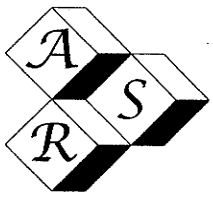
GENERAL FOR LABORATORY SYSTEMS

TECHNICAL MANUAL



Advanced Research Systems, Inc.

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TABLE OF CONTENTS

1. General Technical Manual for Laboratory Systems
2. System Technical Manual
3. Compressor Technical Manual
4. Expander Technical Manual
5. Gas Lines Technical Manual

Each manual is specific for the equipment supplied and is ready for insertion by you, the customer, into the three-ring binder supplied.

NOTE

If a conflict exists between System manual instructions and procedures and the individual component manuals, the information in the System manual shall take precedence.

If in doubt, please contact Advanced Research Systems, Inc. for clarification.

NOTE

Revisions in Technical Manuals are identified by vertical lines in right margin, adjacent to the changed sentence, paragraph or data.

General Technical Manual for Laboratory Systems

SAFETY

GENERAL

ADVACNED RESEARCH SYSTEMS, INC. EQUIPMENT IS DESIGNED TO OPERATE SAFELY WHEN THE INSTALLATION, OPERATION AND SERVICING ARE PERFORMED IN ACCORDANCE WITH THE INSTRUCTIONS IN THIS TECHNICAL MANUAL. CONSULT ADVANCED RESEARCH SYSTEMS, INC. WITH ANY QUESTIONS YOU MAY HAVE CONCERNING THE OPERATION OR MAINTENANCE OF THIS EQUIPMENT. FOR CONTACT INFORMATION, SEE THE SERVICE SECITON OF THIS MANUAL.

SPECIAL NOTICES

THREE TYPES OF SPECIAL NOTICES – WARNING, CAUTIONS, AND NOTES – ARE USED IN THIS TECHNICAL MANUAL. THEY APPEAR AS FOLLOWS AND SERVE THE PURPOSES STATED.

WARNING

WARNINGS CALL ATTENTION TO ACTIONS OR CONDITIONS WHICH CAN RESULT IN INJURY OR DEATH TO PERSONNEL.

CAUTION

CAUTIONS CALL ATTENTION TO ACTIONS OR CONDITIONS WHICH CAN RESULT IN DAMAGE TO THE EQUIPMENT OR IN ABNORMAL PERFORMANCE.

NOTE

NOTES give important, additional information, explanations or recommendations related to the procedure or discussion presented.

WARNINGS and CAUTIONS, like other safety instructions, appear in the text where they are especially applicable. Because of their importance, they are summarized in this Safety section, the first section to be read.

WARNINGS

DO NOT REMOVE, MODIFY OR BLOCK ANY PRESSURE RELIEF DEVICES. MATERIAL FAILURE AND RESULTING PRESSURE RELEASE CAN CAUSE INJURY TO PERSONNEL IN THE WORK AREA.

DISCONNECT GAS LINES ONLY WHEN THE COMPRESSOR IS STOPPED. DISCONNECTING THE EXPANDER WHILE IT IS COLD CAN CREATE EXCESSIVELY HIGH INTERNAL PRESSURE AS THE GAS WARMS. MATERIAL FAILURE AND UNCONTROLLED PRESSURE RELEASE CAN CAUSE INJURY TO PERSONNEL IN THE WORK AREA.

NEVER USE COMPRESSED GAS FROM A CYLINDER WITHOUT A PROPER REGULATOR. OVER PRESSURIZATION CAN CAUSE PERSONAL INJURY IF THE SYSTEM EQUIPMENT RUPTURES.

WHEN HANDLING PRESSURIZED GAS LINES AND OTHER PRESSURIZED EQUIPMENT, ALWAYS WEAR EYE PROTECTION.

ALLOW THE EXPANDER TO WARM TO ROOM TEMPERATURE BEFORE DISCONNECTING ANY GAS LINES. COLD GAS TRAPPED IN THE EXPANDER CAN REACH A DANGEROUSLY HIGH PRESSURE AS IT WARMS.

NEVER APPLY HEAT TO A PRESSURIZED GAS LINE OR OTHER PRESSURIZED COMPONENTS.

ALL ELECTRICAL SUPPLY EQUIPMENT MUST MEET APPLICABLE CODES AND BE INSTALLED BY QUALIFIED PERSONNEL.

DISCONNECT THE POWER TO THE COMPRESSOR BEFORE TROUBLE-SHOOTING THE ELECTRICAL COMPONENTS.

PERMIT ONLY QUALIFIED ELECTRICAL TECHNICIANS TO OPEN ELECTRICAL ENCLOSURES, TO PERFORM ELECTRICAL CHECKS OR TO PERFORM TESTS WITH THE POWER SUPPLY CONNECTED AND WIRING EXPOSED. FAILURE TO OBSERVE THIS WARNING CAN RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK.

