COMPRESSOR REMANUFACTURING / REBUILDING MANUAL
VOLUME 1

SECTION 5 TABLES OF GENERAL INFORMATION
SUB SECTION D BULLETINS OF CHANGES OR MODIFICATIONS
D.3 COPELAND

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SECTION 5 TABLES OF GENERAL INFORMATION
SUB SECTION D BULLETINS OF CHANGES AND MODIFICATIONS
D.3 COPELAND BULLETINS
3.a 4R and 6R continuity

a.1 The 4R and 6R can be miswired internally at the terminal block and still pass all electrical tests, even if operated with two (2) contactors

a.2 By removing ALL JUMPER BARS and then applying a simple continuity test on each PAIR of terminals, internal miswiring can be almost eliminated. (remember MURPHEYS LAW will still apply)

a.3 If it is miswired internally there will be NO CONTINUITY.

3.b H & K MODELS USED AS AIR COMPRESSORS

b.1 All members should be aware that once the OEM ships a product with a Copeland compressor being used as an air compressor (Dental offices are large users), they will have NO WARRANTY COVERAGE FROM Copeland

b.2 These compressors CANNOT be used for refrigeration application without modifications.

b.3 These models have CADMIUM PLATED valve plates AND CYLINDER HEADS. They DO NOT HAVE an oil return hole from the suction cavity to the crankcase,nor do they have the MILLS DEVICE holes from the suction cavity to the cylinder bores.
Thus you can rest assured , that if one of these compressors is applied to a refrigeration as is, a failure will be assured.

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D.3 COPELAND BULLETINS
3.c VALVE PLATES (ASSEMBLY CHANGES)

c.1 In order to PREVENT the discharge reed retainer posts,screws and nuts, from working loose and damaging the compressor, the threads should be coated with LOCTITE (or equivalent) GRADE AV.

Note: Check current Loctite application information for most recent numbers.

c.2 Application of this type product should be done in accordance with the vendors recommendations.

c.3 Application and assembly completion should be very closely monitored in regards to time product is air exposed. Again adhere to vendors recommendations.

c.4 ITEMS TO LOOK OUT FOR IN VALVE PLATE ASSEMBLY

a. Examine all tapped threads before assembly

b. Once a bolt does not go into the tap straight, DO NOT FORCE. Threads must be undamaged before re-using the valve plate. Any thread that is TOO LOOSE or TOO TIGHT Must not be processed.

c. Once the thread tap is damaged DO NOT USE

d. Watch for consistence in application of adhesive in bolt threads

e. PAY PARTICULAR attention to bolt length, mixed bolt lengths are a NO - NO

f. NEVER mix left over bolts in other boxes of bolts.

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3.d 4R and 6R Stators and rotors

d.1 The newer FULL ROUND (no flat sides) and the Vented rotor MUST be used on all 6R - 30 H.P. compressors. (also see bulletin **3.q**) with the full round stator bore. The reason being that if the unvented rotor is used with the full round stator bore the pressure drop across the motor is such that LUBRICANT return will be marginal.

d.2 The full round stator and vented rotor can be used in all compressors.

d.3 On all other 4R and 6R models, both combinations can be used, this is due to the smaller volumes the compressors handle.

d.4 4R and 6R ten (10) H.P. motors built by EMERSON

Due to POOR starting characteristics which is uncommon in three phase motors, the Copeland part # 047-5006-00 rotor CANNOT be used with Copeland part # 046-5009-00 stator.
ONLY the rotor part # 047-5006-07 is acceptable with part # 046-5009-00 stator.

Rotor # 047-5006-00 should be scrapped.

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3.e OIL PUMP SCHRADER VALVES

e.1 On final test,all compressors with oil pumps the oil pressure MUST be checked at the SCHRADER VALVE PORT or TEE. When replacing the flare cap,be sure NOT TO overtorque the flare nut or tee.

e.2 Over-Torque of the flare cap on the schrader valve,can distort the fitting so the plunger or core will not depress which will give a service person a false indication of no oil pressure. In the event you receive a compressor reported as having no oil pressure, and the compressor checks out good,check and make certain that the schrader valve is in fact functional.

3.f LARGE OIL SUMPS

f.1 Models 4RA5,4RH5, 6RA5 and 6RH5 have the large oil sump, 4RA, 4RH, - 6RA & 6RH models can be converted to the dash 5 models, by replacing the bottom plate with the oil sump assembly part no. 998-1314-00.

f.2 It the compressor body is machined for a threaded type oil screen installed internally, then a pipe plug must be used to plug this port.

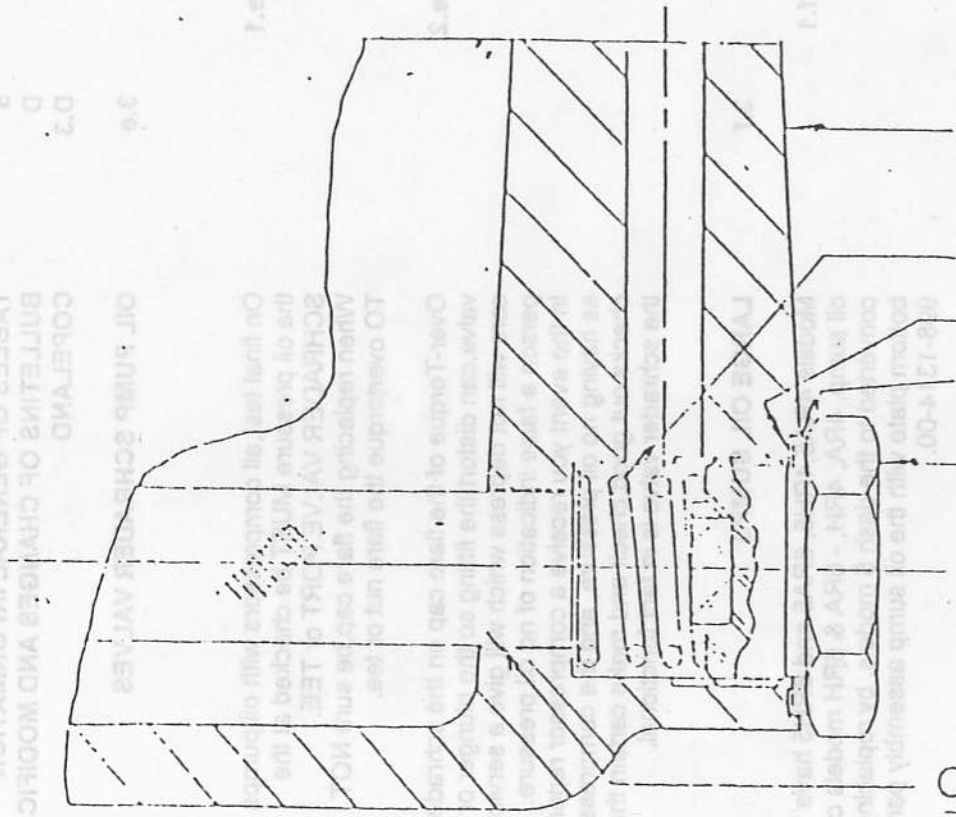
f.3 See attached drawings for further information.

3.g OIL PRESSURE SAFETY CONTROL BRACKETS

g.1 All Copeland models MR,MW,NR,9R,9T,9W,4R,6R, 8R and a "D" models should have an oil pressure safety control mounting bracket installed, with a warning decal affixed.

g.2 The O.E.M specifies that all compressors with an oil pump, are required to have an oil pressure safety control installed and functional to meet their warranty requirements (this does not include the K,E,L series).

g.3 Further OEM data relating to this application can be found Copeland bulletin AE-1213 & AE 1095-R9



