OPERATION AND MAINTENANCE MANUAL
Bldg M-231, MCB, Camp Lejeune, NC
Contract: N62470-88-C-3764

RENOVATION OF BUILDING M-231
CONTRACT NO. N62470-88-C-3764

Transmittal No. 105

Item No. 1

OPERATION & MAINTENANCE MANUAL
DIVISION 15 - MECHANICAL

General Contractor:

C.B.C. Enterprises, Inc.
1312 E. Little Creek Road
Norfolk, Virginia 23518
(804) 588-6100

Mechanical Subcontractor:

G. R. Michaels & Co.
331 32nd Street
Newports News, Virginia 23607
(804) 245-9173

C. B. C. ENTERPRISES, INC.

It is hereby certified that the (equipment) (meterial) shown and marked in this submittal is that proposed to be incorporated into Contract No. 88-C-37VA

(✓) is in compliance with the Contract drawings and specifications and is submitted for Government approval

( ) is a deviation from the Contract drawings and specifications and is submitted for Government approval

and can be installed in the allocated spaces

Certified by

Date 11/5/91

OPERATION AND MAINTENANCE

Renovation of Building M-231

Marine Corps Base

Camp Lejeune, North Carolina

Contract: N62470-88-C-3764

G.R. Michaels & Co.
331 32nd Street
Newport News, Virginia

TAB PLACEMENT HERE

DESCRIPTION:

None

☑ **Tab page did not contain hand written information**

☐ **Tab page contained hand written information**
***Scanned as next image**

Renovation of Building M231
Marine Corps Base
Camp Lejeune, NC
Contract: N62470-88-C-3764

I N D E X

TAB PLACEMENT HERE

DESCRIPTION:

1

☒ Tab page did not contain hand written information

☐ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Renovation of Building M231
Marine Corps BAse
Camp Lejeune, NC
Contract: N62370-88-C-3764

Electric Water Coolers

General Contractor:

CBC Enterprises, Inc.
1312 E. Little Creek Road
Norfolk, Virginia
Phone: (804) 588-6100

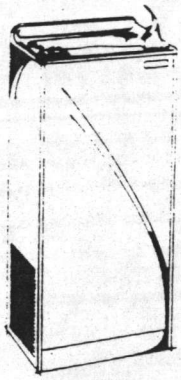
Mechanical Contractor:

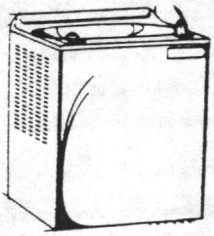
G.R. Michaels & Co.
331 32nd Street
Newport News, Virginia
Phone: (804) 622-3099
Mr. Terry Gregston

Wholesaler and Supplier:

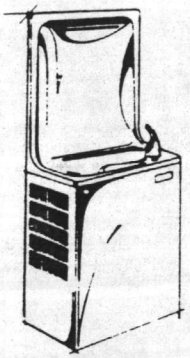
Ferguson Enterprises, Inc.
600 Rotary Street
Hampton, Virginia
(804) 826-5300
Steve Saunders

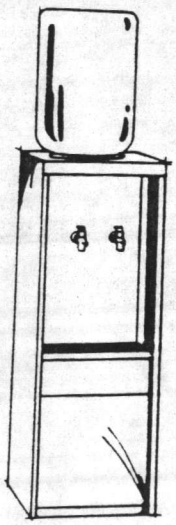
INSTALLATION & SERVICE INSTRUCTIONS

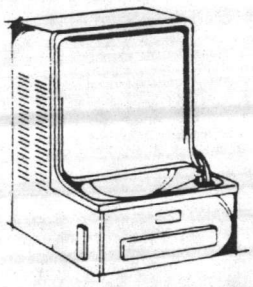


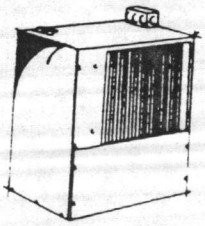


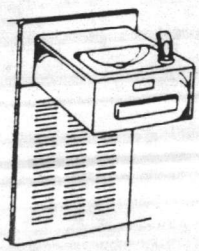
- WATER COOLERS
- BOTTLE WATER COOLERS
- PACKAGED WATER CHILLERS

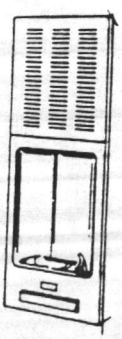












INTRODUCTION

This manual is prepared as a guide to the periodic inspection and general servicing of water coolers. It is intended for use in routine maintenance and minor servicing, but not for the repair of the refrigeration system. A cooler in warranty which has a refrigeration defect must be repaired by an authorized service center, or by the factory, whichever is determined by your local sales representative. If you are not familiar with the name and phone number of service personnel in your area, we will be happy to supply this information upon request.

START-UP PROCEDURE

INSTALLATION

1. Insure proper ventilation by maintaining 4" clearance from cabinet louvers to wall on each side of cooler.
2. Water inlet 3/8" IPS. Waste 1-1/4" O.D. tailpiece for slip trap. Contractor to supply waste trap in accordance with local codes.
3. Connecting lines to be of copper or brass, thoroughly flushed to remove all foreign matter before connected to cooler. If flushing does not remove all particles, a water strainer should be installed in supply lines.
4. Connect cooler to building supply line with a shut-off valve and install a union connection between the valve and cooler.
5. Electrical: Insure power supply is identical to that specified on cooler serial plate.

NOTE: As a preventive measure, a water line strainer should be installed ahead of the inlet water connection whether the installation is made on new or old plumbing. The strainer will prevent clogging water lines and bubbler valves.

START-UP

1. Release air from tank by holding button down. Steady stream flow assures all air removed.
2. Stream height is factory set at 35 PSI. If supply pressure varies greatly, stream height will need adjustment. (See service procedure page 3.)

These products are designed to operate on 20 psig to 105 psig supply line pressure. If inlet pressure is above 105 psig, a pressure regulator must be installed in the supply line. Any damages caused by reason of connecting this product to supply line pressures lower than 20 psig or higher than 105 psig is not covered by warranty.

3. On H models (hot tank), depress lever and assure full stream flow. **DO NOT** connect electrical power until full water flow is assured.
4. Rotate condenser fan blade to insure proper clearance and free fan action. (Not required on all models.)

PRINCIPLE OF OPERATION

REFRIGERATION CYCLE

The cycle of operation of the refrigeration system for the water coolers is as follows: Hot, high pressure refrigerant vapor is pumped by the compressor through the discharge tube of the compressor. In passing through the condenser, the vapor gives up some of its heat to the room air and condenses to liquid. The liquid refrigerant passes out the bottom of the condenser, through a drier and capillary tube into a larger tube which is coiled and bonded to the water storage tank. In removing heat from the water, the liquid refrigerant is boiled off into low pressure vapor which flows through the suction tube, to the compressor.

The temperature control bulb is located in a control well which extends outside the water tank. In this position, the control is made responsive to the temperature of both the water and refrigerant.

WATER COOLING CYCLE

The water cooling cycle is as follows:

The building water supply enters the cooler through the inlet water connection of the cooler. When in the cooling tank, the water is cooled by contact with the refrigerated walls of the tank.

CLEANING STAINLESS STEEL AND BRONZETONE BASINS

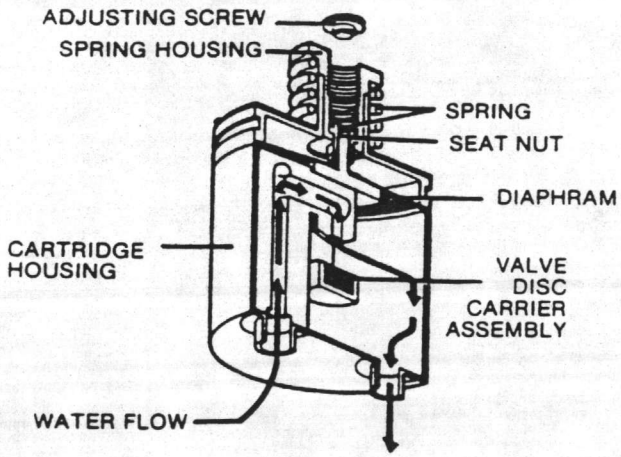
Clean stainless steel and bronzetone surfaces with only a mild detergent or vinegar and water. Rinse well with clean water and wipe dry with a soft cloth. Any misuse or abrasion can eventually damage the finish. (Never use steel wool or other types of abrasive pads.)

Note: Cleaning abrasives, strong solutions and chemicals will damage the basin. The manufacturer is not liable for the finish beyond the date of installation.

CLOGGED WATER LINES AND STREAM HEIGHT ADJUSTMENT

NOTE: The following procedure requires that you make provisions for catching water that might damage customer's premises.

Insufficient bubbler stream or no stream may be caused by a clogged water line. It may also be caused by an in-operative bubbler cartridge assembly or one that requires cleaning or adjustment.



CUTAWAY VIEW BUBBLER CARTRIDGE ASSEMBLY

1. Remove hex nut, and button.
2. Attempt to adjust stream height by inserting screw driver blade into bubbler cartridge adjusting screw and turn right to raise. Push down on cartridge spring housing and observe stream.
3. If the stream height has not increased, shut off water inlet valve and unscrew the bubbler cartridge retainer nut. Lift out the bubbler cartridge. Open water inlet valve, making provision to catch water at cartridge body housing. If full flow of water is obtained from the valve body, shut off water inlet valve, disassemble and clean bubbler cartridge assembly or install replacement.

If still little or no water flow, disconnect building supply line to cooler, remove stainer located inside 3/8" female fitting - clean or replafe strainer. Reinstall supply line, check and adjust stream height.

CLEANING CONDENSER

Accumulations of lint and dust on condenser reduces cooling capacity and affects economy of operation. Cooler should be kept free of such accumulations by use of vacuum cleaner, stiff bristle brush, or supply of compressed air. To clean:

1. Remove front panel and unplug service cord from electrical outlet
2. Insert vacuum cleaner nozzle or brush between blades of fan, turning blades as necessary and taking care not to bend blades or damage fin surface. (Condenser fan not used on all models.)
3. Clean cabinet side louvers at outlet side of condenser.

PREPARING COOLER FOR SHIPMENT OR STORAGE

All water in the cooler, connecting tubing and fittings should be drained from cooler before it is shipped or stored. If this is not done, serious damage from freezing may result.

DRAINING WATER FROM COOLING TANK

1. Disconnect power supply and plumbing connections. If necessary, move cooler to location where water spill will not cause damage.
2. Remove plug from tank drain.
3. Depress push-button to open bubbler valve, allowing air into tank to assist in draining water.

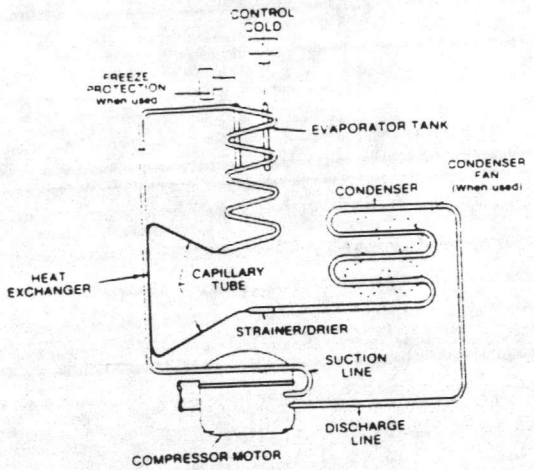
DRAINING WATER FROM HOT WATER TANK

1. Remove plug from tank drain.
2. Depress valve to assist in draining water.

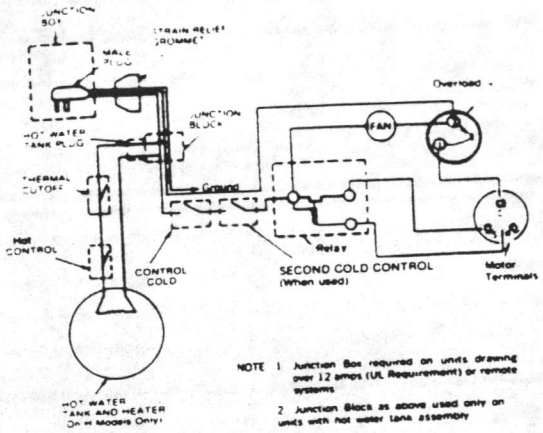
GENERAL

Before assuming a refrigeration system is defective, evaluate the cooling load of the unit. The load may be exceeding the capacity of the unit. Examine the installation and determine if adequate ventilation is being provided. Obstacles in the air stream or a dirty condenser will reduce cooling capacity. Check the electrical service. The supply voltage must be equal to the voltage specified on the data plate. After making the above checks and the problem still exists, proceed as follows:

REFRIGERATION SCHEMATIC



WIRING SCHEMATIC



FAILURE ANALYSIS

The refrigeration system operates on demand of the cold control. If the cold control contacts remain closed and the refrigeration system continues to operate, any of the following conditions may exist:

A. Cold control is defective.
B. Refrigerant charge has partially or completely leaked out.
C. Refrigerant circuit is restricted.
D. Compressor is defective.
E. Dirty condenser.

The refrigeration system starts but does not continue to operate, check the following conditions:

A. Condenser fan motor is inoperative.
B. Refrigerant circuit restricted or blocked.
C. Running voltage more than 10% under rated voltage.
D. Dirty condenser or restricted fan blade.

