

AT 39.2/016

CRYOGENICS
MAINTENANCE
MANUAL
NARRABRI
&
MOPRA

MARK BLAND 27.NOV.1992

NOTE

- 1. Maintenance to the cryogenic system is to be carried out ONLY BY CRYOGENIC STAFF , except in the case of emergencies when cryogenic staff can not be contacted. The reason for this is that damage to the system may occur , due to those unfamiliar with the workings of the entire system.**
- 2. If any part of the cryogenic system is to be turned off - the Primary Monitor must be Isolated in the control room first.**

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SECTION 1

SYSTEM DESCRIPTION

The cryogenics system used by the Australian Telescope consists of CTI 1020R compressors and 1020 cryodynes. These are linked by stainless steel lines and fittings. Basically helium gas is compressed by the compressor which supplies the cryodyne with helium gas at a pressure of 290 PSI. The helium gas is forced through the displacers in the cylinder (Ref. Fig. 5.1) to make the gas expand thus causing a cooling effect. The return pressure from the cryodyne is 80 PSI , this is caused by the displacers expanding the gas. The system is totally enclosed and runs continuously.

Primary Monitor Alarm

The cryogenics system is linked to the primary monitor alarm. If the supply pressure to the cryodyne falls below 220 PSI a pressure switch mounted on top of the manifold board will cut power to the cryodyne causing the primary monitor to sound an alarm in the control room.

Other important readings such as temperature and vacuum pressure are monitored in the cryogenics Lab , on CAMON. Any readings outside the limits set are flagged on the screen for attention by cryogenics staff.

Set Limits

CX CRYOGENICS

Supply pressure	250 to 350 PSI
Return pressure	60 to 115 PSI
70 k stage	0 to 80 k
20 k stage	0 to 35 k
Vacuum	0 to 0.01mBa

LS CRYOGENICS

Supply pressure	250 to 350 PSI
Return pressure	50 to 115 PSI
70 k stage	0 to 125 k
20 k stage	0 to 35 k
Vacuum	0 to 0.01mBa