003-0409-00-4
COVER-BOTTOM OIL SUMP

006-0195-00-2 SPRING-OIL SCREEN

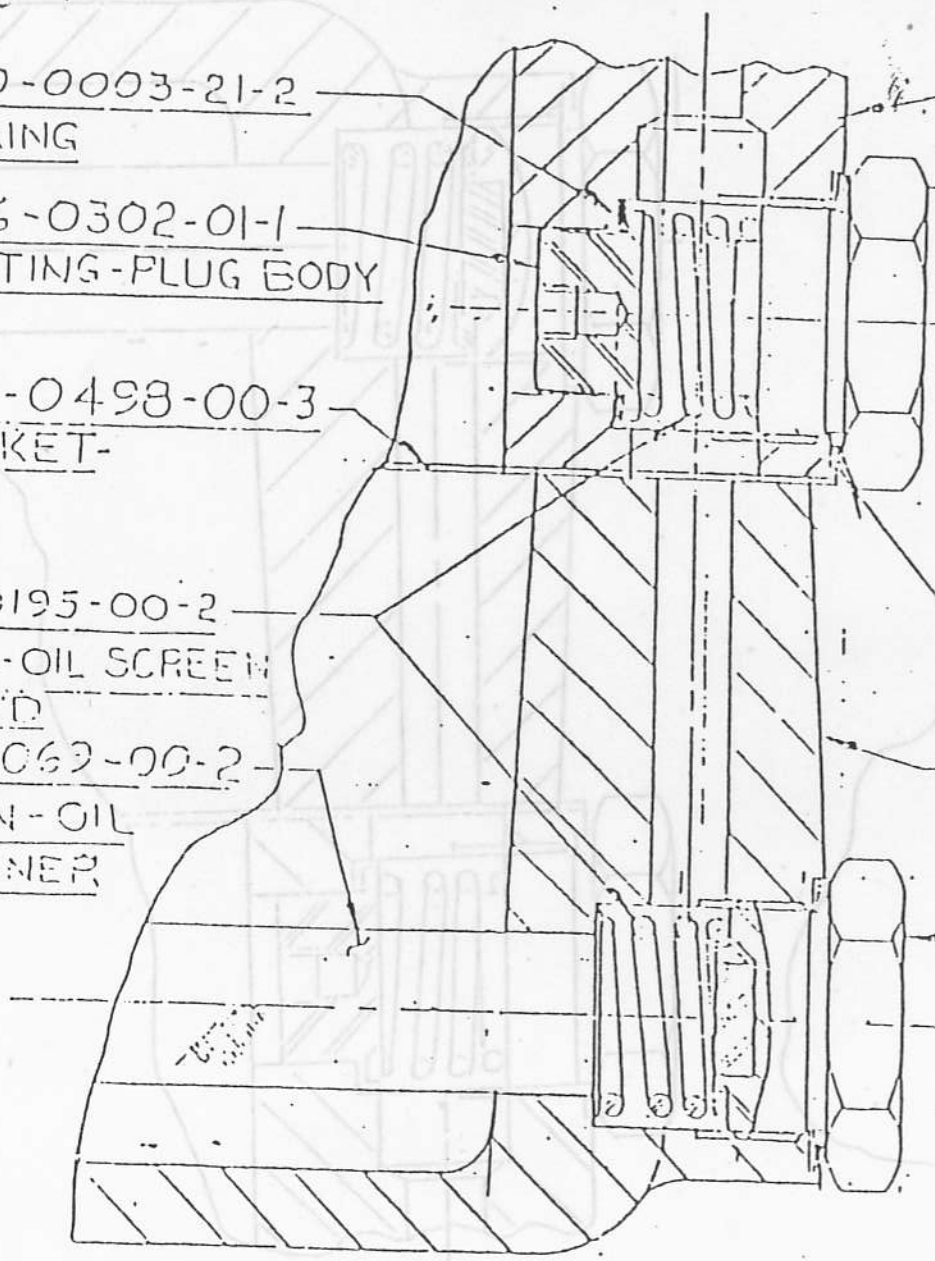
020-0006-27-2 GASKET

020-0006-25-2 GASKET
GRT-1581

036-0296-00-1 FITTING
OIL STRAINER CLEANOUT PLUG
MAGNETIC

SRN 1531

013-0069-00-2 SCREEN-OIL STRAINE



020-0003-21-2
"O" RING

036-0302-01-1
FITTING-PLUG BODY

020-0498-00-3
GASKET-

006-0195-00-2
SPRING-OIL SCREEN
2-REQ'D

013-0069-00-2
SCREEN-OIL
STRAINER

BODY-COMPRESSOR

036-0307-00-1 FITTING-OIL PLUG

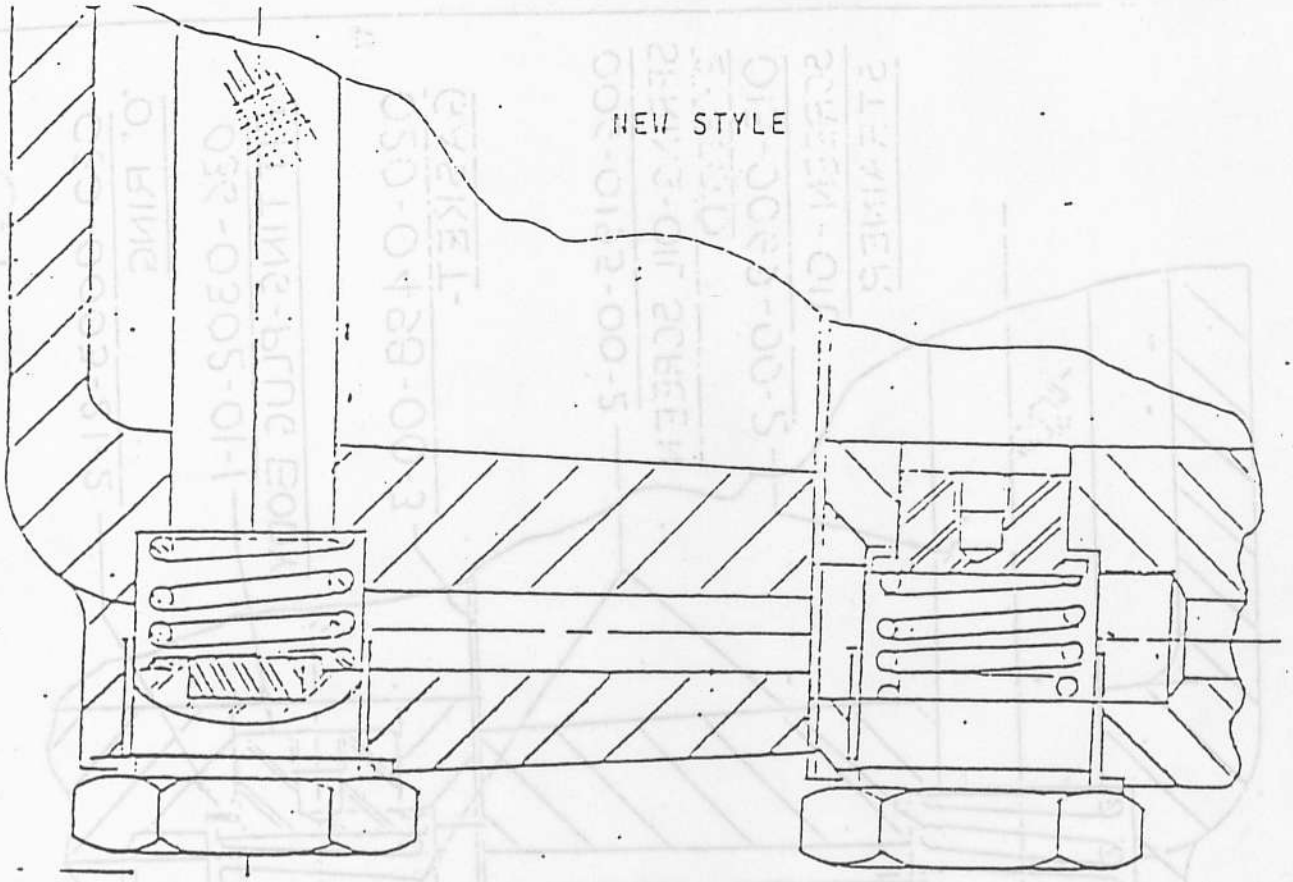
020-0006-27-2 GASKET 2-REQ'

020-0006-25-2 GASKET 2-REQ'

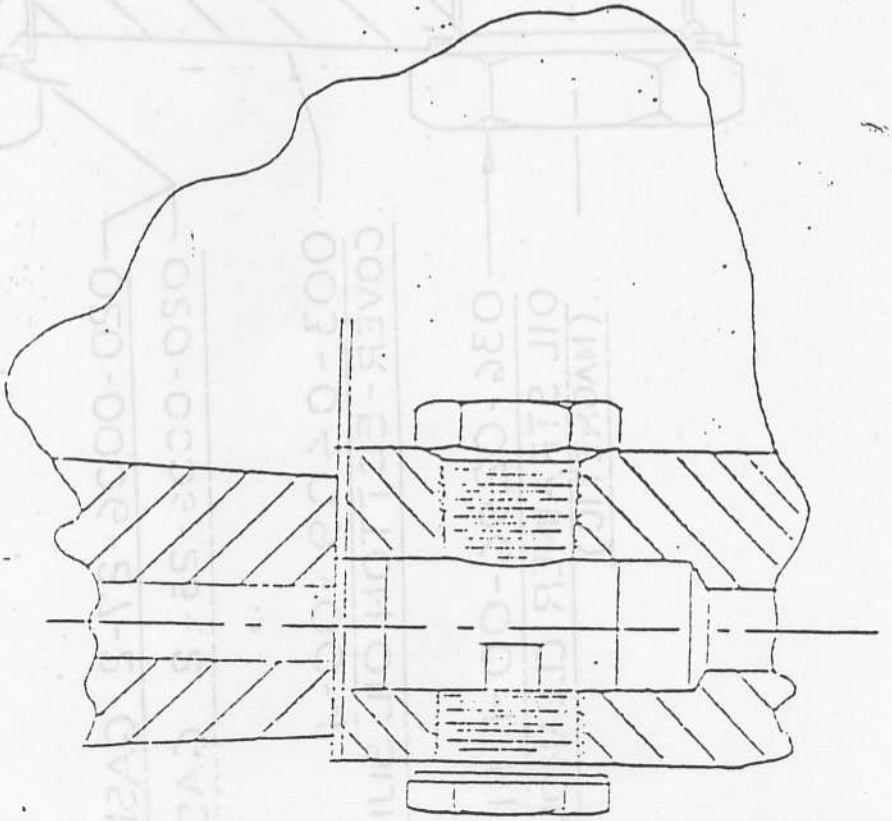
003-0409-00-4
COVER-BOTTOM OIL SUMP

036-0296-00-1 FITTING-
OIL STRAINER CLEANOUT PLUG
(MAGNETIC)

NEW STYLE



OLD STYLE



SECTION 5 TABLES OF GENERAL INFORMATION
SUB SECTION D BULLETING OF CHANGES AND MODOFICATIONS
D.3 COPELAND

3.h 4R & 6R HOUSING COVERS

h.1 The 4R and 6R housing covers have been revised by adding an oil shield assembly.

h.2 The housing covers can be converted by machining then drilling and tapping two (2) holes to secure the shield.
The part numbers involved are

005-0074-00	Old style
005-0074-01	New style

h.3 Oil shield (Copeland part # 005-0254-00) is then attached to the cover.

h.4 This modification applied to all 4R and 6R compressors

Note: The 4RE and 6RE compressors were originally fitted with this modification.

3.i INTERMEDIATE STAGE PRESSURE TAP

i.1 The cylinder heads for the 9T series, must be drilled and tapped where the valve is to be inserted.