The refrigeration system does not start, check following conditions:

A. Electrical power supply.
B. Cold control is defective.
C. Compressor electrical component(s) defective.
D. Compressor defective.

Once the nature of the refrigeration system failure has been identified, the individual components should be checked in the order listed above. For example, if the refrigeration system does not start, first check the cold control (B) and so on until the defective part is found. The procedure for checking the various components is outlined in the reference paragraphs.

ELECTRICAL COMPONENTS

Cold Control—A cold control can fail in either the open or closed contact position. Failure in the open position (compressor and condenser fan motor will not run and warm water is dispensed. Replace the control. Failure of the control in closed position (compressor and condenser fan motor run continuously and water freeze-up has occurred) indicates the contacts have fused together. Replace control.

Fan Motor (when used)—Check voltage at motor terminals. If motor is inoperable at rated voltage, replace. If motor does not come up to normal speed, disconnect electrical supply and turn fan by hand. Replace motor if motor does not turn freely after oiling.

Capacitor (when used)—While working on the electrical circuit, check the electrical system thoroughly before applying power. Improperly wired capacitors can burn out the compressor windings in one minute or less without the compressor protector tripping. Capacitor terminal with red dot or + should be connected to line side of circuit. A replacement capacitor must have an equal or higher voltage rating and a capacitance rating (M.F.D.) equal to that of the capacitor it replaces. We suggest replacement be ordered from factory.

Replacement start capacitors should be of the bleed resistor type. The bleed resistor prevents arcing across potential relay contacts. In an emergency situation when a bleed resistor capacitor is not available, purchase a two watt 15,000 ohm resistor and solder across the terminals of a properly rated capacitor for relay protection.

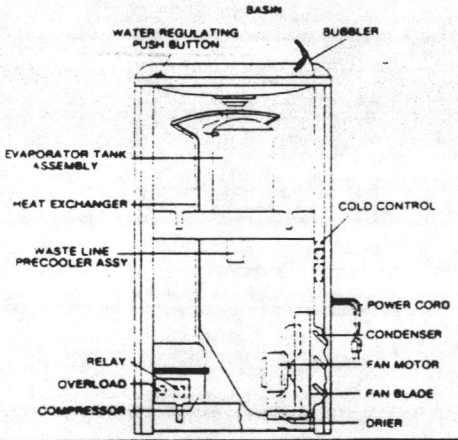
Compressor Relay—A compressor relay is designed to function with a specific compressor. Use only relay specified for compressor being used.

Compressor Protector - Overload—Compressor protector is designed to trip on excessive temperature and/or current. Use only specified replacement overload protector.

REFRIGERANT SYSTEM

NOTE: TAPPING INTO THE REFRIGERATION SYSTEM WILL VOID WARRANTY UNLESS FACTORY AUTHORIZED

With a refrigeration system that operates electrically with little or no cooling effect, make the following observations before opening the system. Feel the compressor discharge line. A warm discharge line indicates the compressor is pumping. Inspect the capillary tube at the inlet and outlet connections. A frosted line indicates a partial loss of refrigerant or a restriction. Apply heat sparingly to the cold section of the capillary and allow the system to operate. Return to a normal operating condition



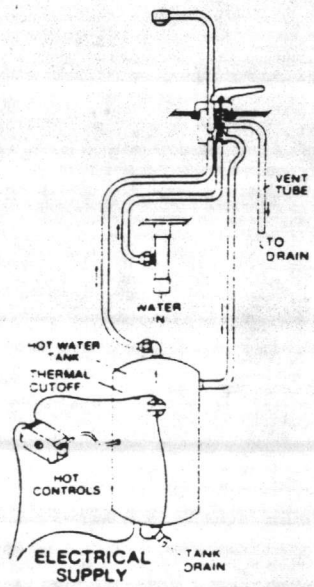
would indicate the restriction is caused by moisture in the system. A system restricted by moisture will eventually fail because of excessive acid buildup; therefore the system should be opened, flushed, evacuated, and recharged. If additional information about the refrigeration system is required, it will be necessary to tap into the refrigeration circuit.

A low pressure reading would indicate a loss of the refrigerant charge or a restriction in the refrigerant circuit. To establish the difference, add a small amount of refrigerant (same type as specified on the data plate) in a gaseous form to the refrigerated circuit and compare gauge reading with refrigerant pressure-temperature chart. An increase in the pressure indicates an initial low charge or a leak in the system which will require repair. A continuing low pressure indicates a restriction which can be found in the manner previously described.

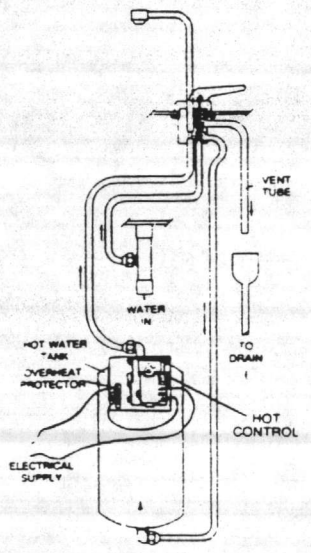
Leak Testing—With the system pressurized with refrigerant, check all joints and components with a leak detector capable of sensing a leak of .5 oz. per year. Once the leak is found, bleed the refrigerant from the system and repair using silver solder.

Component Replacement—to obtain maximum performance of refrigeration system after a repair, it is essential that all replacement components be identical to the factory supplied parts. Replacement parts lists are available for each model so that the correct parts can be obtained. In most units a parts list is attached to rear side of front panel.

HOT WATER SYSTEMS



PRESSURE HOT WATER SYSTEM PRIOR TO 1980



PRESSURE HOT WATER SYSTEM AFTER 1980

Since all supply water has air and gases in solution, which are released when heated, the hot water system must be vented to relieve these gases. This is accomplished through the use of a double seating hot water valve. When the valve is closed to line pressure, the area above the seat and the hot water supply line is open to the atmosphere, therefore no relief valve is required.

1. DESCRIPTION OF THE HOT WATER CIRCUIT

Pressure Type—A tee in the "Water In" connection supplies water to the hot water valve. As hot water is dispensed, the vent tube is closed, water flows to the bottom of the heater tank. The pressure of the water forces heated water from the top of the tank and through the dispensing valve.

Bottle Type—Water runs directly from the reservoir of the cooling unit to the bottom of the heater tank. Hot water is drawn from the top of the tank when dispensing valve is open.

CAUTION—Avoid overfilling water reservoir. After changing water bottles, depress cold water faucet until bubbler appears in bottle. This will insure correct water level. Over-filling the reservoir may cause boiling, over-heating, and possible damage to the water cooler.

2. ELECTRICAL HEATING SYSTEM

An elecrical heater element immersed in the heater tank is used as the source of heat. The temperature of the water is controlled by a thermostat to control a maximum temperature of 180°F. When provided, a thermal cut off is located on the heater tank for thermo-protection.

3. SERVICING THE HOT WATER SYSTEM

Problem—No Hot Water

Solution A—Check the electrical supply to the heating system. When this is not the source of trouble, disconnect electrical supply and test each electrical component individually with an ohm-meter for continuity. Replace part proved defective.

Problem—Water Too Hot

Solution A—The thermostat located in the machinery compartment is adjustable. Adjust to lower setting.

Solution B—The hot water tank may be cycling on the hot thermostat due to the thermostat setting to high or burnt contacts in the thermostat. With failure in adjustment of thermostat, replace thermostat. Models equipped with thermal cut off, may also require replacement.

FOOT PEDAL MODELS

Foot pedal and valve linkages are normally trouble free, as they are made for easy operation and of the simplest design. Each model cooler has its own foot pedal and linkage design, but however, the maintenance and repair are similar.

When trouble is encountered with a reduced or restricted water flow, see page 2 — Stream Height Adjustment before any changes are made in the linkage. This is normally the source of trouble.

All linkages are provided with a return spring which is adjustable. When linkage gives evidence of binding or noise in operation, lubricate the trouble spot with a light odorless, tasteless grease.

AUTHORIZED REPAIR CENTER

The hermetic refrigeration system of a cooler in warranty must never be opened in the field. Such repair work should be done at an authorized repair center.

If warranty has expired, the components of the refrigeration system can be field replaced. Extreme care has to be taken in cleanliness, dehydration, evacuation and charging of the system. Cleanliness is most important in servicing the refrigeration system, since dirt can contaminate or cause a restricted flow of refrigerant through the system.

Maximum care is maintained in the production of the cooler to assure a moisture level of 10 PPM or less. Moisture cannot be tolerated in the system, since it has an oxidizing effect on the refrigeration parts or may freeze the capillary exit blocking the flow of the refrigerant.

Precautions are also taken in manufacture to exclude air and non-condensibles from the system. The system is swept with a refrigerant vapor and evacuated to 250 microns.

Charging of the system with refrigerant is critical. An overcharge causes the suction line to frost or sweat and may cause damage to the compressor.

The service centers attempting to service the refrigeration system in the field should have a vacuum pump capable of pumping down to 100 microns, a vacuum gauge capable of reading 10 microns, a Halogen leak detector capable of sensing a refrigerant lead of .5 ounces per year, a charging system capable of charging within 0.10 ounces by weight and a thorough knowledge of the refrigeration system.

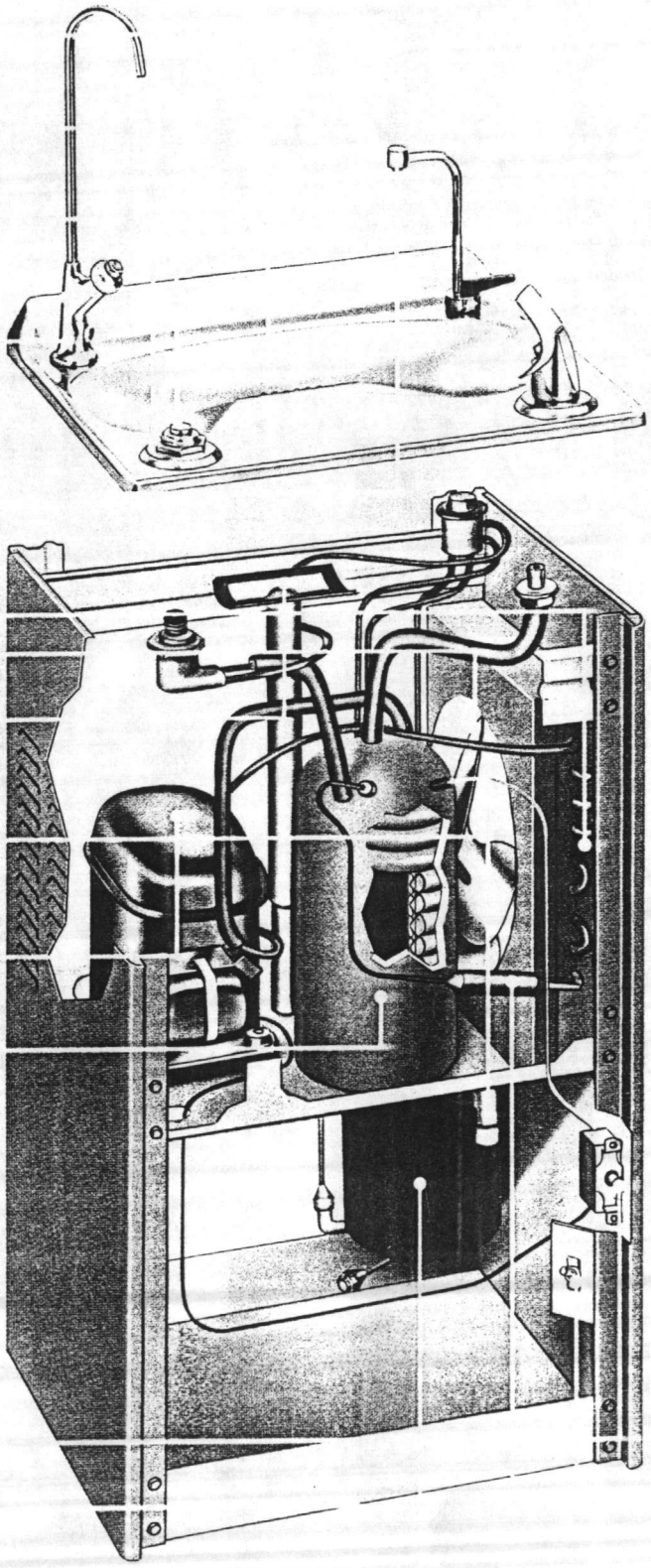
It is highly recommended therefore, to have the cooler with an internal refrigeration defect repaired only at a factory authorized repair center.