GENERAL LAYOUT NARRABRI

WEST VIEW

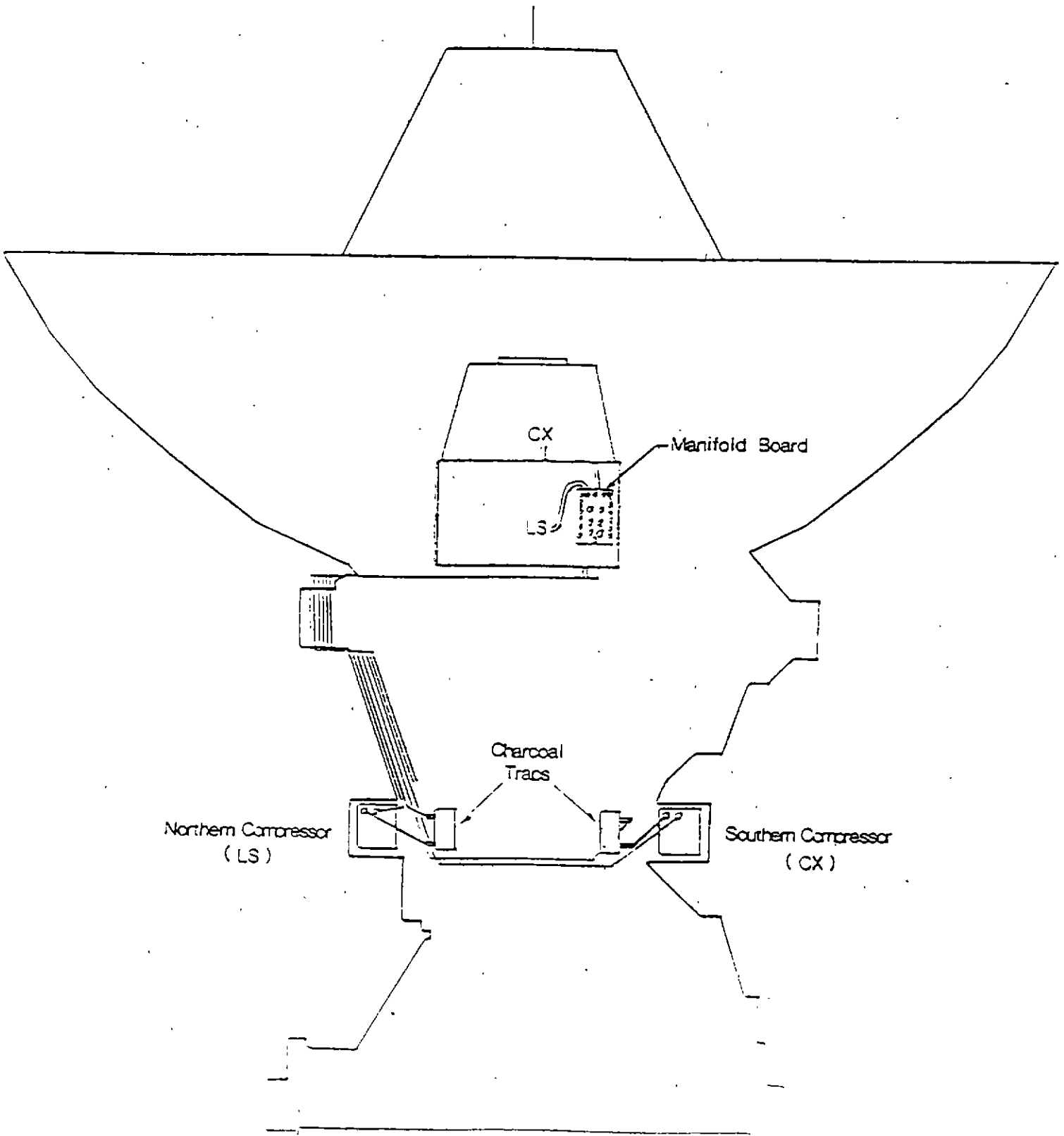


Fig. 1

SECTION 2

CHANGING COMPRESSORS

- NOTE. 1 Isolate the antenna primary monitoring system before starting.
- 2 **ANTENNA 6 ONLY.** At time of writing the LS valves are in the off position , because of possible leak. The LS supply and return gas is controlled by the KQ line. ie
- Return valve = Compressor 3 on KQ line.
 - Supply valve = Compressor 3 on KQ line.
- refer section 2 page 4.

When a compressor needs to be changed because of failure or requires an overhaul, the remaining compressor can run both the LS and CX receiver cryodynes. This is a temporary measure to minimize warming of the cryodyne. One compressor can not supply enough helium gas to maintain the proper working temperature of 2 cryodynes for more than a few hours, because of this a maximum time limit of 3 hours must be observed. The normal change over time for compressors is 1 to 1.5 hours.

If a total shut down of the LS or CX cryogenics system is needed read through section 3 before starting.