1.2 The stator covers for the 6R and 6T series should be drilled and tapped, and the valve installed per drawing.

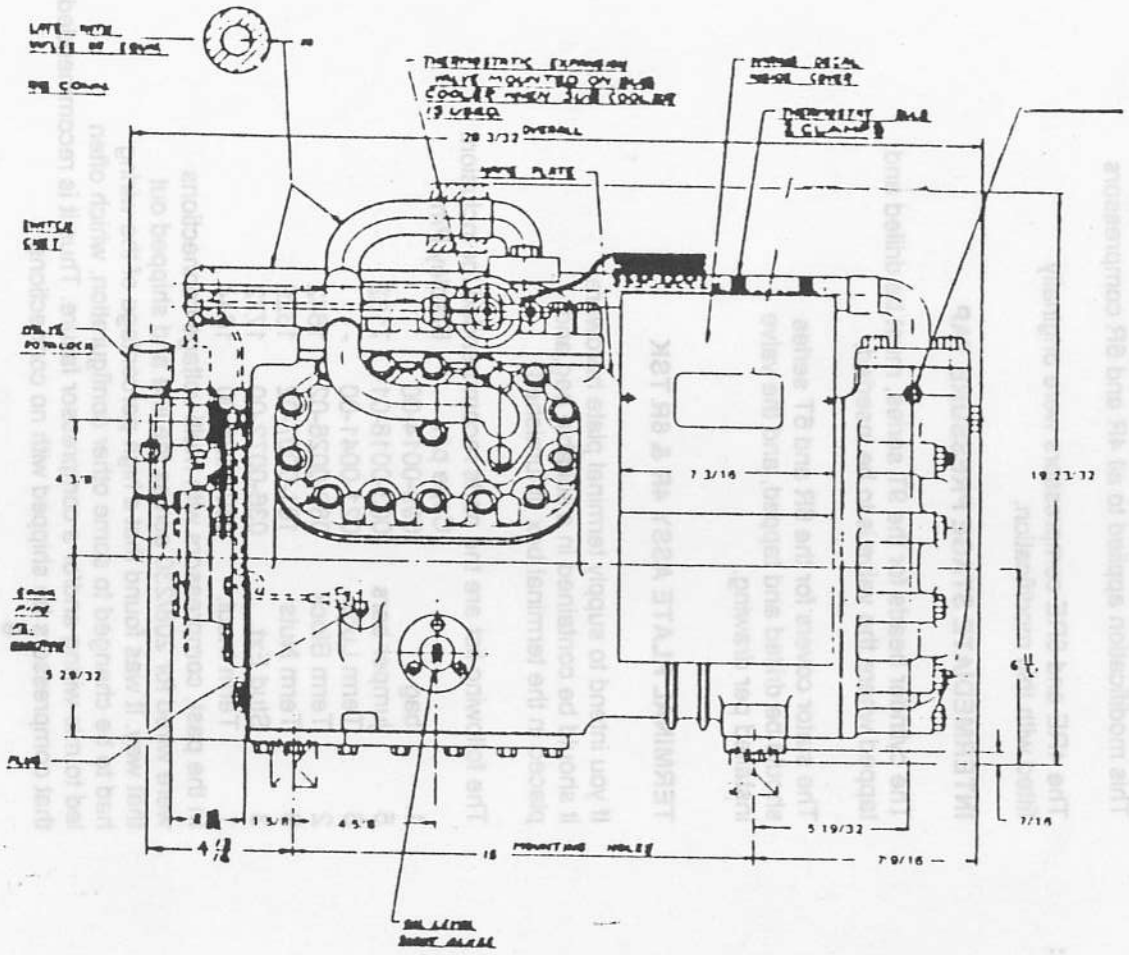
3.j TERMINAL PLATE ASSY 4R & 6R TSK

j.1 If you intend to supply terminal plate hardware it should be contained in a suitable bag,and placed in the terminal box (if furnished)

j.2 The following list are the parts recommended for inclusion.

		Cope p/n	Bradley P/n
1.	bag	099-0014-00	
5	jumper bars	003-0018-01	7162
6	Term Lugs	021-0041-00	- -
2	Term Block	080-0026-02	1642
9	Term Nuts	101-0007-02	1629
3	Stud Ext.	036-0072-00	1772
1	Term Insul.	080-0025-00	1644

j.3 In the past, compressors with multi voltage connections were wired for 208/230 across the line and shipped out that way. It was found that a high percentage of the wiring had to be changed to some other configuration, which often led to mis-wiring and/or a compressor failure. Thus it is recommended that compressors be shipped with no connections.



6-9

SECTION 5 TABLES OF GENERAL INFORMATION
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D.3 COPELAND
3.k MR BODY DATA

k.1 This information is quite old, but needs to be repeated so;
The MR casting has been revised so that all suction gasses are passed through the rotor,which improves motor cooling and also reduces liquid slugging.

k.2 The old style bodies and the new style are fully interchangeable EXCEPT MRA-1.
ALL MRA1-0500 must be built into MRF1-0500
Only the new style body should be used in replacing the MRA1
This can be accomplished by converting MRF2 to MRA2.
The only difference in the two machines is the valve plate.
Remember the MRA2 has a low temp valve plate.

k.3 The new style casting requires a vented rotor (has holes all the way through), Therefor the old style rotor cannot be used in the new style body. The vented rotor can be used in both old and new style bodies.

3.l INHERENT PROTECTION IN OLD STYLE BODIES

l.1 The information contained in this bulletin related to bodies of such age, that they are no longer in the circuit (LL,LH,95,96 etc.) In the event you come upon such a body and need to modify it, contact your Technical Coordinator for the data contained in this bulletin.

SECTION 5 TABLES OF GENERAL INFORMATION
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3.m MODIFICATIONS TO LSG AND LAM1

m.1 The OEM says, that due to low suction gas velocities on low temperature application,proper oil return has been a problem. Then during defrost, the oil returns faster than the small oil return hole in the suction chamber can handle, so the excess oil coes through the compressor and back into the system.

m.2 To improve the oil return, they have enlarged the suction chamber cavity,which will help oil separation and to increase the flow of oil from the suction chamber they have placed a snorkel valve in the path of the suction gas,which reduces crankcase pressure below suction pressure.

m.3 With the enlarged suction cavity,a new suction screen Copeland P/N 013-0038-00 will be required.

m.4 The "MILLS DEVICE" holes leading to the cylinders from the suction chamber MUST be plugged, or the effects of the modification will be lost.

m.5 To further improve the LSG-LAM1 compressor, the OEM recommends using the 0057 valve plate assembly. They state this is a more efficient valve plate and is ALMOST slug proof.

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3.n ROTOR LOCKING DEVICES

N.1 ROTOR LOCKING DEVICES

USED ON MODELS	CRANKSHAFT KEY	ROTOR LOCK BOLT	ROTOR WASHER	ROTOR LOCK
ALL 4R & 6R 10 & 20 H.P.	075-0003-04	100-0013-69	102-0047-01	032-0188-01
6RA 30H.P. 6RB , 6RE	075-0003-05	100-0013-69	102-0047-01	032-0188-01
6RH,6RK,6RP 35 H.P.	075-0009-03	100-0013-69	102-0047-04	032-0188-02
MRA, MRB,MRC MRF,MRH,MWF	075-0009-02	100-0062-11	102-0047-02	032-0188-00
NRB,NRD,NRE	075-0009-04	100-0062-09	102-0053-00	032-0188-00
NRL,NRM,NRN	075-0009-01	100-0062-09	102-0047-00	032-0188-00

ROTOR SPACER WASHERS

Rotor spacer washers must be used as set forth below in order to provide a positive stop when using rotors with a large chamber. these rotors tend to work over the shoulder of the shaft which results in a loose rotor locking device.

WASHER NO.	APPLICATION
102-0053-00	All NR,both new style and old style. All 4R and 6R when using old style shaft.
102-0053-01	All EA, ER, 3R, LA, LW, MR, MW and corresponding old models.
102-0053-02	All 9RC-1010,9RC2, 9RP, 9RS, 9RT, & 9TH due to the large shoulder on the shaft of other 9R compressors, no washer is required. 9RC1 old crankshaft # 007-0035-00 will use rotor bolt # 100-0013-68. 9RC1 new crankshaft # 007-0108-00 will use rotor bolt # 100-0062-11

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	3.n	ROTOR LOCKING DEVICES (CONTINUED)

n.2

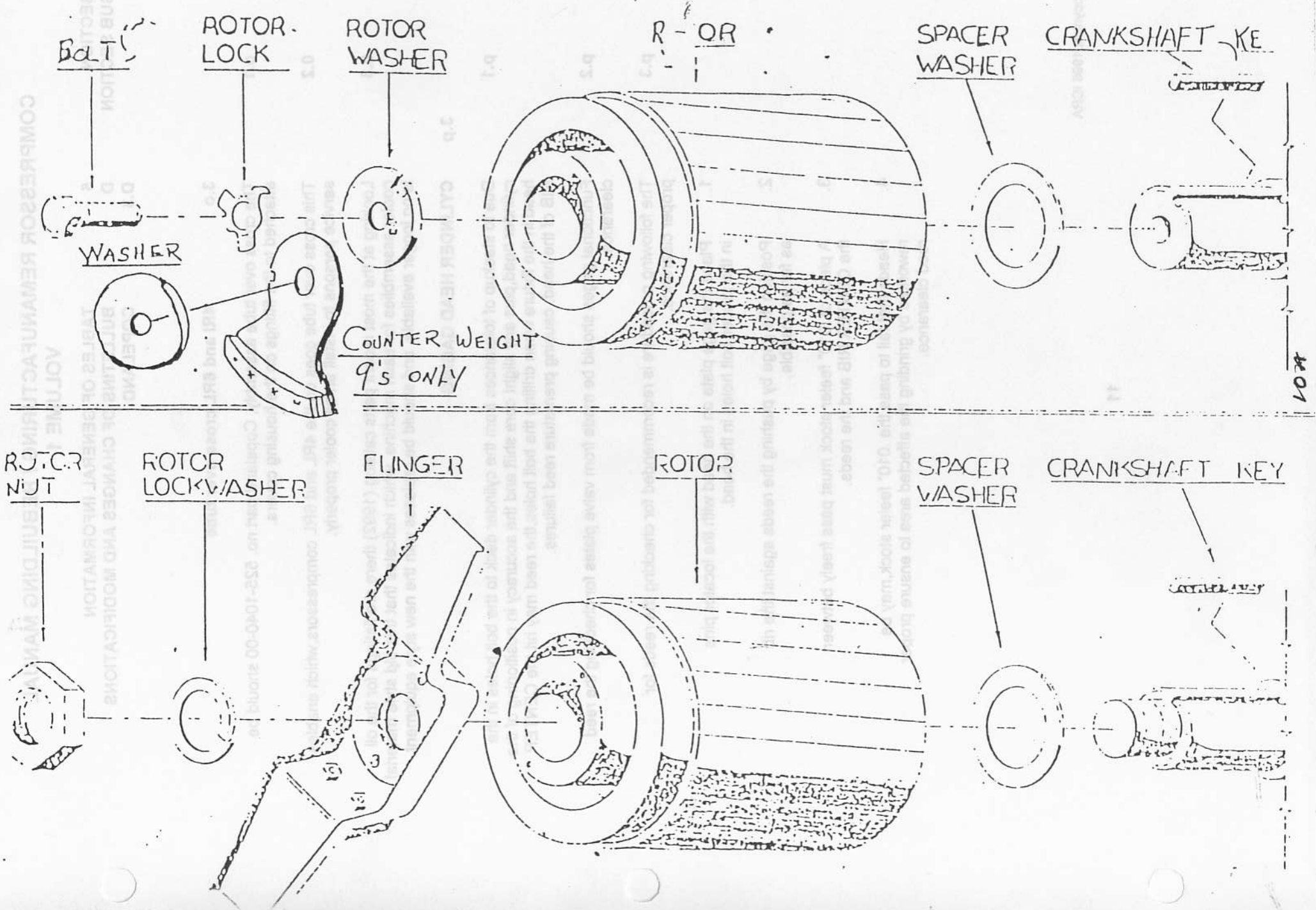
MODEL	CRANKSHAFT	ROTOR KEY	ROTOR BOLT	COUNTER WEIGHT
9RA,9RB,9RC 9RJ,9TK,9TL 9W, 5 & 7.5 H.P.	007-0133-02	075-0009-00	100-0062-11	
9RA,9RB,9RC 9RF,9TK,9TL 9W 5 & 7.5 H.P.	007-0218-00**	075-0009-00	100-0062-11	016-0027-00
9RS,9RT,9TH	007-0109-00	075-0009-01	100-0062-07	
9RS3, 9TH	007-0186-00**	075-0009-01	100-0062-07	016-0027-02
9RC1 , 9RP2 1010	007-0133-00	075-0009-00	100-0062-07	
9RC1 , 9RP2 1010	007-0185-00**	075-0009-00	100-0062-07	016-0026-00
9RS1 , 9RT 1500	007-0186-00**	075-0009-01	100-0062-07	016-0026-01