WATER COOLER FEATURES

1. *Flexi-Guard.® Exclusive safety bubbler. Keyed in location to prevent rotation. Standard on all models with separate push-button controls.*
2. *Cascade® Basin. Splash-resistant. Multi-level deck design. One-piece nickel-bearing stainless steel.*
3. *Separate Push-Button Control. Positioned to be sanitary and easily accessible.*
4. *In-Line Flow Regulator. Automatically maintains constant stream height at line pressures of 20 to 105 P.S.I.*
5. *Glass-Filler. Optional. (Requires factory preparation.*

   NOTE: Models equipped for glass filler require pressurized cooling tank.
6. *Hot Water Dispenser. Optional. Insulated storage tank heats and serves up to 40 cups (6 oz.) of 180° water per hour.*
7. *Condenser Coil. Fin and tube type.*
8. *Fan Motor and Blade. Heavy duty. Permanently sealed and lubricated.*
9. *Drain Outlet. 1¼-inch diameter by up to 4-inches long for hook-up to 1¼-inch slip joint fitting. Positioned for easy accessibility.*
10. *Water Inlet Connection. ⅜-inch female pipe thread for hook-up to incoming water line. Unobstructed for easy installation.*
11. *Compressor and Motor. Hermetically sealed. Permanently lubricated. Factory tested.*
12. *Non-Pressurized Cooling Tank. Combination tube-type. Tube portion is continuous coil of copper tubing. Tank is copper. Fully insulated with polyurethane foam which meets Underwriters' Laboratories requirements for self-extinguishing plastic. (U.L.-94HB)*

    Storage tank is subject to line pressure only when regulator button is pressed. In the unlikely event of a burst tank, only stored water would be released not the full line of flow
13. *Pre-Set Cooler Control. Requires altitude adjustment only.*
14. *Drier. Prevents internal moisture from contaminating refrigeration system.*
15. *Tank for hot water dispenser.*
16. *On-off switch for hot water dispenser.*



TAB PLACEMENT HERE

DESCRIPTION:

2

☒ **Tab page did not contain hand written information**

☐ **Tab page contained hand written information**
***Scanned as next image**

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Renovation of Building M231
Marine Corps BAse
Camp Lejeune, NC
Contract: N62370-88-C-3764

General Contractor:

CBC Enterprises, Inc.
1312 E. Little Creek Road
Norfolk, Virginia
Phone: (804) 588-6100

Mechanical Contractor:

G.R. Michaels & Co.
331 32nd Street
Newport News, Virginia
Phone: (804) 622-3099
Mr. Terry Gregston

Wholesaler and Supplier:

Ferguson Enterprises, Inc.
600 Rotary Street
Hampton, Virginia
(804) 826-5300
Steve Saunders

OPERATION & MAINTENANCE MANUAL

TACO EQUIPMENT

PROJECT: Building M231

LOCATION: Camp LeJeune, NC

CONTRACTOR: G.R. Michaels - Newport News, VA

WHOLESALER: Ferguson Enterprises, Inc. - Newport News, VA

REPRESENTED BY: N.H. Yates & Co., Inc.
3923 Deep Rock Rd.
Richmond, VA 23233

INSTALLATION AND OPERATION INSTRUCTIONS

NUMBER
IS 300-2.2

Effective: September 1, 1982
Supersedes: IS300-4
dated 3/31/68

TACO BASE MOUNTED PUMPS

(SLEEVE AND BALL BEARING)

Plant ID No. 001-922

A—INSTALLATION

A1-LOCATION

Locate pump in an easily accessible place with sufficient space around it for maintenance and servicing. On larger pumps allow head room for the use of hoists or overhead cranes. Locate pump on a dry and clean place so that motor will be protected from moisture and dust.

On closed heating systems place compression tank at the suction side of the pump. When pump head is less than 20 feet, it is permissible to connect compression tank to discharge side of pump.

On open systems, install pump close to liquid supply and make suction piping as short and as straight as possible.

A2-FOUNDATION

The foundation serves to carry the pump weight and to absorb vibration. Normally, the foundation is made of concrete block, preferably tied in with the floor or ground. Make the foundation block about 4" longer and 4" wider than the base of the frame. Height of the block may vary from 2/3 to 1 times the *width* of the foundation (Fig. 1). When foundation is poured, provide a hole near each of the four (4) corners. To simplify installation and maintenance use lead Anchors. Place the front Anchor about 2" from the edge of the foundation to clear overhanging casings (Fig. 2).

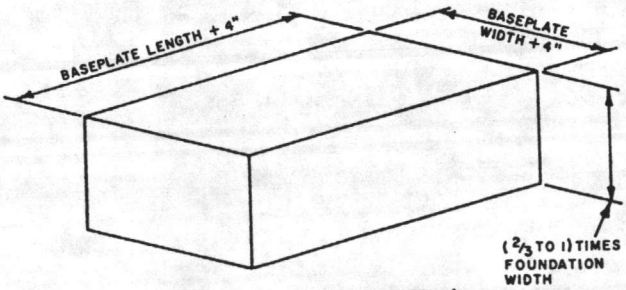


Fig. 1—Foundation Block

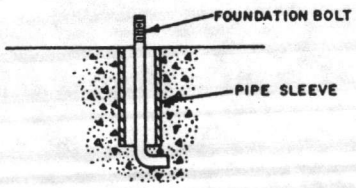


Fig. 2—Foundation Bolt

A3-PIPING

Correct piping is of prime importance for the proper operation and long life of the pump. Stresses induced by piping will cause excessive wear of seals, bearings, and couplings that could ultimately destroy these elements.

Both suction and discharge piping should be suspended close to the pump connections, so that no pipe weight rests on the pump. Pipe flanges and pump flanges should align perfectly before connections are made, piping should never be drawn by force into place.

Thermal expansion of piping requires special attention on heating installations. If no room is provided for pipe expansion, stresses are induced in the piping that will exert a load on the pump. Forces created by pipe stresses can exceed by far the load exerted through pipe and water weight. Stress forces can distort pump, bend shafts, wear out seals, and impeller wear rings, and ultimately burn out bearings. To protect pump from thermal pipe stresses, provide spring hangers and flexible connectors that are suitable to compensate for pipe expansion. (See Fig. 3).

Install gate valves on both suction and discharge side of the pump to allow servicing without draining the system. Also provide a flanged nipple (spool) between gate valve and suction end of the pump to enable you to take the pump apart without disturbing piping (Fig. 3). In order to have them easily accessible, the pump and flange nipples should not be covered with insulation.

On open pumping systems drawing water from a level below the pump (suction lift) install a foot valve with strainer. On open systems where the pump is located below the suction water level (suction head) install a check valve in the discharge line close to the pump.

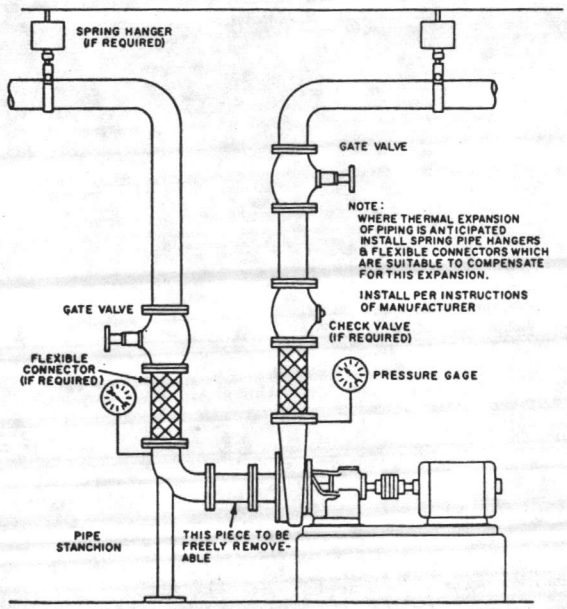


Fig. 3—Typical Installation—Vertical Piping

A—INSTALLATION-Continued

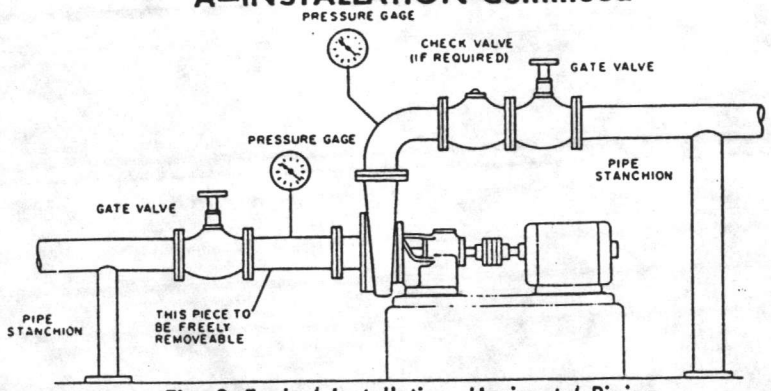


Fig. 3—Typical Installation—Horizontal Piping

A4-PUMP SETTING

When pump is set on its foundation, make sure to have it properly levelled. Place baseplate over foundation bolts provided for it, place shims at corners of baseplate when required and level with a spirit gauge. Tighten baseplate firmly to its foundations. Check also level of suction and discharge flanges.

A5-COUPLING ALIGNMENT

Proper alignment of pump and driver will assure trouble-free operation and long life of the pump. Misalignment will cause rapid wear of seals, couplings, and bearings. All pumps are carefully aligned before leaving the factory. However, experience indicates that alignment invariably changes in shipping and handling. Therefore, it is of utmost importance that alignment be checked at various steps of the installation process. i. e., after leveling, after piping, and after first few weeks of operation.

Check alignment by placing a slotted straight edge across the coupling halves at top, bottom, and at the sides. If any light is seen between the straight edge and one of the coupling flanges, it means the unit is out of alignment. (Fig. 4)

If light is seen at top and bottom position of the straight edge, alignment is out of height. Usually shims are placed under the motor feet. Loosen the four motor bolts, remove or add shims as required to correct proper height. Tighten the motor bolts and check to make sure alignment was corrected properly.

If alignment is out on the sides of the coupling, loosen the four motor bolts and lightly tap the motor in the direction required. Tighten the four motor bolts and check to make sure alignment was corrected properly.

As alignment in one direction may alter the alignment in another, be sure to check all alignments made.

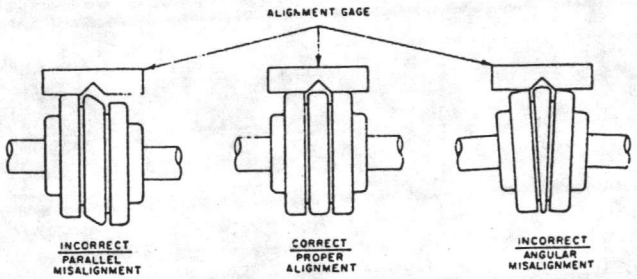


Fig. 4—Coupling Alignment

A6-CONNECTING PIPING

Piping may now be connected to pump. Make sure that pump and pipe flanges are strictly parallel and properly spaced for the gasket that will be used. Also check that pipes are supported properly and do not rest on pump flanges. Never draw pipes by force to pump flanges. Recheck alignment after piping connections are made. If misalignment was caused by piping, it is a sign that pipe stresses distorted the pump. Correct piping to relieve stresses.

B—PUMP START-UP & OPERATION

Before starting up pump for the first time several items are to be checked to avoid damaging pump.

B1-LUBRICATION

Sleeve Bearing pumps are filled with oil at the factory but some oil might be lost during shipment. As a matter of precaution, check oil level before starting up pump. Proper level is at the center of the sight glass. If oil level is too low, remove top cover (Fig. 5) and refill.

Drain and refill oil well once a year. Initial filling is Socony Mobil DTE Heavy Medium Oil, but any premium SAE Grade 20 Non-Detergent Motor Oil can be used.

Motor bearings also might loose oil during shipment. Check oil level as indicated on motor instruction. Electric motors have either an oil cup or a pipe plug for filling. An overflow is located at the side of the bearing area. Before starting unit, fill motor bearing with an oil can until oil flows out of overflow.

Ball Bearing pumps are greased at the factory. Grease will not flow out during shipment, so no checking will be required at startup.

Regrease ball bearings every two years or 3,000 hours of operation. Initial filling is LUBRIKO-grease, Density M31, manufactured by Master Lubricants Company, Philadelphia.

Any general purpose ball bearing grease No. 3 NLGI (National Lubricating Grease Institute) hardness may be used.

To grease bearings open side covers (Fig. 5), slide them about 1/2" to the side and introduce grease thru the opening with a putty knife. Fill grease chamber 2/3 high. Excessive grease causes unnecessary friction and will overheat bearing. If bearings run hot after regreasing, stop pump, open side cover, and wipe out excessive grease. Overheating will then cease.

Motor ball bearings also are greased at the factory. Grease should be replaced as indicated by motor manufacturer's instruction. Normally greasing is required every two years. On electric motors grease is usually introduced through a grease fitting with a grease gun.

B—PUMP START-UP & OPERATION-Continued

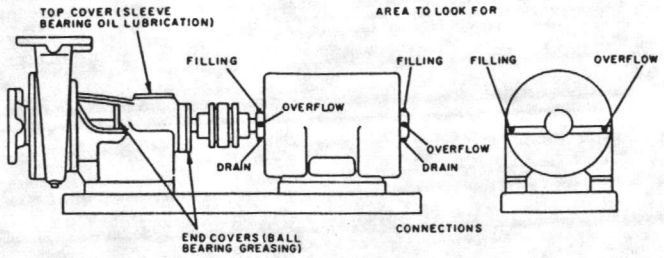


Fig. 5—Lubrication Points

B2-MOTOR WIRING & SENSE OF ROTATION

Check wiring of motor before starting to make sure that connections are wired properly for the voltage in use. Overvoltage can burn out motor windings. Check heater element in magnetic starter to see that it is rated the same as the motor.