DURING OPERATION, SOME SURFACES UNDER THE COMPRESOR'S COVER BECOME HOT. AVOID INJURY FROM BURNS BY ALLOWING THE COMPRESSOR TO COOL FOR ½ HOUR AFTER SHUTDOWN BEFORE REMOVING THE COVER FOR MAINTENCE.

THE COMPRESSOR IS CHARGED WITH HELIUM GAS. VENT THE COMPRESSOR TO ATMOSPHERIC PRESSURE BEFORE DISASSEMBLY,

WARNINGS

EXCEPT WHEN DISCONNECTING ADSORBER OR GAS LINES. UNCONTROLLED PRESSURE RELEASE CAN CAUSE INJURY TO PERSONNEL IN THE WORK AREA.

THE EXPANDER IS CHARGED WITH HELIUM GAS. VENT BOTH SUPPLY AND RETURN AEROQUIP COUPLINGS TO ATMOSPHERIC PRESSURE BEFORE DISASSEMBLY, EXCEPT WHEN DISCONNECTING GAS LINES. UNCONTROLLED PRESSURE RELEASE CAN CAUSE INJURY TO PERSONNEL IN THE WORK AREA.

THE ADSORBER IS CHARGED WITH HELIUM GAS. FOLLOWTHE ADSORBER VENTING PROCEDURE FOR SAFE DISPOSAL OF THE USED ADSORBER.

ALWAYS VENT A GAS-CHARGED COMPONENT BEFORE BEGINNING TO DISASSEMBLE ITS COUPLINGS. GAS PRESSURE CAN LAUNCH A LOOSE COUPLING WITH ENOUGH FORCE TO CAUSE PERSONAL INJURY.

THE COMPRESSORS'S ELAPSED TIME METER CONTAINS A LITHIUM BATTERY. DO NOT REMOVE THE BATTERY. DO NOT RECHARGE, DISASSEMBLE, MUTILATE, WET OR DISPOSE OF THE METER IN FIRE.

USE TWO WRENCHES WHEN DISCONNECTING A GAS LINE COUPLING TO AVOID LOOSENING THE EXPANDER COUPLING. GAS PRESSURE CAN PROJECT THE COUPLING WITH ENOUGH FORCE TO CAUSE INJURY.

EXTREME COLD CAN CAUSE INJURY FROM FROSTBITE. ALLOW THE REFRIGERATOR (EXPANDER) TO WARM TO ROOM TEMPERATURE BEFORE REMOVING THE VACUUM SHROUD. BE CAREFUL NOT TO TOUCH ANY FROSTED PARTS.

DURING VACUUM LEAK CHECKING, DO NOT PRESSURIZE THE VACUUM SHROUD. INTERNAL PRESSURE CAN LAUNCH THE SHROUD WITH SUFFICIENT FORCE TO CAUSE PERSONAL INJURY AND EQUIPMENT DAMAGE.

FOR MATRIX ISOLATION EXPERIMENTS, LIMIT THE QUANTITY OF GAS INJECTED INTO THE VACUUM SHROUD TO KEEP THE INTERNAL PRESSURE OF THE SHROUD SUBATMOSPHERIC WHEN THE SYSTEM WARMS TO ROOM TEMPERATURE.

WARNINGS

AVOID ICING INSIDE THE VACUUM SHROUD. PROMPTLY REPAIR VACUUM LEAKS. WHEN FROZEN GASES WARM TO ROOM TEMPERATURE, THE PRESSURE INCREASE WITHIN THE SHROUD CAN LAUNCH THE SHROUD WITH SUFFICIENT FORCE TO CAUSE PERSON INJURY AND EQUIPMENT DAMAGE.

CAUTIONS

MODIFICATION TO EQUIPMENT WITHOUT THE CONSENT OF THE MANUFACTURER WILL VOID THE WARRANTY.

DO NOT CRIMP THE GAS LINES. SUBSEQUENT ATTEMPTS TO BEND THE GAS LINES MAY DAMAGE THEM.

CHECK THE CONDITION OF THE GASKET SEAL ON THE MALE HALF OF EACH AEROQUIP COUPLING. BE SURE THE GASKET SEAL IS IN PLACE AND THE SEALING SURFACES ON BOTH THE MALE AND FEMALE HALVES ARE CLEAN BEFORE CONNECTING. REPLACE THE GASKET SEAL IF IT IS DAMAGED OR MISSING.

KEEP THE GAS LINE COUPLINGS ALIGNED WHEN MAKING OR BREAKING A COUPLING CONNECTION. LEAKAGE CAN OCCUR DUE TO THE WEIGHT OF THE GAS LINE OR DUE TO A SHARP BEND NEAR THE CONNECTION.

WHEN HANDLING ANY VACUUM SURFACES, WEAR CLEAN, LINT-FREE GLOVES TO PREVENT CONTAMINATION.

