I.O.M. #096 2/05

INSTRUCTION MANUAL • INSTALLATION • OPERATION • MAINTENANCE

MILACRON MODEL

MCW

PORTABLE CHILLER

MILACRON MODEL

MCA

PORTABLE CHILLER

Covering models Air-Cooled & Water-Cooled
5 to 40 tons
With standard LE Instrument

(or optional HE Instrument)

MILACRON

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www.milacron.com
Phone: 513-536-2584

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INSTRUCTION MANUAL

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COVERING

INSTALLATION
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MAINTENANCE

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1.0 SAFETY

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1.1 INTRODUCTION

A. This manual provides installation, operation and maintenance information. The manual is prepared specifically for the operating and service personnel responsible for the efficient operation of this machine and should be available to them.

B. The contents of this manual and all engineering information contained herein are the exclusive property of the Milacron Marketing Company. It is furnished for customer use and information only and is not an authorization or license to furnish this information to others.

C. NOTES, CAUTIONS, WARNINGS, and DANGERS are used throughout the manual to emphasize important and critical information.

1. NOTE: a note is used to emphasize any operating procedures, conditions, etc.

CAUTION

A CAUTION IS USED TO EMPHASIZE OPERATING PROCEDURES, PRACTICES, ETC., WHICH IF NOT STRICTLY OBSERVED, MAY RESULT IN MINOR PERSONAL INJURY OR DAMAGE TO MACHINERY.

WARNING

A WARNING IS USED TO EMPHASIZE OPERATING PROCEDURES., PRACTICES, ETC., WHICH, IF NOT CORRECTLY FOLLOWED, MAY RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

DANGER

A DANGER IS USED TO EMPHASIZE OPERATING PROCEDURES, PRACTICES, ETC., WHICH, IF NOT CORRECTLY FOLLOWED, WILL RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

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1.2 SAFETY PRECAUTIONS

A. The safety precautions for this Milacron machine have been prepared to assist the operating and maintenance personnel in the performance of good safety procedures.

WARNING

IN ORDER TO CLEARLY SHOW DETAILS OF MACHINES, SOME COVERS, SHIELDS, DOORS AND GUARDS HAVE BEEN REMOVED OR SHOWN IN THE OPEN POSITION. BE CERTAIN THAT ALL PROTECTIVE DEVICES ARE PROPERLY INSTALLED BEFORE OPERATING THIS EQUIPMENT. FAILURE TO HEED THIS WARNING MAY RESULT IN SERIOUS PERSONAL INJURY AND/OR DAMAGE TO YOUR MACHINE.

DANGER

OPERATING AND MAINTENANCE PERSONNEL MUST READ AND UNDERSTAND THESE PRECAUTIONS COMPLETELY BEFORE OPERATING, SETTING UP, RUNNING, OR PERFORMING MAINTENANCE ON THE MACHINE. FATAL INJURY MAY RESULT IF THE PREVIOUS INSTRUCTIONS ARE NOT COMPLETELY FOLLOWED.

B. These safety precautions are to be used as a guide to supplement the following:

1. All other information pertaining to the machine.

2. Local, plant, and shop safety rules and codes.

3. Federal and state safety laws and regulations.

4. NOTE: emphasis will be placed on the latest edition of the Occupational Safety and Health Standards, which is available from the Department of Labor, Washington, D.C. These standards (found in part 1910, title 29 of the code of Federal Regulations) contain the current general industry Occupational Safety and Health Regulations set forth by federal legislation. Also applicable are standards from the American National Standards Institute, such as ANSI B151.1-1990.

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WARNING

READ THE INSTALLATION SECTION OF THIS MANUAL, AND BE CERTAIN THAT YOU UNDERSTAND IT BEFORE ATTEMPTING TO MOVE OR INSTALL THIS MACHINE. FOLLOW ALL SAFETY PRECAUTIONS. FAILURE TO HEED THIS INSTRUCTION MAY RESULT IN SEVERE PERSONAL INJURY OR DAMAGE TO YOUR MACHINE.

1.2.1 PERSONAL SAFETY ATTITUDES AND ACTIONS

A. Remember, in order to avoid accidents, you must think and act in a safety-minded manner. Know and respect your machinery. Read and practice the prescribed safety procedures. Make sure that everyone who works for you, with you, or near you, fully understands and follows these safety precautions and procedures when operating the machine.

B. Always be mentally alert on the job, and stay in good physical condition. A person who is not alert runs a greater risk of being injured. Do not operate this machine while you are under the influence of legal or illegal drugs or alcohol.

WARNING

DO NOT CLIMB ON THE MACHINE. CLIMBING ON THE MACHINE CAN CAUSE A MACHINE MALFUNCTION, AND MAY RESULT IN INJURY TO THE CLIMBER. DO NOT STAND ON ANY PART OF THE MACHINE. DO NOT REACH UNDER OR OVER COVERS WHILE THE MACHINE IS OPERATING. FAILURE TO HEED THIS WARNING MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

C. Avoid sudden movements, loud noises, etc., which can distract others who are working near you. Be alert to conditions in your working area and throughout the plant. Observe “No Smoking”, “High Voltage”, and other warning signs.

D. Use tools for their intended use only. Check tools and equipment frequently. Never use worn tools, frayed power cords, etc. You should check to make sure that all electrical equipment is properly grounded. Short cuts are not compatible with “safety mindedness”.

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E. During machine operation, pay attention to the molding process. Be alert for excessive vibration, unusual sounds, or other indications of problems, and give them your immediate attention.

F. Be neat, and keep your work area clean. Place oily rags in a covered metal container. Place trash and scrap in the proper waste containers promptly; nails, broken glass, and chips are particularly dangerous. Always use a broom and pan to pick up debris. Never pick up debris with your bare hands as serious cuts may result. Remove mails from lumber and containers that may be handled by your or others.

G. Compressed air can be hazardous when it is used improperly. Never use compressed air for cleaning the machine, work area, workbench, tools, workpieces, measuring instruments, or clothes. Make sure that air blasts from air-operated tools do not carry chips or dirt toward you or others. Never blow air toward other people or toward the machine, since the air itself may contain small chips.

I. Keep your machine in good operating condition at all times. Inspect it regularly for parts that show wear or abuse. Replace worn parts with authorized parts only. Report unusual sounds, smoke, heat, damaged components, etc., to your supervisor.

WARNING

WEAR THE PROPER CLOTHING FOR THE JOB AT ALL TIMES, ALWAYS WEAR APPROVED EYE OR FACE PROTECTION AND KEEP THEM (GLASSES, SHIELDS, ETC.) CLEAN. WEARING SAFETY-TOE SHOES WITH SKIDPROOF SOLES WILL HELP TO KEEP YOU FROM SLIPPING AND FALLING. WEAR A SAFETY HAT. KEEP YOUR PROTECTIVE EQUIPMENT IN GOOD CONDITION AND BE SURE IT MEETS OR EXCEEDS ANY REQUIRED OR RECOMMENDED STANDARDS. FAILURE TO HEED THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSON INJURY.

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WARNING

ACCIDENTS DUE TO CLOTHING OR OTHER ARTICLES OF APPAREL BECOMING ENTANGLED IN MOVING MACHINE ELEMENTS CAN CAUSE SEVERE INJURIES TO YOU OR OTHERS. TO MINIMIZE THIS RISK, NEVER WEAR NECKTIES, SCARVES, LOOSE HANGING CLOTHING, OR JEWELRY, SUCH AS NECKLACES, RINGS, OR WATCHES, AROUND MOVING MACHINERY. WEAR A SHORT SLEEVE SHIRT OR ROLL YOUR SLEEVES UP PAST YOUR ELBOW. AND KEEP YOUR SHIRTTAILS TUCKED IN. RESTRAIN LONG HAIR WITH A CAP OR HAIR NET. WEAR GLOVES ONLY WHEN THEY ARE ESSENTIAL FOR HANDLING ROUGH, SHARP, OR HOT PARTS, AND NEVER WHEN THE GLOVES CAN BECOME ENTANGLED IN THE MACHINE.

1.2.2 WORK AREA

A. Make sure your work area is free of hazardous obstructions and be aware of protruding machine members while working around it. Keep materials and equipment out of the aisles. Equipment should always be returned to its proper storage place after use. Keep your workbench neat and clean. Keep your tools and workpieces in order.

WARNING

DO NOT LEAVE FOREIGN ARTICLES LYING ON THE MACHINE. THEY COULD CAUSE INJURY BY DISTRACTING OR HITTING THE OPERATOR. THEY COULD ALSO CAUSE MACHINE MALFUNCTION BY SHORTING AND ELECTRICAL CIRCUIT OR BY JAMMING THE MACHINE.

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WARNING

ALWAYS KEEP YOUR WORKING AREA CLEAN. DIRTY WORK AREAS WITH HAZARDS SUCH AS OIL OR WATER SPILLS MAY CAUSE SOMEONE TO FALL TO THE FLOOR OR INTO THE MACHINE, RESULTING IN SERIOUS PERSONAL INJURY. IF SPILLAGE OR LEAKAGE OCCURS, IMMEDIATE ATTENTION IS RECOMMENDED. FAILURE TO HEED THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.

B. If work platforms are used around the machine, make sure that they are sturdy and that they include antislip surfaces. Report worn or broken flooring, stair treads, handrails or any other unsafe conditions to your supervisor. When climbing, make sure ladders and scaffolds are well built and in good condition. Never climb on stock, machines, tote pans, boxes, piles of skids, etc.

C. Keep working space around electrical equipment clear of obstructions and arranged neatly so that authorized personnel have convenient access to all areas requiring their attention.

D. Avoid grinding operations near the machine. Abrasive dust can cause inaccuracy, excessive wear, and possible part failures.

1.2.3 SETUP AND OPERATIONS

A. Become familiar with the machine before attempting any setup, operation, or maintenance work. Respect the machine's power and capability. Memorize the location of all stop buttons before being faced with an emergency. Learn what malfunctions each warning light or alarm buzzer indicates. Know the controls and all external moving parts of the machine. Read and understand all sections of this manual and operate the machine only as set forth herein.

B. Only qualified personnel instructed in safety procedures and all machine functions should be entrusted to operate this machine. Never change the machine settings, or attempt to repair the machine, unless you are trained and authorized to do so.

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CAUTION

WHEN YOUR MACHINE FIRST ARRIVES AT YOUR PLANT OR WHENEVER IT IS RELOCATED, CERTAIN SAFETY PRECAUTIONS MUST BE OBSERVED. CONSULT THE INSTALLATION SECTION OF THIS MANUAL FOR PROPER METHODS AND PROCEDURES BEFORE ATTEMPTING TO LIFT, MOVE, OR INSTALL THE MACHINE. MAKE CERTAIN THAT YOUR LIFTING EQUIPMENT IS RATED FOR SAFE LIFTING ABOVE THE MACHINE WEIGHT. RESOLVE ANY QUESTIONS ABOUT LIFTING, MOVING, OR INSTALLING THE MACHINE BEFORE BEGINNING THESE PROCEDURES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

DANGER

DO NOT ATTEMPT TO PERFORM ANY SETUP, OPERATION, OR MAINTENANCE WORK ON THE MACHINE UNTIL YOU READ AND UNDERSTAND ALL SECTIONS OF THIS MANUAL. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN FATAL INJURY.

DANGER

UNDER NO CIRCUMSTANCES ALLOW ANYONE TO CLIMB THE STRUCTURE OF THE MACHINE. ALSO, NEVER REACH IN UNDER THE GATE OR GUARD. NEVER REACH OVER, UNDER, OR AROUND ANY MACHINE GATES OR GUARDS WHILE THE MACHINE IS OPERATING. FATAL INJURY MAY RESULT IF THESE INSTRUCTIONS ARE NOT FOLLOWED COMPLETELY.

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WARNING

SHUT OFF THE POWER TO THE MACHINE IF YOU LEAVE THE OPERATING AREA. NEVER LEAVE THE MACHINE RUNNING UNATTENDED. ALWAYS TURN THE MAIN DISCONNECT SWITCH TO THE “OFF” POSITION BEFORE ATTEMPTING TO CLEAN THE MACHINE AT THE END OF THE WORKING DAY, OR IF GUARDS OR COVERS ARE REMOVED TO EXPOSE HAZARDOUS AREAS. DISREGARDING THESE INSTRUCTIONS MAY RESULT IN SEVERE PERSONAL INJURY OR MACHINE DAMAGE.

C. Keep all electrical equipment in safe and proper working condition. Defective equipment should be repaired or be permanently disconnected. Thoroughly inspect any seldom-used electrical equipment before use to assure it is safe and fit to be used.

WARNING

OPERATING AND MAINTENANCE PERSONNEL MUST READ, UNDERSTAND, AND FULLY COMPLY WITH ALL MACHINE-MOUNTED WARNING AND INSTRUCTION PLATES. SUCH PLATES MUST NOT BE REMOVED, PAINTED OVER, ALTERED, OR DEFACED. PLATES WHICH BECOME UNREADABLE MUST BE REPLACED. REPLACEMENTS ARE AVAILABLE FROM MILACRON. DISREGARDING THESE INSTRUCTIONS MAY RESULT IN SEVERE PERSONAL INJURY OR MACHINE DAMAGE.

D. For the protection of the operator and others nearby, it is recommended that a vacuum device be used instead of compressed air when cleaning any plastic shot spillage from the machine.

1.2.4 MAINTENANCE SAFETY

A. Before starting:

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WARNING

BEFORE ATTEMPTING TO PERFORM MAINTENANCE ON THIS MACHINE, READ, KNOW, UNDERSTAND AND PRACTICE ALL OF THE SAFETY INSTRUCTIONS IN THIS MANUAL. READ AND COMPLY WITH ALL MACHINE MOUNTED WARNING PLATES. KNOW AND PRACTICE ALL SAFETY RULES SET FORTH BY YOUR COMPANY. FAILURE TO HEED THIS WARNING MAY RESULT IN SEVERE PERSONAL INJURY.

B. Never attempt to make repairs for which you are not properly trained. Only qualified service and maintenance personnel should perform maintenance or repair work on Milacron machines. Always consult the manual before beginning any service or repair work. If you have questions or are uncertain about the procedure, contact a Milacron office for further information. Use only Milacron replacement parts; others may impair the general safety and operation of the machine. Warning or danger signs should be placed conspicuously around the machine before performing maintenance or service work.

C. When working on electrical equipment::

DANGER

BEFORE WORKING ON ANY ELECTRICAL CIRCUITS, LOCK THE MAIN DISCONNECT SWITCH IN THE “OFF” POSITION. DO NOT WORK ON THE MACHINE WITH THE ELECTRICAL POWER ON. ANY MAINTENANCE WORK THAT REQUIRES THE ELECTRICAL POWER TO BE ON SHOULD BE PERFORMED ONLY BY A MILACRON FIELD SERVICE REPRESENTATIVE. THE MACHINE’S OWNER IS RESPONSIBLE FOR DETERMINING THAT ANY OTHER PERSON PERFORMING WORK WITH THE ELECTRICAL POWER ON IS TRAINED AND TECHNICALLY QUALIFIED TO DO SO. FAILURE TO HEED THIS WARNING MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

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D. Before removing or opening any electrical enclosure, cover, plate, or door, make certain that the main disconnect switch is in the open or OFF position. If any tool is required to remove a guard, cover, bracket, or any basic part of the machine or controller, lock the main disconnect switch in the OFF position using the locking key provided with the machine. Tag the disconnect switch or post a sign indicating that maintenance is being performed.

E. Control circuits connected with YELLOW wires are powered from a source away from the machine. These circuits carry voltage even when a machine's main disconnect switch is OFF. Therefore, before working on electrical circuits connected with yellow wires, locate the circuit's power source and lock it in the OFF position. (There may not be any of these on your machine.)

F. Even with all electrical power disconnected, the control has some residual voltage present for a time. Also internal components such as capacitors will store high voltage for an indefinite period. For these reasons, only qualified and trained electronic technicians who know how to deal with these hazards should be permitted to perform service work inside the control.

G. When removing electrical equipment, place numbered tags or labels on any wires not already marked to identify them for proper re-connection. If it is necessary to replace wiring, make certain it is of the proper gauge so that is will have adequate current carrying capacity. Close and securely fasten all guards, covers, shields, plates, and doors before power is reapplied.

H. Working space around electrical equipment must be clear of obstructions. Also, illumination should be adequate to allow for proper operation and maintenance.

I. The nearest Milacron regional office must be notified before any changes are made to the control software. Software changes must be made by qualified personnel using approved methods and supplied equipment. After the control is reprogrammed the following must be checked immediately:

1. Any change to the programming must include all previous safety-related devices, plus any new safety devices or safety methods which are now indicated.

2. All safety-related devices must be inspected and tested to ensure that they are working properly.

3. Safety guards, doors, shields, limit switches, etc., must be interlock protected so that the machine will not operate if they are not in position.

J. It is mandatory that all wiring diagrams, programming sheets, programming tapes, and other documentation be updated when

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changes are made to the control program, or to any electrical or electronic circuit hardware. All personnel who come into contact with the machine must be immediately alerted to any and all changes made.

K. It is the responsibility of the owner/user to add any additional protective components that become necessary from modifications or changes to the machine or its components or operational characteristics.

L. Inspect and test all safety devices regularly to assure that they function properly. Replace all malfunctioning components before operating the machine again. All safety-related guards, shields, etc., must be in place before and during machine operation.

WARNING

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARDS REQUIRE THAT SIGNALS ENTERING INTO OR LEAVING FROM THIS UNIT, CONNECTING TO AN EXTERNAL SOURCE OVER 30 VOLTS, AND NOT DISCONNECTED WHEN THE MAIN DISCONNECT SWITCH IS TURNED OFF, BE IDENTIFIED BY USING CONDUCTORS WITH YELLOW INSULATION (OR WITH YELLOW SLEEVING OR MARKING ON SUCH WIRES IF MULTI-CONDUCTOR CABLES OR OTHER SPECIAL WIRING METHODS ARE USED). FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN SEVERE PERSONAL INJURY.

DANGER

WHEN PREPARING TO WORK ON THE MACHINE, BEFORE REMOVING OR OPENING ANY ELECTRICAL OR MECHANICAL GUARD OR COVER, MAKE CERTAIN THAT THE MAIN DISCONNECT SWITCH IS LOCKED IN THE “OFF” POSITION AND TAGGED TO INDICATE THAT MAINTENANCE IS BEING PERFORMED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SEVERE OR FATAL PERSONAL INJURY.

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DANGER

WHENEVER WORK IS TO BE PERFORMED AWAY FROM THE MAIN DISCONNECT SWITCH, PLACE THE DISCONNECT SWITCH IN THE OFF POSITION AND TAG IT WITH LABEL STATING “OUT OF SERVICE, DO NOT START! MAINTENANCE BEING PERFORMED”. ADDITIONAL PRECAUTIONS, SUCH AS LOCKS ON THE CIRCUIT BREAKERS OR BREAKER BOXES, OTHER SIGNS OR WARNINGS ARE ALSO REQUIRED TO ENSURE THAT THE EQUIPMENT WILL NOT BE ENERGIZED BY OTHER PERSONNEL WHILE MAINTENANCE IS BEING PERFORMED. FAILURE TO ADHERE TO THESE INSTRUCTIONS MAY RESULT IN FATAL INJURY.

M. Working on components which can fall:

DANGER

ALWAYS MAKE CERTAIN THAT ANY COMPONENT IS SAFELY POSITIONED BEFORE WORKING ON IT - FOR EXAMPLE, ON A STURDY WORKBENCH. NEVER WORK ON A COMPONENT WHILE IT IS HANGING FROM A CRANE OR ANY OTHER LIFTING MECHANISM. FAILURE TO HEED THIS WARNING MAY RESULT IN FATAL INJURY.

N. Before reconnecting power:

WARNING

ORANGE IDENTIFYING MARKINGS ON COVERS, AND GUARDS, ETC., INDICATE THAT THEY ARE TO BE REMOUNTED IMMEDIATELY AFTER ADJUSTMENTS HAVE BEEN MADE TO THE COMPONENTS UNDER THEM. BE SURE ALL GUARDS, COVERS, PLATES, AND DOORS ARE CLOSED AND SECURELY FASTENED BEFORE POWER IS APPLIED. FAILURE TO HEED THIS WARNING MAY RESULT IN SERIOUS PERSONAL INJURY.

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O. Forcing and hammering parts:

1. Never hammer parts together or force them to make them work. When striking a workpiece or fixture for adjustment, use a babbit or soft hammer and wear protective eyewear.

1.2.5 VENTILATION SAFETY

A. Fumes, dust, and gases may be produced in a plastics processing environment. Adequate ventilation must be supplied. It is recommended that the construction, installing, inspection, and maintenance of exhaust systems conform to the requirements of ANSIZ9.2, “Design and Operation of Local Exhaust Systems”, and also to any recommendations from the material supplier.

1.2.6 MATERIALS

A. Various materials may be used with this machine. Before using, mixing, or diluting materials in the machine, contact the manufacturer or authorized supplier of the material to determine whether or not the material is suitable for the intended application, and request a Material Safety Data Sheet (MSDS) from the material manufacturer.