ROTOR WASHERS

102-0002-61	9RA, 9RB, 9RC, 9RJ, 9TK, 9TL, 9W in 5 and 7.5 H.P. Sizes
102-0002-62	ALL OTHER 9R MODELS LISTED ON THIS SHEET

** Indicates new 9R balanced crankshafts with counterweights.

Note 1: Rotor washer part # 102-0047-02 and 102-0047-03 can be used with tang outward or removed if there is interference.


BOLT
ROTOR LOCK
ROTOR WASHER
ROTOR
SPACER WASHER
CRANKSHAFT KEY
WASHER
COUNTER WEIGHT
9's ONLY
ROTOR NUT
ROTOR LOCKWASHER
FLINGER
ROTOR
SPACER WASHER
CRANKSHAFT KEY

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3.o 4RI and 6RL cross over tube

o.1 The cross over tube assembly, Copeland part no. 525-1040-00 should be attached to the fittings on the housing covers.

0.2 This cross over tube goes on the 4RL and 6RL compressors,which enables service persons to install an oil cooler properly.

0.3 Looking at the most recent parts catalog (1992) there are listings for the oil cooler assemblies for each machine, which indicates that this old style material is no longer available, and should be replaces with the new style equipment.

3.p CYLINDER HEAD GAGING

p.1 Due to stackup of tolerances from the cylinder deck to the bolt holes in the cylinder head,plus any slight core shift and the accuracy in positioning of the head in the fixture when drilling the bolt holes,the reed may hit the CENTER RIB of the head, causing premature reed failures.

p.2 Functional gages should be made from valve plates for checking the reed clearance.

p.3 The following procedure is recommended for checking the reeds for proper clearance.

1. Place the gage plate on the head with the locator pins in the proper bolt holes in the head.
2. Position the gage by pushing the reeds against the rib as far as possible.
3. A piece of .010" feeler stock must pass freely between the CENTER RIB and the reeds.
4. Heads that fail to pass the .010" feeler stock,may be reworked by grinding the affected area to ensure proper reed clearance.

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3.q RESTRICTIONS ON ROTOR P/N 047-0003-10

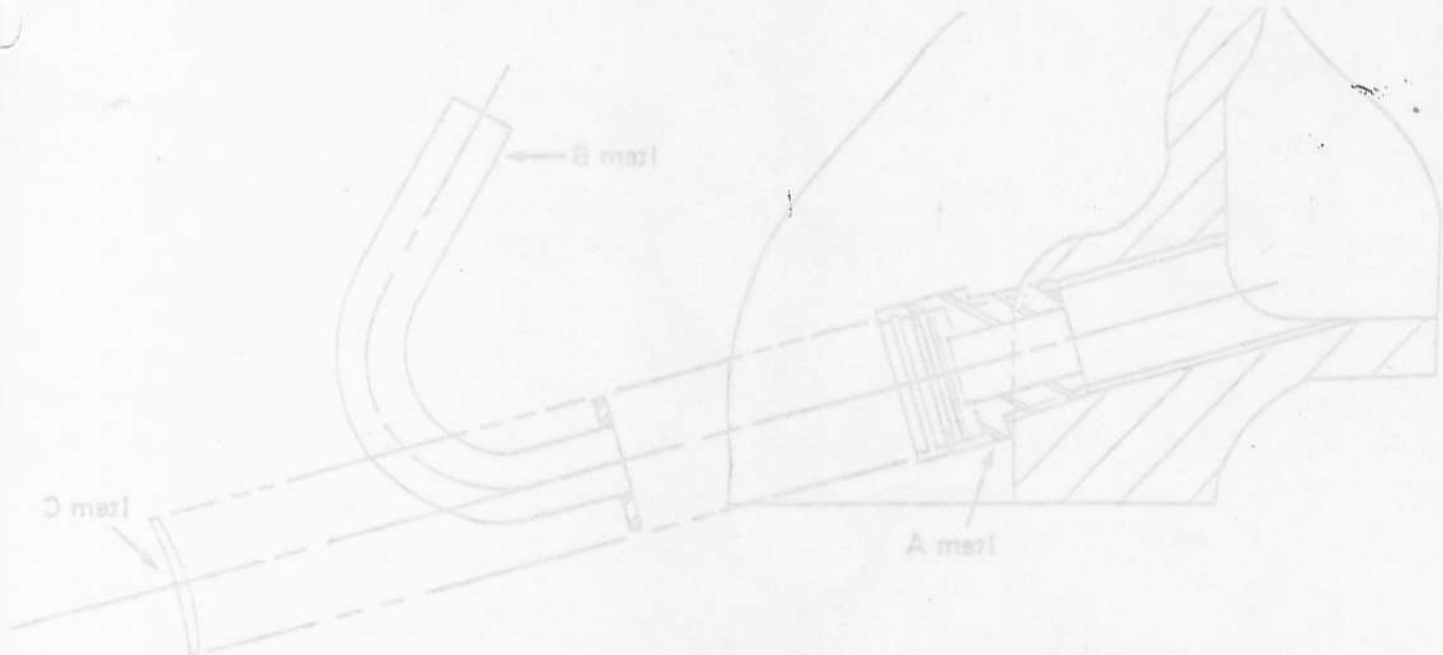
q.1 This rotor (Copeland part no 047-0003-10) is used with stator 046-0015-02 for model 6RA4-3000-TSK (Hi - temp application)

q.2 This rotor has no vent holes.

q.3 This combination can only be used in the old style casting # 001-0148-00 This casting has a slotted bore which allows no restriction for the suction gas which would cause a pressure drop.

q.4 This stator and rotor combination cannot be used in the 001-0158-00 casting. Rotor with no vent holes will cause a pressure drop due to the full round bore in the casting.

old 6e Rotor OBSolete



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3.r CHECK VALVE FOR 4R AND 6R COMPRESSORS

r.1 Prior to 1965, Copeland 4R and 6R compressors has ball type 1/8-27 NPT oil check valves. Since they introduced the high efficiency valve plates and the thin piston rings in 1979-80, the oil tube was added to the check valve.

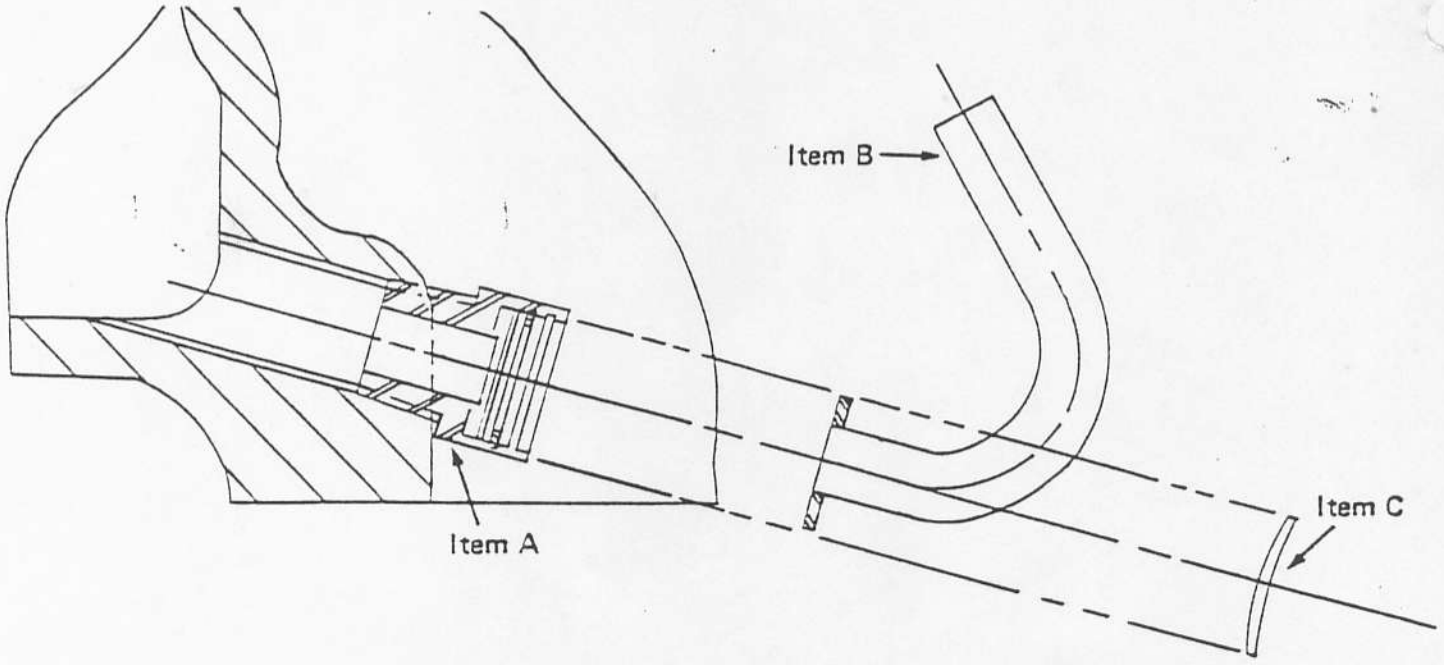
r.2 It is recommended that all 4R and 6R compressors be remanufactured using this later style check valve.

r.3 Use of the older style check valve may cause the compressor to experiance excessive oil carryover rates, and may have an adverse effect on the service life of the compressor.