AMP RATING FOR 3 PHASE SQUIRREL CAGE INDUCTION MOTORS

Motor HP	220 Volt 1750 RPM	220 Volt 3450 RPM	440 Volt 1750 RPM	440 Volt 3450 RPM
1/4	1.0	–	.5	–
1/3	1.4	–	.7	–
1/2	1.8	–	.9	–
3/4	2.4	2.2	1.2	1.1
1	3.6	3.4	1.8	1.7
1 1/2	4.8	4.6	2.4	2.3
2	6.2	5.6	3.1	2.8
3	9.0	8.0	4.5	4.0
5	14.4	13.4	7.2	6.7
7 1/2	20.0	19.2	10.0	9.6
10	26.4	25.6	13.2	12.8
15	39.0	38.0	19.5	19.0
20	51.0	50.0	25.5	25.0
25	62.0	60.0	31.0	30.0
30	74.0	72.0	37.0	36.0
40	96.0	–	48.0	–
50	120.0	–	60.0	–

Before attempting to check out sense of rotation of pump, fill pump with water to provide lubrication of the seal. **Do not operate pump dry for motor checkout.**

Next throw the switch and see if direction of rotation corresponds with arrows on frame of pump. The direction of rotation is counterclockwise facing the suction end of pump. Direction of rotation of three phase motors can be easily reversed by interchanging two of the three wires at the terminal board of the motor. Reversing of single phase motors is done by interchanging some internal wires or clamps. Instructions for reversing are found either on the motor nameplate or inside the motor terminal cover.

B3-PUMP START-UP

After you have checked lubrication and wiring you are ready to start the pump.

Open the gate valve in the suction side and close the valve on the discharge side. Start motor, wait until unit has come to full speed and then open discharge valve slowly. Do not run pump for more than a few minutes with completely shut valves. If system conditions call for part-time operation against shut valves, install a bypass line from discharge to suction.

B4-MECHANICAL SEAL AND STUFFING BOX CARE

Mechanical Seal (See caution below)*

Mechanical seals are the most delicate component of the pump. Special care has to be given to them to assure trouble-free operation.

The sealing element of a mechanical seal consists of a carbon washer rotating against a stationary ceramic ring.

Surfaces of both are highly lapped to assure sealing. Any dirt that penetrates between the two mating parts will cause a rapid wear of the seal faces and will ultimately result in seal leakage.

New heating systems are usually contaminated by various materials such as construction debris, welding slugs, pipe joint compound, mill scale, etc. It is of utmost importance that such systems be cleaned out thoroughly before putting pump into continuous operation.

Cleaning of a heating system is simple and easy. First flush out system with cold water at city pressure to remove all loose foreign matter that penetrated into the system. Afterwards boil out system with chemicals to remove dirt adhering to pipes.

Chemicals most commonly used for this procedure are sodium triphosphate, sodium carbonate, or caustic soda, but any nonfoaming detergents as used in dishwashers can be applied.

Fill system with clean water, add cleaning chemicals (1) lb. for every 40 to 50 gallons of water, (or Mfrs. Instruction) start pump and heat up system. Let system run for a few hours, then drain and refill with fresh water. Your pumps are now ready for continuous duty. (See caution below).*

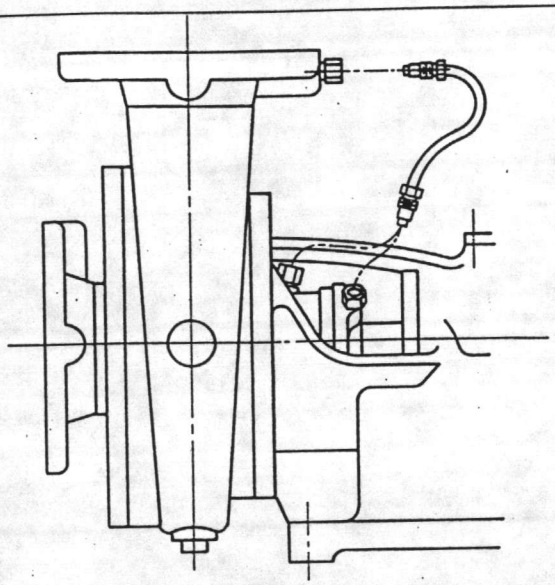
Stuffing boxes are less delicate in operation than mechanical seals. No chemical cleaning is necessary as on mechanical seal pumps, but flushing out with cold water is beneficial on this type of pump too.

After pump is started up adjust gland of stuffing box evenly so that it drips from one to three drops of water per minute. This drip is absolutely essential to prevent damage to packing and shaft sleeve. It also prevents overloading of motor. Excessive dripping may cause air to enter pump under certain conditions.

Sump of pump should be piped to any convenient sewer or drain. A pipe tapping is provided for this purpose at the side of the sump. Never plug this drain tapping.

*CAUTION: The addition of certain chemical additives to systems utilizing TACO Equipment, voids the warranty.

INSTALLATION OF EXTERNAL CIRCULATION TUBE

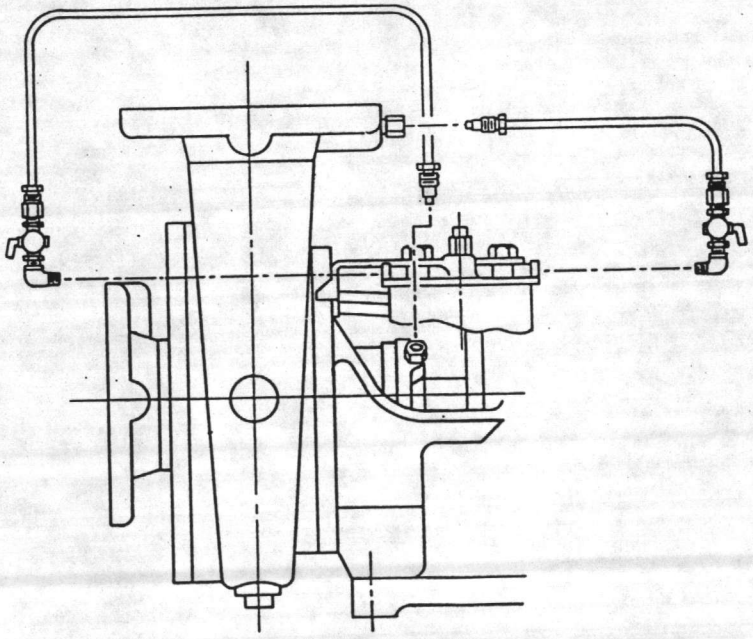


IMPORTANT

Before filling system with water, assemble external circulation tube to pump casing as follows:

1. Screw nut into body until hand tight.
2. With a wrench continue tightening for about one and one-half full additional turns. (It is not necessary to tighten nut all the way down)

INSTALLATION OF PUROCELL FILTER



IMPORTANT

1. Attach Filter to the pump by loosening the top bolt on the frame and casing and slip bracket under bolt and tighten.
2. If Recirculating line is installed — remove from frame and insert this end into inlet of Filter.
3. Attach line from outlet of the filter to seal retainer cap.

Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627

Litho in U.S.A.

Taco (Canada) Limited 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 Telephone: 416-625-2160 Telex: 06-961179

Taco Instruction Sheet

102-052

Horizontal Circulators Nos. 110 thru 120

Plant I.D. No. 001-318

APPLICATION:

1. Maximum recommended working pressure is 125 psi (862 K Pa).
2. Maximum water temperature must not exceed 240°F.
3. Cast Iron Circulators should be used for closed systems only.
4. Bronze circulators must be used in open or fresh water systems and potable water systems.

INSTALLATION:

1. Mounting position — Circulators must be mounted with motor in a horizontal position.
2. Rotating casing — Casing has an arrow on front which indicates direction of flow. To rotate casing remove the casing bolts, rotate casing and replace bolts. Make sure gasket is properly located before tightening bolts.
3. Electrical connections — Observe all applicable codes when connecting to power supply. The motors do not require overload protection.
4. Fill system — It is good practice to flush a new system of foreign matter before starting circulator.

TO REPLACE MOTORS:

1. Disconnect wiring.
2. Loosen the two set screws at pump end of spring coupling, remove bolts between bracket and motor and separate.
3. Loosen other set screw of coupling and remove coupling from old motor.
4. Slide coupler with single set screw over new motor shaft and tighten against flat surface of shaft.
5. Place new motor assembly into bracket and replace bolts.
6. Extend pump end of spring coupling over impeller shaft 3/16" and tighten both set screws. If impeller and shaft move into body during this operation, water will flow from weep hole in bracket. If this does occur, extend spring coupler a little more or until water stops flowing. CAUTION: UNDER NO CIRCUMSTANCES SHOULD THE WEEP HOLE BE PLUGGED.
7. Rewire motor.

TO REPLACE SPRING COUPLING

Follow same procedure outline above.

LUBRICATING INSTRUCTIONS

Re-oil pump and motor annually with SAE No. 30 oil.

*CAUTION: The addition of certain chemical additives to systems utilizing TACO Equipment, voids the warranty.

TACO, Inc., 1160 Cranston St., Cranston, RI 02920 (401) 942-8000 Telex: 92-7627
TACO, (Canada) Ltd., 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 (416) 625-2160 Telex: 06-961179

REPLACING SEALS

Water flowing from weep hole in bracket normally indicates dirt on the seat or seal needs replacement. Before taking pump apart extend spring coupling and impeller shaft into body as far as it will go. This will separate the seal halves and permit a greater flow thru the weeping hole and wash any foreign matter off the seats. Release and if flow stops, it indicates that the seals do not require replacement. If the flow does not stop, loosen the two set screws on the coupling and extend as far as it will go. If leak stops it means there was insufficient tension on the coupling. If leak continues, indications are that the seal needs replacement. Proceed as follows: —

1. Disconnect wiring.
2. Valve off or drain system.
3. Remove body bolts and pull entire assembly out of body.
4. Loosen the two set screws at pump end of spring coupler, file off any burrs on shaft and pull impeller and shaft from bracket.
5. Pry out old seal seat from bracket with a screwdriver and old part from impeller shaft with a pair of pliers.
6. Clean shaft and seal bearing surfaces thoroughly with clean cloth.
7. Dip CARBON part of seal in water to lubricate, place on top of impeller shaft with carbon facing up. Push down on shaft with palm of hand as far as it will go. Then with both thumbs push all the way down making certain that prongs engage the two holes in the impeller. If there are no holes in the impeller, break off the prongs with a pair of pliers and smooth burrs with a file.
8. Separate rubber from ceramic part, wet it and set into recess in bracket. Set ceramic seal into rubber with seat facing out by starting at a slight angle first, then pushing away and down simultaneously. The rubber rings should not be folded over during the operation. Make certain that both the rubber and ceramic are "bottomed" squarely.
9. Clean both seal surfaces with a clean lintless cloth.
10. Place a few drops of oil along the impeller shaft and push slowly with a twisting motion through ceramic part into bracket and spring coupling.
11. While holding impeller and shaft with seal faces mating, insert an Allen wrench into one of the set screws in the coupling, extend spring — 3/16".
12. Remove old body gasket, clean surfaces and replace with new gasket.
13. Place entire assembly into body, replace and tighten bolts gradually and evenly all around.
14. Refill system. If water leaks from weep hole in bracket increase tension on spring coupling slightly more or until leak stops.
15. Rewire motor.

Taco **Instruction Sheet** 202-001

Heat Exchangers

INSTALLATION

1. Allow sufficient clearance for removal of tube bundle.
2. After initial start and run at operating temperatures and pressures, shut down and tighten head bolts.
3. Make certain that tubing is full of water before introducing steam or hot water into shell, otherwise flashing or noise may occur.

CLEANING

Shell and tube bundle should be flushed out periodically. If cleaning is necessary, remove head and bundle to clean inside of shell and outside of tubes. Replace gaskets if necessary.

If unit is installed in a hard water area, inside of tubing can be cleaned as follows: –

1. Break water connections and plug bottom opening.
2. Fill the tubes with a solution of 1 part muriatic acid to 10 parts of water and allow to stand for 2 hours:
   CAUTION: A longer period may cause damage to the copper tubing.
3. Drain off and flush **thoroughly** with clean water.
4. Re-assemble unit.

NOTE

Commercially available cleaners may also be used.

REPLACEMENT PARTS

When ordering replacement parts specify

1) Complete Model Number
2) Date of Manufacture
3) Special Materials if Required

Normally, the only replacement parts required would be:

1 — Tube Bundle
1 — Set of Gaskets

NOTE: When ordering replacement tube bundles care must be take to insure correct construction and proper materials. **Units** manufactured prior to 1974 should have the prefix RUX.

Example: A replacement bundle for a B10212-L built in 1970 would be a RUX10212-L.

Replacement heads are also available if required.

Quality Through Design — COMPARE.

TACO, INC. 1160 Cranston St., Cranston, RI 02920 (401) 942-8000 Telex: 92-7627
TACO (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario, Canada Telex: 06-961179

Instruction Sheet

102-006

SUPERSEDES: IS 102-006 dated 3/1/85

PLANT I.D. #001-924

Boiler Feed Valves
(Reducing Valves)
Models 329-3, 329-T3 and 335-3

Dual Controls
Models 334-3 and 334-T3

RATINGS

Boiler Feed Valve (Reducing Valve)	
Supply pressure at inlet	100 psi max.
Factory setting of system side	12 psi
Setting Range	5 psi to 25 psi
Relief Valve in Dual Control	
Set to relieve at 29 psi-30 psi	
Temperature—212°F max.	

DESCRIPTION

The Boiler Feed Valves are adjustable pressure reducing valves that automatically maintain system pressure. They are equipped with a "fast fill" lever that can be used to override automatic closing during purging.