1.3 LIFTING AND CARRYING

A. Improper lifting or carrying can result in serious injury; especially back injury. This section contains some suggestions that can serve to help you avoid such injury.

B. Evaluate the load first for weight and size. Inspect the load for nails and other protrusions which might cause injuries. Decide whether it can be moved by one person, several, or whether a device like a fork-lift or crane will be required. Get the necessary help before proceeding.

1.3.1 LIFTING AND CARRYING

A. Make sure that your footing is secure. Crouch as close to the object as practical. Get a good grip on the object. Lift slowly by straightening your legs. Keep your back relatively straight. Your leg muscles, not your back, should do the work. Keep the load close to your body as you come up. Raise the load to the carrying position before you begin walking. If it is necessary to change your direction while carrying the load, turn your body with changes of foot positions.

B. To set the load on a bench or table, place it on the edge and let thetable provide part of the support. Then push the load forward using your arms and , if necessary, part of the body.

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C. If you must lift the load higher than your waist, first lift it waist high (as just described), then rest it on a support while you change your grip. Now bend your knees again to give added leg muscle power for the final lift.

D. When carrying an object, be sure you can see clearly over the load. Do not try to change the loads position or adjust it, while you are in motion. If the load interferes with normal walking, get help.

E. Put the load down on the floor surface from a waist high carrying position by bending your knees. Keeping your back straight and the load close to your body, lower the object with your arm and leg muscles.

1.3.2 LIFTING AND CARRYING BY MECHANICAL DEVICE

A. For loads that are too heavy for safety standards, or that exceed your own physical strength limitations, use a power hoist or other mechanical carrying device. Bulky or hard to handle objects should also be lifted or carried with such devices rather than by hand. This can help you avoid injury. Use hook-up methods recommended by your safety department, and know the signals for safely directing a crane operator.

B. There are many other safety suggestions that could be made. If there is a question regarding safety, ask your company safety engineer or call your Milacron representative.

WARNING

REGULARLY INSPECT SLINGS, CHAINS, HOISTS AND OTHER LIFTING DEVICES. FOR FREQUENCY OF INSPECTIONS, REFER TO THE WILLIAMS-STEIGER OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) 1910.179 AND ANY INSTRUCTIONS APPLICABLE TO THE EQUIPMENT. REPAIR OR DISCARD UNSAFE EQUIPMENT PROMPTLY. FAILURE TO HEED THIS WARNING MAY RESULT IN SERIOUS PERSONAL INJURY.

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WARNING

CRANES, HOISTS, SLINGS, EYEBOLTS, ETC. HAVE SAFETY-RATED CAPACITIES WHICH SHOULD NEVER BE EXCEEDED. BE SURE THAT EQUIPMENT IS ADEQUATE FOR THE LOAD AND APPLICATION. REFER TO STANDARDS AND APPLICABLE INSTRUCTIONS FOR ANY LIFTING EQUIPMENT YOU USE. (FOR EXAMPLE, USAS STANDARD B18.15, PUBLISHED BY THE AMERICAN SOCIETY OR MECHANICAL ENGINEERS, UNITED ENGINEERING CENTER, NEW YORK, CONTAINS INFORMATION CONCERNING SAFE LIFTING LOADS FOR DIFFERENT SIZE EYEBOLTS, FOR VARIOUS ANGLES OR LIFT, AND FOR VARYING APPLICATIONS.) FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY.

DANGER

NEVER PLACE ANY PART OF YOUR BODY UNDER A SUSPENDED LOAD OR MOVE A SUSPENDED LOAD OVER ANY OTHER PERSON. BE CERTAIN THAT YOU HAVE A SAFE SPOT TO DEPOSIT A SUSPENDED LOAD BEFORE LIFTING IT. FATAL INJURY MAY RESULT IF THESE INSTRUCTIONS ARE NOT COMPLETELY FOLLOWED.

1.4 OCCUPATIONAL SAFETY AND HEALTH ACT COLOR CODING SYSTEM

A. The Occupational Safety and Health Act (OSHA) designated a color coding system for the marking of various areas on machines. This coding is also part of an ANSI standard. The system is designed to point out the various areas of the machine which are shielded or guarded, the potential pinch points, and other areas of potential hazard. Since operator safety, with maximum machine productivity is of upmost concern, everyone who works around the machine should read and understand this color coding system:

1. “Stop buttons or electrical switches used for the emergency stopping of the machine shall be RED”.

2. “ORANGE shall be used as the basic color for designating dangerous parts of machines, or energized equipment which may cut, crush, shock, or otherwise injure personnel, to emphasize such hazards when enclosure doors are open, or when gear, belt, or other guards around moving equipment are open or removed, exposing unguarded hazards.”

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Note: the color orange should never be exposed when all safety guards and covers are properly in place.

3. "YELLOW shall be the basic color for designating caution and for marking physical hazards such as: striking against, stumbling, falling, tripping, and 'caught in between'. Solid yellow and black stripes, yellow and black checkers (or yellow with a suitable contrasting background) should be used interchangeable, using the combination which will attract the most attention in the particular environment.

4. "Colors shall meet the tests specified in Section 3, Color Definitions, of ANSIZ53.1-1967. Safety Color Code for marking Physical Hazards."

5. When surfaces of the machine have been color code for safety precautions, these colors should not be changed.

1.5 OSHA LOCKOUT OR TAGOUT SYSTEM

A. Effective January 8, 1990, an OSHA regulation requires a "positive, lockable" means to remove all energy sources from equipment prior to service or maintenance. For further information on this regulation, "Typical Minimal Lockout or Tagout System Procedures" published in the Federal Register, Volume 54, Number 169, Page 36691, dated Friday, September 1, 1989.

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2.0 GENERAL

2.1 INTRODUCTION
2.2 UNIT LOCATION
2.3 EFFICIENCY
2.4 SAFETY
2.5 CLEAN AIR ACT
2.6 MISCELLANEOUS

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2.1 INTRODUCTION

A. This manual covers portable chillers from 5 to 40 tons.

B. When calling for assistance from the Manufacturer's Service Department, it is important to know the model and serial number of the particular unit. The model number encodes critical unit information which is helpful in any attempt to troubleshoot operating difficulties. The serial number allows the service team to locate manufacturing and testing records which can have additional information relating to a particular unit.

2.2 UNIT LOCATION

A. For air-cooled and water-cooled models:

1. These units are designed for indoor use only.

2. For most efficient operation, locate the chiller in a clean, dry and well ventilated environment.

B. For air-cooled models:

1. The unit has an air-cooled refrigerant condenser. For air-cooled condensers, a motor driven fan (on models from 5 to 15 tons) or a centrifugal blower (on models from 15 to 30 tons) generates air flow through the condenser to remove heat from the refrigerant system. The air cooled condenser on the unit will discharge a maximum of 15,000 BTU's per hour per ton of cooling.

2. The unit must have a minimum entering air temperature of 60°F and a maximum entering air temperature of 95°F for efficient operation.

3. The unit must have a minimum of two feet clearance at the air intake and six feet at the vertical exhaust air discharge.

4. The unit must have all enclosure panels in place before operating compressor. Air will not be drawn through the condenser coil if they are not in place. This will cause the compressor to lockout on the high pressure safety fault.

2.3 EFFICIENCY

A. Long term efficiency of operation is largely determined by proper maintenance of the mechanical parts of the unit and the water quality. The Manufacturer recommends filtering where required to prevent solids from plugging critical parts (pumps, heaters, seals for example). The Manufacturer highly recommends the services of a competent water treatment specialist be obtained and his

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recommendations followed. The Manufacturer accepts no responsibility for inefficient operation, or damage caused by foreign materials or failure to use adequate water treatment.

2.4 SAFETY

A. It is important to become thoroughly familiar with this manual and the operating characteristics of the unit.

B. It is the owner's responsibility to assure proper operator training, installation, operation, and maintenance of the unit.

C. Observe all warning and safety placards applied to the chiller. Failure to observe all warnings can result in serious injury or death to the operator and severe mechanical damage to the unit.

2.5 CLEAN AIR ACT

A. The unit contains HCFC-22 (chlorodifloromethane). This is a class 2 substance.

B. Effective July 1, 1992, it is unlawful for any person in the course of maintaining, servicing, repairing, or disposing of refrigeration equipment to knowingly vent or otherwise dispose of any class 2 substance used as a refrigerant in the manner which permits such substance to enter the atmosphere.

C. De minimis releases associated with good faith attempts to recapture, reclaim or recycle such substance shall not be subject to the prohibition set forth in the preceding paragraph.

2.6 MISCELLANEOUS

A. The unit is designed to circulate temperature stabilized fluid through the process resulting in process temperature control.

B. The ability of the unit to maintain process temperature control is significantly affected by the method of installation as outline in section 2 of this manual.

C. If the operator has any questions concerning the location and operation of the unit, contact the The Manufacturer's Service Department.

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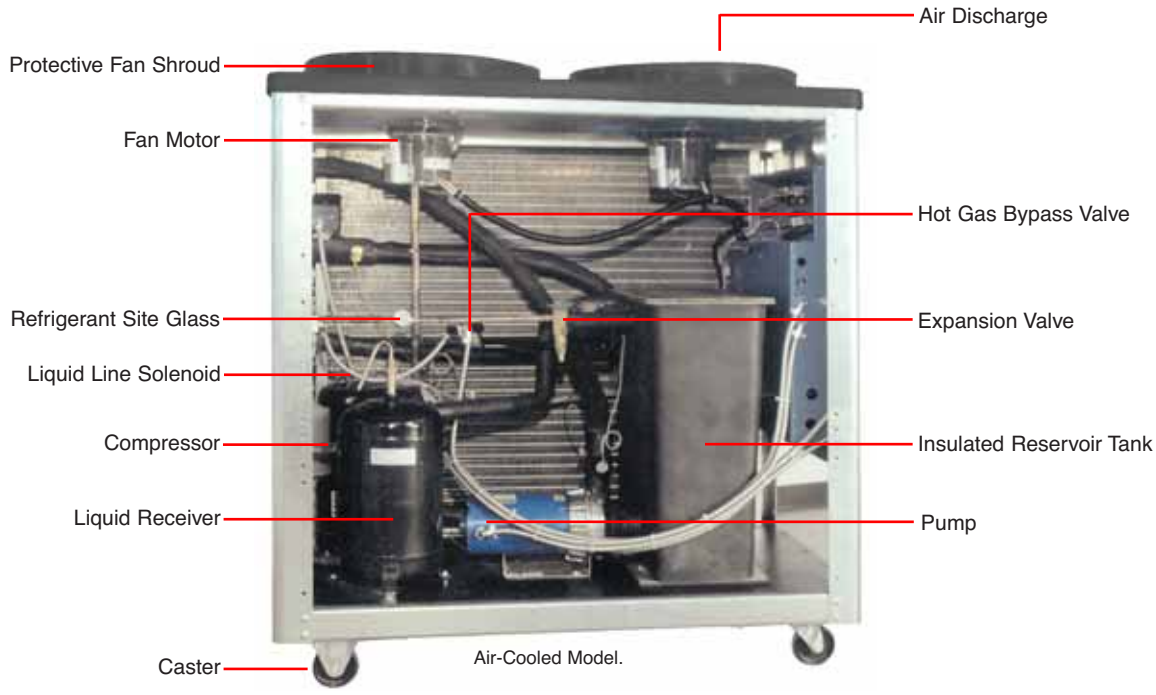

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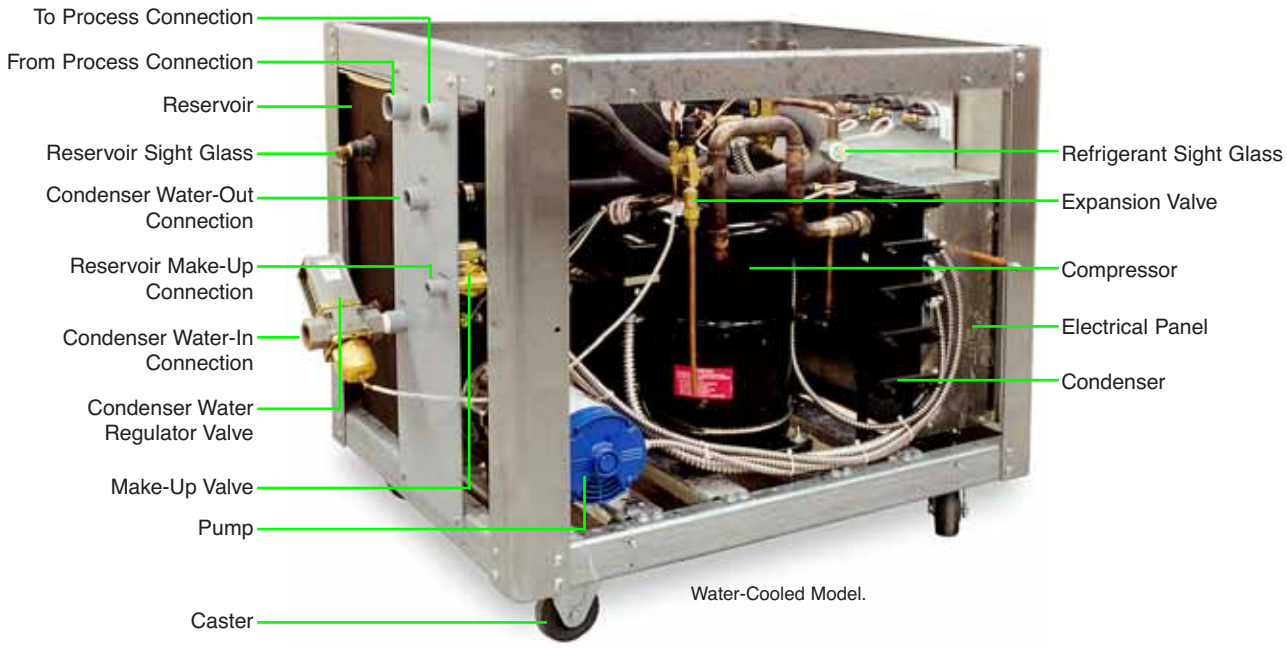

Water-Cooled Model.

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3.0 INSTALLATION

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3.1 GENERAL

A. All process piping materials (such as hose, rigid piping, valves or filters) used in process water piping circuitry must be rated for 100°F minimum temperature and 100 PSI minimum pressure.

B. All such materials must have the equivalent or larger diameter of the particular process connection that length of process water piping is connected to.

3.2 TO AND FROM PROCESS CONNECTIONS

A. Connect the **'TO PROCESS'** to the 'water in' manifold on the mold or process.

B. Connect the **'FROM PROCESS'** port to the 'water out' port on the process manifold.

C. Process water piping circuitry should be designed to avoid an excessive use of elbows and/or lengths of pipe or hose. If hose is the material of choice, avoid tight twists or curls and excessive lengths.

D. Valves and filters may be installed in the process water piping circuitry to facilitate service and maintenance provided that such devices maintain the full inside diameter of the process connection. If installed, all such devices must be open and clean during unit operation.

Air-cooled model shown.

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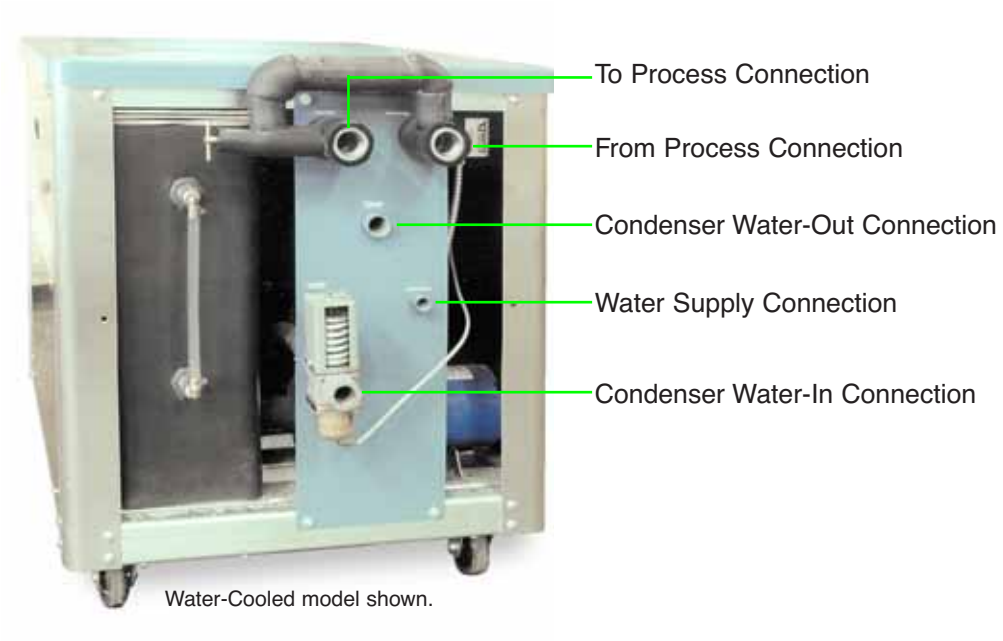

Water-Cooled model shown.

3.3 WATER SUPPLY CONNECTION

A. The automatic water supply make-up system continually monitors the reservoir tank and fills it when needed. Connect as follows:

1. Connect the chiller's **'WATER SUPPLY'** port to the plant's city water source.

2. Minimum water supply pressure requirement is identified on the equipment data plate. This is normally 20 psi.

3. Be certain to use a water supply line equipped with a back flow prevention device to prevent contamination of potable water.

3.4 AIR COOLED CONDENSER

A. Air-cooled condensers require ambient air temperatures between 60°F and 95°F for efficient operation. Operating above above 95°F may result in elevated condensing pressures and eventual shut-down on the high pressure safety switch. In such cases, a water assist unit may be necessary for operations. Air temperatures below 60°F may result in below normal condensing pressures and poor condensing. In such cases, a low-ambient damper assembly is required. Check with the the Manufacturer's service department for more information on operating with ambient air temperatures above 95°F or below 60°F.

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B. Air flow is generated by the motor mounted fans (figure 3.4A) or centrifugal blowers (figure 3.4B). Air flow is from the outside of the chiller, through the condenser and exhausted through the top of the unit. On centrifugal blowers models, exhaust air can be ducted outside of the plant's interior environment. Special duct work is required and a HVAC contractor should be consulted for sizing and material specifications. Exhaust air can not be ducted on motor mounted fan models.

Typical fan assembly Figure 3.4A

C. A free air space of at least two (2) feet is required at the condenser intake and six (6) feet at the condenser discharge to allow for proper air flow.

Typical blower assembly Figure 3.4B

D. At full load, the chiller will discharge approximately 15,000 BTU's per hour per ton of cooling.

E. On blower units, air discharge duct work should be sized by a qualified HVAC engineer. Sizing shall be according to rated CFM at the static pressure of .90 inches of water. See figure 2.4C at right.

CFM RATINGS

MODEL	*CFM*
15 TONS	15,000
20 TONS	20,000
25 TONS	25,000
30 TONS	30,000

Figure 3.4C

F. On blower units, a damper control assembly is required in low ambient temperature areas or when outdoor air make-up is used. The assembly works in conjunction with refrigerant head pressure to regulate air flow to maintain proper refrigerant head pressure when condenser intake air temperature will be less than 60°F. See figure 3.4D to the right.

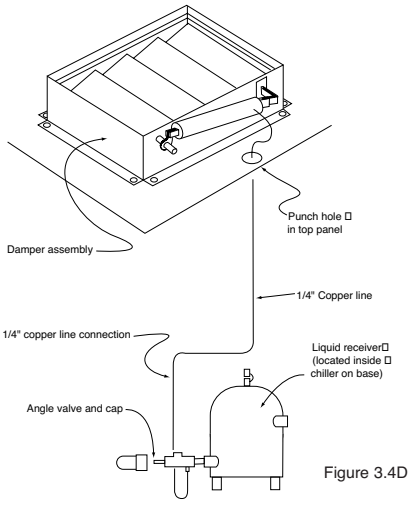

Figure 3.4D

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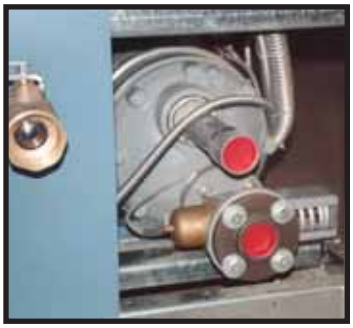
G. All air cooled units must have all enclosure panels in place before operating compressor. Air will not be drawn through the condenser coil if they are not in place. This will cause the compressor to lockout on the high pressure safety fault.

3.5 WATER-COOLED CONDENSER

A. Connect the '**CONDENSER WATER IN**' port to the plant's city water supply or tower system supply.

1. Required consumption from a city water source is 1.5 gpm at 65°F per ton of rated capacity.

2. Required consumption for a tower water source is 3 gpm at 85°F per ton of rated capacity.



Typical condenser connections - 30 ton unit Figure 3.5A

B. Connect the chiller's **'CONDENSER WATER OUT'** port to the plant's drain or tower system return.

1. **Note:** if dumping to the plant's open drain, drainage shall be done according to local codes.