Model 1020R Helium Compressor

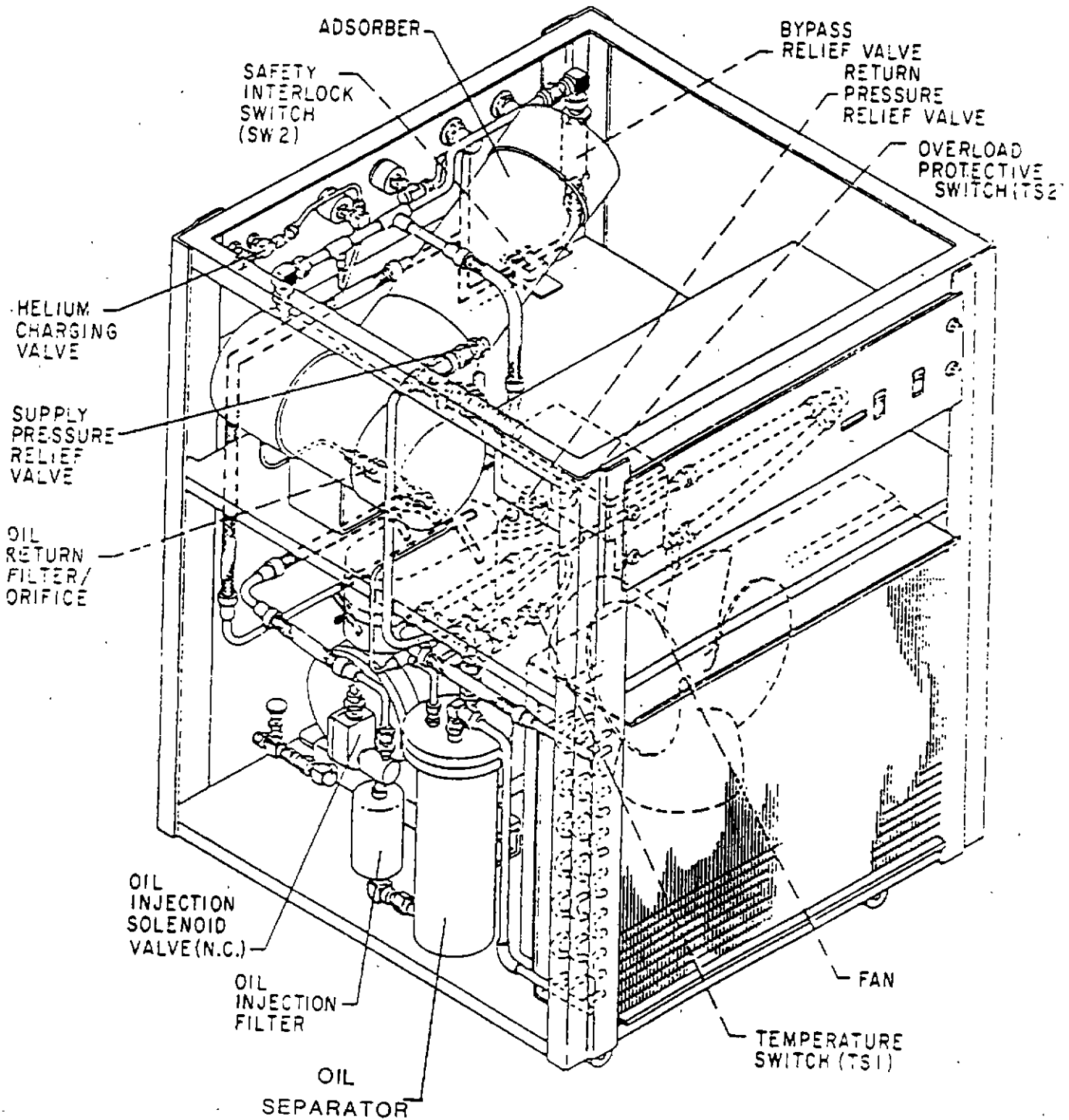


Fig 2.1

208/230 VAC, 3Ø, 60HZ OR
200/220 VAC, 3Ø, 50HZ
INPUT VOLTAGE

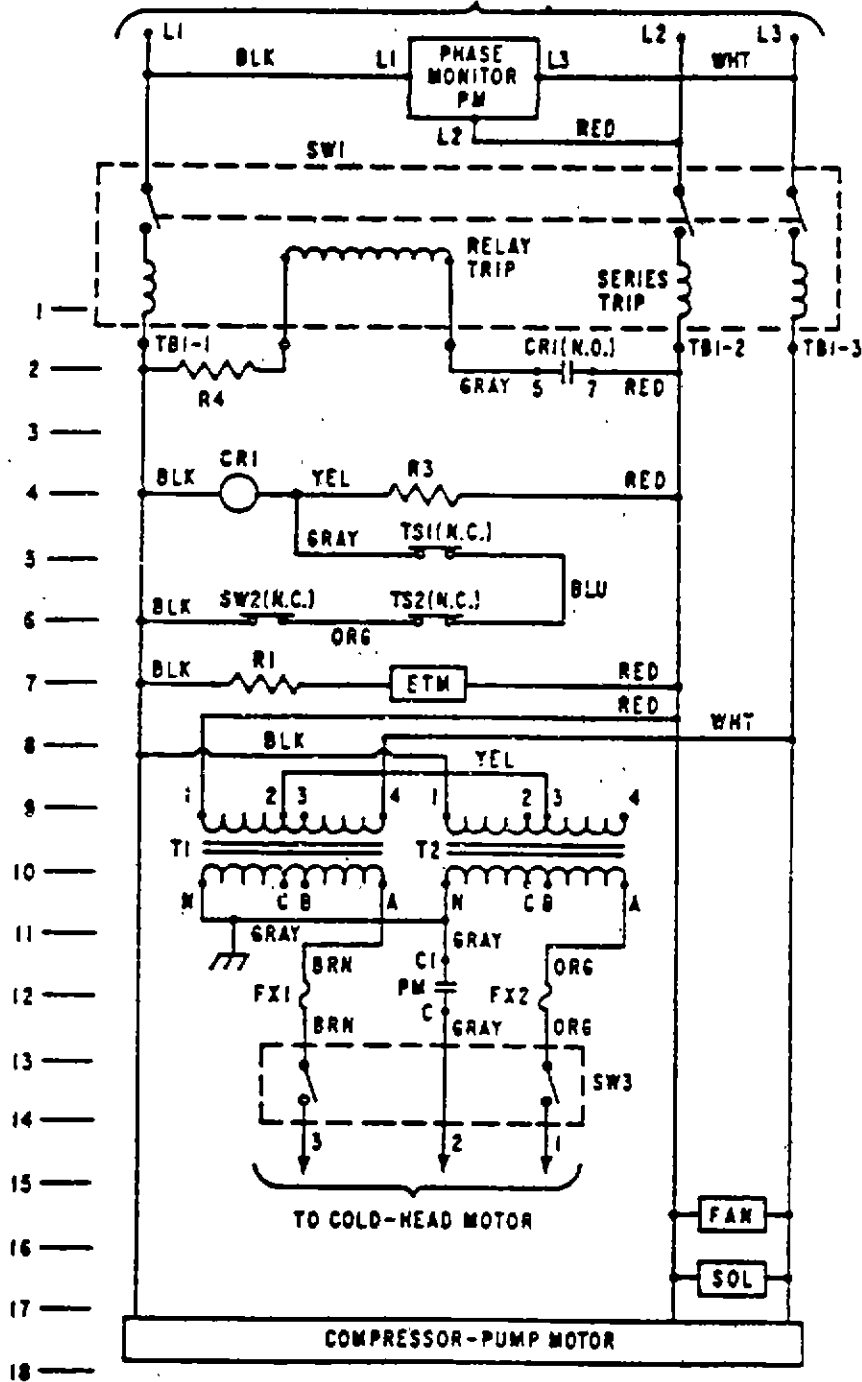
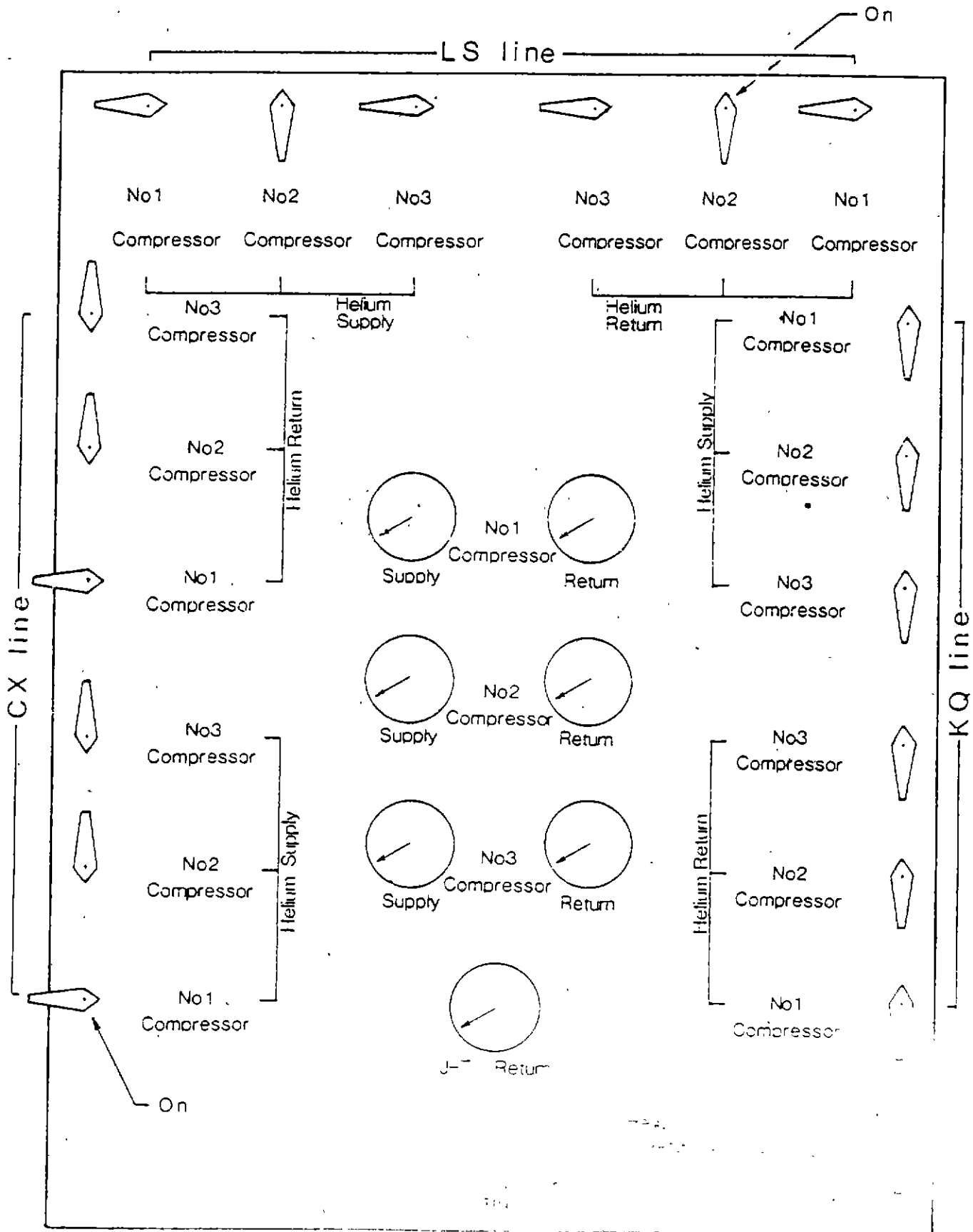