ITEM "A" CHECK VALVE

ITEM "B" TUBE ASSY (MUST BE VERTICAL)

ITEM "C" TRUARC RING



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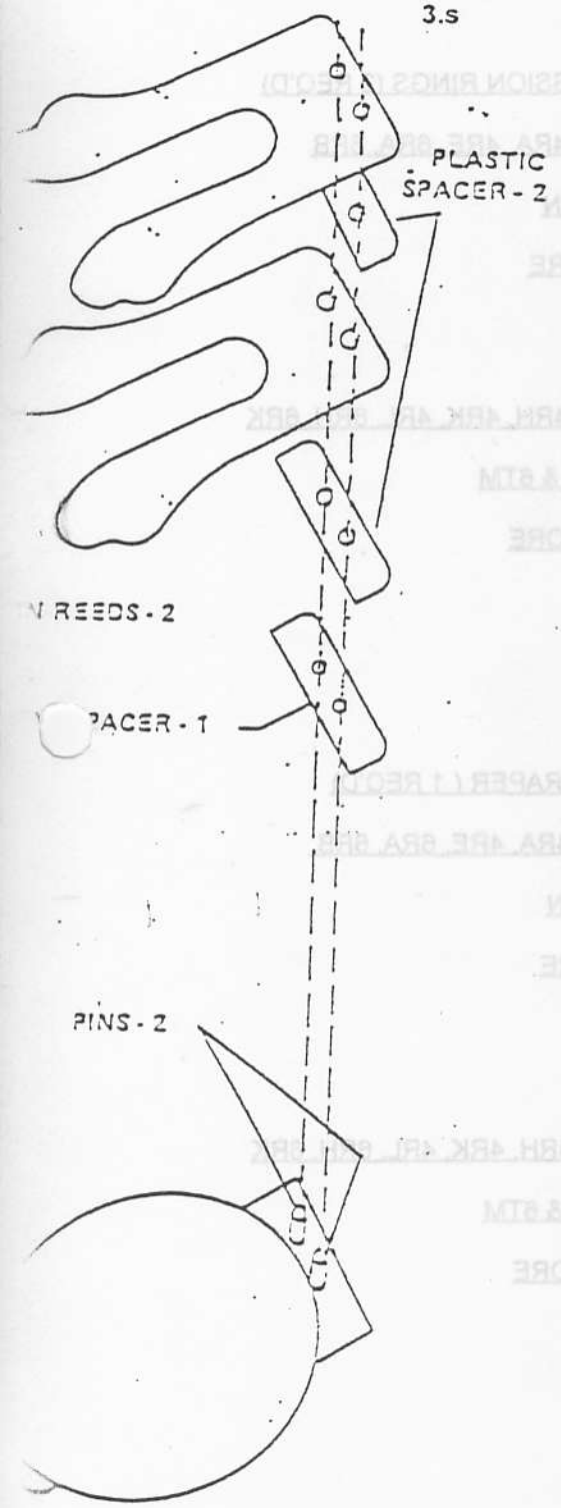
3.s LARGE BORE VALVE PLATE REPAIR PROCEDURES



s.1 These procedures relate to the large bore (2 15/16") compressors

s.2 Follow all safety and good workmanship procedures in removing the cylinder head and valve plate.

s.3 Using new materials (pins also) follow the diagram and install reeds as indicated

s.4 At final assembly. torque cylinder heads to 400 " lbs allow to rest for 1 hour and RETORQUE to 450 "lbs. (Use criss cross method of bolt torque)

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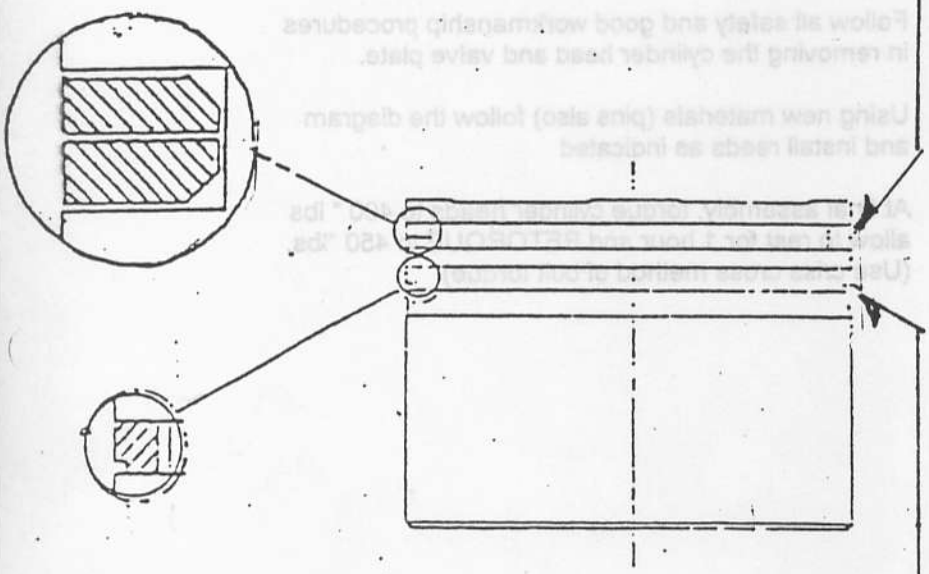
	3.t	4R & 6R RING INSTALLATION PROCEDURE



COMPRESSION RINGS (2 REQ'D)

MODELS 4RA, 4RE, 6RA, 6RB

6RE, & 6RN

2 1/2 " BORE

MODELS 4RH, 4RK, 4RL, 6RH, 6RK

6RL, 6RP & 6TM

2 11/16" BORE

RING - SCRAPER (1 REQ'D)

MODELS 4RA, 4RE, 6RA, 6RB,

6RE, & 6RN

2 1/2" BORE

MODELS 4RH, 4RK, 4RL, 6RH, 6RK

6RL, 6RP & 6TM

2 11/16" BORE

COMPRESSION & SCRAPER RINGS
TO BE ASSEMBLED AS SHOWN

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3.u INTERNAL RELIEF VALVES IN 4RA / 4RE -1000 UNITS

u.1 Recent information from several sources gives substance to the report that the 4RA / 4RE compressors, which up to this date have not been required to have internal relief valves installed,are being fitted with relief valves by the OEM

u.2 It would appear that it would be wise and prudent for all members who remanufacture these compressors install such a valve. This is especially important now with the advent of the newer refrigerants that operate at higher pressures, and should be considered if for no other reason, to reduce any potential liability in the event that something should occur.

u.3 The part number (Copeland part #) is 998-0051-00

u.4 This change should also be considered for the 4D series compressors in the same horsepower range.

u.5 This is not a mandatory change,(at this time)

First issued 3 February 1994
Revised 7 February 1996

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	3.v	INFORMATION REGARDING OLD "D" BODIES

v.1 Recently one of our members sent information to this office that is of interest to our members.
This information centers around the old style "D" (made by modifying "R" bodies) and specifically the 4 & 6 series.
The information that surfaced, indicates that the OEM in the remanufacturing process, one action sometimes taken, was to resurface the block deck (after the inserts have been installed), with the result of reducing clearance below a desirable level for the discharge button, due to removal of material from the base block.

v.2 The corrective action taken by the vendor, is to use a thicker gasket to make up for the loss of base material

v.3 The gaskets noted were app .054" thick for the 2-11/16" compressors, and .050" for the 2 15/16" machines.

v.4 This bulletin is sent as a reminder that all small details need to be observed, especially with the older "D" units that came from modified bodies.

Original message 23 December 1994
Revised 7 February 1996

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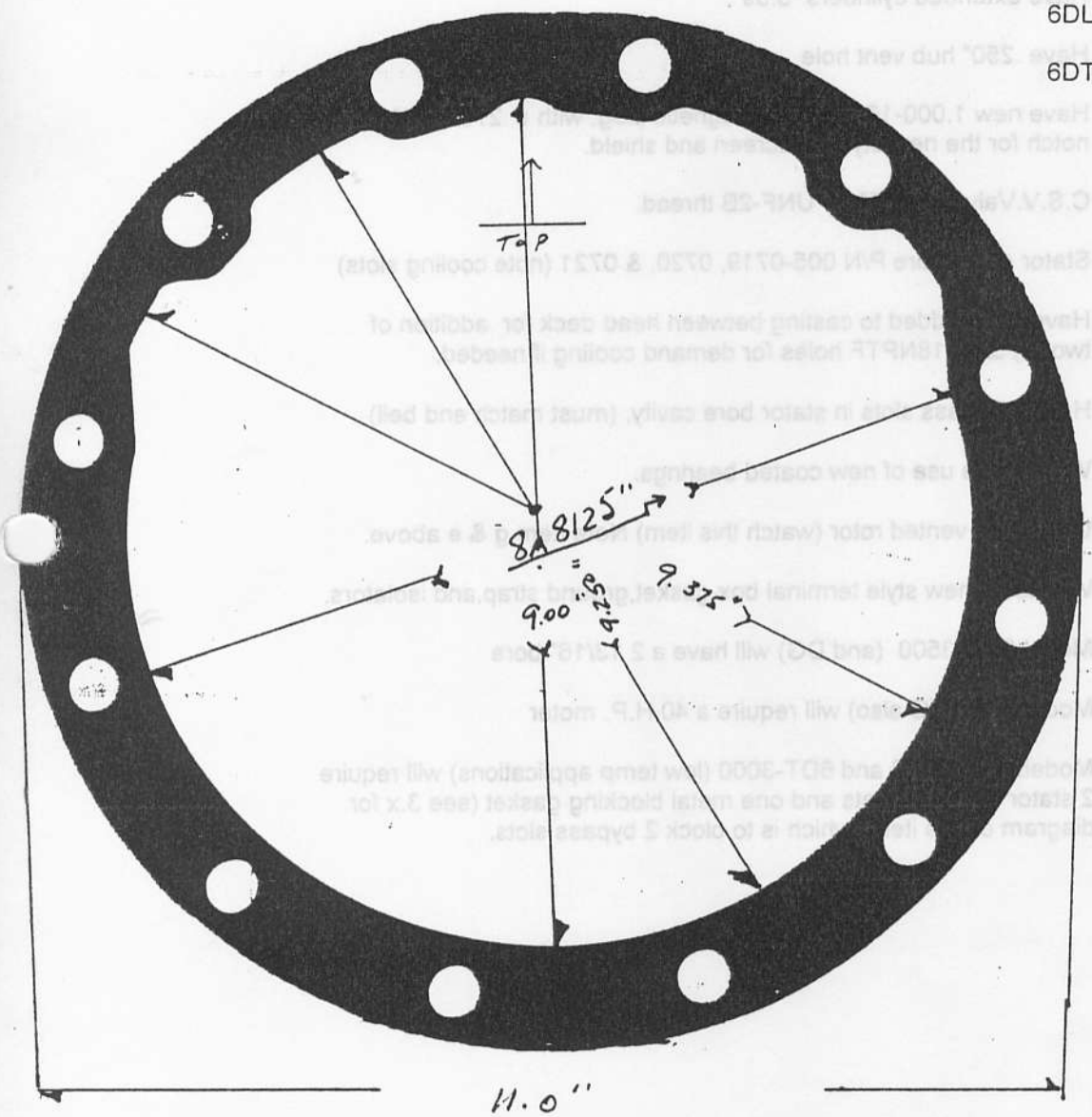
3.x DIMENSIONAL DIAGRAM FOR 6D SPACER PLATES