C. The pressure differential requirement between the condenser "water in" and the condenser "water out" lines must be 30 psi for adequate efficiency.

D. The installation of a strainer in the condenser "water in" line is recommended. This removes solids from the water supply and serves to protect the water saver (regulator) valve.

E. The water saver (regulator) valve (figure 3.5B) is located in the condenser "water in" line. During winter months, or cold seasons, the valve will throttle the water flow through the condenser. The amount of flow is based on the refrigerant head pressure and the regulator will modulate the valve's orifice to maintain a head pressure of 210 psi for best efficiency.

Typical Regulator Valve Figure 3.5B

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3.6 ELECTRICAL CONNECTION

A. NEMA 1 MODELS

1. Electrical power supply requirements for Nema 1 units are identified on the equipment data plate. Determine the plant's voltage supply is the same as the unit's voltage requirements.

WARNING: Do not connect the unit to a voltage supply not equal to the unit's voltage requirements as specified on the unit's data plate. Use of incorrect voltage will void the unit's warranty and cause a significant hazard that may result in serious personal injury and unit damage.

2. A customer supplied, four conductor cable is required for connection to a customer supplied fused disconnecting means. The fused disconnecting means shall be sized and installed according to the unit's power supply requirements and local electrical codes.

3. Connect the four conductor power cable to power entry terminal block on the unit's electrical panel. Then connect the power cable to the fused disconnect switch.

B. NEMA 12 MODELS

1. NEMA 12 units are constructed with a dust tight electrical enclosure and branch circuit fusing. Electrical power supply requirements are identified on the equipment data plate. Determine the plant's voltage supply is the same as the unit's voltage requirements.

WARNING: Do not connect the unit to a voltage supply source not equal to the unit's voltage requirements as specified on the unit's data plate. Use of incorrect voltage will void the unit's warranty and cause a significant hazard that may result in serious personal injury and unit damage.

2. Appropriate conduit and fittings should be selected which will maintain the integrity of the cabinet.

3. Supply a power conductor sized according to the unit's power supply requirements. Connect the power conductor to the unit's power supply entry terminal block or the fused disconnect switch. Some Nema 12 models may be supplied with an optional disconnect switch. The owner supplied fused disconnecting means shall be sized and installed according to the unit's power supply requirements and local electrical codes.

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C. CONTROL CIRCUIT WIRING

1. The unit's supplied control circuit is 110 volt, 1 phase, 60 cycle. The control circuit is supplied by the factory installed transformer. An inline control circuit fuse is provided.

D. GENERAL

1. Make certain all ground connections to the unit are properly affixed.

2. Make certain power conductor, disconnecting means, and fusing are properly sized according to the unit's power supply requirements.

E. INFORMATION REGARDING 'PHASING' OF SCROLL COMPRESSORS

1. All portable chillers that have pumps, the compressor(s) will be set in phase with the pump during the testing process at the factory.

2. After installation the phase status must be checked by observing the pump motor shaft on the end of the pump and comparing its rotation to the directional arrow on the motor. In either case, if the phase needs to be altered, it should be done at the main power entry.

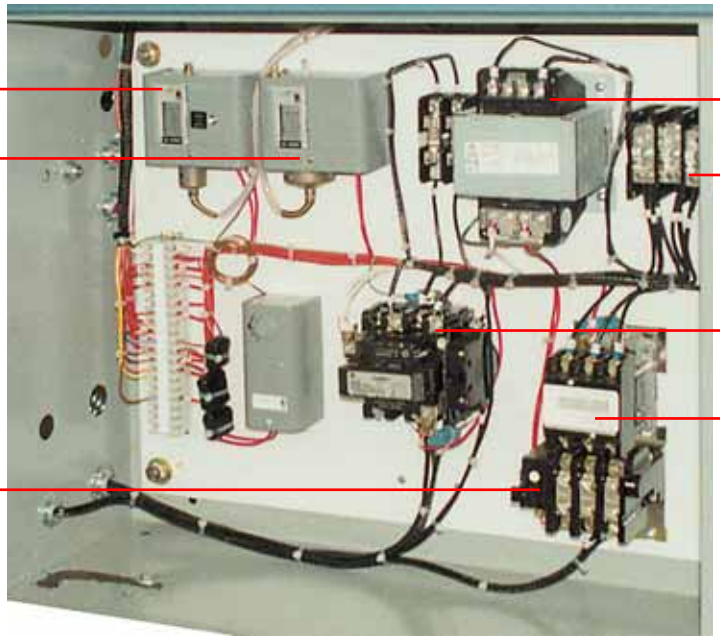

Figure 3.5A Typical electrical panel

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4.0 OPERATIONS

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4.1 GENERAL

A. Failure to follow the factory required operations procedure may adversely affect the unit's ability to adequately control process temperature and may create a hazardous operating condition which may result in serious operator injury and/or unit damage.

B. **IMPORTANT:** if this unit contains a hermetic or semi-hermetic reciprocating compressor it is equipped with a crankcase heater on the compressor. While the compressor is idle, the crankcase heater prevents freon vapor from migrating to and condensing in the compressor crankcase. If freon is allowed to condense in the crankcase, it can be drawn into the cylinders upon start up. This can cause catastrophic damage to the connecting rods, pistons, and valve plates.

To avoid this, **BEFORE THE UNIT IS STARTED, THE POWER SUPPLY SHOULD BE APPLIED TO THE UNIT FOR AT LEAST 12 HOURS, OR UNTIL THE BOTTOM OF THE COMPRESSOR IS WARM TO THE TOUCH.**

If the power has been disconnected more than two hours, the power should be applied for six hours before restarting. Power should be applied to the unit continuously, except for service purposes. The crankcase heater should be checked for proper operation on a regular basis.

UNITS WITH SCROLL COMPRESSORS DO NOT HAVE A CRANKCASE HEATER AND THIS PROCEDURE IS NOT NECESSARY.

C. The OPERATIONS segment of this manual is divided into the following sections:

4.2 **Start up/operations** - follow this segment to start the unit after the initial install to the process system or to restart the unit after reinstallation to the same or different process system.

4.3 **Instrument LE** - includes information on setpoint selection and adjustment, and feature explanations.

4.4 **Instrument HE** - includes information on setpoint selection and adjustment, and feature explanations.

4.5 **Pressure Gauges**.

4.6 **Shut down procedure** - follow this segment to shut down the unit. This segment includes information on system shut down, electrical power supply precautions, and disconnection from system.

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4.2 START UP / OPERATION PROCEDURE

A. SYSTEM FILL

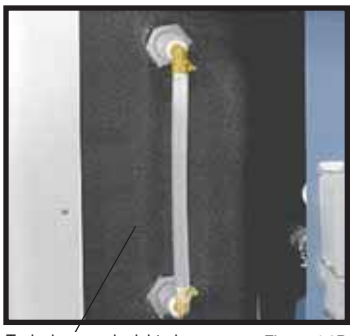
1. The unit has an internal reservoir which must be filled and maintained for proper operation. The unit has a level switch mounted at the proper water level in the reservoir.

2. **WATER QUALITY CONTROL.** Lack of, as well as, improper water treatment can damage the chilling unit. The services of competent water treatment specialist should be obtained and their recommendations followed. It is the equipment owner's responsibility to prevent damage from foreign material or inadequate water treatment. See water treatment section elsewhere in this manual for more information.

3. **FOR OPTIONAL AUTOMATIC FILL**: engage the water supply to unit. The level switch will activate the make-up solenoid (figure 4.2A), which will open and the water supply will fill the reservoir tank.

Make-up solenoid valve Figure 4.2A

4. **MANUAL FILL:** disconnect the electrical power supply and remove all necessary cover panels to access the reservoir. Add fluid directly to the reservoir. When the pump is first started, as process lines are filled and air is purged, additional fluid may be required to restore the reservoir to the correct level. Verify reservoir level via the coolant sight glass (figure 4.2B).



Typical reservoir sight glass Figure 4.2B

B. ELECTRIC MOTOR PHASING (PUMP ROTATION)

1. The operator must determine the unit is phased correctly by visually inspecting the rotation of the pump motor shaft. The procedure is outlined below. Incorrect phasing results in poor operation and eventual damage to the unit.

a. Supply electrical power to the unit. Once the correct voltage is supplied to the unit, the POWER switch on the unit's control panel will illuminate. Adjust the

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setpoint to 70°F to prevent the compressor from activating during this procedure.

b. Remove all necessary cover panels to access the pump motor. **Note that the electrical power is engaged at this point and caution must be observed while the electrical supply is engaged and cabinet panels are removed and opened.**

c. Locate the electric motor (figure 4.2C). The electric motor can be identified when the electrical panel cover is open. The operator must identify the motor shaft inside the electric motor housing. The motor shaft can be seen through the vent slots in the motor housing or by removing the shaft cover.

Electric motor Figure 4.2C

d. Toggle the unit's START and STOP keys (figure 4.2E). This will quickly cycle the pump motor "on" and then "off".

Figure 4.2D

e. Observe the motor shaft. When the ON/OFF SWITCH is on, the motor shaft will rotate. When switched off, the shaft will slowly "coast" to a stop. As the shaft slows, the operator can identify the rotation of the motor shaft. Correct rotation (correct phase) is "clockwise", when viewed from the rear of the motor. Incorrect rotation is "counter-clockwise" (incorrect phase) when viewed from the rear of the motor. If the shaft does not rotate when the ON/OFF SWITCH is on, the operator must identify the cause as outlined in the troubleshooting and repair section of this manual.

f. If the motor shaft is phased correctly (shaft turns in a clockwise direction), continue with **step C**. If the motor shaft is **NOT** phased correctly (shaft turns in a counter-clockwise direction), correct as outlined in **step 2**.

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2. If the unit is phased **incorrectly**, the operator must:

a. Disengage the electrical power supply to the unit at the unit's disconnect switch. Follow proper lockout procedures before proceeding.

b. Once the electrical power supply is disengaged, reverse any two power leads of the power cord at the disconnect terminals.

c. **Note:** reversing any two power leads of the power cord will correctly phase the power supply to the unit. **The operator must reverse the power leads at the disconnect switch only and *not* at the power entry terminals on the unit's electrical panel.** The unit's internal electrical system wiring is phased correctly at the factory and must not be altered in the field.

C. PROCESS FLOW ADJUSTMENTS

1. The operator must determine and set proper water flow rate for the most efficient and trouble free operation.

a. Water flow rate through the process is determined by the pressure losses in the process loop. Generally, higher flow rates result in turbulent flow achieving maximum temperature control and lower maintenance. Since the evaporator in most liquid chillers is flow sensitive, the efficiency of operation is directly related to the flow of liquid.

b. Maximum chiller efficiency is obtained at approximately 2.4 gpm per ton of rated capacity. Low liquid flow can reduce efficiency and in some cases allow ice to develop in the evaporator which can damage the evaporator. Excessive liquid flow will trip the motor overload protection circuit.

c. Some models are equipped with a low coolant flow safety switch (figure 4.2F) to stop the unit if the liquid flow falls to approximately 33% of full flow. This is a paddle type flow switch which is mounted directly in the water stream.

Figure 4.2F

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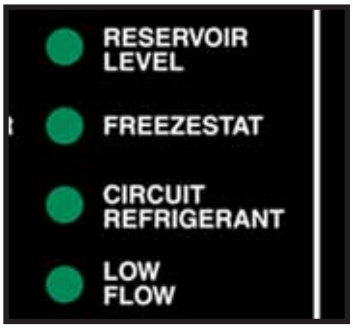
2. Press the START key on the display to activate the process pump. Wait a few moments to allow air to be purge from system. Observe the COOLANT pressure gauge for steady readout. Two items the operator for look for are low flow or excessive flow conditions.

3. ***LOW FLOW:*** If the LOW FLOW light (figure 4.2G) is 'flashing red' be sure all process valves are open. If all process valves are open, then a low flow condition exists.



Low flow light on LE instruments Figure 4.2G

a. To operate under a low flow condition, it is necessary to install a flow bypass system in the process circuitry. This will allow a portion of the flow to bypass the process and return directly to the chiller. This keeps the total flow above the cutoff point. Figure 4.2H illustrates a typical bypass loop.

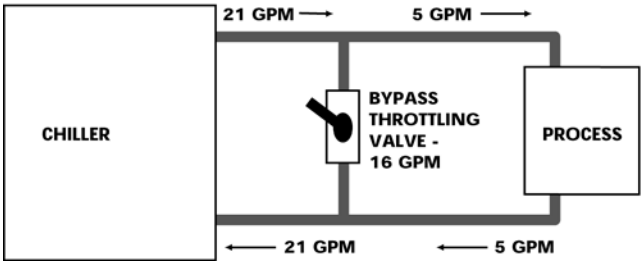


Figure 4.2E Typical low flow by-pass loop

b. Some models may have a factory installed bypass. Adjust the valve accordingly.

4. ***EXCESSIVE FLOW:*** if the flow rate exceeds the motor HP capacity, the electric motor will draw excessive amps. This is a result of the process loop's ability to flow water at a greater rate than can be provided by the pump. This eventually results in tripping the thermal motor overload relay (overload relays open) and the unit will shut down and illuminate red the LOW FLOW light on the display.

a. If an excessive flow situation is encountered and the motor overload circuit has tripped, the operator must manually reset the overload relay (figure 4.2I) before operations can continue. This is done by opening the electrical panel cover, identifying the reset lever on the overload relay, and pushing the reset lever "in" until the overloads are reset

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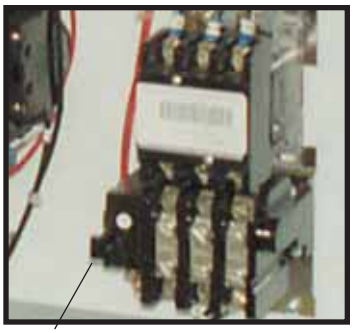
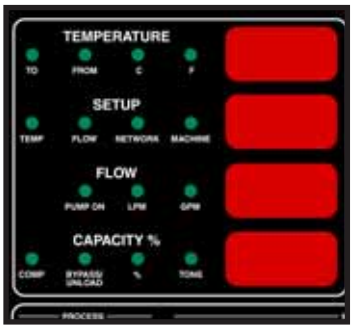
(evidenced by a "clicking" sound as the overloads reset).



Reset level on overload relay Figure 4.2I

4. HE Series instruments display the process flow rate in the FLOW display window (figure 4.2J). To adjust the process flow rate, continue with **step 5**.

5. To set the process flow rate via the digital flow meter for units with the HE Series Instrument:



Flow Display Figure 4.2J

a. Determine the pump's HP rating and maximum GPM flow rate. Standard models are listed in the specifications chart (figure 4.2K). The displayed flow rate should not exceed the maximum flow rate during operations. If the maximum flow rate is exceeded, a possible overload condition may develop.

MODEL	HP	GPM
MK-5A	2	12
MK-7.5A	2	22
MK-10A	2	28
MK-15A	3	36
MK-20A	3	48
MK-25A	5	60
MK-30A	5	72

This chart is for standard models only. Consult with the factory if optional pump motors are installed.

Motor HP and GPM chart Figure 4.2K

b. Start the unit and observe the indicated flow rate. If the indicated flow is higher than the maximum flow rate for the unit, a throttling valve must be installed in the "from process" water line. The preferred throttling valve is a manual activated ball valve. If necessary, follow proper shut down and disconnect procedures to install a throttling valve.

c. With the throttling valve installed, fully close the valve and then engage the pump motor. Slowly open the throttling valve and monitor the indicated flow rate until the flow rate is below the pump's maximum flow rate. At this point, the process flow is now correctly adjusted. The valve should remain in the position during operations.

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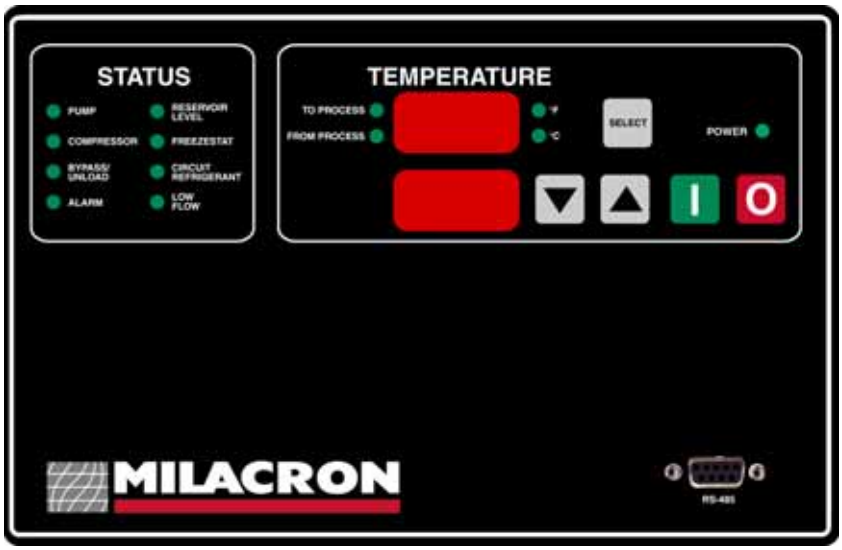

Chiller Control.

Figure 4.3A

3.3 LE SERIES INSTRUMENT / OPERATION

A. INSTRUMENT START-UP

1. When the correct electrical power and adequate water supply pressure are supplied to the unit, it is possible to start the unit for temperature control duty.

2. When the electrical power supply is supplied to the unit, the instrument (figure 4.3A) will momentarily illuminate all indicating lights and digits on the display head. After a short delay, the instrument will display the software version number. At this time, the operator can verify that all lights and digits are functioning properly. If the operator determines an indicating light or digit does not illuminate, the instrument must be removed and sent to the factory for repair.

3. With electrical power supplied to the unit, the POWER light will illuminate. The display will remain dark with exception of the RESERVOIR LEVEL light which will be ‘solid green’ if this condition is ‘ok’. The FLOW light will ‘flash red’ to indicate that the pump is not on (not generating flow). This is the normal “stop” state of the instrument. If the operator determines the RESERVOIR LEVEL light is ‘flashing red’, the operator must determine the reason and correct:

a. **Water level**: when the reservoir water level is below the level switch mount, the automatic water make-up system is activated in an effort to restore the reservoir to the proper operating level.

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b. If the reservoir does not fill in a reasonable amount of time, check the operation of the make-up solenoid valve or determine in the water supply valve (customer supplied) is fully open. The water level sight glass is provided to visually check the reservoir level.

4. After a 'flashing red' indication is diagnosed and repaired, the 'flashing red' indication will automatically turn 'solid red'.

5. When the START key is pressed, the instrument will immediately check the status of the motor overload switch (PUMP light); the freezestat safety switch (FREEZESTAT light); high pressure safety switch, low pressure safety switch and the oil pressure safety switch (CIRCUIT REFRIGERANT light) for acceptable operating conditions. If these systems are found to be 'ok', the lights will be 'solid green' and the unit will begin process operations. If a system is not found to be 'ok', the light will 'flash red' and the instrument will prevent operation (check the troubleshooting section of this manual for more information):

a. **Motor overload switch open:** a dark PUMP light possibly indicates the electric pump motor overload relay is open. The pump motor is protected from overload conditions (excessive flow) by a set of thermal overload relays which open (trip) with excessive amperage and prevent electric power from reaching the electric motor. If the overload relay is open, the overload relay must be reset before operations can continue. An excessive flow condition must be corrected immediately.

b. **Freezestat safety switch open:** a 'flashing red' FREEZESTAT light indicates the freezestat safety switch is open. This normally occurs when the 'to process' temperature is below the freezestat setting. The typical freezestat setting is 38°F for setpoint temperatures from 48° to 70°F. If the 'to process' temperature is higher than the freezestat setting, check for proper operation of the freezestat safety switch.

c. **High pressure switch open:** a 'flashing red' CIRCUIT REFRIGERANT light possibly indicates the refrigerant high pressure switch is open. This normally occurs when condensing pressures exceed normal parameters, as indicated by the HIGH PRESSURE refrigerant gauge. To continue operations, the operator must reset the safety switch by pressing in the reset lever. A high pressure condition must be corrected immediately.

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d. **Low pressure switch open:** an “L-P” in the temperature display window indicates the low pressure safety switch is open. Chiller operations stop when the refrigerant suction pressure drops below 58 PSI. While the compressor is inactive, the pressure normally builds back up to the cut-in pressure of 63 PSI, at which point the low pressure safety switch automatically resets, and a 3 minute time delay cycle begins (to prevent compressor short-cycling). If the low pressure safety switch does not reset, operations are prevented. Contact the service department for further instructions.

e. **Low oil pressure switch open:** a ‘flashing red’ CIRCUIT REFRIGERANT light indicates the oil pressure safety switch is open. The oil pressure safety switch is found on 15 to 30 ton semi-hermetic compressors. Normally, the switch will open if there is insufficient oil in the compressor crankcase or due to lack of sufficient compressor warn up before operations start. This switch must be manually reset before operations can continue.