fig 2.2

ELECTRICAL SCHEMATIC FOR THE MODEL 1020F COMPRESSOR
8031023G001 OR 8031023G002

MANIFOLD BOARD

VALVES IN NORMAL OPERATING POSITION



CHANGING SOUTHERN COMPRESSOR No 1 (CX)

Removal

1. Locate manifold board in Vertex room and refer to fig. 2.4
2. Turn OFF SUPPLY valve followed by the RETURN valve (No 1 compressor on CX line) then turn ON RETURN valve followed by the SUPPLY valve (No 2 compressor on CX line) this results in the northern No 2 (LS) compressor running both the CX and LS cryodynes.

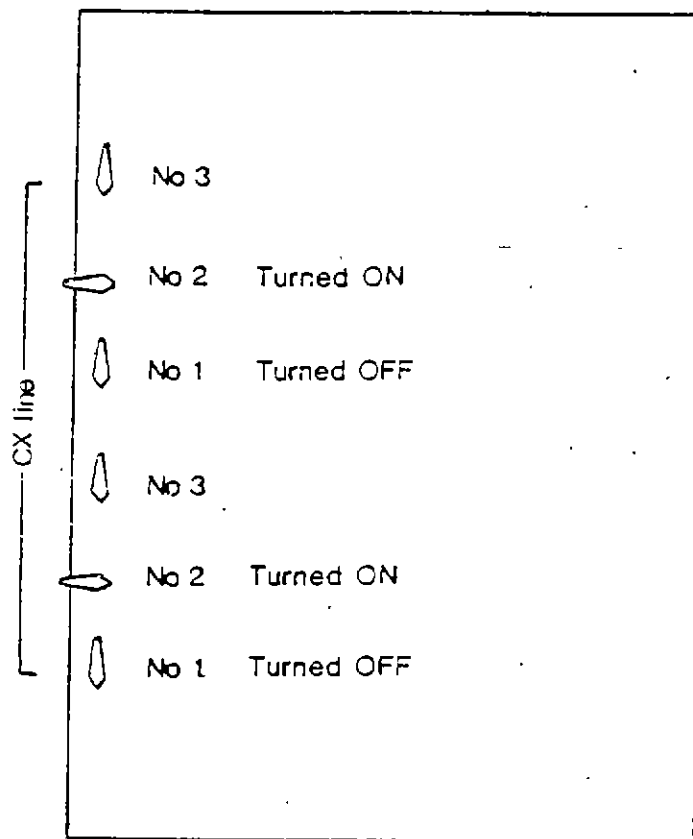


fig.2.4

GO TO SOUTHERN COMPRESSOR

3. Turn compressor OFF and remove plug.
4. Remove the 2 hold down bolts (1 either side at bottom), remove SUPPLY and RETURN lines.