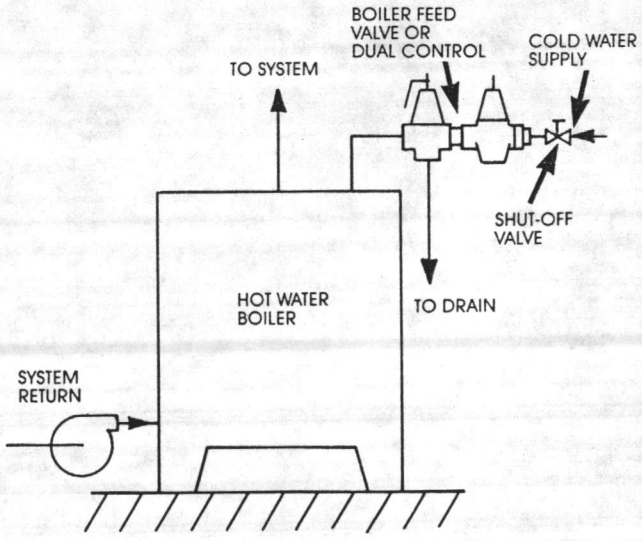
329-3: ½" union connection with a sweat tailpiece at inlet end and a threaded connection at the outlet end.
329-T3: same as 329-3 except the inlet union connection is threaded.
335-3: ¾" cast brass body with threaded connections at body ends.

The Dual Control consists of a 329 Boiler Feed Valve with an in-line pressure relief valve connected at its outlet end.

334-3: ½" union connection at inlet with sweat tailpiece and a threaded connection at the outlet end.
334-T3: same as the 334-3 except the union end tailpiece is threaded.

INSTALLATION

1. Install the Boiler Feed Valve or the Dual Control in a horizontal position in the cold water supply pipe to the boiler.
2. Install a shut-off valve on the upstream side of the Boiler Feed Valve. This valve, provided for isolation purposes during maintenance, must be open at all times during operation so that the Boiler Feed Valve can maintain pressure automatically.
3. Flush out the supply pipe to clear it of chips, scale, dirt, etc. before connecting it to the inlet of the Boiler Feed Valve.
4. Connect a pipe from the bottom "DRAIN" connection of the Relief Valve in the Dual Control. Direct it to some convenient open drain, such as a floor drain or set tubs. Always obey local regulations. DO NOT install a valve of any kind in the drain pipe. The pipe must always pitch down from the valve, with no part of it above the valve, and be no smaller in size than the valve drain connection size.



COMPARE. YOU'LL TAKE TACO.

Printed in U.S.A.

Taco, Inc., 1160 Cranston Street, Cranston, RI 02920. Telephone: 401/942-8000. Telex: 92-7627.
Taco (Canada), Ltd., 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2. Telephone: 416/625-2160. Telex: 06-961179.

Form No. F-102-006 Effective August 1, 1989

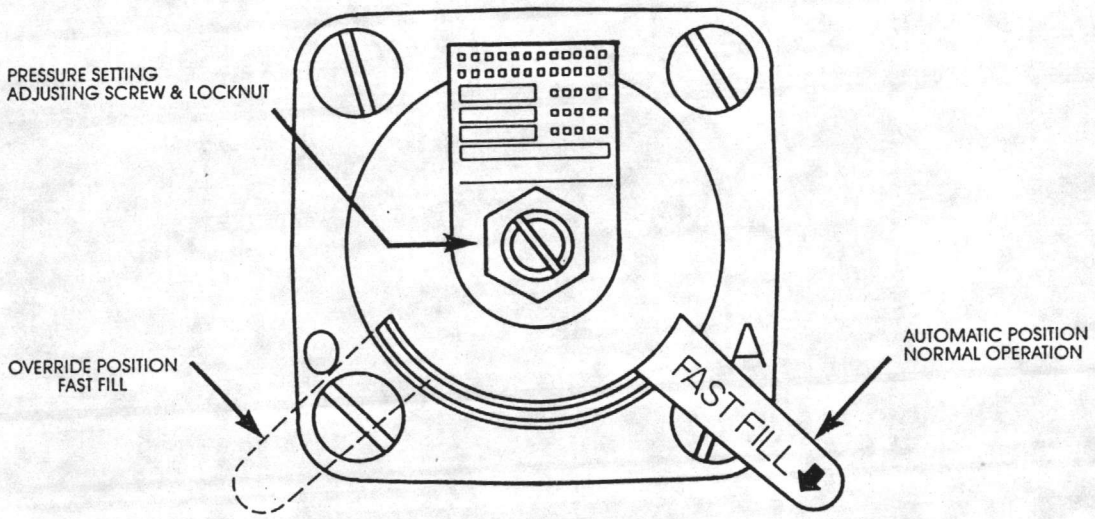
OPERATION

1. To fill the system, open the shut-off valve upstream of the Boiler Feed Valve. This valve must always be kept open when the system is in operation.

2. The FAST FILL lever must be pushed all the way over to the side of the cover slot, over the "A" on the cover flange for AUTOMATIC operation. The supply water will flow into the system until it is full and under pressure.

3. The Taco Boiler Feed Valves have such a high flow capacity that the FAST FILL feature is not usually needed during filling. It is supplied for use during purging of the system. By moving the lever down and to the side over the "O" on the flange of the cover (OVERRIDE position), the valve will be held open, overcoming the closing action of pressure increases against its diaphragm.

4. After filling and purging, the FAST FILL lever must be placed at the AUTOMATIC ("A" side) position. Under system pressure the lever will move up and be secured in the notch. The lever should not be moved during system operation. This position allows the valve to maintain normal pressure in the system automatically.



5. The Boiler Feed Valve is factory set to deliver water to the boiler at 12-14 psi. This pressure is sufficient for a 3-story building. To determine the required pressure if the factory setting is not sufficient to lift the water to the highest radiation, calculate the number of feet from the regulator to the top of the highest radiation. Multiply this by .43 and add 3 psi. This is the pressure needed to raise the water to the highest radiation and keep it under sufficient pressure. To increase the valve setting, loosen the locking nut on the adjusting screw at the top of the valve. Now turn the adjusting screw in (clockwise) slowly until the gauge indicates the pressure calculated. Then lock the adjusting screw with its locking nut.

6. The pressure relief valve of the Dual Control is non-adjustable and is set to relieve at 30 psi.

> CAUTION: The addition of certain additives to systems utilizing Taco equipment voids the warranty. Avoid oil. Oil-free antifreezes, ethylene glycol and propylene glycol are acceptable.

Taco	INSTRUCTION SHEET
NUMBER **IS-400-1.1(281)**	Effective: March 1, 1981 Supersedes: IS400-2-1 dated 7/30/76

AIR CONTROL

1 — Select proper size based on flow (GPM) thru System

Taco Air Control Less Strainer	*Maximum Flow GPM*	*Taco Air Control With Strainer*
AC2	80	AC2F
AC25	130	AC25F
AC3	190	AC3F
AC4	330	AC4F
AC5	550	AC5F
AC6	900	AC6F
AC8	1500	AC8F
AC10	2600	AC10F
AC12	3400	AC12F
AC14	4700	AC14F
AC16	6000	AC16F
AC18	8000	AC18F
AC20	10000	AC20F

2 — Install Air Control in Supply Line between boiler and pump(s) as indicated in Diagram on reverse side.

3 — Install Expansion Tank (s) as close to Air Control as possible with horizontal pipe (if any) pitching up to tank.

4 — If a shutoff valve is installed in Expansion Tank line, use a Gate Valve and make certain it is fully open when system is in operation.

5 — A connection for a Vent is provided at the top of the Air Control.

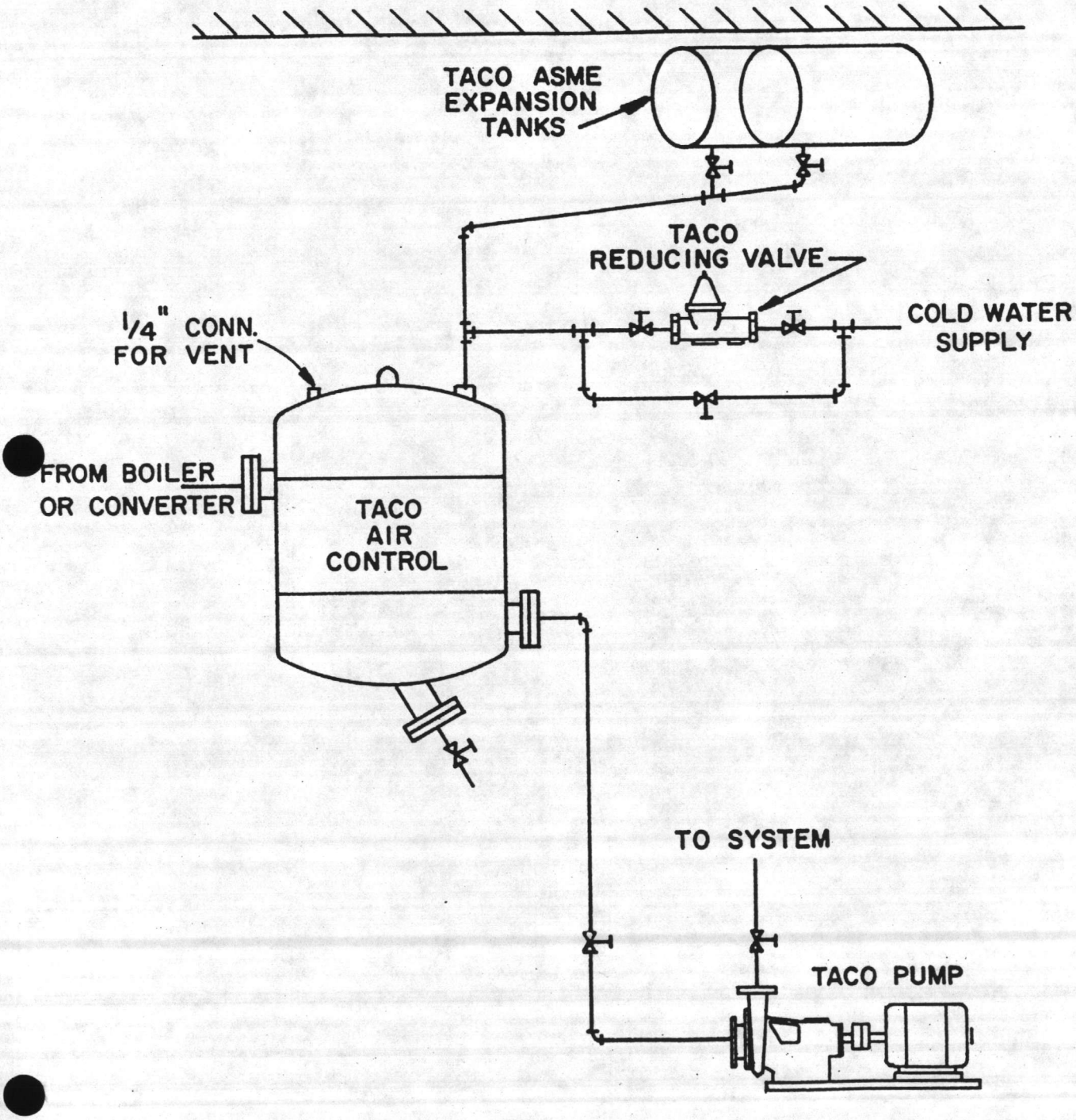
When the system is first filled, all you have to do is Vent heating units and high points if necessary for quick filling. Thereafter, any entrained air is separated continuously as water is pumped thru the Air Control.

Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627

Litho in U.S.A.

Taco (Canada) Ltd. 3090 Lenworth Drive, Mississauga, Ontario Telephone: (416) 625-2160 Telex: 06-961179

AIR CONTROL


TACO ASME
EXPANSION
TANKS
TACO
REDUCING VALVE
COLD WATER
SUPPLY
1/4" CONN.
FOR VENT
FROM BOILER
OR CONVERTER
TACO
AIR
CONTROL
TO SYSTEM
TACO PUMP

REPLACEMENT PARTS LIST

NUMBER

PL300-2.3

Effective: June 1, 1989
Supersedes: PL300-2.3 dated 6/1/83

FOR FOLLOWING MODEL NUMBERS:

BM or CC: 2008 2012 2508 2510 3008 & 4006
SB or BB: 2008 2012 2508 2510 3008 & 4006

WHEN SELECTING AND ORDERING PARTS, ALWAYS REFER TO SERIAL NUMBER ON NAME PLATE

–Example–

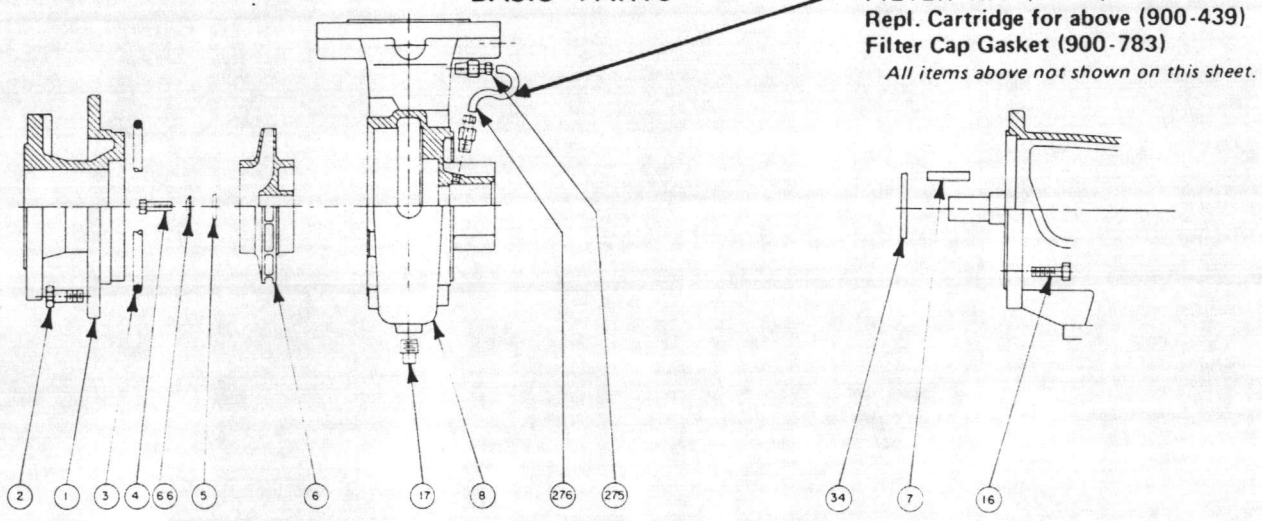
FLANGE SIZE — 2008 – 7.9 B5B2 — FRAME SIZE & STYLE

NOMINAL IMPELLER DIAMETER — MATERIAL OF CONSTRUCTION

ACTUAL IMPELLER DIAMETER — SEAL OR PACKING DESIGN

BASIC PARTS

FILTER KIT (900-1)
Repl. Cartridge for above (900-439)
Filter Cap Gasket (900-783)
All items above not shown on this sheet.