6. Press the START push button to activate the coolant circuit. If the existing coolant temperature is above the currently selected setpoint temperature, the refrigerant circuit will activate. The operator can stop process operations (refrigerant and coolant circuits) by pressing the STOP push button.

7. To select the operating setpoint, use the SELECT key to index through the temperature functions until the ‘SP’ is displayed in the top window. The current setpoint temperature is displayed in the bottom window. Use the UP and DOWN ARROW keys to change the setpoint temperature.

8. **PRECAUTIONS:** the instrument is programmed from the factory with a setpoint range of 48° to 70°F. To operate below 48°F, the addition of inhibited propylene glycol and modification of the safety control settings are required. Diligent monitoring of the water/glycol solution is mandatory to prevent freezing of the evaporator. Freezing may cause the evaporator to rupture allowing water and freon to mix which will cause major damage to the refrigeration system. Operating above 70°F requires the addition of a refrigerant crankcase pressure regulating (CPR) valve. The CPR valve is necessary to prevent overloading of the compressor which can cause premature failure. Contact your local refrigeration contractor or the factory for further information. The operating range of the instrument may be changed to 20°F - 90°F by adjustment of the CPU DIP switch. Refer to

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the technical section of this manual for more information. The instrument is set up from the factory to give an alarm light and a 115 volt alarm output if the temperature to process deviates more than 10° from the setpoint.

9. After selecting the setpoint temperature, the operator may leave the display in the SET POINT state. The display will automatically return to the TO PROCESS temperature state after thirty seconds. If the operator leaves the display in any state other than the TO PROCESS state, the display will automatically revert after 30 seconds of inactivity.

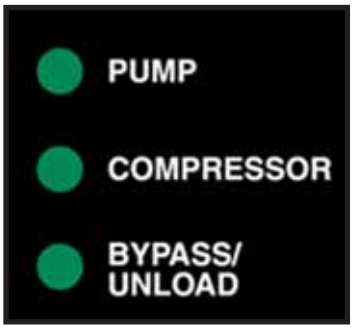
10. The setpoint temperature is continuously displayed in the lower window for quick comparison to actual process temperature.

11. The operator can stop operations by pressing the STOP push button. This will disengage the refrigerant and coolant circuits.

B. INSTRUMENT OPERATION

1. When the START push button switch is pressed on, the instrument will begin temperature control operations and the 'to process' temperature will begin to drop.

2. When the 'to process' temperature drops 1° below the setpoint, the instrument will activate the capacity control system to match the cooling capacity to the present load, as indicated by the BYPASS/UNLOAD light (figure 4.3B).



Bypass / Unload light Figure 4.3B

3. If the load is less than the minimum capacity of the chiller, the 'to process' temperature will continue to drop. At 3° below setpoint the compressor will stop and enter a 3 minute time delay period before restarting at 1° above setpoint. The time delay is to prevent short cycling damage to the compressor.

C. INSTRUMENT CONTROLS (figure 4.3C)

1. **START**: (green color button) this push button engages/disengages electrical supply to the coolant pump and refrigerant compressor. Please note that the refrigerant compressor will not start unless the coolant pump in operating.

2. **STOP**: (red color button) this push button disengages

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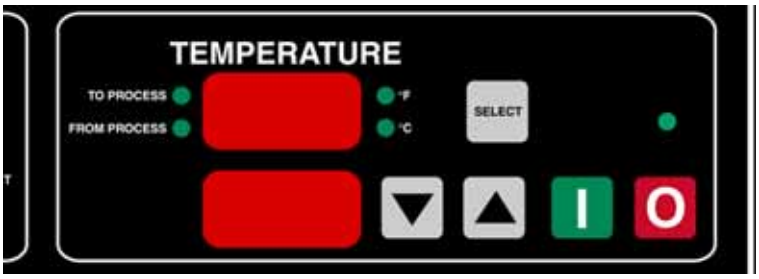

Figure 4.3C

electrical supply to the the coolant pump and refrigerant compressor.

3. **SELECT:** depress to index through the “to”, “from” and “set point” temperatures.

4. **UP ARROW**: depress and hold this push button to increase the setpoint temperature. If this push button is pressed momentarily the setpoint value is incremented by one degree. If the push button is held down for more than one second, the setpoint will increase slowly at first and then faster after about two seconds.

5. **DOWN ARROW**: depress and hold this push button to decrease the setpoint temperature. If this push button is pressed momentarily the setpoint value is incremented by one degree. If the push button is held down for more than one second, the setpoint will increase slowly at first and then faster after about two seconds.

6. **POWER LIGHT**: illuminates when the proper supply of electrical power is applied to the unit.

D. TEMPERATURE DISPLAY (figure 4.4C)

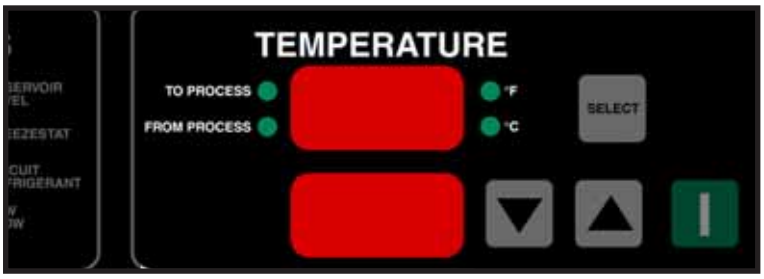

Figure 4.3D

1. The upper three digit display window indicates the appropriate temperature either in **Fahrenheit** or **Celsius** (as selected). The lower window also displays the numeric value for the setpoint temperature. A ‘solid red’ TO or FROM light will illuminate beside the parameter currently being displayed.

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2. The instrument is programmed at the factory to indicate temperature in Fahrenheit. The instrument can be programmed to display temperature in Celsius by changing the orientation of the DIP switch. Refer to the technical section of this manual for more information.

3. **TO PROCESS:** indicates liquid temperature being delivered from the chiller.

4. **FROM PROCESS:** indicates liquid temperature returning to the chiller.

5. **°F:** indicates temperature is displayed in Fahrenheit temperature scale.

6. **°C:** indicates temperature is displayed in Celsius temperature scale.

E. STATUS DISPLAY (figures 4.3D)

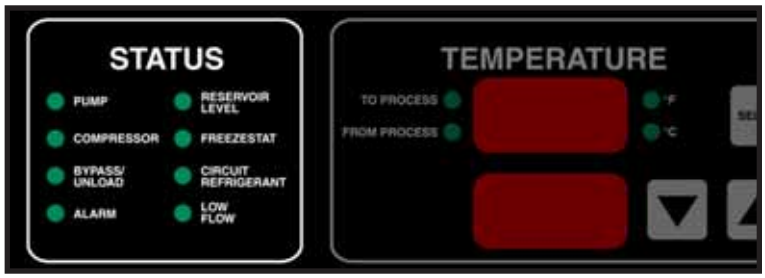

Figure 4.3D

1. **PUMP**: illuminates 'solid red' when the coolant pump is operating. The PUMP light will remain dark if the pump is not operating.

2. **COMPRESSOR**: illuminates 'solid red' when the instrument engages the compressor contactor. Engaging the compressor contactor supplies electrical current to the compressor. If the compressor is unable to operate, the light will remain dark.

3. **BYPASS/UNLOAD:** illuminates 'solid red' when the instrument has engaged the capacity control system.

4. **ALARM**: illuminates 'solid red' when the "to process" temperature has deviated +/- 10° from setpoint. Note: the temperature deviation alarm circuit is only activated after the chiller has cooled the circulating fluid to the setpoint one time.

5. **RESERVOIR LEVEL**: illuminates 'flashing red' when the process water level has dropped below the safe operating

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level, at which time the automatic water make-up system activates to restore the reservoir to the correct level. When the reservoir level is ‘ok’, the light will remain dark.

6. **FREEZESTAT**: illuminates ‘flashing red’ when the evaporator out temperature has reached the minimum safe operating temperature (normally 40°F) at which time the compressor will shut down to avoid water freezing. When the water temperature is above the freezestat setting, the light will remain dark.

7. **CIRCUIT REFRIGERANT**: illuminates when a refrigerant safety switch (high pressure safety, low pressure safety or oil pressure safety) has opened preventing the compressor from operating until the condition is resolved. When the refrigerant circuit safety switch are ‘ok’, the light will remain dark.

8. **LOW FLOW**: illuminates ‘flashing red’ when the process fluid flow is below the minimum safe operating rate. When the flow is above the safe operating rate, the light will be dark. When the flow rate is ‘ok’, the light will remain dark.

9. **L-P LOW REFRIGERANT PRESSURE:** When the refrigerant low pressure drops below 58PSI the compressor will stop and an “L-P” will be displayed in the temperature window. See troubleshooting.

4.4 HE SERIES INSTRUMENT / OPERATION

HE instrument display

Figure 4.4A

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A. INSTRUMENT START-UP

1. When the correct electrical power is e supplied to the unit, it is possible to start the unit for temperature control duty.

2. When the electrical power supply is supplied to the unit, the instrument (figure 4.4A) will momentarily illuminate all indicating lights and digits on the display head. After a short delay, the instrument will display the controller software version number. At this time, the operator can verify that all lights and digits are functioning properly. If the operator determines an indicating light or digit does not illuminate, the instrument must be removed and sent to the factory for repair.

3. With electrical power supplied to the unit, the POWER light will illuminate. The display will remain dark with exception of the WATER LEVEL, PROBE and PHASE lights which will be 'solid green' if those conditions are 'ok'. The FLOW light will 'flash red' to indicate that the pump is not on (not generating flow). This is the normal "stop" state of the instrument. If the operator determines the WATER LEVEL, PROBE and PHASE lights are 'flashing red', the operator must determine the reason and correct:

a. **Water level**: when the reservoir water level is below the level switch mount, the automatic water make-up system is activated in an effort to restore the reservoir to the proper operating level. If the reservoir does not fill in a reasonable amount of time, check the operation of the make-up solenoid valve or determine in the water supply valve (customer supplied) is fully open. The water level sight glass is provided to visually check the reservoir level.

b. **Probe:** a possible cause of a probe error is the probe service connection is wet. Locate the 2 pin (white plug) service connection, open and dry with compressed air. If this action does not remove the error indication, inspect the probe wiring, which could be incorrect or damaged. Probe connections are at the instrument panel. Correct wiring is (from top to bottom) 'white' - 'black' - 'white' - 'black' - 'red' - 'red'. If the probe connections are correct, the probe may be faulty and should be replaced.

c. **Phase:** follow the procedure outline in section 4.2 paragraph B 'Electric Motor Phasing' to clear a phase error. If a phase error can not be cleared even through the pump motor is rotating correctly, the three phase monitor is defective and should be

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replaced. Disconnect the unit until a replacement is obtained.

4. After a 'flashing red' indication is diagnosed and repaired, the 'flashing red' indication will turn 'solid red'. The operator can clear a 'solid red' fault indication by pressing the START key.

5. When the START key is pressed, the instrument will immediately check the status of the motor overload switch (PUMP OL light), the high pressure safety switch (HI PRESSURE light), the low pressure safety switch (LOW PRESSURE light), the low oil pressure safety switch (LOW OIL light), and the freezestat safety switch (FREEZESTAT light) for acceptable operating conditions. If these systems are found to be 'ok', the lights will be 'solid green' and the unit will begin process operations. If a system is not found to be 'ok', the light will 'flash red' and the instrument will prevent operation (check the troubleshooting section of this manual for more information):

a. **Motor overload switch open:** a 'flashing red' PUMP O/L light indicates the electric pump motor overload relay is open. The pump motor is protected from overload conditions (excessive flow) by a set of thermal overload relays which open (trip) with excessive amperage and prevent electric power from reaching the electric motor. If the overload relay is open, the overload relay must be reset before operations can continue. An excessive flow condition must be corrected immediately.

b. **High pressure switch open:** a 'flashing red' HI PRESSURE light indicates the refrigerant high pressure switch is open. This normally occurs when condensing pressures exceed normal parameters. To continue operations, the operator must reset the safety switch by pressing in the reset lever. An high pressure condition must be corrected immediately.

c. **Low pressure switch open:** a 'flashing red' LOW PRESSURE light indicates the low pressure safety switch is open. Chiller operations stop when the refrigerant suction pressure drops below 58 PSI. While the compressor is inactive, the pressure normally builds back up to the cut-in pressure of 63 PSI, at which point the low pressure safety switch automatically resets, and a 3 minute time delay cycle begins (to prevent compressor short-cycling). If the low pressure safety switch does not reset, operations are prevented. Contact the service department for further instructions.

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d. **Low oil pressure switch open:** a 'flashing red' LOW OIL light indicates the oil pressure safety switch is open. The oil pressure safety switch is found on 15 to 30 ton semi-hermetic compressors. Normally, the switch will open if there is insufficient oil in the compressor crankcase or due to lack of sufficient compressor warn up before operations start. This switch must be manually reset before operations can continue.

e. **Freezestat safety switch open:** a 'flashing red' FREEZESTAT light indicates the freezestat safety switch is open. This normally occurs when the 'to process' temperature is below the freezestat setting. The typical freezestat setting is 38°F for setpoint temperatures from 48° to 70°F. If the 'to process' temperature is higher than the freezestat setting, check for proper operation of the freezestat safety switch.

B. INSTRUMENT OPERATION

1. When the START key is pressed, the instrument will activate all displays and begin operations.

2. Use the SELECT key to index through the temperature and set up functions until the TEMP light is illuminated. The operator can push and hold the SELECT key to automatically index through each function.

3. When the TEMP light is illuminated, the setpoint temperature is displayed in the TEMPERATURE DISPLAY window. Use the UP and DOWN ARROW keys to change the setpoint temperature.

4. **PRECAUTIONS:** the instrument is programmed from the factory with a setpoint range of 48° to 70°F. To operate below 48°F, the addition of inhibited propylene glycol and modification of the safety control settings are required. Diligent monitoring of the water/glycol solution is mandatory to prevent freezing of the evaporator. Freezing may cause the evaporator to rupture allowing water and freon to mix which will cause major damage to the refrigeration system. Operating above 70°F requires the addition of a refrigerant crankcase pressure regulating (CPR) valve. The CPR valve is necessary to prevent overloading of the compressor which can cause premature failure. Contact your local refrigeration contractor or the factory service department for further information. The operating range of the instrument may be changed to 20°F - 90°F by adjustment of the CPU DIP switches. Refer to the technical section of this manual for more information.

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5. After selecting the setpoint temperature, the operator may leave the display in the that state. The display will automatically return to the TO PROCESS temperature state after 10 seconds. If the operator leaves the display in any state other than the TO PROCESS state, the display will automatically revert after 10 seconds of inactivity.
6. During operations, if the 'to process' temperature drops 1° below the setpoint, the instrument will activate the capacity control system to match the cooling capacity to the present load, as indicated by the BYPASS/UNLOAD light.

7. If the present load is less than the minimum capacity of the chiller, the 'to process' temperature will continue to drop. At 3° below setpoint, the compressor stops and enters a 3 minute time delay cycle before restarting at 1° above setpoint. The time delay is to prevent short-cycling damage to the compressor.

C. INSTRUMENT CONTROLS (figures 4.4B)

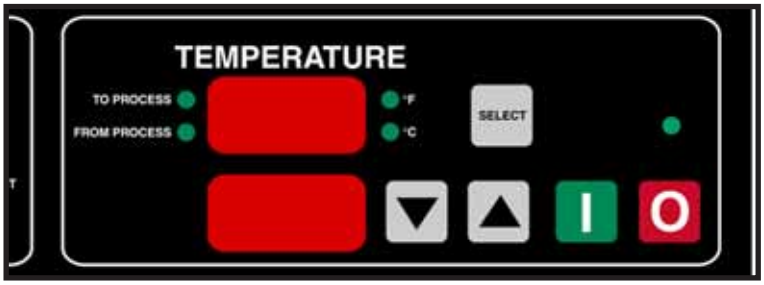

Figure 4.4B

1. **SELECT:** depress to index through the 'to', 'from' and 'set point' temperatures.

2. **UP ARROW**: depress and hold this push button to increase the setpoint temperature. If this push button is pressed momentarily the setpoint value is incremented by one degree. If the push button is held down for more than one second, the setpoint will increase slowly at first and then faster after about two seconds.

3. **DOWN ARROW**: depress and hold this push button to decrease the setpoint temperature. If this push button is pressed momentarily the setpoint value is incremented by one degree. If the push button is held down for more than one second, the setpoint will increase slowly at first and then faster after about two seconds.

4. **START**: starts the coolant and refrigerant circuits. The refrigerant circuit is prevented from operation without the coolant circulating pump operating.

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5. **STOP:** disengages the coolant pump and the refrigerant system.

D. TEMPERATURE DISPLAY (figure 4.4C)

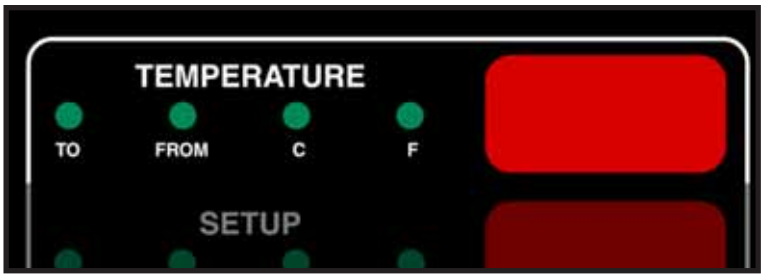

Figure 4.4C

1. **TO:** illuminates when the 'to process' water temperature displayed. TO is the default setting of the TEMPERATURE DISPLAY window.

2. **FROM:** illuminates when the 'from process' water temperature is selected. Note: the instrument will revert back to the TO process temperature display after 10 seconds if the FROM process temperature display was selected and left in that state.

   a. Use the SELECT key to index to the FROM indication lights. The 'from process' temperature will be displayed in the TEMPERATURE DISPLAY window.

3. **°C:** illuminates when the °C (Celsius) temperature display parameter is selected.

4. **°F:** illuminates when the °F (Fahrenheit) temperature display parameter is selected. °F is the default setting of the instrument.

E. SETUP DISPLAY (figure 4.4D)

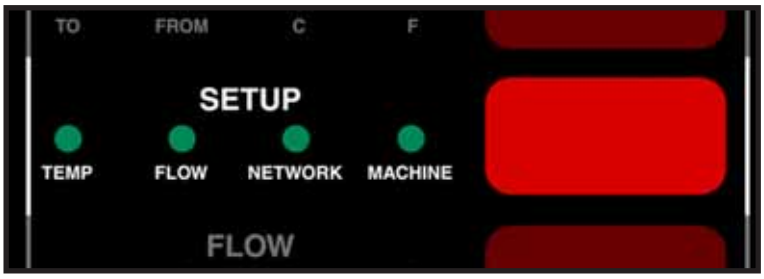

Figure 4.4D

1. When the SELECT key is pressed, the display will cycle forward through all available setup parameters. **The selected setup parameter is indicated in the**

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TEMPERATURE DISPLAY (i.e. 'SP' for setpoint, 'tON' for tons) and the parameter value is displayed in the SETUP DISPLAY window. Values are selected with the Up and DOWN arrows keys.

a. The available parameters are listed here and are explained in detail in the following paragraphs:

NORMAL DISPLAY MODE

SP - setpoint temperature
tON - tonnage display in CAPACITY window
PCt - percent display in CAPACITY window
HI - high temperature deviation limit
Lo - low temperature deviation limit
LoF - low flow limit
Pro - protocol selection
Adr - protocol address selection
rAt - protocol baud rate selection
Unt - temperature/flow unit selection

EXTENDED DISPLAY MODE:

AFL - alternate flow sensor selection
int - internal small flow sensor selected
ALT - large flow sensor selected
ton - chillers size in tons
CAP - capacity display selection
Prb - from process probe calibration
LPt - low pressure time delay

2. **TEMP:** illuminates when the following parameters are selected:

SP - setpoint temperature
tON - tonnage display in CAPACITY window
PCt - percent display in CAPACITY window
HI - high temperature deviation limit
Lo - low temperature deviation limit

a. **'SP':** indicates the setpoint temperature can be adjusted. Adjust the setpoint temperature by:

1. Use the SELECT key to index to the 'SP' display in the TEMPERATURE DISPLAY window (the TEMP light is illuminated). The setpoint temperature value is displayed in the SETUP DISPLAY window. Use the UP arrow or DOWN arrow keys to select the setpoint temperature value.