CHANGING NORTHERN COMPRESSOR No 2 (LS)

Remove

1. Locate manifold board in Vertex room and refer to fig. 2.5
2. Turn OFF SUPPLY valve followed by RETURN valve (No 2 compressor on LS line) then turn ON RETURN valve followed by the SUPPLY valve (No 1 compressor on LS line). This results in the southern No 1 (CX) compressor running both LS and CX cryodynes.

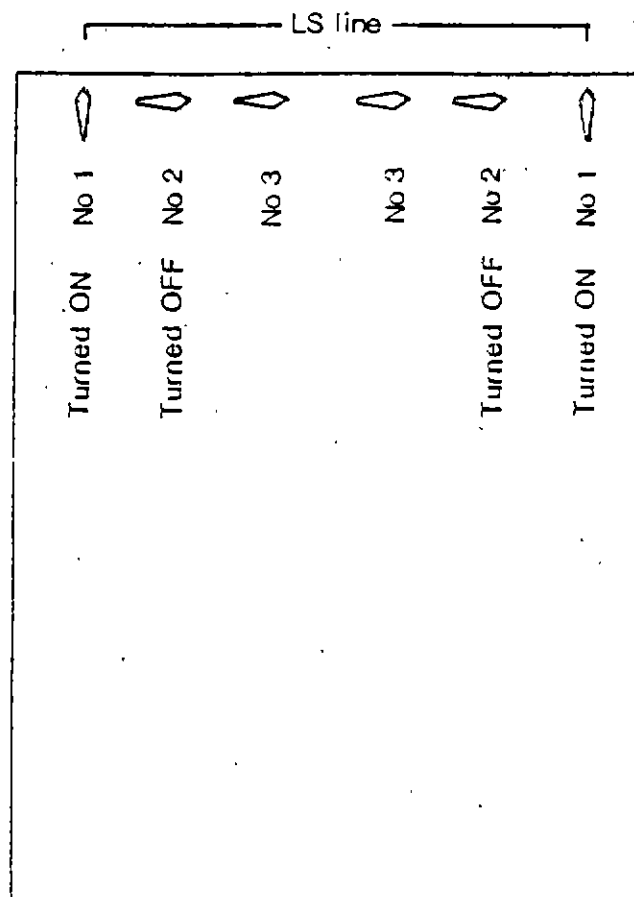


fig 2.5

GO TO NORTHERN COMPRESSOR

3. Turn compressor OFF and remove plug.
4. Remove the 2 hold down bolts (1 either side at bottom) remove SUPPLY and RETURN lines.

INSTALLATION

NOTE. Compressor must be warmed up to operating temperature (70 C) with oil prime manifold fitted in lab prior to being installed in antenna.

1. Place compressor in position and secure with the two (2) hold down bolts.
2. Inspect end of supply and return lines for contamination and for the presence of gaskets. If contaminated clean before fitting to compressor. Tighten firmly but DO NOT over tighten.
3. Plug in and turn power on , there is a two (2) minute delay before compressor starts.
4. When compressor has started go to Vertex room, if installing northern (LS) compressor turn OFF valves No 1 then turn ON valves No 2 (Refer to fig. 2.3). If installing southern (CX) compressor turn OFF valves No 2 then turn ON valves No 1.
5. Check SUPPLY and RETURN pressure on receiver monitor they should read;
SUPPLY 290 to 300 PSI.
RETURN 70 to 100 PSI.
6. If SUPPLY pressure is less than 290 PSI charge compressor with Ultra High Purity Helium (bottle in cryo lab)..
 - (a) Remove cap (fig. 2.6)
 - (b) Turn main valve on (helium bottle).
 - (c) Turn regulator valve on until gas can be heard and felt coming out of charging line. Slowly screw line onto compressor nipple and jiggle end of line whilst doing so (take at least 30 seconds for this step). This purges the line of air.
 - (d) When line is firmly screwed on open regulator to 295 PSI.
 - (e) Turn charge valve (fig. 2.6) ON slowly, when SUPPLY pressure gauge and or regulator gauge reach 295 PSI turn OFF charge valve.
 - (f) Turn main valve OFF on bottle followed by the regulator valve.
 - (g) Remove charge line and replace cap.

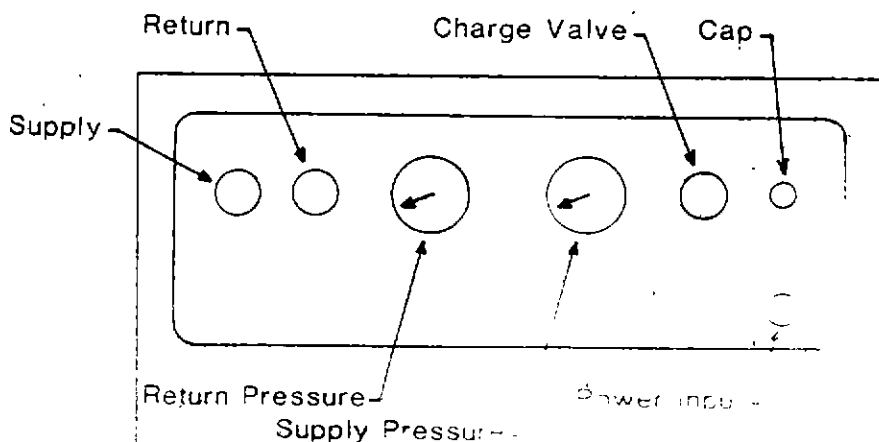


fig 2.6

SECTION 3

SYSTEM SHUT DOWN

NOTE. Isolate the antenna Primary Monitoring System before starting.