Item No.	No. Reqd.	DESCRIPTION	PART NO. PER PUMP SIZE						REMARKS
			2008	2012	2508	2510	3008	4006	
1	1	Suction Cover	920-003C	884-003C	928-003C	922-003C	934-003C	938-003C	Iron Only
2	8	Suction Cover Bolts	10-216	10-211	10-216	10-211	10-216	10-230	
3	1	Suction Cover 'O' Ring	912-005RP	868-004RP	912-005RP	862-005RP	912-005RP	918-005RP	
4	1	Impeller Bolt (SS)	10-257	10-259	10-257	10-257	10-257	10-257	
5	1	Impeller Washer	926-004RP	926-004RP	926-004RP	926-004RP	926-004RP	926-004RP	
6	1	Impeller	920-002B	884-002B	928-002B	922-002B	934-005B	938-002B	Brz. Only
7	1	Impeller Key (SS)	13-104	13-105	13-104	13-104	13-104	13-104	
8	1	Casing (Mech. Seal)	920-030RP	884-007RP	928-021RP	922-024RP	934-021RP	938-021RP	w/Throtl. Bush
8	1	Casing (Packed)	920-032RP	884-009RP	928-023RP	922-026RP	934-023RP	938-023RP	w/Throtl. Bush
16	4	Casing Bolt	10-201	10-201	10-201	10-201	10-201	10-201	3/8-16x1-1/8
17	1	Drain Plug	16-102	16-104	16-102	16-102	16-102	16-102	3/8 NPT
34	1	Slinger Ring	900-044RP	900-044RP	900-044RP	900-044RP	900-044RP	900-044RP	
66	1	Belleville Washer	900-053RP	900-053RP	900-053RP	900-053RP	900-053RP	900-053RP	
275	2	Fitting	900-798RP	900-798RP	900-798RP	900-798RP	900-798RP	900-798RP	
276	1	Tube	900-728	900-728	900-728	900-728	900-728	900-728	

Taco, Inc. 1160 Cranston Street, Cranston, Rhode Island 02920 Telephone: (401) 942-8000 Telex: 92-7627

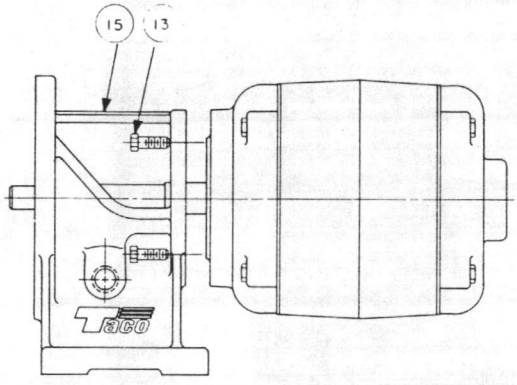
Litho in U.S.A.

Taco (Canada) Limited 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 Telephone: 416-625-2160 Telex: 06-961179

FRAME SIZE & STYLE – 0000-00-XX00

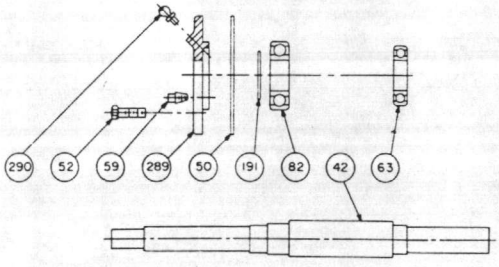
B1	**BALL BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.
B2	**SLEEVE BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.
B3	**SLEEVE BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.
B6	**SLEEVE BEARING DESIGN:**	Update pump with 840-124RP Complete Frame Assembly. Please furnish all nameplate data to insure proper updated nameplate.

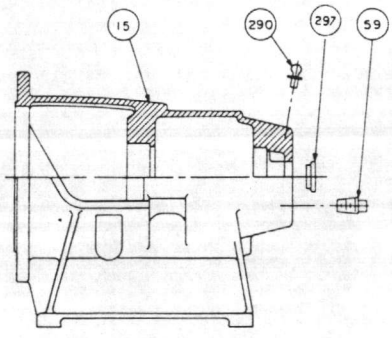
B4 CLOSE COUPLED (CC)



NEMA FRAME Size "T"	NEMA FRAME Size "U"	ITEM 13 FR. BOLT Part No.	ITEM 15 PUMP FR. 1750 "T"	ITEM 15 PUMP FR. 3450 "T"	ITEM 15 PUMP FR. 1750 "U"	ITEM 15 PUMP FR. 3450 "U"
	48	10-201			920-004C	920-004C
	56	10-201			920-004C	920-004C
143	182	10-201			920-004C	920-004C
145	184	10-201	920-004C		920-004C	920-004C
182	213	10-223	920-004C		928-004C	928-004C
184	215	10-223	920-004C		928-004C	928-004C
213	254	10-223	928-004C	928-004C	928-004C	928-004C
215	256	10-223	928-004C	928-004C	928-004C	928-004C
254	285	10-223		928-004C		900-126C
256	286	10-223		928-004C		900-126C
284		10-223		900-126C		

B5 BALL BEARING DESIGN:

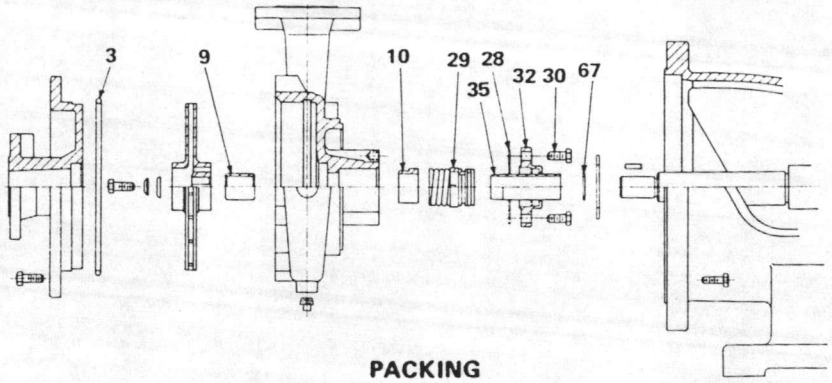




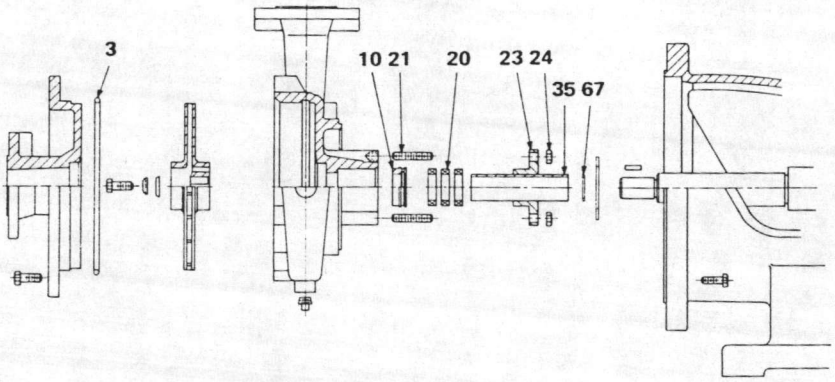
Item No.	No. Req.	DESCRIPTION	PART NO.	REMARKS REMARKS
74	1	Frame Assembly (complete)	840-124RP	
15	1	Frame	840-111	
42	1	Shaft	840-113RP	Add S for Stainless Steel
50	1	Bearing Plate Gasket	840-123RP	
52	4	Bearing Plate Bolt	10-230	3/8 - 16 x 1
59	2	Drain Plug	16-111	1/8 NPT Brass
63	1	Ball Bearing	840-114RP	
82	1	Ball Bearing	840-071RP	
191	1	Retainer Ring	15-105	
289	1	Bearing Cover Plate Assembly	840-120RP	
290	2	Lubrication Fitting	15-200	
297	1	End Cap	820-368RP	

SEAL OR PACKING DESIGN – 0000-00-00X0

MECHANICAL SEAL



PACKING

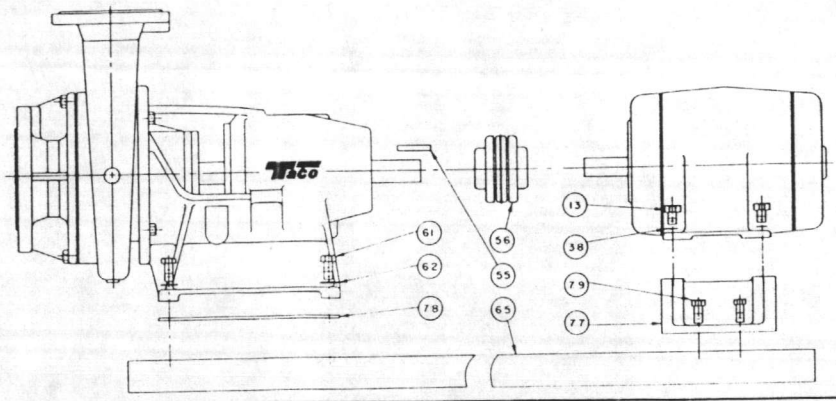


TYPE B STANDARD. TYPE D HI-TEMP. TYPE P PACKED. TYPE E CERAMIC.

Item No.	No. Reqd.	DESCRIPTION	SEAL OR PACKING DESIGN				REMARKS
			Type 'B'	Type 'D'	Type 'P'	Type 'E'	
3	1	'O' Ring	*See Page 1*				
9	1	Impeller Spacer	920-026RP	900-026RP	NA	900-026RP	
10	1	Throttle Bushing	920-016RP	920-016RP	920-008RP	920-016RP	
20	1	Packing Set	N/A	N/A	900-241RP	NA	
21	2	Studs	N/A	N/A	900-029RP	NA	
22	1	Filler Ring (Not shown)	N/A	N/A	900-030RP	NA	
23	1	Gland	N/A	N/A	920-015BRP	NA	Bronze Only
24	2	Hex Nuts	N/A	N/A	12-129	NA	3/8 – 16
28	1	Retainer Cap Gasket	920-014RP	920-014RP	N/A	920-014RP	
29	1	Water Seal	900-024RP	900-087RP	N/A	900-215RP	
91	1	WATER SEAL KIT	840-128BRP	840-128DRP	N/A	840-128ERP	Incl. Items No. 28, 29, 35 & 67
30	4	Retainer Cap Bolts	10-208	10-208	N/A	10-208	3/8 – 16 x 7/8
32	1	Seal Retainer Cap	920-020RP	920-020RP	N/A	920-020RP	
35	1	Sleeve	900-027BRP	900-027BRP	920-006RP	900-027BRP	
67	1	Sleeve Gasket	920-007RP	920-007RP	920-007RP	920-007RP	