2. When the instrument is in the default state (TO process temperature display), the operator may adjust the setpoint

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temperature with the UP arrow or DOWN arrow keys without first using the select key. However, if the instrument is in any other state (i.e. the NETWORK parameter state) the operator must use the SELECT key to index to the TEMP indication to adjust the setpoint.

b. **tON:** programs the display of capacity tons in the CAPACITY DISPLAY window. Use the UP arrow or DOWN arrow keys to select 'yes' or 'no'. Note: the TONS light will illuminate if this is selected.

c. **PCt:** programs the display of capacity percent in the CAPACITY DISPLAY window. Use the UP arrow or DOWN arrow keys to select 'yes' or 'no'. Note: the % light will illuminate if this is selected.

d. **Hi:** programs the high alarm temperature deviation limit. This is the high temperature setting at which an alarm is activated if the 'to process' temperature reaches it. 1 - 30 units selectable.

e. **Lo:** programs the low alarm temperature deviation limit. This is the low temperature setting at which an alarm is activated if the 'to process' temperature decreases to it. 1 - 30 units selectable.

2. **FLOW:** illuminates when the following parameters are selected:

LoF - low flow limit

a. **LoF:** programs the low flow value. During operations, if the flow decreases to the selected value an alarm is activated. Note: 30 seconds of flow stability must be maintained before the instrument will set the flow alarm. 0 - 999 units selectable.

3. **NETWORK:** illuminates when the following parameters are selected:

Pro - protocol selection
Adr - protocol address selection
rAt - protocol baud rate selection

a. **Pro:** programs the protocol selection. The protocol is the data format for communications between the unit and the host computer. SPI (standard Society or Plastics Industry) or CAC (standard used of older CMI machines) protocols selectable.

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b. **Adr:** programs the communication address. This is the number assigned to the unit in a network. 1 - 99 units selectable.

c. **rAt:** programs the baud rate. The baud rate is the data transfer rate between the unit and the host computer. 1200, 2400, 4800, 9600 units selectable.

4. **MACHINE:** illuminates when the following parameters are selected:

NORMAL DISPLAY MODE

Unt - temperature/flow unit selection

EXTENDED DISPLAY MODE:

AFL - alternate flow sensor selection
int - internal small flow sensor selected
ALT - large flow sensor selected
ton - chillers size in tons
CAP - capacity display selection
Prb - from process probe calibration
LPt - low pressure time delay

a. **Unt:** programs temperature/flow display. Select 'F' for Fahrenheit temperature display with GPM (gallons per minute) flow display or select 'C' for Celsius temperature display with LPM (liters per minute) flow display.

b. To show the parameters in the extended display mode, the #3 DIP switch must be toggled. Refer to section 5.8 for more details.

c. **AFL:** programs the alternate flow sensor selection. A 'YES' will set the instrument to the internal flow sensor. A 'NO' will set the instrument to the external flow sensor. Typically the instrument is programmed for the correct flow sensor from the factory.

d. **int:** a 'NO' selection for the 'AFL' parameter will activate the internal flow sensor. The 'int' parameter will allow a calibration factor for the small flow sensor.

e. **ALT**: a 'YES' selection for the 'AFL parameter will activate the external flow sensor. The 'ALT' parameter will allow a calibration factor for the larger flow sensor.

f. **ton:** programs the chiller size in tons.

g. **CAP:** programs the CAPACITY DISPLAY selection. A 'ton' display will activate a continuous tonnage

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display. A ‘PCt’ display will activate a continuous percent display. A ‘ALT’ display will activate a alternating display between tons and percent with a 8 second cycle.

h. **Prb:** programs the ‘from process’ probe calibration. Use this to fine tune the ‘from process’ probe to display the same temperature as the ‘to process’ probe, assuming a temperature equilibrium.

i. **LPt:** programs the low pressure time delay. This can avoid nuisance defaults on the low pressure switch when the compressor is unable to rebuild pressure within the time delay. Check with the factory service department before altering this parameter.

F. FLOW DISPLAY (figure 4.4E)

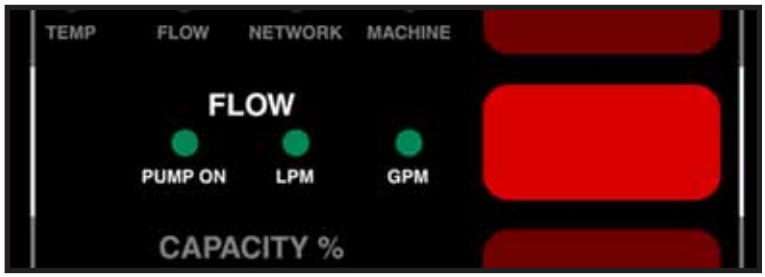

Figure 4.4E

1. The FLOW display shows information concerning the pump generated flow. The flow measuring mechanism is installed in the ‘from process’ water line. Typically, an internal flow sensor is provided with the chiller. In some cases, a larger external flow sensor is provided.

a. **PUMP ON:** illuminates when the pump is operating.

b. **LPM:** illuminates to indicate flow display in ***liters per minute***. This light illuminates when the ‘Unt’ parameter was toggled to ‘C’.

c. **GPM:** illuminates to indicate flow display in ***gallons per minute***. This light illuminates when the ‘Unt’ parameter was toggled to ‘F’.

G. CAPACITY % DISPLAY (figure 4.4F)

1. The CAPACITY % display shows information concerning the ‘in use’ capacity of the unit.

a. **COMP:** a ‘solid red’ light indicates the ‘to process’ temperature is below setpoint and the compressor is off and in the 3 minute time delay mode. A

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Figure 4.4F

'flashing red' light indicates the 'to process' temperature is above the setpoint, but the compressor is still off and in the three minute time delay cycle.

b. **BYPASS/UNLOAD:** illuminates when the hot gas bypass capacity system is on.

c. **%:** illuminates to indicate percent of capacity display. This display is a percent of the chiller's total capacity in current use. The % display is continuous when the 'CAP' parameter is toggled to the 'PCt' selection. The % and TONS display will alternate on a 8 second cycle when the 'CAP' parameter is toggled to the 'ALT' selection.

d. **TONS:** illuminates to indicates tonnage display. This display is a numeric indication of the chiller's current capacity in use. The TONS display is continuous when the 'CAP' parameter is toggled to the 'ton' selection. The % and TONS display will alternate on a 8 second cycle when the 'CAP' parameter is toggled to the 'ALT' selection.

H. PROCESS DISPLAY (figure 4.4G)

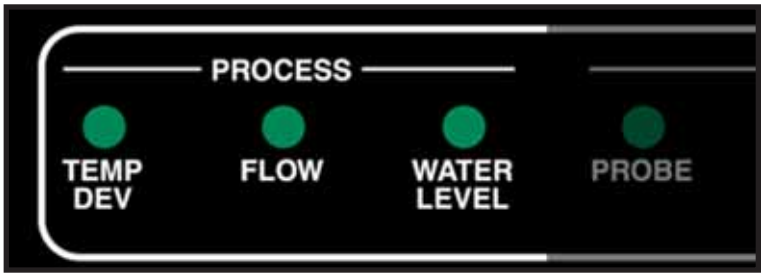

Figure 4.4G

1. The process display is an alarm indication for the temperature deviation, flow and water level.

a. **TEMP DEV:** illuminates according to the current state of temperature deviation:

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1. **SOLID GREEN:** when the process temperature is within the programmed parameters.

2. **SOLID YELLOW:** if the process temperature deviates outside the programmed setting.

3. **FLASHING RED:** If the temperature remains out of band for 90 seconds or more. The alarm circuit is activated.

b. **FLOW:** illuminates according to the current state of flow:

1. **SOLID GREEN:** the process flow is within the programmed parameters.

2. **FLASHING RED:** if the flow deviates beyond the programmed parameters.

3. **SOLID RED:** if the flow had once deviated but is now within the programmed parameter.

c. **WATER LEVEL:**

1. **SOLID GREEN:** the reservoir water level is at proper operating level.

2. **FLASHING RED:** the reservoir water level has dropped below the proper operating level. The automatic water make-up system has activated to restore the water level.

I. MACHINE STATE DISPLAY (figure 4.4H)

Figure 4.4H

1. Machine status lights indicate the operating status of several machine components. Further operational information for each component is located in section 6.0 Consult the section 4.0 for troubleshooting information. For each component:

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a. **SOLID GREEN:** indicates the component is currently at an acceptable run condition.

b. **FLASHING RED:** indicates the component is currently at an unacceptable run condition.

c. **SOLID RED:** indicates the component had once been at an unacceptable run condition but is now at an acceptable run condition. A 'solid red' light can be cleared to a 'solid green' light by pressing the START key.

2. **PROBE:** indicates the status of the 'to process' and 'from process' sensor probes.

3. **PUMP O/L:** indicates the status of the pump motor overload relay. See section 3.2 paragraph C 2 for more proper operation of the pump overload relay.

4. **HI PRESSURE:** indicates the status of the refrigerant high pressure safety switch.

5. **LO PRESSURE:** indicates the status of the refrigerant low pressure safety switch.

6. **LOW OIL:** indicates the status of the low oil pressure safety switch. This light activates on models with a 15 - 30 ton semi-hermetic compressor.

7. **COMPRESSOR:** indicates the operating status of the compressor.

8. **FREEZESTAT:** indicates the status of the freezestat safety switch.

9. **PHASE:** indicates the status of the electrical phasing of the unit. See section 3.2 paragraph B for more information on correct unit phasing

H. COMMUNICATIONS DISPLAY (figure 4.4I)

1. The communication display indicates the kind of exchange between the host computer and the unit. A single light is used:

a. **GREEN FLASH:** indicates the unit is sending information to the host computer.

b. **YELLOW FLASH:** indicates the host computer is sending information to the unit.

c. **RED FLASH:** indicates a communications fault.

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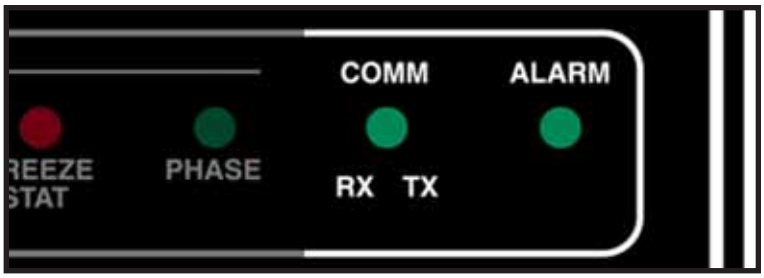

Figure 4.4I

I. ALARM DISPLAY (figure 4.4I)

1. ALARM: when this light illuminates 'solid red', an unacceptable condition has developed, at which time a 115 volt alarm output is generated for an external (factory or customer installed) alarm beacon or buzzer. The visual and/or audible alarm signal can be silenced by pressing the START key.

4.5 PRESSURE GAUGES

A. PRESSURE GAUGES

1. PROCESS PRESSURE GAUGE: indicates process pump pressure.

2. REFRIGERANT HEAD PRESSURE GAUGE: indicates refrigerant pressure on the discharge side of the compressor. The refrigerant head pressure is also the condensing pressure which is critical to equipment efficiency. Head pressure on air condensed units will vary with ambient temperature between 190-290 psi.

3. LOW PRESSURE GAUGE: indicates refrigerant pressure on the suction side of the compressor. This pressure will fluctuate with the operating temperature.

4.6 SHUT DOWN/DISCONNECT SEQUENCE

A. PRECAUTIONS/WARNINGS

1. The operator must precisely follow all shut down procedures outlined in this manual. If the operator fails to follow precisely all procedures outlined in this manual, an unsafe condition can develop resulting in damage to the unit or personal injury.

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B. UNIT SHUT DOWN

1. **To shut down the unit without disconnecting from the process:** Press the stop button. Maintain electrical power to the unit at all times except for service purposes.

2. **To shut down the unit and disconnect from the process:**

   a. Press the stop button.

   b. Disengage the electrical supply to the chiller at the disconnecting device.

   c. Disconnect all process lines.

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5.0 TROUBLESHOOTING

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5.1 UNIT WILL NOT START

A. **Power off.** Check main disconnect.

B. **Main line open.** Check fuses.

C. **Loose terminals.** Tighten terminals with POWER OFF.

D. **Control circuit open.** check control voltage fuses and transformer.

5.2 COMPRESSOR HUMS BUT WILL NOT START

A. **Contactor.** Check contacts and contactor operation.

B. **Low voltage.** Check voltage at main and at the unit. If voltage is OK at the main but low at the unit, increase wire size. If low at main, consult your local power company. Voltage must be +/- 10% nameplate rating.

C. **No power on one phase of a three phase unit.** Check fuses in control panel and main disconnect. Also check unit wiring, main plant fuse and wiring. If the problem is with the main power supply coming into the plant, call the local power company.

D. **Loose terminals.** Tighten terminals with POWER OFF.

5.3 SHUTS OFF ON HIGH PRESSURE CONTROL

Note. Refrigerant high pressure will vary with ambient temperature from minimum of 190 psi to as high as 280 psi. The high pressure switch manually reset when discharge pressure falls to a safe level. The switch is located inside the electrical panel.

A. **Air-cooled units:**

1. **Insufficient condenser air flow.** Check condenser filter for dirt, fins may be plugged with dirt or foreign material. Also, check for proper fan rotation.

   Note: all enclosure panels must be attached.

2. **Fan motor not operating.** Have electrician check fuses and wiring, motor starter and overloads, and motor. Repair or replace motor if defective.

B. **Water-cooled units:**

1. **Water regulator valve.** Adjust condenser water regulator valve to maintain 190 to 210 PSIG refrigerant head

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pressure. If valve is defective, have valve repaired or replaced by a refrigeration serviceman.

2. **Insufficient condenser water flow.** Check condenser water pumping system.

3. **Condenser water temperature too high.** Check cooling tower or proper operation city water temperature.

4. **Condenser water tubes scaled.** Clean with brushes and chemicals approved by the Advantage Service Department.

C. **Improperly set high pressure control.** Have refrigeration serviceman reset or replace the control if defective.

5.4 SHUTS OFF ON LOW PRESSURE CONTROL

Note: The low pressure switch will automatically resets when the pressure rises above the cut-in pressure. If this does not occur contact the the Manufacturer's service department for instructions.

The low pressure switch is set to cut-out at 58 psi and cut-in at 63 psi. If a low pressure condition exists for more than five seconds the compressor will stop and a "L-P" fault will appear in the display window.

After the refrigerant pressure rises above the cut-in pressure, a three minute time delay will occur before the compressor restarts. This will protect the evaporator and compressor from damage should a problem occur in the refrigeration system or if the chiller is operated under circumstances which could cause damage to the refrigeration system.

A. **Air-cooled units:**

Head pressure too low. Check that entering air temperature is above 60°F. If below 60°F, find out reason why.

B. **Water-cooled units:**

Head pressure too low. Adjust condenser water regulating valve to maintain 190 to 210 PSIG refrigerant head pressure. Have refrigeration serviceman repair valve or replace if defective.

C. **Low refrigerant charge.** Check for adequate refrigerant charge (bubbles or misty sight glass indicates low charge). If charge is low, have system checked for leaks and recharged by a refrigeration serviceman.

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D. **Improperly set low pressure switch.** Have a refrigeration serviceman reset control or replace if defective.

E. **Restriction in the liquid line.**

1. **Clogged filter drier.** Check for pressure or temperature drop and have drier core replaced by a refrigeration serviceman.

2. **Liquid line valve or suction valve on compressor is partially closed.** Open fully.

3. **Liquid line solenoid not opening fully or leaking during off cycle.** have repaired or replaced if defective by a refrigeration serviceman.

4. **Expansion valve plugged or inoperative.** Check thermal bulb and capillary tube for damage. Have repaired or replaced if defective by a refrigeration serviceman.

5.5 COMPRESSOR SHUTS OFF ON INTERNAL OVERLOAD

A. **Control does not reset.** Have compressor windings and internal solid state safety control checked by a refrigeration serviceman. Have it repaired or replace if defective.

5.6 LOW OR NO PROCESS PRESSURE OR WATER FLOW

A. **Valves.** Check if water valves are open.

B. **Pump.** Check pump for correct rotation. Check pump suction for restriction. Replace motor if defective.

C. **Filters.** Check filter in the chilled water circuit and clean if necessary.

D. **Pressure switch (or flow switch).** Readjust or replace if defective.

E. **Fuses and wiring.** Have electrician check the fuses and wiring.

5.7 COOLING CAPACITY INADEQUATE

A. **Low refrigerant charge.** Check for adequate refrigerant charge (bubbles or misty sight glass indicates low charge). If charge is low, have system checked for leaks and recharged by a refrigeration serviceman.

B. **Hot-gas bypass valve stuck open.** Have repaired or replace if defective by a refrigeration serviceman.

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C. **Expansion valve plugged or inoperative.** Check thermal bulb and capillary tube for damage. Have repaired or replaced if defective by a refrigeration serviceman.

D. **Plugged filter.** Check filter in chilled water circuit and clean.

E. **Air in system.** Purge air.

5.8 SENSOR

The sensor is a solid state temperature transducer which converts temperature input to proportional current output. To quickly test for a defective probe, switch connections between the defective probe and a probe known to be working properly. A defective sensor will display a "---" in the display window on the instrument control.

5.9 COOLANT PUMP

A. The centrifugal pump is designed to operate at a specific flow and pressure at the maximum run load amp draw of the motor. Too much flow can overload the motor and cause the overload circuit to open and stop the pump.

B. If the overload trips, check for electrical shorts, loose wires, or blown fuses. If these check OK, reset the overload circuit and restart the chiller.

C. Check the amp draw and if overloaded, partially close the from process line valve until the amp draw drops to the proper level.

5.10 OIL PRESSURE

A. This switch must be manually reset after the problem is resolved.

B. Check for low oil level in the compressor crankcase or insufficient compressor warm up before start-up.

C. Defective crankcase heater, internal compressor damage causing the compressor to pump too much oil through the system, defective oil pump, or plugged pick up screen in compressor oil sump. **Note:** only semi-hermetic compressors 15-30 tons have an oil pressure safety switch.

5.11 CRANKCASE HEATER

A. If the crankcase heater is not drawing current during the compressor off cycle, check for a defective crankcase heater, defective fuses or defective interlock on the compressor starter.

B. Scroll compressors do not have crankcase heaters.

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5.12 CHILLER CONTROLLER

A. The display is used for all normal set ups, diagnostics, temperature readout, and operational information. **Note:** the display is not field repairable. It can be easily removed and replaced if required.

B. The CPU contains the software and various electronic components which make the instrument work. **Note:** the CPU is not a field repairable part. It can be easily removed and replaced if a problem arises.

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6.0 MAINTENANCE

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6.1 WARRANTY SERVICE PROCEDURE

A. In the event of a problem with a chiller that can not be resolved by normal troubleshooting procedures, the customer is invited to consult the Service Department for assistance. The correct model number and serial number of the chiller must be available. The service department will attempt to isolate the problem and advise repair procedures. Often times, with the customer's input and with the machine diagnostics, problems can be determined with "over-the-phone" consultation.

B. If the problem is beyond the scope of "over-the-phone" consultation, and if the warranty status of the machine is valid, the Manufacturer will contact the nearest authorized service contractor and provide authorization to conduct an "on-site" inspection of the unit in order to determine the course of repair. If the chiller is not covered by the warranty, the Manufacturer will advise on the repair and recommend available service contractors.

C. It is of the utmost importance that you provide the correct model number and serial number of the machine in question. This will allow the Service Department to obtain the correct manufacturing records which will help to properly troubleshoot the problem and obtain the proper replacement parts when they are required. This information is stamped on the data tag that is attached to the electrical enclosure of each machine.

D. The Service Department must be notified prior to any repair or service of a warranty nature. Warranty claims will not be honored without prior authorization.

6.2 PERIODIC PREVENTATIVE MAINTENANCE

A. Lubricate all motors. Note that some motors are supplied with sealed bearings.

B. Tighten all wire terminals.

C. Clean and check motor starter and contactor contacts.

D. Check safety switch settings.

E. Clean condenser fins of dust and dirt (air cooled models only).

F. Back flush evaporator.

G. Check glycol/water solution ratio for operating temperature.

H. Check system for leaks.

I. Refrigerant sight glass: check for bubbles when compressor is

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operating at 100%. Check the moisture indicator for a color other than green.

J. Clean unit.

6.3 SPECIAL MAINTENANCE

A. Any service of the refrigeration system must be accomplished by a certified refrigeration technician.

1. Addition of compressor oil.

2. Addition of refrigerant.

3. Repair of a refrigerant leak.

4. Adjustment of super heat.

5. Changing of filter-drier or drier core.

6. Repair of a refrigeration solenoid.

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6.4 SOLENOID VALVE SERVICE

A. Units with the water make-up system use a solenoid valve (figure 6.4A) to regulate flow into the reservoir tank. The solenoid valve is controlled by the float switch.

Typical water make-up solenoid valve

Figure 6.4A

B. Generally, solenoid valves fail due to poor water quality, low water flow, or defective valve elements.

C. The operator should follow this procedure to service the make-up solenoid valve:

1. Disengage process operations according to the procedure outlined in **section 4.4**. The operator must be certain process fluid temperature is under 100°F and pressure is relieved (pressure gauge reads “0”) and water system flow is shut off and all pressure relieved.

