZED** system the tip of the copper tube will be the shutdown level.

**Figure 3:**  
Deep Upper Tank



3. For **ATMOSPHERIC** (non-pressurized) and **PRESSURIZED CROSS FLOW COOLING SYSTEMS** the shutdown point is determined by the mounting position of the L150/EL150K1 relative to the top tank of the radiator (see step 5).

4. For a **PRESSURIZED SYSTEM**, determine the point of entry (tube connection) in the radiator top tank (away from the top hose connection). Many radiators have a pipe nipple provided. If a connection is not provided, you must either weld or solder a fitting or use one of the Murphy PS fittings (see *PS Fittings Installation* page 2). This connection should be as close to the radiator core as possible.

For **MARINE AND MOBILE EQUIPMENT** installations, the top tank connection should be near the vertical centerline of the radiator. This will compensate for changing level due to roll and pitch of the machine during operation.

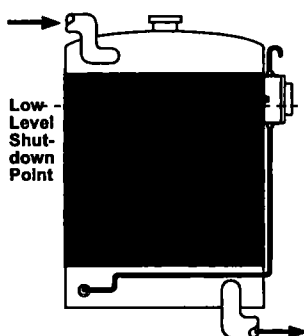
5. For an **ATMOSPHERIC SYSTEM** a tube connection in the top tank may not be required. Determine the lowest desired level of coolant in the top tank. Mount the L150/EL150K1 so that the mounting ears are approximately 1/4 in. (6 mm) above that level (Figure 3). A back mounting option is available for the L150 and EL150K1 for radiators with fabricated steel top tank and/or for use with some condensor cooling systems.

For an **ATMOSPHERIC** system install a 1/4 in. (6 mm) diameter tube in the top fitting of the L150/EL150K1. This tube **MUST** EXTEND ABOVE the top tank. Form the tube into a cane so that the open end of the tube points down but still extends ABOVE the HIGHEST coolant level. The tube can be connected to the top tank if desired. Follow instructions for a **PRESSURIZED SYSTEM**.

6. For most applications, the bottom tube connection is made at the drain cock. Remove the drain cock and install a brass tee. Reinstall the drain cock into the tee. Attach a copper or other suitable tube to the remaining opening of the tee and to the bottom connection of the L150/EL150K1.

If a drain cock is not provided, you must attach a fitting or use a Murphy PS fitting the same as for the top tank instructions.

**Figure 4: Atmospheric System**



7. Wire according to appropriate alarm or shutdown circuits (see *Standard Electrical Diagrams* on page 4).
8. Refill the cooling system according to manufacturer's instructions.
9. Start the engine and allow it to run until the thermostat opens. Increase engine speed to the FULL operating speed and observe that the indicating pointer remains at or near the full position. If the pointer drops to the LOW position shutdown or alarm will occur due to coolant flow through the L150/EL150K1. If alarm or shutdown occurs, drain the coolant - or clamp off the upper and lower hoses.

**CAUTION: BE SURE SYSTEM PRESSURE IS RELIEVED AND HOT COOLANT CANNOT ESCAPE.** Remove the four (4) mounting screws holding the cover assembly. Invert the float chamber so that the 1/2 NPT connection is on top and the 1/4 NPT connection is on bottom. Reinstall the float and cover assembly in the upright position. Install larger I.D. tubing from the top of the float chamber (1/2 NPT) to the radiator top tank. The smaller 1/4 NPT connection on the bottom will restrict coolant outflow from the L150/EL150K1. Check for unrestricted float movement by rotating the switch test knob.

Refill the cooling system and repeat step 9.

10. Place a catch basin under the drain cock. Open the drain cock and observe that coolant is leaving the radiator.

For a **PRESSURIZED** cooling system, shutdown will occur when coolant drops below the entry point of the top tank tube connection.

For an **ATMOSPHERIC OR CROSS FLOW PRESSURIZED COOLING SYSTEM**, shutdown will occur when coolant drops approximately 1/4 in. (6 mm) below the level of the case mounting ears. If shutdown does not occur, adjust the L150/EL150K1 mounting as described above.