MOTOR PARTS – NOT PART OF SERIAL NUMBER

–Motor Frame Sizes Must be Specified When Ordering Parts Shown Below–



Item No.	No. Reqd.	DESCRIPTION	MOTOR FRAME SIZE (NEMA STD.) 'T'						REMARKS
			143-145T	182T	184T	213T	215T	254T	
65	1	Base Plate	820-957	820-957	820-957	840-418	840-418	840-418	
77	2	Spacer	840-098C	840-003C	840-004C	840-005C	840-006C	840-041C	
78	2	Frame Spacer	NA	NA	NA	NA	NA	NA	
56	1	Coupler	900-193	900-206	900-206	900-195	900-195	900-197	
38	4	Mtr. Lck. Wshr.	14-104	NA	NA	NA	NA	NA	5/16
38	4	Mtr. Lck. Wshr.	NA	14-101	14-101	14-101	14-101	NA	3/8
38	4	Mtr. Lck. Wshr.	NA	NA	NA	NA	NA	14-100	7/16
62	4	Frm. Lck. Wshr.	14-102	14-102	14-102	14-102	14-102	14-102	1/2
13	4	Mtr. Hx. Hd. Blt.	10-214	NA	NA	NA	NA	NA	5/16-18x1¼
13	4	Mtr. Hx. Hd. Blt.	NA	10-221	10-221	10-221	10-221		3/8-16x1¼
13	4	Mtr. Hx. Hd. Blt.	NA	NA	NA	NA	NA	10-209	7/16-14x1½
13	4	Mtr. Hx. Hd. Blt.	NA	NA	NA	NA	NA	NA	7/16-14x1¼
61	4	Fr. Hex. Hd. Blt.	10-238	10-238	10-238	10-238	10-238	10-238	1/2-13x1⅝
61	4	Fr. Hex. hd. Blt.	NA	NA	NA	NA	NA	NA	1/2-13x2½
79	4	Spr. Hx. Hd. Blt.	10-230	10-230	10-230	10-230	10-230	NA	3/8-16x1
55	1	Coupler Key	13-100	13-100	13-100	13-100	13-100	13-100	1/4x1/4x1½
47	1	Coupler Guard	820-796	820-796	820-796	820-796	820-796	840-125	
48	4	CG. Rd.Hd. Scw.	10-408	10-408	10-408	10-408	10-408	10-408	1/4-20x3/8
111		Coup. Insert	900-512	900-512	900-512	900-513	900-513	900-514	

Item No.	No. Reqd.	DESCRIPTION	MOTOR FRAME SIZE (NEMA STD.) 'T'							REMARKS
			256T	284T	284TS	286T	286TS	324TS	326TS	
65	1	Base Plate	840-418	840-419	840-419	840-419	840-419	840-419	840-419	
77	2	Spacer	840-040	NA	NA	NA	NA	NA	NA	
78	2	Frame Spacer	NA	840-106	840-106	840-106	840-106	840-107	840-107	
56	1	Coupler	900-197	900-538	900-197	900-538	900-199	900-538	900-538	
38	4	Mtr. Lck. Wshr.	NA	NA	NA	NA	NA	NA	NA	5/16
38	4	Mtr. Lck. Wshr.	NA	NA	NA	NA	NA	NA	NA	3/8
38	4	Mtr. Lck. Wshr.	14-100	14-100	14-100	14-100	14-100	14-108	14-108	7/16
62	4	Frm. Lck. Wshr.	14-102	14-102	14-102	14-102	14-102	14-102	14-102	1/2
13	4	Mtr. Hx. Hd. Blt.	NA	NA	NA	NA	NA	NA	NA	5/16-18x1¼
13	4	Mtr. Hx. Hd. Blt.	NA	NA	NA	NA	NA	NA	NA	8/8-16x1¼
13	4	Mtr. Hx. Hd. Blt.	10-209	NA	NA	NA	NA	NA	NA	7/16-14x1½
13	4	Mtr. Hx. Hd. Blt.	NA	10-202	10-202	10-202	10-202	10-248	10-248	7/16-14x1¼
61	4	Fr. Hex. Hd. Blt.	10-238	NA	NA	NA	NA	NA	NA	1/2-13x1⅝
61	4	Fr. Hex. Hd. Blt.	NA	10-217	10-217	10-217	10-217	10-231	10-231	1/2-13x2½
79	4	Spr. Hx. Hd. Blt.	NA	NA	NA	NA	NA	NA	NA	3/8-16x1
55	4	Coupler Key	13-100	13-100	13-100	13-100	13-100	13-100	13-100	1/4x1/4x1½
47	1	Coupler Guard	840-125	840-125	840-125	840-125	840-125	862-164	862-164	
48	1	CG. Rd. Hd. Scw.	10-408	10-408	10-408	10-4088	10-408	10-408	10-408	1/4-20x3/8
111	4	Coup. Insert	900-514	900-515	900-514	900-516	900-515	900-575	900-575	

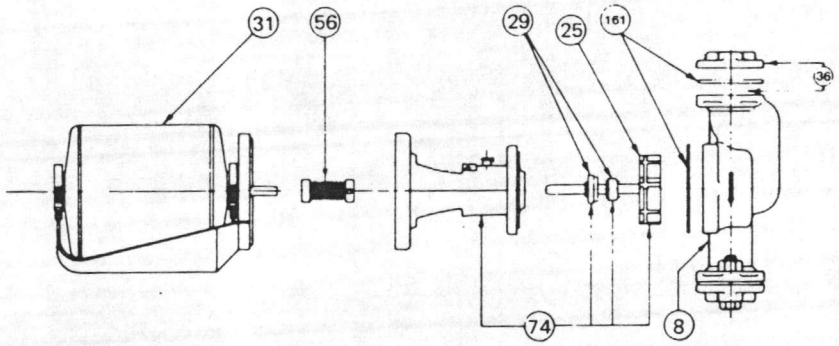
MATERIALS OF CONSTRUCTION — — — 0000-00-000X

DESCRIPTION	1* STANDARD CONSTRUCTION	2 BRONZE FITTED	3* ALL BRONZE	4* ALL IRON	REMARKS *NO LONGER AVAILABLE

Taco	REPLACEMENT PARTS LIST
NUMBER **104-003**	Effective: April 1, 1989 Supersedes: 104-003 dated 4/15/87

REPLACEMENT PARTS FOR 110 Through 120

REFER TO 103-104 for LIST PRICES



ITEM #3 BODY GASKET	
MODEL NUMBER	PART NUMBER
HC, 110, 112 & 117	110-364RP
HDH, 111, 113 & 120	120-009RP

ITEM #8 BODY		
MODEL NO.	CAST IRON	BRONZE
HC, 110 & 112	110-226RP	110-226BRP
HDH & 111	111-004RP	111-004BRP
113	113-001RP	113-001BRP
120-1 to 120-5	NA	NA
120-6 to 120-12	120-083RP	120-083BRP

ITEM #25 IMPELLER & SHAFT		
MODEL NO.	CAST IRON	BRONZE
HC, 110, 110 & 110B	110-207RP	110-207RP
HDH, 111 & 111B	111-053RP	111-053RP
112, 112C & 112B	112-043RP	112-055RP
113, 113C & 113B	113-009RP	113-009RP
120-1 to 120-5	120-056RP	120-060RP
120-6 to 120-12	120-038RP	120-054RP

ITEM #29 SEAL	
MODEL NO.	PART NO.
All 110 to 120-12	110-275RP

ITEM #31 MOTOR ASSEMBLY	
MODEL NO.	PART NO.
HC & 110 & 117	110-223RP
HDH, 111 & 113	110-185RP
112	112-074RP
All 120	120-105RP

ITEM #56 COUPLER	
MODEL NO.	PART NO.
All 110 to 120-12	110-009RP

ITEM #74 BRACKET ASSEMBLY			
MODEL NO.	CAST IRON	BRZ. FITTED	BRONZE
HC, 110 & 117	110-361RP	110-361RP	110-362BRP
HDH & 111	111-058RP	111-058RP	111-059BRP
112	112-120RP	112-103BRP	112-103BRP
113	113-013RP	113-013RP	113-012BRP
120-1 to 120-5	120-076RP	120-078RP	120-077BRP
120-6 to 120-12	120-067RP	120-069RP	120-068BRP

ITEM #113 FLANGE GASKET SET	
MODEL NUMBER	PART NUMBER
Flat Red Rubber	110-023RP
Round Cork (Thick)	110-227RP
110 to 113	110-339RP
120-1 to 120-5	120-008RP
120-6 to 120-12	1600-169RP

ITEM #161 GASKET KIT	
MODEL NO.	PART NO.
110 to 113	110-127RP
120	120-073RP

ITEM #36 FLANGE SET		
MODEL NO.	CAST IRON	BRONZE
120-1 to 120-5	120-044RP	120-044BRP
120-6 to 120-12	1600-032RP	1600-032BRP

MOTOR ASSEMBLY L/MOTOR	
MODEL NO. & HP	PART NO.
110 (1/12 HP)	110-082RP
111 & 113 (1/8 HP)	110-008RP
112 (1/3 HP)	110-042RP
120 (1/6 HP)	110-008RP

ITEM —
Flange Set
¾", 1", 1¼", & 1½"
Interchangeable.
Refer to Price Sheets
103-003. For 120
models with 2 holes,
specify 1600-032BRP
for Bronze, 1600-032RP
for Cast Iron.

For 120 models with 4
holes, specify 120-044RP
for Cast Iron, 120-044BRP
for Bronze.

Taco

NUMBER
304-027

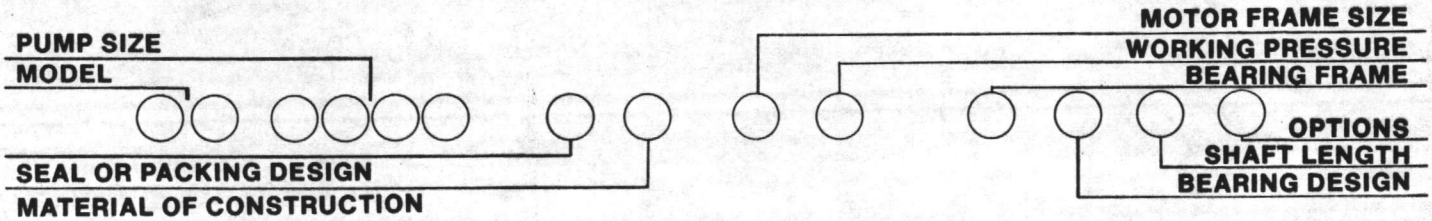
REPLACEMENT PARTS LIST

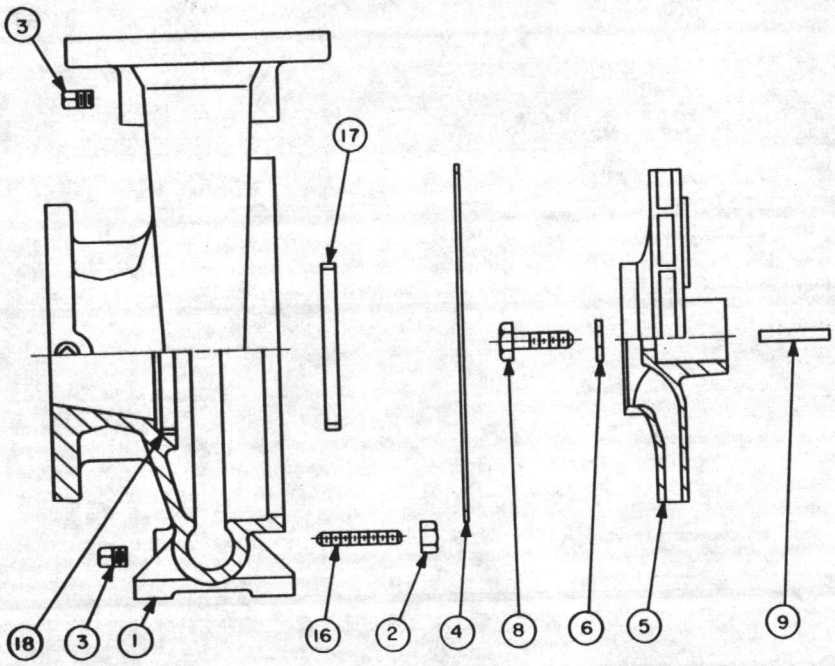
Effective: April 15, 1987
Supersedes: 304-027
dated 1/31/86

FOR FOLLOWING MODEL NUMBERS

FM1210, 1510 & 2010

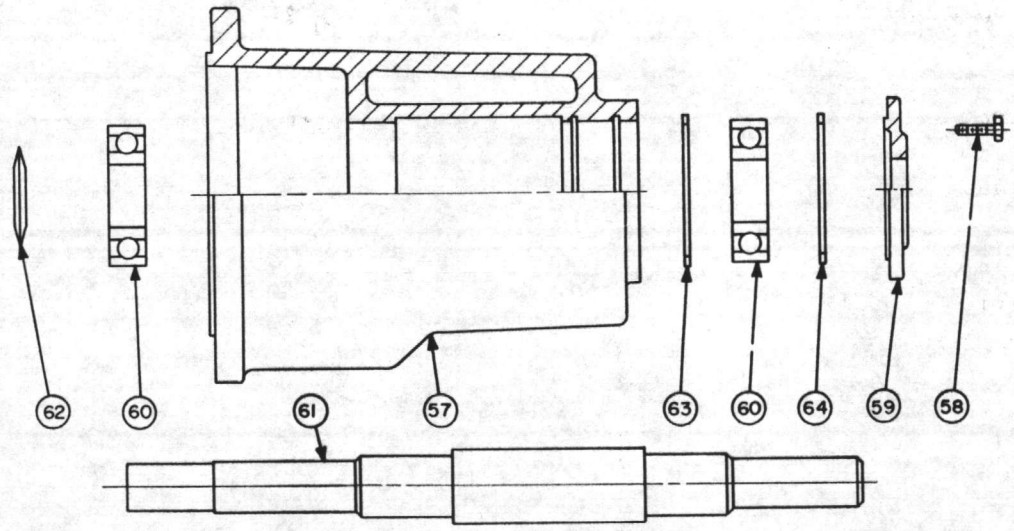
WHEN SELECTING AND ORDERING PARTS, ALWAYS REFER TO SERIAL NUMBER ON NAME PLATE





ITEM NO.	NO. REQ.	DESCRIPTION	1210	1510	2010
1	1	Casing	31144-161-124-5	31144-163-124-9	31144-166-124-0
2	12	Nut	12-111	12-111	12-111
3	2	Sq. Head Plug	16-102	16-102	16-102
4	1	Gasket	950-119	950-119	950-119
5	1	Impeller (CI)	31637-123-124-4	31646-517-124-7	31677-543-124-4
5	1	Impeller (Brz.)	31637-123-445-4	31646-517-445-7	31677-543-445-4
6	1	Impeller Washer	25127-110-000-7	25127-110-000-7	25127-110-000-7
8	1	Impeller Bolt	21763-448-951-7	21763-448-951-7	21763-448-951-7
9	1	Impeller Key	13-119	13-119	13-119
16	12	Stud	21712-437-950-1	21712-437-950-1	21712-437-950-1
17	1	Wear Ring (CI)	34114-210-124-4	34114-211-124-1	34115-172-124-4
17	1	Wear Ring (Brz.)	34114-210-445-4	34114-211-445-1	34115-172-445-4
18	1	Dowel Pin	21123-076-939-8	21123-076-939-8	21123-076-939-8
43	1	Cover Wear Ring (CI)	NA	NA	NA
43	1	Cover Wear Ring (Brz.)	NA	NA	NA