2. Disengage main power supply. The operator must verify the proper lockout procedures are followed.

3. Remove or open any access cover panel and set aside to gain access to the cooling solenoid valve.

4. The operator must be certain all water system pressure is relieved.

5. Identify the retaining screw (figure 6.4B) on the solenoid valve coil. Remove the screw. Keeping all electrical connections intact, lift the coil off of the enclosure tube and set aside.

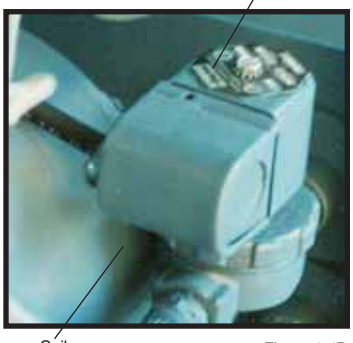

Figure 6.4B

6. Use a pair of channel lock pliers or a pipe wrench to separate the bonnet assembly from the valve body. The plunger is “loose” inside the enclosing tube. Be certain it is retained in the enclosure tube as the bonnet is removed (figure 6.4C).

7. Identify the diaphragm assembly. Gently remove the assembly from the valve body (figure 6.4D).

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8. Identify the mesh screen. Gently removed the mesh screen and clean or replace as necessary.

9. Clean the valve body.

10. Reset the mesh screen into the valve body.

11. If a new diaphragm assembly was obtained, continue with step 12. If not, disassemble the diaphragm assembly and note component order (figure 6.4E). Clean the valve port, plate, collar and O-ring. Once cleaned, reassemble the diaphragm.

12. Set the reassembled diaphragm assembly or the new assembly back into the valve body. The stem should be facing out of the valve body.

13. Inset the plunger with spring first into the enclosing tube of the top bonnet (figure 6.4F). Holding the plunger in the enclosure tube, set the top bonnet onto the valve body and tighten.

14. Place the coil onto the top bonnet and replace the retaining screw.

15. Open the water supply and drain valves (if installed) to circulate water through the supply and drain manifolds. Check the solenoid valve for leakage. Restart the unit as outlined in **section 4.**

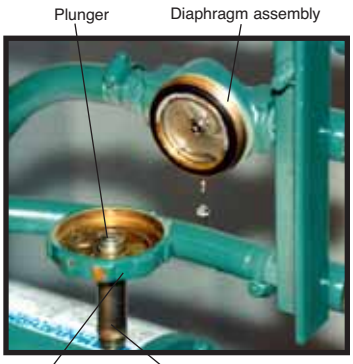

Figure 6.4C

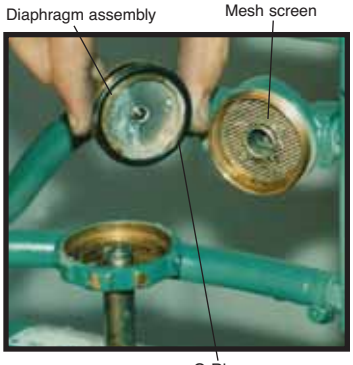

Figure 6.4D

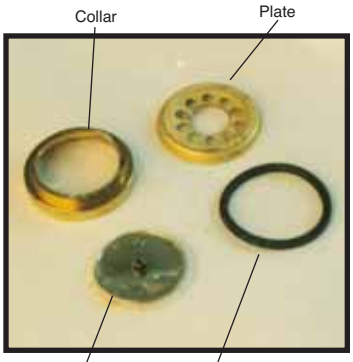

Figure 6.4E

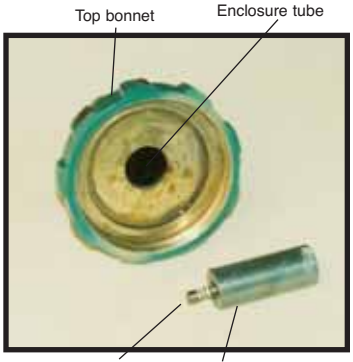

Figure 6.4F

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6.5 PUMP SEAL SERVICE

A. The coolant pump seal is a carbon/niresist shaft seal assembly including a stationary member, rotating member and tension spring (figure 6.5A).

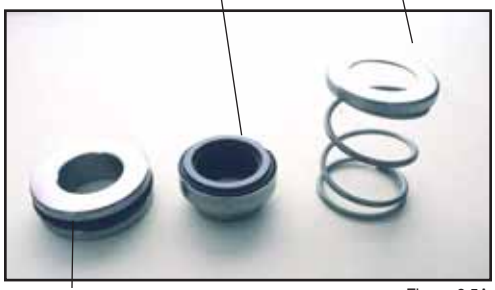

Figure 6.5A

B. The operator can determine the pump seal is leaking when fluid is identified leaking from the pump case adapter. Generally, a pump seal will leak due to inadequate unit pressure, excessive flow and poor fluid quality.

C. The operator should follow this procedure to replace the pump seal:

1. Disengage process operations according to the procedure outlined in **section 6.4**. The operator must be certain process fluid temperature is under 100°F and pressure is relieved (COOLANT pressure gauge reads “0”) and water make-up flow is shut off and all pressure relieved.

2. Disengage main power supply. The operator must verify the proper lockout procedures are followed.

3. Access the pump motor by opening or removing any cover panels as necessary (figure 6.5B).

Figure 6.5B

4. Drain machine. The machine can be drained by using the drain valve located on the pump case. Drain fluid into a suitable container for reuse or disposal according to manufacturer’s instructions (if a glycol solution is used).

5. Locate and remove the three motor wire leads from the motor wiring terminals. The operator should “map”

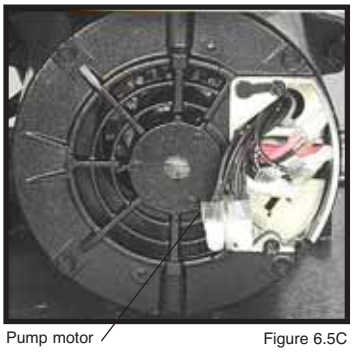

Figure 6.5C

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the wire terminal locations to ensure correct rewiring. The power cord should be removed from the motor housing (figure 6.5C).

6. Locate and remove the pump casing bolts. These bolts secure the motor and motor adapter to the pump casing (figure 6.5D).

Figure 6.5D

7. Separate the motor and motor adapter from the pump casing to expose the pump impeller (figure 6.5E). Remove the motor and motor adapter from the unit and place on a workbench to continue the procedure.

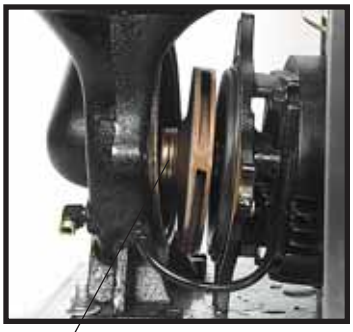

Figure 6.5E

8. Locate and remove the dust cap from motor end to expose slotted motor shaft. The motor shaft is free to rotate, but must be secured to remove the impeller. To secure the motor shaft, insert a flat bladed screw driver in slot to hold the shaft stationary (Figure 6.5F).

Figure 6.5F

9. Locate and remove impeller locking screw (Figure 6.5G). Using a socket and ratchet, the impeller retaining screw can be removed. Once the retaining screw is removed, the impeller can be “unthreaded” from the motor shaft to expose the pump seal assembly.

10. Remove all seal parts (Figure 6.5H). Note seal component arrangement to facilitate reassembly.

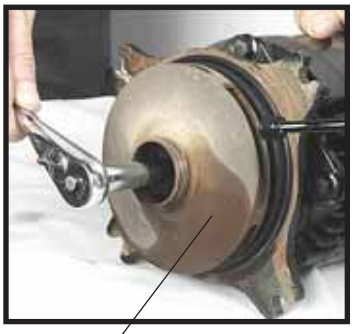

Figure 6.5G

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11. Clean motor shaft and lubricate with a mild soap solution.

12. Install new stationary seal member in pump casing cavity (figure 6.5I). The operator must be certain the stationary seal member is fully squared and seated in cavity.

Figure 6.5H

13. Slide the rotating member onto lubricated pump shaft (figure 6.5J). The operator must be certain not to damage or tear rubber bellows assembly.

14. Place the spring onto the rotating member.

Figure 6.5I

15. Align the impeller, spring and rotating member before reinstalling the impeller (figure 5.5K). The operator must be certain the spring and rotating member are aligned before the impeller is fully tighten and the impeller retaining screw is reinstalled.

16. Clean pump casing, cavities, impeller and O-ring before reassembly.

Figure 6.5J

17. Mate the motor and motor adapter to the pump casing. Reinstall the pump casing bolts.

18. Reconnect the motor power cord and leads.

19. Restore all cover panels as were removed.

Figure 6.5K

E. When the pump seal replacement procedure is complete, the operator may restart the unit according the **section 4**.

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6.6 CHECKING THE REFRIGERANT CHARGE

A. All standard chillers are manufactured with thermostatic expansion valves as the metering device to the evaporator.

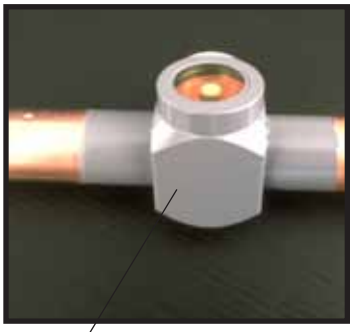

Figure 6.6A

B. All standard chillers have a refrigerant sight glass (figure 6.6A) with a moisture indicator. To check the refrigerant charge under normal operating conditions:

1. Remove the plastic cap covering the sight glass.

2. Start the chiller and allow system pressures and temperatures to stabilize.

3. With the unit operating at 100% capacity (not in the "capacity control" mode) the sight glass should appear clear with no foam or bubbles evident. If foam or bubbles are evident, the chiller has suffered from a loss of refrigerant and should be checked by a qualified refrigeration technician.

4. The "dot" in the middle of the sight glass is the moisture indicator. It should appear green at all times. A white or yellow color indicates moisture has invaded the refrigeration system, which is detrimental to the life of the compressor. The filter-drier should be replaced by a qualified refrigeration technician.

6.7 PROPER CLEANING PROCEDURE FOR BRAZED PLATE EVAPORATORS

A. The brazed plate evaporator is made of stamped stainless steel plates, furnace brazed together with copper based joints. The complex geometry of the flow passages promotes turbulent flow which gives high efficiency and reduces fouling by mineral deposits. Large solids such as plastic pellets or chunks of mineral deposits will collect at the water inlet port at the evaporator and restrict flow through some of the passages. If this possibility exists, the Manufacturer recommends filters or strainers be added to the "from process" line. If the evaporator becomes fouled there are a couple of methods for cleaning.

Figure 6.6A

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B. To begin, remove the piping to the “water in” port at the evaporator. Remove any solids that have collected at this point. Then back flush the evaporator to remove any solids that may be trapped between the plates (see back flush procedure below). If there are mineral deposits adhered to the plates, the evaporator must be back flushed with a mild acid solution (5% phosphoric or 5% oxalic acid is recommended.) After cleaning rinse with clear water before returning to service. Continue with step C on the next page.

C. Back flushing procedure:

1. Turn off all power to the machine. For chillers with a reservoir tank, drain the tank to below the evaporator outlet. For chillers without a reservoir tank, drain total unit.

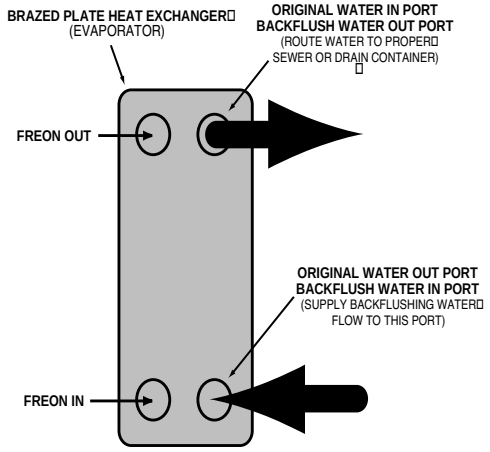
2. Connect a water supply hose to the evaporator water outlet. If acid cleaning, connect the discharge hose from the acid pump to the evaporator outlet port.

3. Connect a hose to the evaporator water supply port and to an appropriate containment vessel. If acid cleaning, connect the evaporator water inlet port to an acid solution reservoir tank. Dispose of all back flush fluid according to local codes.

4. The cleaning fluid source should have at least 20 psi available. If acid cleaning, follow the instructions supplied with the acid solution carefully.

5. When the procedure is complete, reinstall all water lines to original factory orientation. Restart the unit and check for proper operation.

6. **Note:** this procedure is not normal maintenance. Maintaining proper water quality and filtration will minimize the need to back flush the evaporator.



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7.0 COMPONENTS

7.1 WATER SYSTEM

7.2 REFRIGERATION SYSTEM

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7.1 WATER SYSTEM

A. MOTOR/PUMP ASSEMBLY: the motor/pump assembly circulates chilled fluid to the process loop. The pump assembly is built of total stainless steel to maintain water quality (figure 7.1A).

Figure 7.1A

7.2 REFRIGERATION SYSTEM

A. COMPRESSOR: hermetic or semi-hermetic compressors take low pressure/low temperature refrigerant gas and compress the gas into high pressure/high temperature gas (figure 7.2A).

B. AIR COOLED CONDENSER: the air cooled condenser removes BTU's from the compressed refrigerant gas. The action causes the gas to "condense" into a liquid state still under high pressure. Air flow across the condenser is achieved via a motor driven fan assembly or centrifugal blower (figure 7.2B).

C. FILTER-DRIER: the filter-drier removes contaminants and moisture from the liquid refrigerant (figure 7.2C).

D. LIQUID LINE SOLENOID VALVE: controlled by the instrument, this valve closes when the compressor cycles off to prevent refrigerant liquid from migrating to the evaporator. The valve opens when the compressor cycles on.

E. REFRIGERANT SIGHT GLASS: the refrigerant sight glass indicates refrigerant charge and moisture content. Refrigerant charge is determined by a clear liquid flow. Bubbles indicate low refrigerant. Moisture content is indicated by the color of the element. Element color

Figure 7.2A

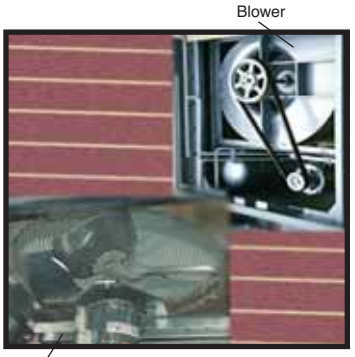

Figure 7.2B

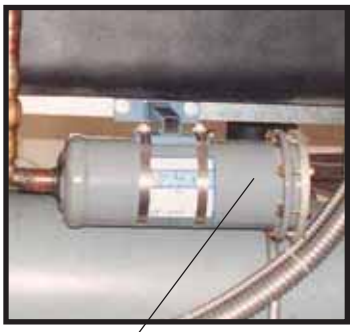

Figure 7.2C

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is normally green. If the color of the element is chartreuse or yellow, the system has been contaminated with moisture. In such case, the filter-drier must be replaced. The replacement of the filter-drier must be completed by a qualified refrigerant service technician (figure 7.2D).

Refrigerant sight glass Figure 7.2D

F. **EXPANSION VALVE:** the expansion valve throttles flow of refrigerant liquid into the evaporator and creates a pressure drop in the refrigerant system that allows the liquid refrigerant to “boil off” inside the evaporator (figure 7.2E).

Expansion Valve Figure 7.2E

G. **EVAPORATOR:** the evaporator is a brazed plate heat exchanger where the refrigerant liquid is allowed to evaporate (boil off) to absorb heat (BTU) from the process fluid. As the heat is absorbed, the process fluid is chilled (figure 7.2F).

H. **HOT GAS BY-PASS SOLENOID:** the hot gas by-pass solenoid prevents short cycling of the compressor by reducing the capacity by 50% when the process fluid temperature nears the setpoint.

Typical hot gas bypass valve Figure 7.2H

I. **HIGH/LOW PRESSURESTATS:** the high/low pressurestats protect the refrigeration system from unsafe operating levels. The **high pressure switch** is factory set to open at 325 psi and protects the refrigeration components and personnel from potential damage of injury from excessive high pressure. The high pressure safety must not be altered in the field for any reason. The **low pressure switch** is factory set to open at 58 psi and to close at 63 psi. The low pressure switch protects the chillers from possible damage due to low operating pressure. The low pressure switch is field adjustable for setpoints below 48°F.

NEVER LOWER THE CUT OUT SETTING WITHOUT ADDING GLYCOL TO THE CIRCULATING SYSTEM. EVAPORATOR DAMAGE WILL RESULT AND WILL NOT BE COVERED BY THE WARRANTY.

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J. **Liquid receiver:** located after the condenser, this component receives and stores liquid refrigerant leaving the condenser.

K. **Service valves:** have been provided throughout the system. Only a qualified refrigeration service technician shall operate these valves.

L. **Crankcase heater:** insures that freon and compressor crankcase oil do not mix during the compressor's "off " cycles. Power must be applied to the chiller previous to startup.

M. **Oil pressure safety switch:** protects the compressor from lubrication failure.

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8.0 RELATED DRAWINGS

8.1 MECHANICAL SCHEMATIC : WATER-COOLED : 5 - 10 TONS
8.2 MECHANICAL SCHEMATIC : WATER-COOLED : 15 - 40 TONS
8.3 MECHANICAL SCHEMATIC : AIR-COOLED : 5 - 10 TONS
8.4 MECHANICAL SCHEMATIC : AIR-COOLED : 15 - 30 TONS
8.5 TYPICAL ELECTRICAL : AIR-COOLED
8.6 TYPICAL ELECTRICAL : WATER-COOLED
8.7 PHYSICAL SCHEMATIC : AIR-COOLED : 7.5 - 10 TONS
8.8 PHYSICAL SCHEMATIC : AIR-COOLED : 5 TONS
8.9 PHYSICAL SCHEMATIC : WATER - COOLED :
8.10 DUCT SCHEMATIC FOR AIR-COOLED CHILLERS

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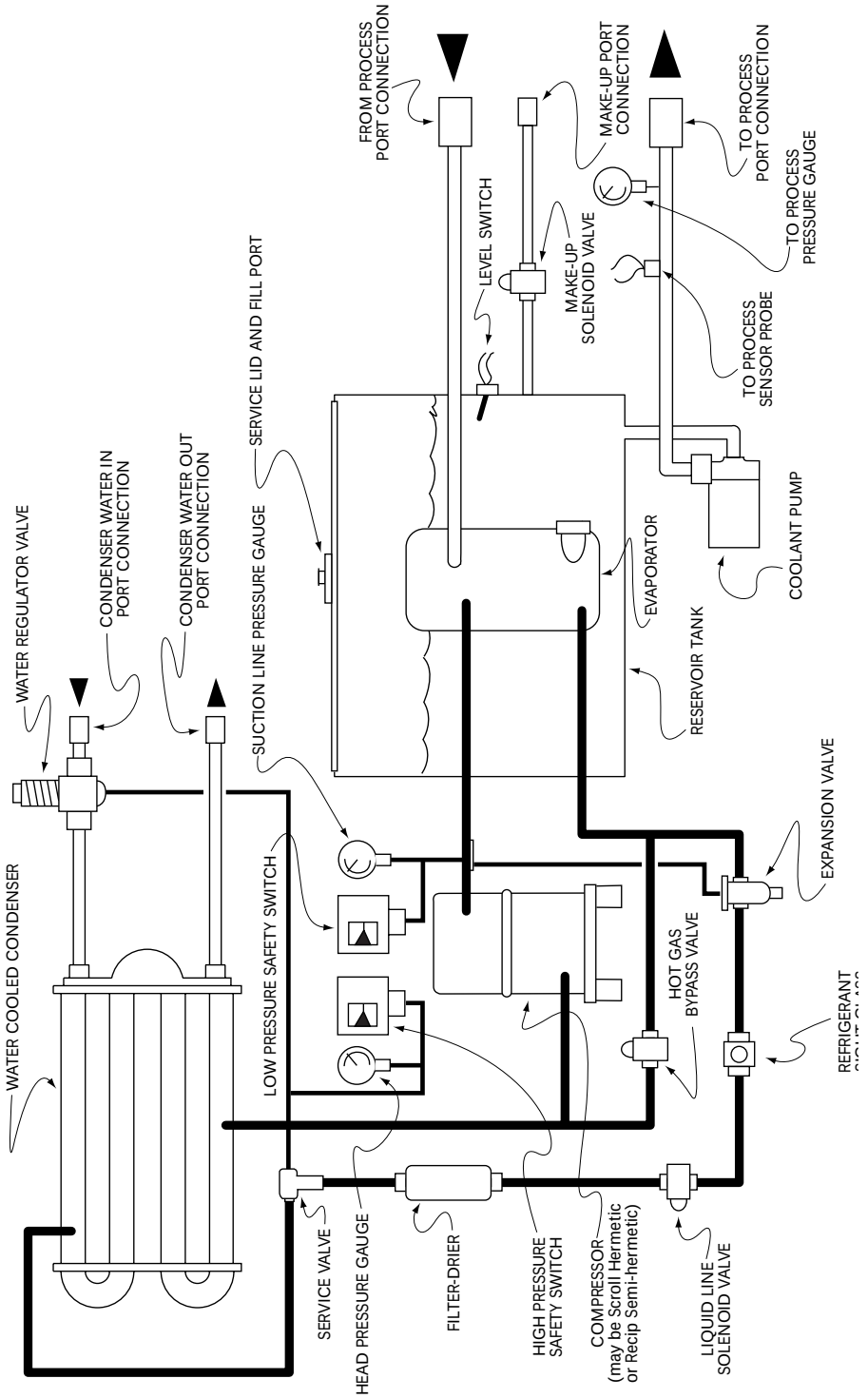
8.1 MECHANICAL SCHEMATIC : WATER-COOLED : 5 - 10 TON MODELS