If the cryogenic system needs to be shut down to avoid damage or change a receiver the following steps must be followed.

1. Turn off valves on manifold board (Ref. Section 2 page 4).
2. Turn off cryodyne drive at bottom of receiver near RF modules.
3. If system is to be shut down over night , a jumper connector must be used to allow the primary monitor to be deisolated.
LS receiver - remove connector from back of cryodyne drive module and insert jumper into end of lead.
CX receiver - remove cryodyne drive cable from output box on turret and insert jumper into turret output.
4. Power down receiver (Ref. section 4 steps 1 to 6)
5. Turn power supply rack switches off - 3 switches.
6. Turn compressors off , switch is on top of compressor.
7. Turn cryogenic air conditioner breakers off , in alidade distribution board.

SECTION 4

CHANGING RECEIVERS

NOTE. Isolate the primary monitoring system before starting.

REMOVAL

Power down receiver by following these steps.

1. Turn off valves on manifold board (Ref. Section 2 page 4).
2. Turn off cryodyne drive at bottom of receiver near RF modules.
3. Turn receiver FET amplifiers off - 4 switches.
4. Turn receiver system power off from left to right - 5 switches.
5. Turn receiver RED rocker switches off - 2 switches.
6. Put jumper connector on cryodyne - in out put (Ref. Section 3).

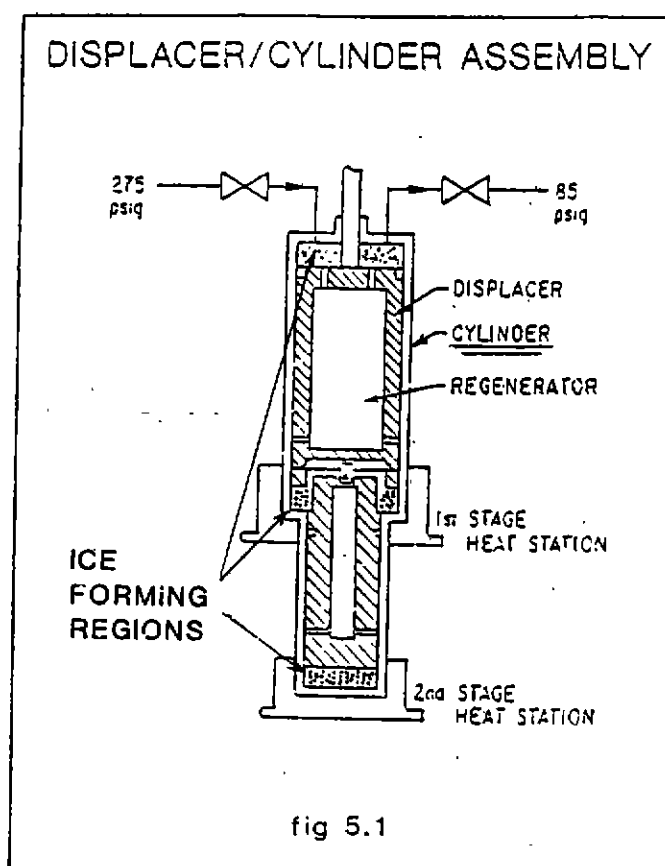
The receiver is now powered down.

7. Remove helium supply and return lines.
8. Remove all power leads , remove coax cables from receiver outputs.
9. Remove leads from noise source .
10. Remove coupler from between feed horn and receiver.
11. Remove the eight (8) hold down bolts (4 at the back and 4 at the bottom).
Tape the packing shims in place so as not to lose them.
12. CX feed horns to remain with receivers, ie CX01 receiver with CX01 feed horn.

To **INSTALL** receiver , reverse removal procedure.

SECTION 5

PURGING A CRYODYNE



NOTE. Isolate the antenna primary monitoring system before starting.

Purging is the use of Ultra High Purity Helium gas to remove atmospheric gases that get into the cryogenic system. When changing a cryodyne it must be purged before starting. If ratcheting (a distinct knocking noise at the end of each stroke) occurs to a cryodyne that is at normal working temperature, it means that ice has formed in the cylinder (fig. 5.1) The receiver must then be warmed to room temperature and the cryodyne purged.

PURGING

SAFETY NOTE Helium at pressure comes out of return manifold , make shore that your face is NOT in line with return manifold.

1. Remove supply and return lines from receiver .
2. Connect purging manifolds (fig. 5.2) to supply and return aeroquip fittings of receiver.
3. Connect Ultra High Purity Helium gas to supply manifold , then set regulator to 300 P.S.I.
4. Turn on valves , of the return followed by supply manifolds to obtain a pressure reading of 280 - 300 P.S.I. for supply and 70 -90 P.S.I. for return. These pressures must be obtained quickly to insure cryodyne is purged properly. Count to 30 then turn off return valve followed by supply valve.
5. Step 4 is repeated four times to give a total of five purging operations. ie. purge 30 seconds wait 60 seconds repeat 4 times.