Spacer plate for

6DL-2700 &

6DT-3000



Material is

.050" mild steel

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	3.y	DASH 3 MODIFICATIONS IN "6-D SERIES

y.1 Design number 001-0343-00, and 001-0344-00

a. Have extended cylinders 3.59"

b. Have .250" hub vent hole

c. Have new 1.000-16 UNF-2B magnetic plug, with a .275-.283" notch for the new style oil screen and shield.

d. C.S.V.Valve is .875"-14 UNF-2B thread.

e. Stator covers are P/N 005-0719, 0720, & 0721 (note cooling slots)

f. Have pads added to casting between head deck for addition of two (2) 3/8 - 18NPTF holes for demand cooling if needed.

g. Have 6 bypass slots in stator bore cavity, (must match end bell)

h. Will require use of new coated bearings.

i. Use a non vented rotor (watch this item) Note item g & e above.

j. Will use a new style terminal box,gasket,ground strap,and isolators.

k. Model 6DH-3500 (and DG) will have a 2 13/16" bore

l. Model 6DH (DG also) will require a 40 H.P. motor

m. Models 6DL-2700 and 6DT-3000 (low temp applications) will require 2 stator cover gaskets and one metal blocking gasket (see 3.x for diagram of this item) which is to block 2 bypass slots.

INTERNATIONAL COMPRESSOR REMANUFACTURERS ASSOCIATION

INFORMATION BULLETIN

21 DECEMBER 1995

It has been brought to the attention of your correspondent that Copeland has issued a Retrofit notice for certain Copeland compressors, and the text of the notice is as follows.

This is to advise you that a retrofit is recommended on Copeland 3D compressors that are operating with R-404A or R-507 refrigerant and polyol Ester oil. The retrofit,consisting of new suction reeds,will ensure the longest possible compressor life and minimize future failures.

Our testing and field experience has recently indicated a higher than normal wear condition that results in shortened life expectancy when these models are operated with R-404A or R-507 and polyol Ester oil. This problem is not found on other models (2D,4D, or 6D) nor does it occur with other refrigerant/oil combinations.

These compressors need to be rertofitted with kit number 998-1247-33 available at no charge through your authorized Copeland Wholesaler.

Please make arrangements to have these kits installed at your earliest convenience. Failure to do so may result in a compressor failure, Therefore, it is to our mutual benefit that these retrofits be done as soon as possible.

Copeland will provide labor allowance of up to $50.00 per compressor to cover the kit installation costs. To receive the labor allowance the removed reeds must be returned to us with an invoice stating the model number,serial number,store number,location and date of retrofit. This should be sent to

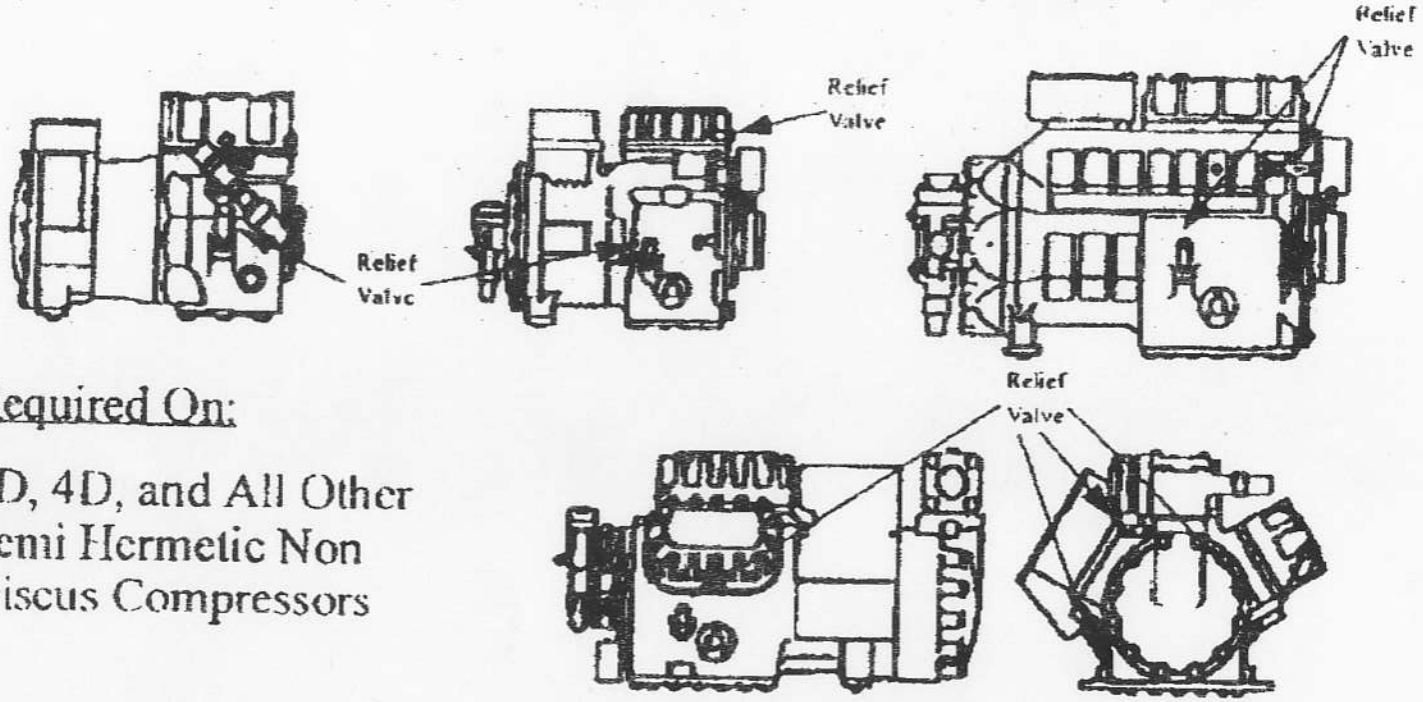
Copeland Corporation
1675 W.Campbell Rd.
Sidney,OH 45635
Attn: service Engineering

If additional kits or technical assistance is required,please contact your authorized Copeland Wholesaler.

Information at hand indicated that this retrofit relates to products from Russell, Co. and low temp products they produced, however it would be wise and prudent to watch for this series compressor, and ensure that the proper valves are installed when re-manufactured

LOW SIDE PRESSURE RELIEF VALVE

Required When Retrofitting R502 To R402A/R404A/R507



Required On:

3D, 4D, and All Other
Semi Hermetic Non
Discus Compressors

Excess Pressure Build-up On Models Indicated Could Result In Compressor Exploding Unless Pressure Relief Valve Is Installed

Copeland EDUCATION

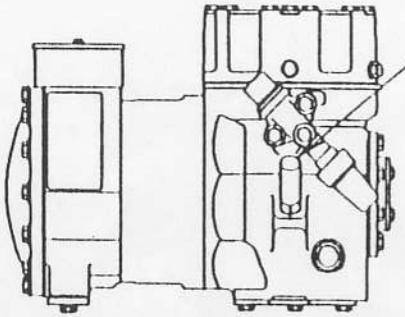
LOW SIDE PRESSURE RELIEF VALVE INSTALLATION INSTRUCTIONS

THIS KIT IS INTENDED FOR FIELD INSTALLATION ON COPELAND COMPRESSORS WHEN RETROFITTING THE SYSTEM WITH HIGH PRESSURE REFRIGERANTS SUCH AS HP80. COMPRESSOR MODELS THAT REQUIRE THIS VALVE ARE:

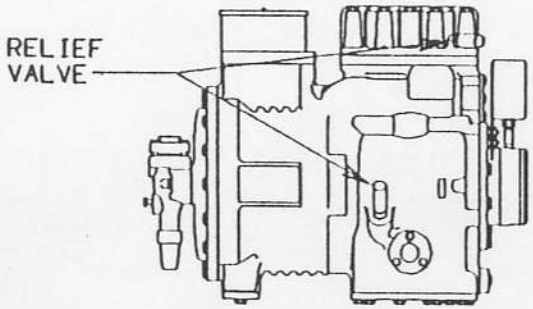
- DISCUS 3D, 4D, 6D, 8D, 9D, & MD
- SEMI-HERMETIC H, K, E, 3, L, N, MR, 9R, 4R, 6R, & 8R

MOUNTING LOCATION

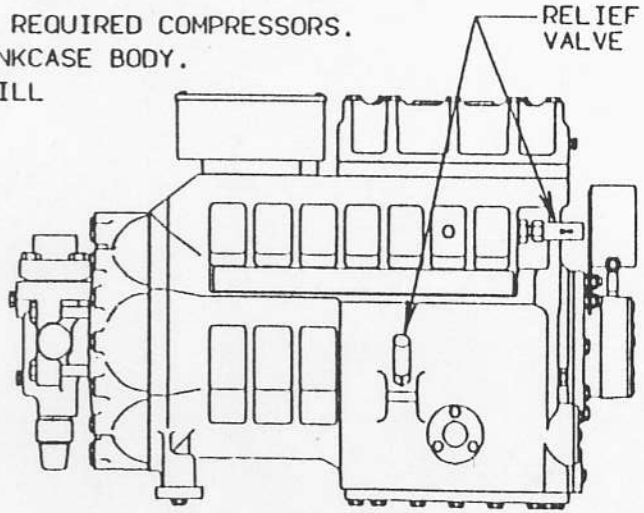
THIS KIT IS SUPPLIED WITH ADAPTERS TO ALLOW FOR INSTALLATION ON ALL REQUIRED COMPRESSORS.
H & K MODELS- INSTALL RELIEF VALVE DIRECTLY TO OIL FILL HOLE ON CRANKCASE BODY.
ALL OTHER MODELS- RELIEF VALVE CAN BE INSTALLED ON EITHER THE OIL FILL HOLE OR EITHER THE HEAD OR BODY. SEE DRAWINGS DEPICTING THE VARIOUS MOUNTING OPTIONS FOR THE PARTICULAR MODEL IN QUESTION.