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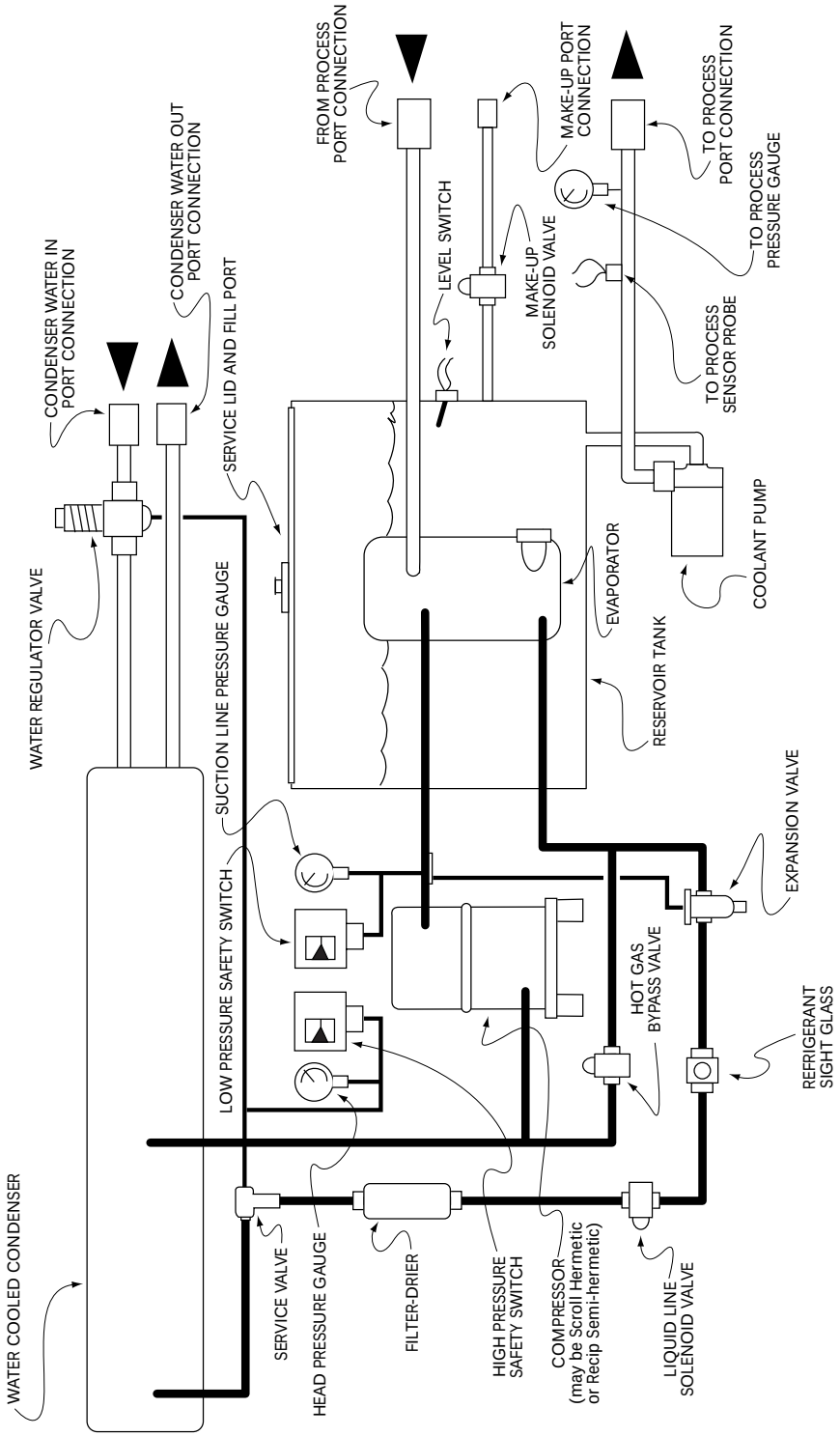
8.2 MECHANICAL SCHEMATIC : WATER-COOLED : 15 - 40 TON MODELS



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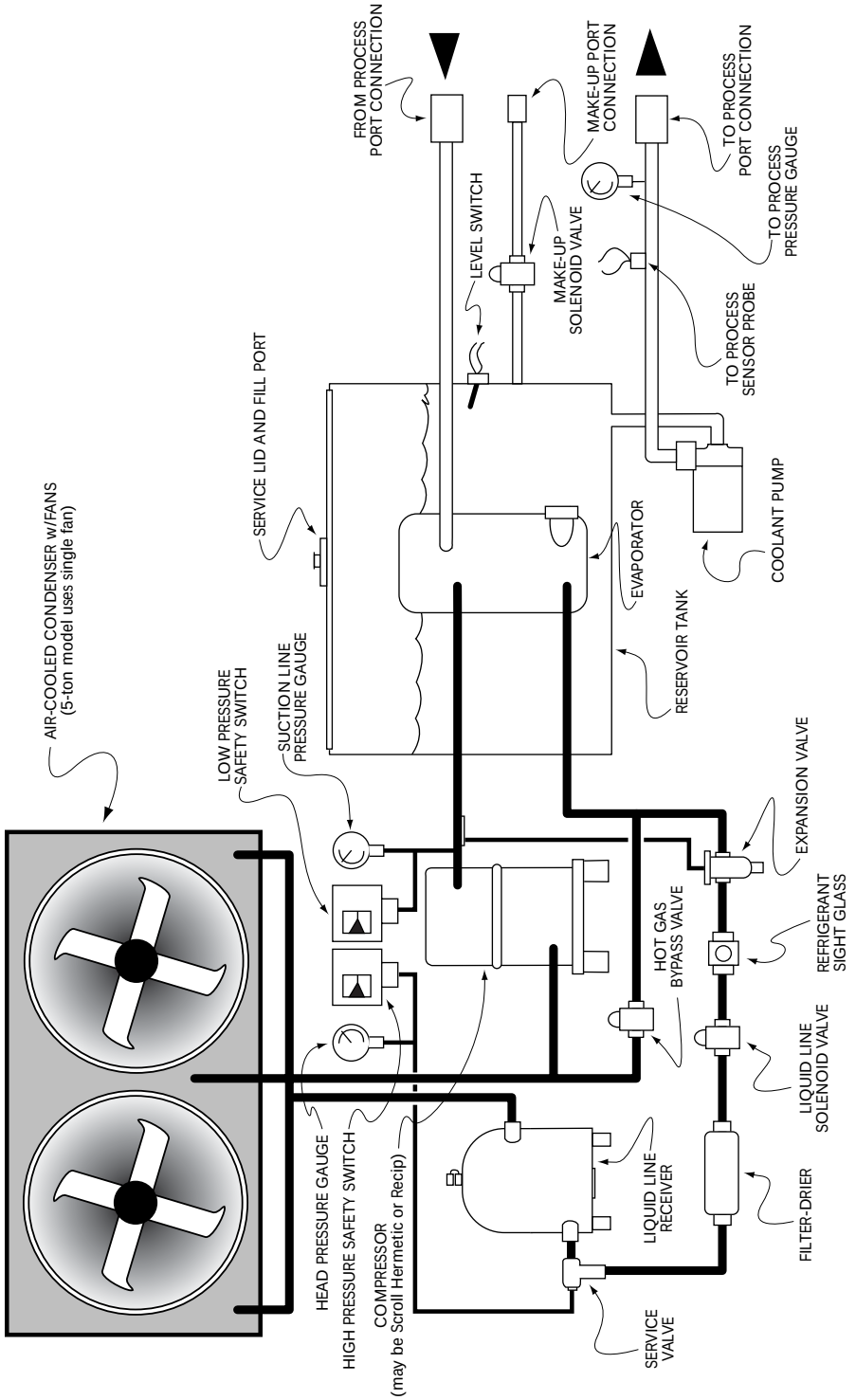
8.3 MECHANICAL SCHEMATIC : AIR-COOLED : 5 - 10 TON MODELS



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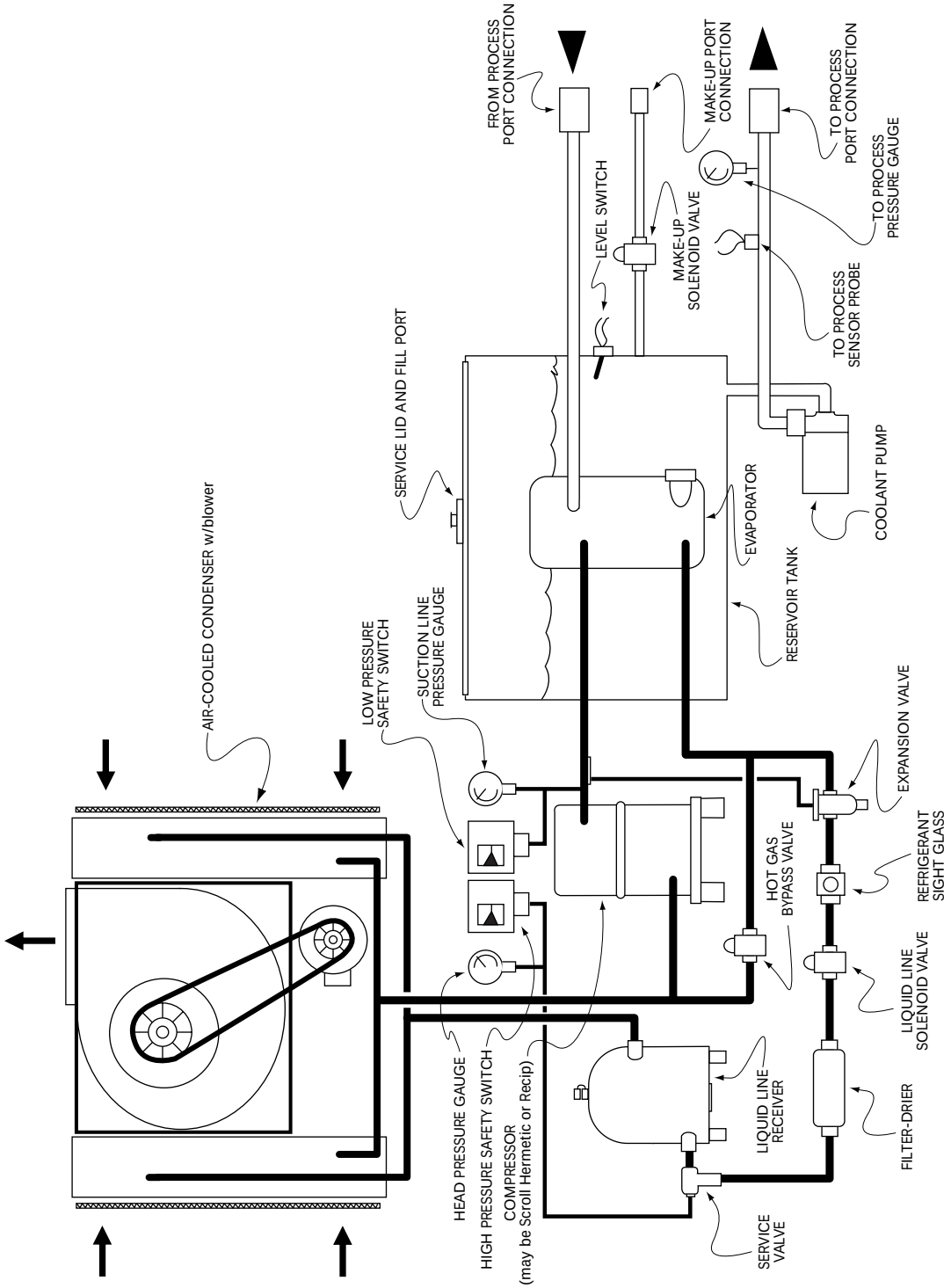
8.4 MECHANICAL SCHEMATIC : AIR-COOLED : 15 - 30 TON MODELS



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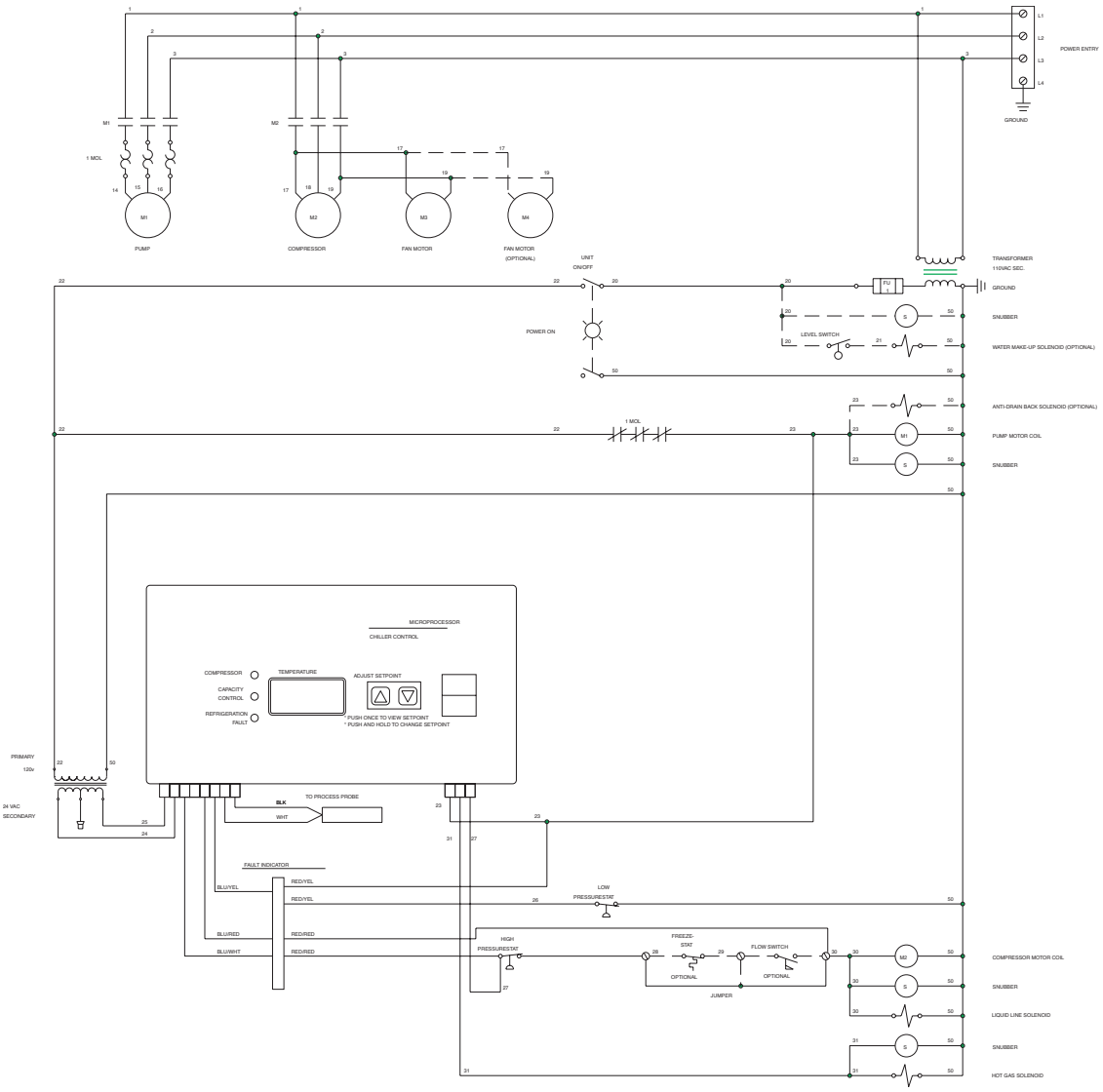
8.5 TYPICAL ELECTRICAL SCHEMATIC : AIR-COOLED MODELS



Electrical schematic #CA-1282 is presented for illustration purposes only.
For exact details, consult the electrical drawing supplied with your machine.

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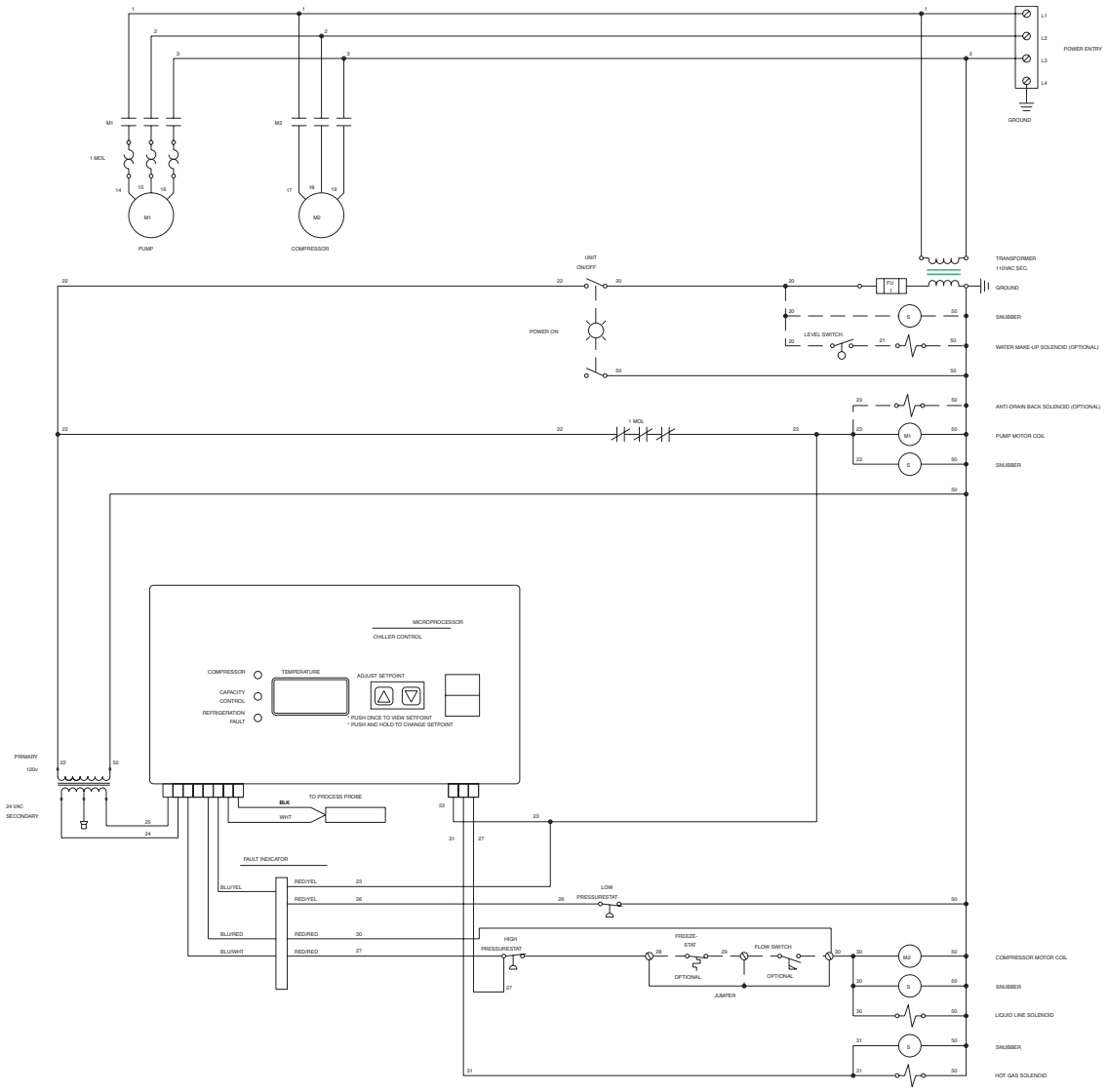
8.6 TYPICAL ELECTRICAL SCHEMATIC : WATER-COOLED MODELS