PURGING MANIFOLD

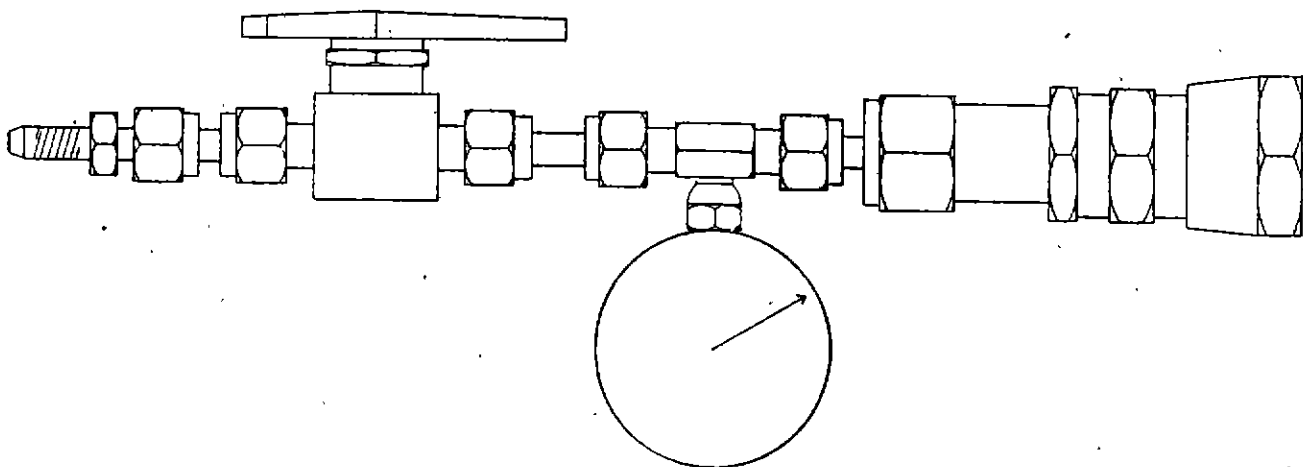


fig 5.2

SECTION 6

CHANGING A CRYODYNE

REMOVAL

1. Remove supply and return lines from cryodyne.
2. DE-GAS cryodyne.
3. Remove the six (6) mounting screws from the cryodyne base. Refer to fig. 6.1
4. Slowly remove the cryodyne from the cylinder.
5. Clean inside the cylinder thoroughly with genesolv and lint free wipes.

INSTALLATION

1. Use a new 'O' Ring between cryodyne and cylinder - Part number 2-231N70.
2. Replace the six (6) mounting screws.
3. Re-connect the supply and return lines.
4. Purge cryodyne (Refer to section 5)
5. Run cryodyne in lab for a short time (approx. 30 minutes) to check system is good.

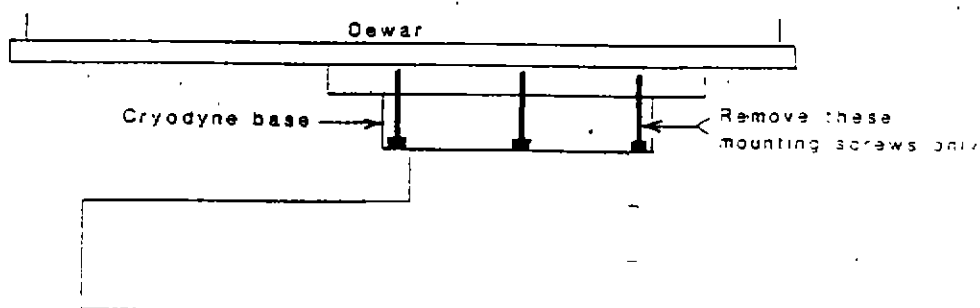


fig 6.1

SECTION 7

CHARCOAL TRAP MAINTENANCE

1. Put charcoal in cans provided , place in oven.
2. Turn on oven to regulator 7 safety 7S. NOTE this is for 2 cans of charcoal, temperature should come up to 100 Deg C and may take some time. DO NOT OVERHEAT AS CHARCOAL MAY IGNITE.
3. Turn on vacuum pump , leave gas ballast on until water vapor is gone , then turn off and leave pumping for 12 hours.
4. Loosen door knob slightly , open nitrogen regulator , turn off valve to vacuum pump and open small valve on side of oven whilst keeping nitrogen nozzle close to introduce inert atmosphere until oven is up to atmospheric pressure.
5. Turn off nitrogen. SAFETY NOTE Nitrogen can KILL.
6. Open oven door , wear gloves , take out cans of charcoal replace with others if required or turn off heaters and pump.

CLEANING PROCEDURE FOR USED CHARCOAL TRAPS

1. Drop all pressure.
2. Dismantle and discard 2 felt pads and charcoal
3. Remove aeroquip fittings.
4. Hose out with water.
5. Ultrasonic bath.
6. Methylated spirits x 3 , rinse and blow.
7. Genesolve or substitute x 3 , rinse and blow.
8. Hot air gun to dry out any residual liquid.
9. Reassemble aeroquips with new 'O' rings.
10. Ready for reassemble.

IN ORDER OF ASSEMBLY

1. 1/8 perforated disc.
2. Felt pad.
3. Cover or plug 12mm hole in tube 'A', pour in activated charcoal and pack to a height of approximately 70mm from top. Pack down firmly and REMOVE PLUG from tube.
4. Felt pad.
5. Stainless steel mesh.
6. Stainless steel mesh.
7. 1/8 perforated disc.
8. Stainless steel ring with slot to key with 12mm pipe.
9. 'O' ring #12-249 , Bona-n paker N219-7.
10. Flange plate , tightening of flange bolts should hold inside assembly tight.