H & K MODELS - OIL FILL ONLY



E,3,L,N,MR,9R MODELS-
OIL FILL OR HEAD



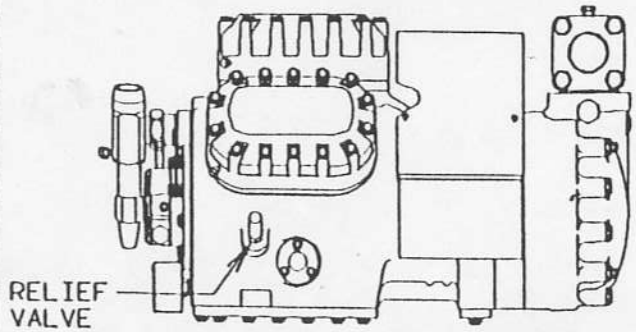
3D, 9D, MD MODELS-
OIL FILL AND BODY SUCTION PASSAGE

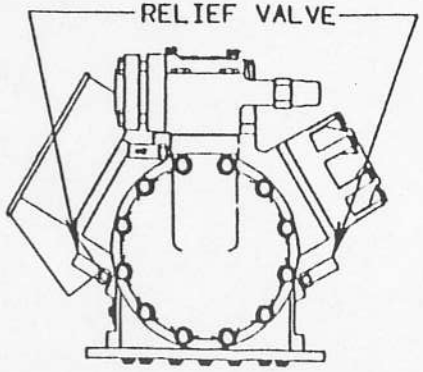
INSTALLATION

WHEN INSTALLING THE VALVE, A PROPER THREAD SEALANT SUCH AS TEFLON ® TAPE IS RECOMMENDED TO PREVENT LEAKS. THE VALVE SHOULD BE TORQUED TO:

- 1/8 NPT VALVE - 11 TO 14 FT-LBS
- 1/4 NPT FITTING- 16 TO 20 FT-LBS
- 1/2 NPT FITTING- 36 TO 43 FT-LBS

FOR ADDITIONAL INFORMATION SEE COPELAND COPELAND CHANGEOVER GUIDELINES R-502 TO HP80. FORM NO. 93-05.





4R, 4D, 6R, 6D, 8R & 8D MODELS- OIL FILL AND STATOR COVER

WARNING

IT IS POSSIBLE THAT EXCESS PRESSURE BUILD-UP ON MODELS INDICATED COULD RESULT IN THE COMPRESSOR EXPLODING UNLESS THE PRESSURE RELIEF VALVE SUPPLIED IN THIS KIT HAS BEEN INSTALLED AS SPECIFIED.

Copeland Demand Cooling Diagnostics

Issued October 1, 1992

Demand Cooling Operating Characteristics

The Copeland Demand Cooling control uses a Negative Temperature Coefficient thermistor **(NTC)**, incorporated in the **Demand Cooling Temperature Sensor (hereafter called "sensor")**, as a compressor discharge temperature monitor. When temperature sensed by the **NTC** thermistor rises, its resistance falls, and when temperature sensed by the thermistor drops, its resistance increases.

The **sensor** resistance signal is coupled to the **Demand Cooling Module (hereafter called "module")**. The **module** uses the signal to determine when the compressor discharge temperature has risen to a point where Demand Cooling is required. When Demand Cooling is required the **module** energizes the **Demand Cooling Injection Valve (hereafter called "injection valve")** and the valve injects saturated refrigerant into the compressor suction cavity until discharge temperature drops to an acceptable level.

Whenever the compressor starts, and the **module** first receives power, there is a one minute delay during which the Demand Cooling system injects saturated refrigerant if required, but waits for compressor discharge temperature to stabilize before checking for alarm conditions. After one minute, if the resistance of the probe is too high (the resistance equivalent of 310°F), or too low (the resistance equivalent of a -4°F) the **module** will trip and deenergize the compressor.

Bench Testing Demand Cooling Components

BENCH CHECK OF THE SENSOR

Required Equipment:

A digital thermometer of ± 1% full scale accuracy. The thermometer probe should be checked for calibration in an ice water bath or compared with another accurately known temperature source.

A digital ohmmeter capable of ± 1% accuracy. The ohmmeter should be checked for accuracy with a known resistance value such as a ±1% resistor.

Room temperature should be stable and between 60°F and 110°F.

1) Wrap the end of the digital thermometer probe and the metal end of the Demand Cooling **sensor** probe together with electrical tape or "Velcro". The end of the probe and the end of the thermometer **must** touch.

2) Place the wrapped probe-**sensor** inside an insulation shield to protect it from air currents. Use a material such as "Permagum" or piping insulation such as "Armaflex". The insulating material should be tightly wrapped around the probe-**sensor** and the wrap secured with wire or tie-wraps if necessary. There should be no free air movement over the metal part of the taped probe-**sensor**.

3) Connect the digital ohmmeter to the two pins on the plug of the **sensor**. Make sure there is a good connection. **Do not take a sensor resistance measurement until there is no change in the ohmmeter display.**

4) Measure the temperature of the thermometer **sensor** and find the corresponding calculated **sensor** resistance value from **Table 1**. Since the values of **Table 1** are not continuous, you will have to interpolate.

5) The **sensor** resistance reading should be within ± 5% of the calculated resistance value of **Step 4**.

End of test

TABLE 1

Thermometer Temp. (°F)	Calculated Sensor Resistance (Ohms)
59	141426
60.8	135000
62.6	128907
64.4	123129
66.2	117639
68	112437
69.8	107478
71.6	102762
73.4	98289
75.2	94041
77	90000
78.8	86139
80.6	82476
82.4	78984
84.2	75663
86	72504
87.8	69480
89.6	66609
91.4	63864
93.2	61254
95	58770
96.8	56394
98.6	54126
100.4	51966
102.2	49914
104	47943
105.8	46053
107.6	44262
109.4	42543

BENCH CHECK OF THE MODULE AND INJECTION VALVE

Required equipment:

A control voltage source the same as the rating of the **module** and the **injection valve**.

A multimeter.

If the jumper supplied on the **sensor** plug of the **module** is not available you may use a small paper clip for the test.

Before starting make sure you have the correct **module** and **injection valve**.

1) With the **module** control voltage disconnected, short the **module sensor** plug female terminals with the jumper or the paper clip. Press the **module** reset button.

2) Attach the **injection valve** leads to terminals **"L2"** and "S" of the **module**. The **injection valve** should be propped in an upright position.

3) You should read zero ohms between the **"L"** and **"M"** terminals of the **module**. This is the Normally Closed **(NC)** contact of the Single Pole Double Throw, **(SPDT), module** alarm relay. You should read an open circuit between **"L"** and **"A"**, the Normally Open **(NO)** contact of the alarm relay.

4) Energize the **module** by bringing module rated voltage to terminals **"L1"** and **"L2"**.

When the **sensor** connection at the **module** is shorted, the **very low resistance** is seen by the **module** as a **very high temperature**, and an injection signal **is** sent to the **injection valve**.

5) The **injection valve** will be energized by the closing of an electronic switch in the **module**. The control voltage to energize the **injection valve** may be measured* across **module** terminals **"S"** and **"L2"**.

*Because this measurement is made across an electronic switch some **"leakage" voltage may be measured when the switch is deenergized**. This voltage is much less than the control voltage which is measured when the electronic switch is closed.

5a) The **injection valve** operation may also be checked by listening to the "click" heard each time the coil of the **injection valve** is energized and the **injection valve** solenoid plunger seats itself.

5b) If background noise prevents an audible check of the **injection valve** coil and magnet operation, grip the **injection valve** magnet housing and loosen its housing cover screw until magnet vibration is felt. This proves solenoid operation. Retighten the magnet housing cover screw after this check.

6) After one minute, the **module** should trip. The run contact **"L"** to **"M"** should open, and the alarm contact **"L"** to **"A"** should close. Deenergize the **module,** disconnect the **injection valve**, and read zero ohms between **"L"** and **"A"** and an open circuit between **"L"** and **"M"**.

7) Reset the **module**. Remove the jumper from the **module** probe plug so there is an open circuit at the plug input.

8) Energize the **module**.

When the **sensor** connection to the Demand Cooling Module **(module)**, is opened the **very high resistance** is interpreted by the **module** as a **very low temperature**. Consequently no injection signal is sent to the **injection valve**.

9) The **injection valve** should **not** be energized. A recheck of **Step 5** will confirm this.

10) Refer to the test of **Step 6** to check the alarm circuit. Reset the **module** after the test.

If the **module** or **injection valve** fails any of the checks it should be replaced

End of test

Installed System Checks of Demand Cooling Components

When the Demand Cooling control injects saturated refrigerant into the suction cavity of the compressor, the outlet tube of the **injection valve**. frosts.

If the **module sensor** connection is opened or shorted while the **module** is energized, the **module** will trip after one minute of operation and must be reset to continue.

Before starting make sure you have the correct **module** and **injection valve**.

IF THE INJECTION VALVE IS NOT INJECTING

1) With the system deenergized, disconnect the **sensor** from the **module** and jumper the terminals of the **module** connector. Energize the system so the compressor is running and the **module** energized. The **injection valve** should begin injecting, and frost should form on the outlet tube of the **injection valve**.

If **Step 1** is successful, go to **Step 4** otherwise go to **Step 2**.

2) If frost does not form in **Step 1**, check to see if there is control voltage* on the coil of the **injection valve** (terminals **"L2"** and **"S"** of the **module**).

*Because this measurement is made across an electronic switch in the **module** some **"leakage" voltage may be measured when the switch is deenergized**. This voltage is much less than the control voltage which is measured when the switch is closed.

If correct control voltage is not present, replace the **module**.

3) If correct control voltage is present, make sure there is a full sight glass of liquid from the receiver at the **injection valve**. If there is not a full sight glass of liquid, the piping from the receiver should be checked before proceeding.