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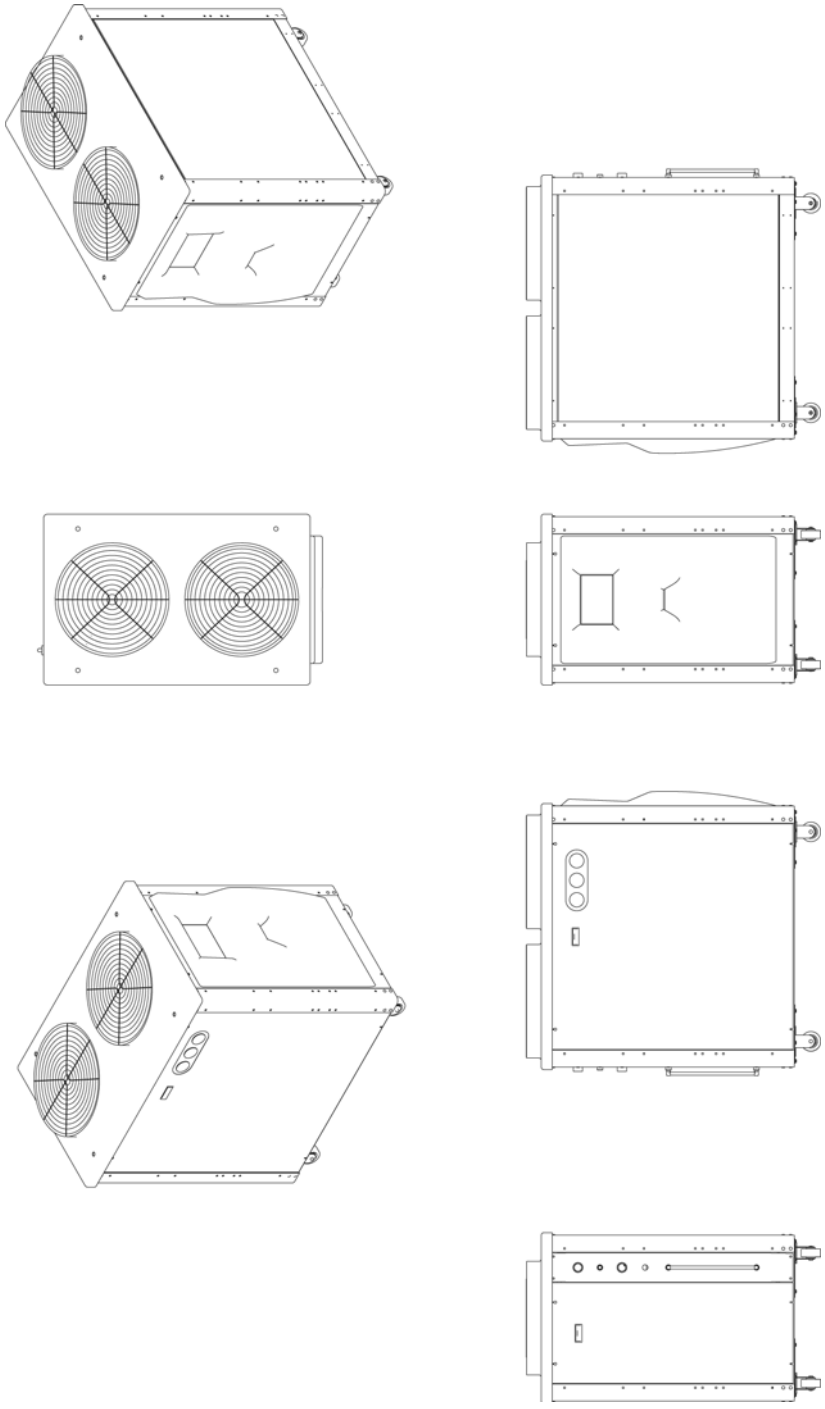
8.7 TYPICAL PHYSICAL : AIR-COOLED MODELS : 7.5 - 10 TONS



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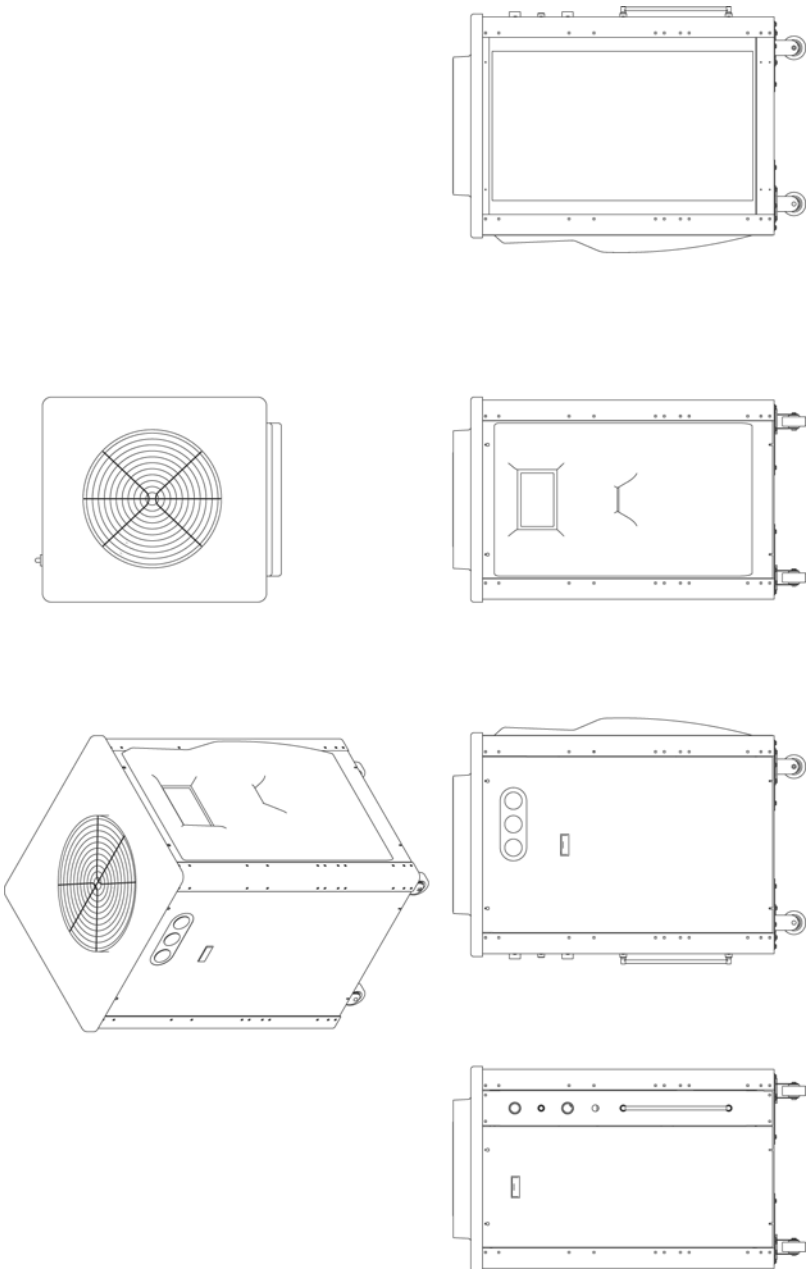
8.8 TYPICAL PHYSICAL : AIR-COOLED MODELS : 5 TONS



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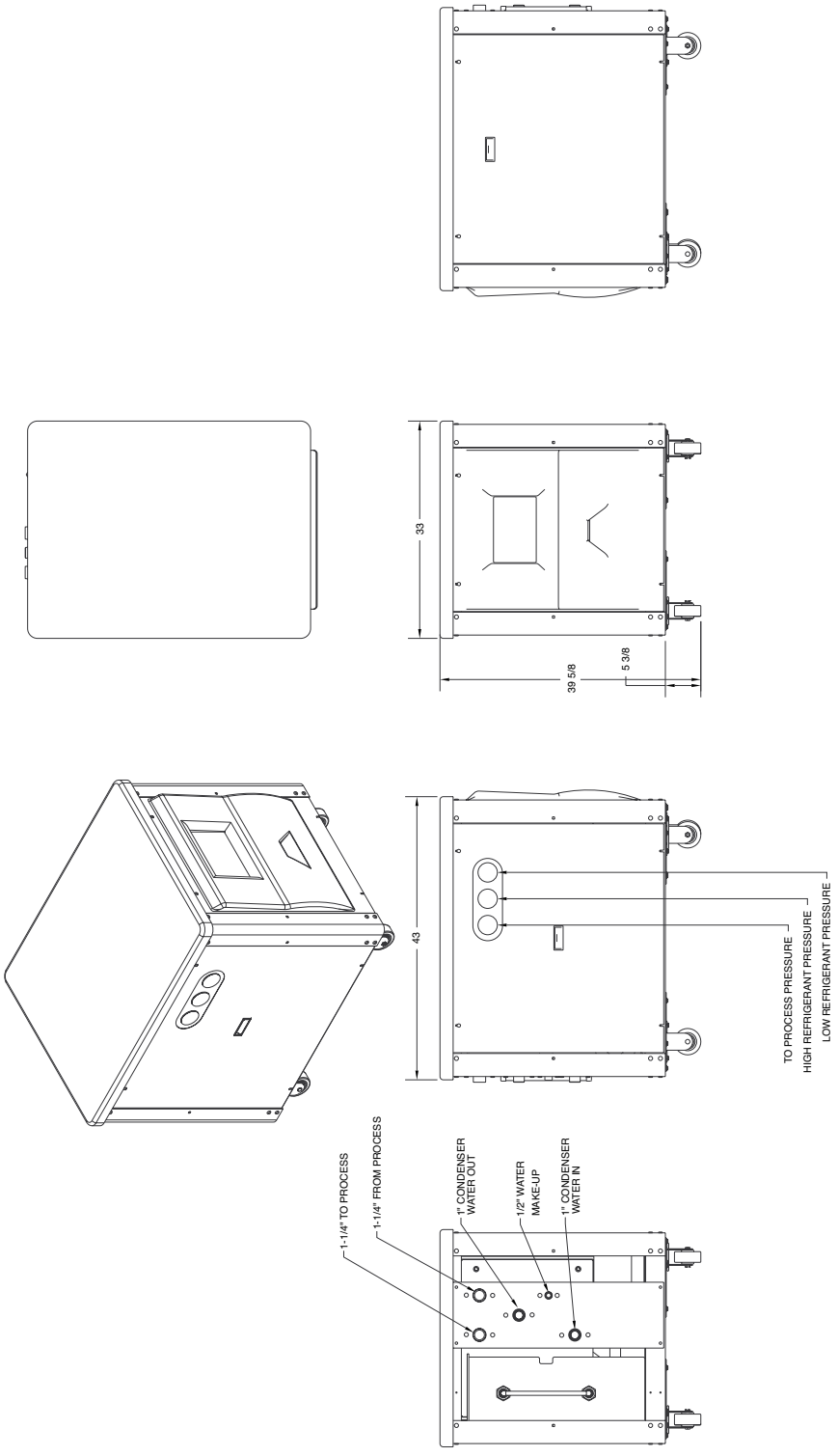
8.9 TYPICAL PHYSICAL : WATER-COOLED MODELS : % TONS



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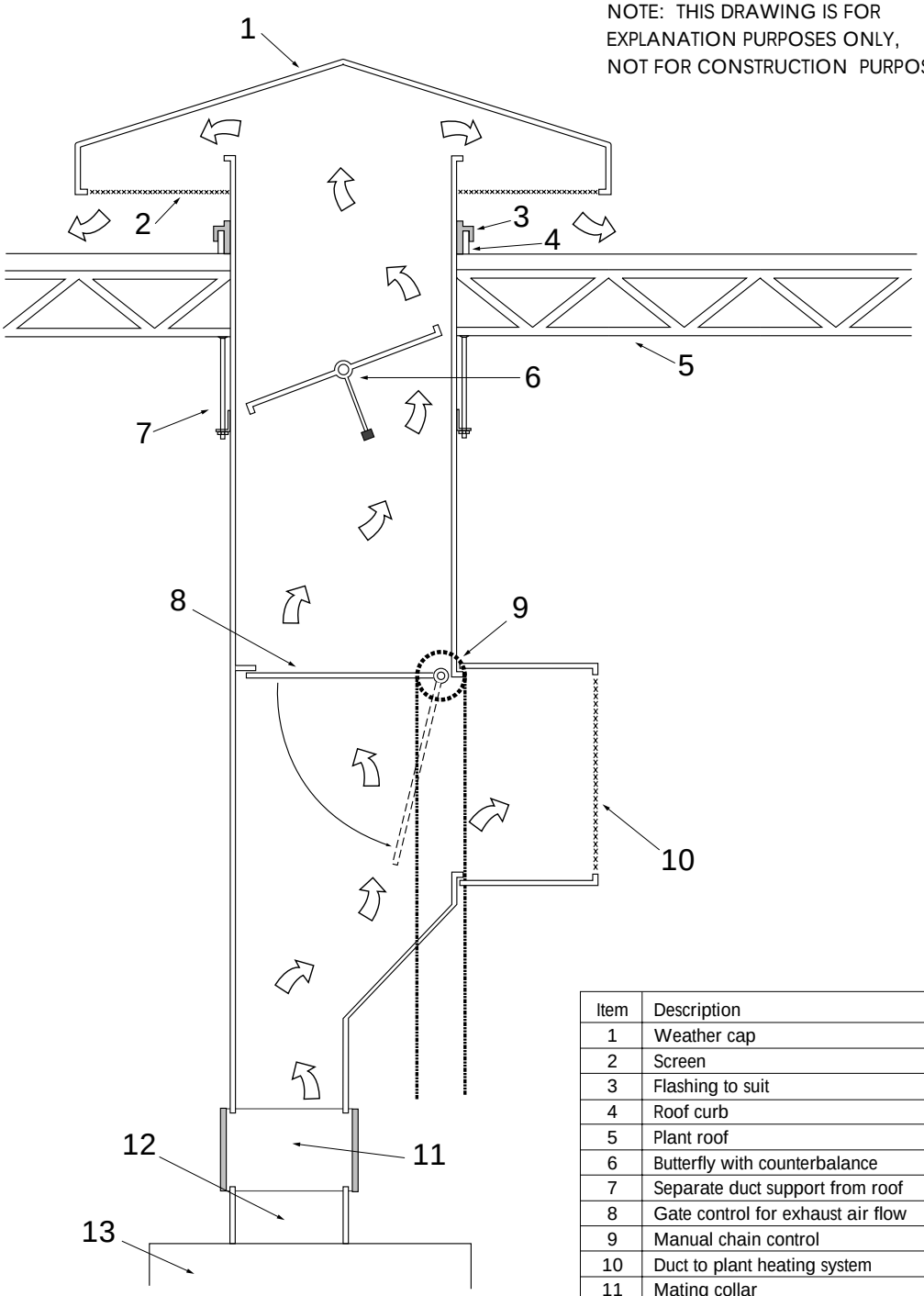
8.10 DUCT SCHEMATIC FOR AIR-COOLED CHILLERS



Item	Description
1	Weather cap
2	Screen
3	Flashing to suit
4	Roof curb
5	Plant roof
6	Butterfly with counterbalance
7	Separate duct support from roof
8	Gate control for exhaust air flow
9	Manual chain control
10	Duct to plant heating system
11	Mating collar
12	Chiller air exhaust port
13	Air cooled chiller

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9.0 APPENDIX

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9.1 OPERATIONS BELOW 48°F

A. Chillers supplied with the automatic water supply system, the water supply connection must be plugged when operating below 48°F or anytime the system utilizes a water/inhibited propylene glycol solution. The system must be manually filled and the mix shall be checked for the proper ratio on a regular basis.

B. Addition of an inhibited propylene glycol solution is required. The ration shall be according to **figure 9.1A**. Too much glycol can cause capacity and control problems. Under no circumstances shall an automotive type antifreeze be used in the chilling unit.

C. The freezestat and low pressurestat settings must be field adjusted according to figure 9.1B.

NEVER LOWER THE CUT OUT SETTING WITHOUT ADDING GLYCOL TO THE CIRCULATING SYSTEM. EVAPORATOR DAMAGE WILL RESULT AND WILL NOT BE COVERED BY THE WARRANTY.

OPERATING TEMPERATURE	*ANTI-FREEZE MIXTURE GLYCOL*	*WATER*
10° - 47°F	30%	70%

Figure 9.1A

OPERATING TEMPERATURE	*LOW CUT-IN*	*LOW CUT-OUT*
48° - 70°F□	63 #□	58 #□
10° - 47°F	45 #	30 #

Figure 9.1B

9.2 WATER QUALITY CONTROL

A. Lack of proper water treatment can damage the chilling unit. The services of a competent water treatment specialist should be obtained and their recommendations followed. It is the equipment owner's responsibility to prevent damage from foreign material or inadequate water treatment.

B. The two main things to consider for water treatment in chillers are corrosion and organism growth. Proper chemical treatment can control PH levels and algae growth. An alternative to chemical treatment is the addition of 30% inhibited propylene glycol to the water. This will help prevent organism growth and coat the heat transfer surfaces with corrosion inhibitor.

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9.3 INHIBITED PROPYLENE GLYCOL

A. To operate liquid chillers below 48°F, it is necessary to add **inhibited propylene glycol** to the circulating system to lower the freeze point and prevent damage to the cooling system. Inhibited propylene glycol contains corrosion inhibitors which are compatible with most industrial heat transfer surfaces. Inhibited propylene glycol is manufactured by:

- Dow Chemical - “DowFrost” (1-800-258-2436)
- Monsanto “Therminol FS” (1-800-459-2665)
- Advantage Engineering “Thermofluid” (1-317-887-0729)

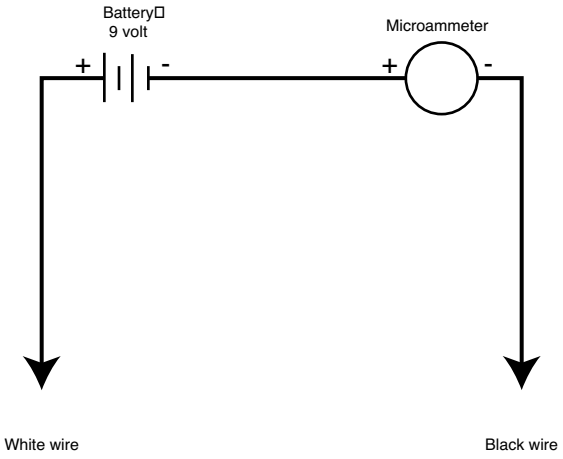
B. Automotive anti-freeze must never be used in industrial heat transfer applications. Automotive anti-freeze contains silicate type corrosion inhibitors designed to be compatible with automotive components. In an industrial application, the silicates will form a gel on the heat transfer surface which will result in substantial reduction in cooling capacity and is virtually impossible to remove.

9.4 SENSOR CURRENT VS TEMPERATURE

-20°F = 243.86	A
-10°F = 249.43	A
0°F = 255.00	A
10°F = 260.57	A
20°F = 266.14	A
30°F = 271.71	A
40°F = 277.27	A
50°F = 282.84	A
60°F = 288.41	A
70°F = 293.98	A
80°F = 299.55	A
90°F = 305.12	A
100°F = 310.69	A
110°F = 316.26	A
120°F = 321.82	A
130°F = 327.39	A
140°F = 332.96	A
150°F = 338.53	A
160°F = 344.10	A
170°F = 349.67	A
180°F = 355.24	A
190°F = 360.80	A
200°F = 366.37	A
210°F = 371.64	A
220°F = 377.51	A
230°F = 383.08	A
240°F = 388.65	A
250°F = 394.22	A

Formula:

- 1 u A = (556.8627 x 10 x °F) = (255 x 10)
- °F = (1 u A - 255 x 10) + (556.8627 x 10)



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9.5 PRESSURE-TEMPERATURE CHART FOR R-22 REFRIGERANT

SATURATED TEMPERATURE	FREON PRESSURE
40°F	68
45°F	76
50°F	84
55°F	93
60°F	100
65°F	112
70°F	122
75°F	132
80°F	144
85°F	156
90°F	168
95°F	182
100°F	196

THESE PRESSURE/TEMPERATURE RELATIONSHIPS ARE IN AN AT-REST, SATURATED CONDITION. FOR EXAMPLE, IF THE UNIT HAS BEEN IN A WAREHOUSE AT 40° AND IS BROUGHT INTO A ROOM WHERE IT IS 80°, IT MAY TAKE A COUPLE OF HOURS FOR THE UNIT TO WARM UP AND THE PRESSURE TO RISE TO THE SURROUNDING AMBIENT CONDITIONS.

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9.6 CHILLER CAPACITY AND DERATE CHART

Standard chiller rating is at 50°F. For all other temperature settings, output tonnage is altered as follows:

OUTPUT TEMPERATURE °F	FULL AVAILABLE % CAPACITY	
60	105%	
50	100%	
45	90%	
40	80%	
35	70%	
30	60%	
25	50%	
20	40%	
15	30%	*
10	22%	*
5	15%	*
0	9%	*
-5	5%	*

NOTES:

If operation of the chiller at less than 48°F is required, an inhibited propylene glycol solution is required.

Consult factory for chiller operation below 20°F.

Ambient conditions affect air cooled chiller operation and capacity. Standard rating is at 95°F entering air temperature. For ambient air conditions greater than 95°F, chiller derating will occur. For ambient of 95-105°F, select the next larger capacity chiller. For ambient over 105°F, consult factory.

* These ranges require special options.

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