**CAUTION: DO NOT ALLOW ENGINE TO RUN WHEN COOLANT DRAINS BELOW THE UPPER TANK. ENGINE DAMAGE CAN OCCUR.**

11. Periodically test switch operation by rotating the test knob on the face of the L150/EL150K1. Rotating the knob forces the pointer mechanism against the contact screw (L150) or the snap switch actuator (EL150K1).

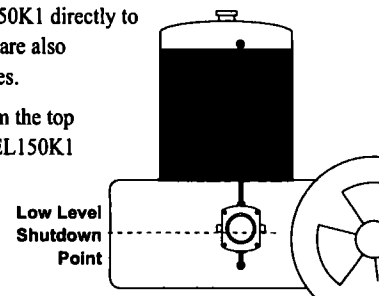
## Condensor/Radiator System

1. Mount the L150/EL150K1 so that the horizontal center line of the L150/EL150K1 is approximately 1/4 in. (6 mm) above the minimum coolant level in the engine head.

**NOTE:** On some engines it is possible to use the back connection option and attach the L150/EL150K1 directly to the engine cylinder. Kits are also available for some engines.

2. Attach a copper tube from the top connection of the L150/EL150K1 to the radiator top tank.

3. Wire and test the system according to above instructions for Pressurized and Atmospheric systems.



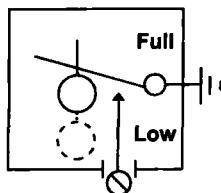
**Figure 5:**  
Condensor/Radiator System

## STANDARD ELECTRICAL DIAGRAMS

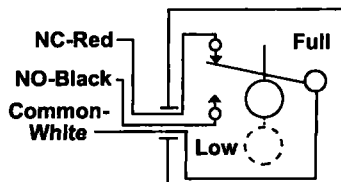


**WARNING: PERFORM THE WIRING OPERATION WITH THE POWER SOURCE "OFF".**

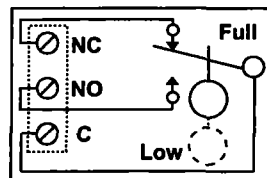
**L150**



**EL150K1**



**EL150EX**



**NOTE:** All models shown with pointer in full position.

## REPAIR KITS

Repair kits are available for the L150, EL150K1 and EL150EX models. When ordering a repair kit specify model repair kit number from chart below:

Model	Components	Repair Kit No.
L150	All parts except case/body	15-00-0138
	Case/body assembly	15-00-0101
EL150K1	All parts except case/body	15-00-0139
	Lens and switch assembly	15-00-0100
	Case/body assembly	15-00-0101
EL150EX	Cover and float assembly	15-00-0110
	Lid assembly	15-00-0108
	Switch/Terminal assembly	15-00-0109

## Replacing the Float and Cover Assembly for the L150 and EL150K1



**WARNING:** Perform the following operation with the power source "OFF". Be sure engine and radiator have cooled and coolant pressure has been relieved. **SEVERE BURNS** can result. Never remove radiator cap on a hot engine.

1. As applicable, shut off liquid to the SWICHGAGE® or drain the system level below the SWICHGAGE®.
2. Disconnect electrical lead(s), one at a time and tag for reinstallation.
3. Disconnect conduit on EL150K1.

4. Remove the four screws that secure the float and glass assembly to the case.
5. Remove and discard the old float and cover assembly.
6. Remove and discard the old gasket.
7. Install the new gasket.
8. Install the new float and cover assembly and secure it with four screws.
9. Re-connect the conduit on EL150K1.
10. Re-connect the electrical lead(s).
11. As applicable, open valves to the SWICHGAGE® or refill the system to proper level.
12. Check the SWICHGAGE® for proper operation at the full indicating position. (Alarm not operated/engine continues to operate.)
13. Check the SWICHGAGE®, alarm/shutdown circuit, by rotating the test knob toward the low level point of the dial: alarm is operated/engine shuts down.
14. Check for unrestricted float movement by rotating the switch test knob.
15. Replacement of the float and cover assembly is complete.



**CAUTION:** On some high voltage CD ignition systems, it may be necessary to coat the L150 contact screw head with RTV to prevent "tracking" and false contact operation during wet or high humidity conditions. Use of the EL150K1 is recommended in these cases.

## Warning

A two year limited warranty on materials and workmanship is provided with this Murphy product. Details are available on request and are packed with each unit.

**murphy**

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