REPEATEDLY CHARING THE SYSTEM WITH HELIUM GAS RATHER THAN LOCATING AND REPARING GAS LEAKS CAN CAUSE A MALFUNCTION. IMPURITIES ARE INTRODUCED AT AN ABNORMAL RATE AND CAN FREEZE IN THE EXPANDER.

FOLLOW CHARGING AND VENTING PROCEDURE TO PREVENT REVERSED FLOW OF SYSTEM GAS. REVERSED FLOW CAN RESULT IN CONTAMINATION OF THE SYSTEM WITH COMPRESSOR OIL.

ALWAYS THOROUGHTLY DRAIN THE COOLANT FROM THE COOLING CIRCUIT IF THE COMPRESSOR IS TO BE SHIPPED OR STORED.

DO NOT ALLOW AIR TO GET INTO THE SYSTEM. MOISTURE FROM THE ATMOSPHERE CAN SERIOUSLY DEGRADE EXPANDER PERFORMANCE.

A LEAKING COUPLING ON A ADSORBER SHOULD NOT BE REPAIRED IN THE FIELD. CONSULT ADVANCED RESEARCH SYSTEMS, INC. VENTING THE ADSORBER WILL INTRODUCE CONTAMINANTS TO THE SYSTEM WHICH CANNOT BE REMOVED IN THE FIELD.

DO NOT TIP THE COMPRESSOR GREATER THAN 5 DEGREES TO AVOID FLOWING OIL INTO UNWANTED PLACES AND CAUSING A NUISANCE SHUTDOWN.

THE EXPANDER HAS BEEN SET AT THE FACTORY FOR OPTIMAL PERFORMANCE AT CUSTOMER'S STATED LINE FREQUENCY. CHECK THAT THE FREQUENCY ON THE ELECTRIC LABEL ATTACHED TO THE MOTOR HOUSING MATCHES CUSTOMER'S ELECTYRIC LINE FREQUENCY. OPERATING A UNIT TUNED FOR 50 Hz ON 60 Hz ELECTRIC SERVICE CAN DAMAGE THE DISPLACER.

AVOID DAMAGING THE CRITICAL SURFACES OF THE VALVE STEM AND VALVE DISC. DEGRADED OPERATION CAN RESULT FROM INSTALLING THESE PARTS WITH DIRTY OR BLEMISHED CRITICAL SURFACES.

DO NOT INSTALL A VALVE DISC WHOSE CRITICAL SURFACE IS DIRTY OR BLEMISHED. DEGRADED OPERATION CAN RESULT.

THE O-RINGS USED ON THE DISPLACER ARE MADE OF SPECIAL MATERIAL. DO NOT SUBSTITUTE STANDARD O-RINGS.

DO NOT APPLY A LUBRICANT TO ANY DISPLACER O-RINGS, SEAL RINGS OR SEAL GROOVES.

AVOID TRAPPING CONTAMINANTS INSIDE THE EXPANDER. DO NOT ASSEMBLE PARTS THAT ARE IN QUESTIONABLE CONDITION.

WHEN REMOVING AND INSERTING THE SAMPLE TUBE, USE CARE TO PREVENT DAMAGING THE TEMPERATURE SERNSOR AND THE SAMPLE TUBE.

99.9% PURE HELIUM GAS IS ACCEPTABEL QUALITY FOR CHARGING THE SAMPLE WELL, BUT IT MUST NOT BE USED TO CHARGE THE COMPRESSOR AND EXPANDER CIRCUIT. CONTAMINANTS WILL BE INTRODUCED AND DETERIORATE EXPANDER PERFORMANCE.

INSERT AND REMOVE THE SAMPLE TUBE QUICKLY TO MINIMIZE THE ENTRY OF AIR TO THE SAMPLE WELL. CONDENSABLE GASES CAN FREEZE IN THE SAMPLE WELL, CONTAMINATE THE SAMPLE, OR FREEZE TO PREVENT ENTRY OR WITHDRAWAL OF THE SAMPLE TUBE.

NEVER OPEN THE VACUUM VALVE WHEN THE CONNECTED VACUUM PUMP IS NOT RUNNING. THE COLD EXPANDER CAN CRYOPUMP OIL INTO THE SHROUD.

USER SHOULD DECIDE IF WINDOWS SHOULD BE REMOVED TO PROTECT THEM FROM DAMAGE DURING DISASSEMBLY

EVACUATE THE VACUUM SHROUD TO AT LEAST 0.05 TORR BEFORE STARTING THE REFRIGERATION SYSTEM TO AVOID SWEATING WHICH PREVENTS COOLDOWN.

FAILURE TO ISOLATE THE SHROUD FROM THE VACUUM SYSTEM WILL ALLOW VACUUM PUMP OIL TO MIGRATE TO THE INTERFACE.

CONTACT INFORMATION

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