COMPLETE ASSEMBLY

1. Evacuate to < 20 microns for 24 hours , charge to 300 PSI.
2. Leak test.
3. Label and notate.

EXPLODED VIEW OF CHARCOAL TRAP

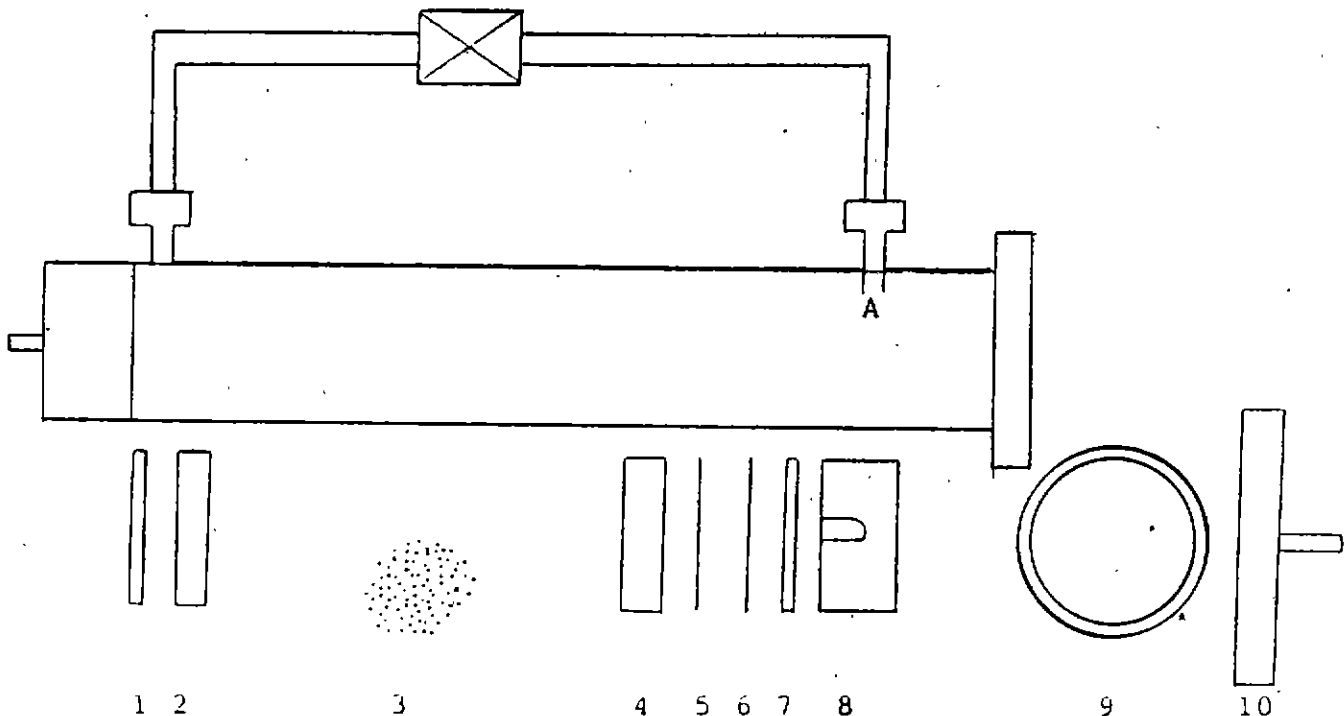


fig 7.1

SECTION 8

MOPRA CRYOGENICS

START UP

1. Connect receiver to vacuum pump and start evacuating. Take note of vacuum in dewar before starting pump.
2. Start compressor - use oil prime manifold. If cold warm sump of compressor with heater before starting. Run compressor for approximately 15 to 20 minutes , remove oil prime manifold and reconnect return and supply lines. Take note of gas pressure , supply should read 290 to 300 PSI top up if needed.
3. Turn on air conditioner breakers on alidade distribution board in pedestal room.
4. Turn on UPS breakers in vertex room.
5. Turn on cryodyne drive breakers on mains isolation panel in vertex room.
6. Turn on power supply switches on receiver.
7. Cryodyne can be started when a vacuum of better than 50 microns is achieved., by switching on the cryodyne drive and manifold valves.
8. Once the cryodyne is running , wait and listen for ratcheting . Wait until a temperature of 250 to 260k is reached , if ratcheting occurs switch off cryodyne and remove supply and return lines (don,t forget monitor lines). Allow cryodyne to warm up (about 290k) than purge refer section 5.

SHUT DOWN

1. Turn off valves on manifold board and cryodyne drive.
2. Turn Fet amplifiers off. 4 switches.
3. Turn system power off , from left to right. 5 switches.
4. Turn Red rocker switches off. 2 switches.
5. Turn power supply rack switches off. 3 switches.
6. Turn UPS off. 4 breakers.
7. Turn compressor off
8. Turn cryogenic air conditioners off - Alidade distribution board., breakers 37,40 and 43.

SECTION 9

OIL CHARGING COMPRESSOR WHILE RUNNING

1. Remove front cover , connect oil charge bottle to aeroquip connection on compressor.
2. Connect Helium gas to oil bottle , set regulator to 150 PSI.
3. Open valve on oil bottle to gas and allow pressure to equalize , then shut off valve.
4. Open valve on oil bottle to compressor , watch oil rise - quite rapidly - shut off valve when oil level is 2/3 full.
5. Disconnect assembly , remove bottles and replace cover.