Piping connections and sizes **must** be chosen to assure a full sight glass of liquid for the **injection valve** during **any** phase of the refrigeration system operation. Piping that is too small, or connections taken from the tops of manifolds rather from the bottom or, may result in a lack of refrigerant available for the **injection valve** just when it needs it most, such as after a defrost.

If a full sight glass is present, and frost still does not form, replace the **injection valve**.

4) With the **module sensor** connector shorted or open, and the **module** and compressor running, the **module** should trip in one minute and stop the compressor.

If the compressor does not stop, check the control circuit wiring to be sure the **module** is wired to stop the compressor when the **module** trips. If the wiring is correct, replace the **module**.

5) Check discharge temperature by performing **Steps 1-5** of the **If the Injection Valve is Cycling On and Off** test.

If the discharge temperature is higher than the allowable **Table 2** selection, Remove the **sensor** from the compressor and use the **Bench Check of the sensor** to check the probe.

Replace the **sensor** if necessary.

End of Test

IF THE INJECTION VALVE IS CONTINUALLY INJECTING

1) Make sure there is a full sight glass of liquid from the receiver. If there is not a full sight glass of liquid there may not be enough liquid to allow Demand Cooling to cycle because it uses all available liquid just to keep discharge temperature below a dangerous level. The piping from the receiver to the **injection valve** should be checked before proceeding.

Piping connections and sizes **must** be chosen to assure a full sight glass of liquid for the **injection valve** during **any** phase of the refrigeration system operation.

2) Deenergize the system and disconnect the **sensor** from the **module**. Energize the system so the compressor is running, the frosting should stop.

If **Step 2** is successful, go to **Step 4** otherwise go to **Step 3**.

3) If frosting does not stop, with the **sensor** disconnected, deenergize the system, disconnect voltage to the **injection valve** then restart the compressor.

If frosting does not stop, replace the **injection valve**. If frosting stops, replace the **module**.

4) If frosting stops when the **sensor** is disconnected, check the system for high suction and/or condensing temperatures before proceeding. As suction and/or discharge temperatures rise toward Demand Cooling limits (-40°F evaporator temperature, +130°F condensing temperature), Demand Cooling will call for injection for longer periods of time and may appear to be continuously injecting.

Use **Figure 1** to check Demand Cooling operating areas. **Figure 1** shows where injection begins for two return gas temperatures (65°F and 20°F). The arrows marked (A) and (B) on the graph show the lowest allowable evaporating temperatures, using as an example 110°F condensing temperature.

Point (A) shows that with 65°F return gas and 110°F condensing temperature, the lowest evaporating without Demand Cooling injection is -5°F. Point (B) shows that if the return gas temperature can be lowered to 20°F, while still at a condensing temperature of 110°F, the evaporating temperature may be lowered to -20°F without Demand Cooling operation.

Your injection point can be approximated by drawing a line representing your return gas temperature in between and parallel to the two return gas temperatures on the graph (Area 2). The higher your return gas temperature is, the closer it will be to the "65° line". The lower it is, the closer it will be to the "20°F line". You can then draw your own dotted lines representing your condensing and evaporating temperatures to see if you are in the in a Demand Cooling injection zone.

The higher your condensing and suction temperatures are, for a given evaporating temperature, the more injection is required until finally Demand Cooling may be energized constantly.

If suction temperature and condensing temperatures are lower than, or borderline to the injection areas of **Figure 1** go to **Step 5**.

If they are much higher the system should be corrected to lower the temperatures or there may be occasional Demand Cooling trips. If lowering system temperatures corrects the continuous problem, the test is ended, if not go to **Step 5**.

5) Deenergize the refrigeration system. Close the suction service valve. Turn the system on and pump down the compressor to 2-3 PSIG. Turn the system off. Wait one minute. The pumpdown should hold and pressure should not rise.

If suction pressure rises then go to **Step 6** if suction pressure does not rise the **sensor** is calling for injection when it is not required and should be replaced.

6) If suction pressure rises, the suction service valve may not be entirely closed, or the valve plate or valve plate gasket may have been damaged. Damage to the valve plate or its gasket can cause discharge gas to be introduced to the suction cavity, resulting in an artificially high suction temperature. The artificial suction temperature, in turn, causes an earlier-than-required Demand Cooling injection.

Replace the compressor valve plate and gaskets if required.

End of Test

IF THE INJECTION VALVE IS CYCLING ON AND OFF

When saturated refrigerant is injected into the compressor suction cavity it lowers the temperature sensed by the **sensor**. The lower temperature in turn causes the **injection valve** to shut-off. After shut-off the temperature in the suction cavity rises again until it is high enough for injection to start. The result of this cycling is that frost on the **injection valve** outlet tubing alternately appears during injection, and then disappears after injection stops.

1) Measure room temperature.

2) Connect the temperature sensor probe to the compressor discharge line 6" from the discharge valve. The probe **must** be tightly secured to the discharge line, and **must** be well insulated so that moving air will not produce a false reading (a poorly insulated probe may cause errors of more than 30°F!).

3) Use **Table 2** to select the family of the test compressor: 2D, 3D, 4D or 6D.

4) Use **Table 2** to select the room temperature and condensing temperature closest to yours. (The evaporator temperature chosen for the data of **Table 2** was -25°F).

5) Because of system variations, there will be deviations from **Table 2**. A measurement of +5% or -10% of the selected **Table 2** discharge pressure may be considered satisfactory.

When operating under published conditions, discharge temperature should never be more than 280°F or less than 200°F.

If **Step 6** is successful the test is ended otherwise go to **Step 7**.

7) If the measured discharge temperature is lower by more than 10% of the discharge temperature of **Table 2**, perform **Steps 5-8** of The **"If The Injection Valve Is Continually Injecting"** test.

If the measured discharge temperature is more than 280°F, replace the **sensor**.

End of Test

TABLE 2

Compressor Model	Room Temp. (°F)	Cond. Temp. (°F)	Disch. Temp. (°F)
2D	80	80	250-270
	110	110	270-280
3D	80	80	240-265
	110	110	265-280
4D	80	80	230-260
	110	110	260-280
6D	80	80	250-270
	110	110	250-270

Discus, R-22 Demand Cooling Areas of Expected Injection

(See page 3 for chart usage)

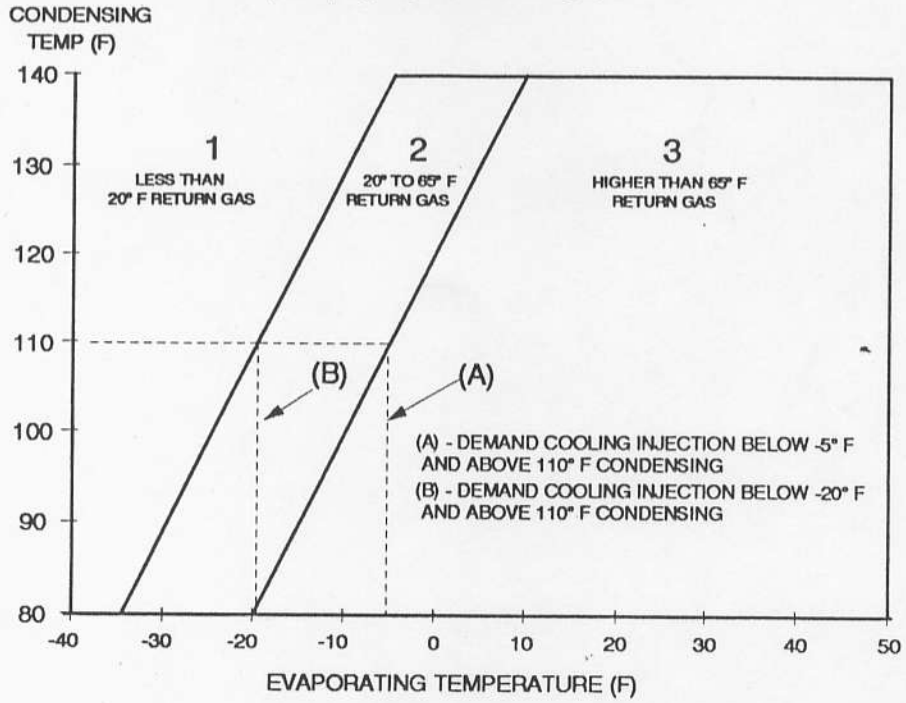


Figure 1

Form No. 92-91

Printed in U.S.A.
Copeland Corporation
Sidney, OH 45365-0669

Copeland®

SECTION 5 **TABLES OF GENERAL INFORMATION**
SUB SECTION D **BULLETINS OF CHANGES AND MODIFICATIONS**
D – 3
Z **MODEL LAC – LAH PUMP CHANGE OVER PROCEDURE**

Z 1 Install New Bearings in housing

Z 2 Using a 2" end mill, surface the body at the bearing on the crankcase side Remove only enough material to make a smooth surface.

Z-3 Lay the compressor down, (crankcase side up)

Z 4 Install crankshaft and oil pump housing (with gasket)

Z 5 Pull and turn crankshaft until oil pump and slot are aligned.

Z-6 Measure distance between crankshaft journal and newly surfaced body.

Z 7 Make spacer for that space (reduce measurement .020") (Old MR. Bearing Will work for this spacer (OEM spacer will be plastic)

Z 8 Check fit of assembly, it should fit smooth, and should be thick enough to Not spin and lock into the bearing (do not use an "L" model bearing)

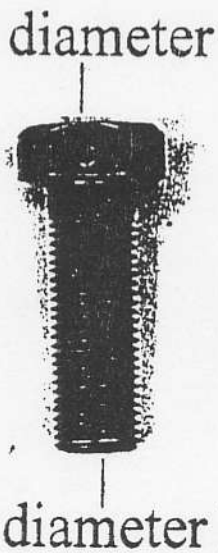
Z 9 Modify rotor bolt to pattern as shown below..

Z 10 Install original slinger, with modified rotor bolt.

Please note, that it is recommended that a replacement crankshaft be used as they also need to be modified, this modification can be done in house, but takes time, an association vendor has replacement shafts in stock.

This information is the courtesy of Orr – A1 , who reports compressor failures have dropped dramatically since this modification has been employed.

Part #	Description	Vendor
CKS 1507	Crankshaft	CMP
PMP 1509	Bearing end with pump	CMP
	Rotor Bolt	House Modification



THE 3/32 AND ¼
Meet and should be clear