FRAME SIZE & STYLE



FRAME PARTS FOR "B" SIZE PUMP

ITEM NO.	NO. REQ.	DESCRIPTION	PART NO.	REMARKS
72	1	Frame Assembly	37652-108-122-Z	All Above Assembled As A Unit
57	1	Frame	37652-108-122-6	
58	8	Hex Hd. Screws	10-215	
59	2	Bearing Cover	37224-609-122-5	
60	2	Ball Bearing	862-101	
61	1	Shaft	36811-516-266-9	
62	1	Deflector	34112-193-005-4	
63	2	Retaining Ring	15-129	
64	1	Retaining Ring	15-126	
65	2	Grease Fitting	25731-108-000-1	Not Shown

66	1	Washer	14-102	Not included with frame
67	1	Bolt	10-234	Not included with frame

COVER MODULE FOR "B" SIZE PUMPS

ITEM NO.	NO. REQ.	SEAL OR PACKING TYPE	DESCRIPTION	1210	1510	2010
11	1	B-D-E	Cover	37165-418-124-9	37165-418-124-9	37165-418-124-9
11	1	P-Y	Cover	37167-419-124-4	37167-419-124-4	37167-419-124-4
24	8		Stud	21712-334-950-7	21712-334-950-7	21712-334-950-7
25	8		Nut	12-110	12-110	12-110

Service

ZOELLER CO.

3280 OLD MILLERS LANE
LOUISVILLE, KY. 40216

"Quality Pumps Since 1939"

News & Views

Date	No.
4-7-86	42E

VORTEX IMPELLER INSTALLATION

All Zoeller Company Vortex design pumps utilize a thread locking adhesive to secure the impeller to the shaft. (Note: The 54 & 56 are not Vortex design pumps.) Always use a thread locking adhesive when replacing any vortex impellers to insure the impeller will remain on the shaft. See chart below for correct adhesive for various units.

Series	Adhesive
54 & 56 (Not Vortex)	(None required)
53, 55, 57, 59	Loctite - # 222
All other series	Loctite - # 262

Loctite products are available through industrial suppliers.

NOTE: Please refer to Loctite Manufactures Recommendations as to the shelf life of their products.

Instructions

1. Thoroughly clean and dry threads on rotor shaft and impeller. (Oil, dirt and grease destroy the adhesive's bonding strength).
2. Place bead of loctite adhesive on threads of the rotor shaft (see Fig. 1).
3. Place impeller carefully on the shaft and tighten until the impeller touches the ceramic seal. Sight check to insure seal alignment. Tighten impeller until it bottoms out on the rotor shaft.

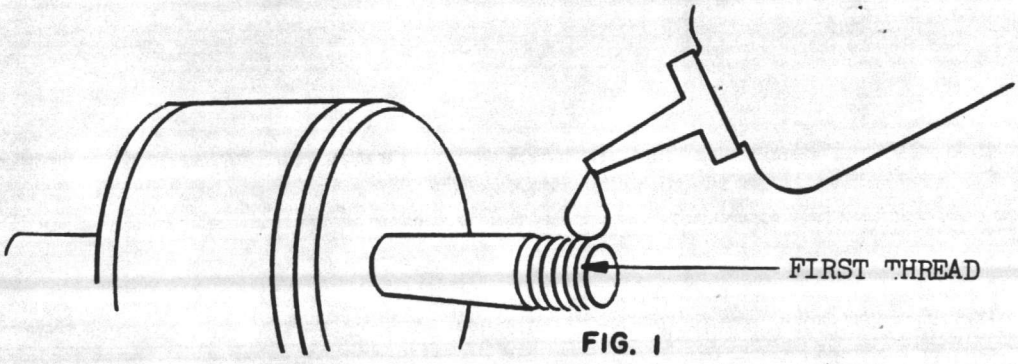


FIG. 1

Keep your *News & Views* for reference. Fill in the following on Record Sheet #

News & Views Date	News & Views No.	Subject	To / For	Supersedes No.
4-7-86	42E	Vortex Impeller Installation		42D

Service

ZOELLER CO.

3280 OLD MILLERS LANE
LOUISVILLE, KY. 40216

"Quality Pumps Since 1939"

News & Views

Date	No.
2-23-89	14B

VISUAL INSPECTION AIDS

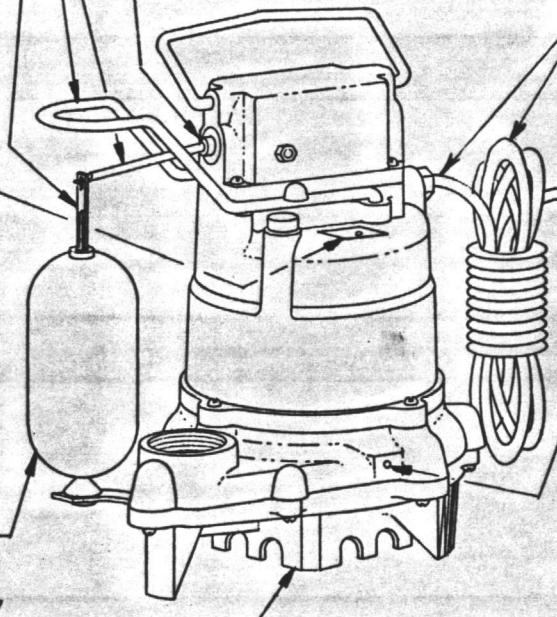
Bent switch arm, float rod or guard indicates abuse or alteration.

Excessive heat or chemical can cause swollen or deteriorated Boot. Indicates abuse.

Cord pulled loose, frayed, cut or damaged indicates rough handling and abuse.

Pump model and date code (date code, or revision letter, & month/year follows model number on tag).

Ground pin cut off or pulled out indicates abuse or an illegal alteration.



Spray here on 50/90 Series is not a leak but a vent. Must be open and clear of debris to prevent air lock. Note: Any pump installed with a check valve must have a vent hole here or between discharge of pump and check valve to prevent air lock.

Excessive heat and/or chemicals cause discoloration, bulges, roughness or sponge appearance. Indicates abuse.

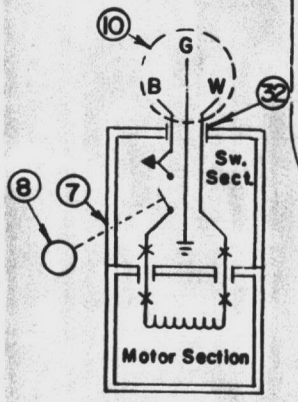
Pump housing, base, strainer or impeller coated with mineral deposits or clogged with mud, concrete or debris indicates abuse.

Cracked or broken castings or parts indicate rough handling, abuse or shipping damage.

Keep your *News & Views* for reference. Fill in the following on Record Sheet #

News & Views Date	News & Views No.	Subject	To / For	Supersedes No.
2-23-89	14B	VISUAL INSPECTION AIDS		14B 7-14-87

Service



Wiring Diagram

Zoeller Co.

3280 Old Miller Lane
Louisville, Kentucky 40216

New's & View's

Date	No.
8-71	25

①—Guard	②—Float Rod
③—Gasket	④—Switch
⑤—Sw. Case	⑥—Handle
⑦—Arm & Seal	⑧—Float
⑨—Thru Wall Seal	⑩—Cord
⑪—Bearing (upper)	⑫—Thrust Washer
⑬—Strainer & Scr.	⑭—Stator
⑮—Shell Assm.	⑯—Wedge & Screw
⑰—Diverter	⑱—Rotor
⑲—Oil (15 oz.)	⑳—Bearing (lower)
㉑—10-24x3/8 SSt.	㉒—Seal (Shell)
㉓—Seal (Shaft)	㉔—Housing
㉕—Guide Assm.	㉖—Lead Wire
㉗—Base	㉘—Impeller
㉙—6-32 x 1/4 Br.	㉚—10-24x3/4 SSt.
㉛—6-32 x 1/4 St.	㉜—Seal (Cord)
㉝—Plug	㉞—Sw & Case Comp.
㉟—Volt/Amp Tag	㊱—Base & Str. Comp.

When Ordering Parts Give:
Model No. 8 Date Code of Mfg. 8
Name of Part (Above) or
Part No. from Part List (FM 255)
Part No. from Part List (F 04)

NOTICE TO INSTALLING CONTRACTOR: Instructions must remain with installation.

"Quality Pumps Since 1939"

NOTICE: VENT HOLE FOR CHECK VALVE SEE #10 BELOW AND # 6 PAGE 2

Zoeller Co.

3280 OLD MILLERS LANE
P.O. BOX 16347 • LOUISVILLE, KY. 40216
(502) 778-2731 • FAX (502) 774-3624

FM0447
0389
~~Supersedes~~
0288

1939 50th 1989 ANNIVERSARY

INSTALLATION INSTRUCTIONS

RECOMMENDED MODELS

SEWAGE	EFFLUENT*	DEWATERING
262 Series 266, 267, 268 Series 282, 284 Series 293, 294, 295 Series 292 Series	53, 55, 57, 59 Series 97 Series 137, 139 Series 161, 163, 165 Series 185, 188, 189 Series	All Models

*Effluent systems should specify that pumps should not handle solids exceeding three fourths inch (¾") in order to prevent large solids from entering leeching fields, mound systems and etc. (50/90 Series have ½", 130 Series have ⅝", 160/180 Series have ¾", solids capability.) Where codes permit, sewage pumps can be used for effluent systems.

PREINSTALLATION CHECKLIST — ALL INSTALLATIONS

1. Inspect your pump. Occasionally, products are damaged during shipment. If the unit is damaged, contact your dealer before using.

2. Carefully read the literature provided to familiarize yourself with specific details regarding installation and use. These materials should be retained for future reference.

3. Make sure there is a properly grounded receptacle available. All pumps are furnished with provisions for proper grounding to protect you against the possibility of electrical shock.

(SEE WARNING BELOW)

4. Make certain that the receptacle is within the reach of the pump's power supply cord. **DO NOT USE AN EXTENSION CORD.** Extension cords that are too long or too light do not deliver sufficient voltage to the pump motor. But, more important, they could present a safety hazard if the insulation were to become damaged or the connection end were to fall into the sump.

5. Check to be sure your power source is capable of handling the voltage requirements of the motor, as indicated on the pump name plate.

6. Make sure the pump electrical supply circuit is equipped with fuses or circuit breakers of proper capacity. A separate branch circuit is recommended, sized according to the "National Electrical Code" for the current shown on the pump name plate.

7. Testing for Ground. As a safety measure, each electrical outlet should be checked for ground using an Underwriters Laboratory Listed circuit analyzer which will indicate if the power, neutral and ground wires are correctly connected to your outlet. If they are not, call a qualified licensed electrician.

8. For Added Safety. Pumping and other electrical equipment must be connected to a three prong grounded receptacle with integral ground-fault circuit interrupter. (GFCI)

9. WARNING: The installation of automatic pumps with mercury float switches or non-automatic pumps using auxiliary mercury float switches is the responsibility of the installing party and care should be taken that the tethered float switch will not hang up on the pump apparatus or pit peculiarities and is secured so that the pump will shut off. It is recommended to use rigid piping and fittings and the pit be 18" or larger in diameter.

10. Information - vent hole purpose. It is necessary that all submersible sump, effluent, and sewage pumps capable of handling various sizes of solid waste be of the bottom intake design to reduce clogging and seal failures. **If** a check valve is incorporated in the installation, a vent hole (approx. 3/16") **must** be drilled in the discharge pipe below the check valve and pit cover to purge the unit of trapped air. Trapped air is caused by agitation and/or a dry basin. This vent hole should be checked periodically for clogging. The 50 Series pumps have a built in vent hole.

CAUTIONS & WARNINGS

WARNING:
FOR YOUR PROTECTION, ALWAYS DISCONNECT PUMP FROM ITS POWER SOURCE BEFORE HANDLING. Single phase pumps are supplied with a 3-prong grounded plug to help protect you against the possibility of electrical shock. **DO NOT UNDER ANY CIRCUMSTANCES REMOVE THE GROUND PIN.** The 3-prong plug **must** be inserted into a mating 3-prong grounded receptacle. **If** the installation does not have such a receptacle, it must be changed to the proper type, wired and grounded in accordance with the National Electrical Code and all applicable local codes and ordinances. Three phase pumps **must** be installed in accordance with the National Electrical Code and all applicable local codes and ordinances.

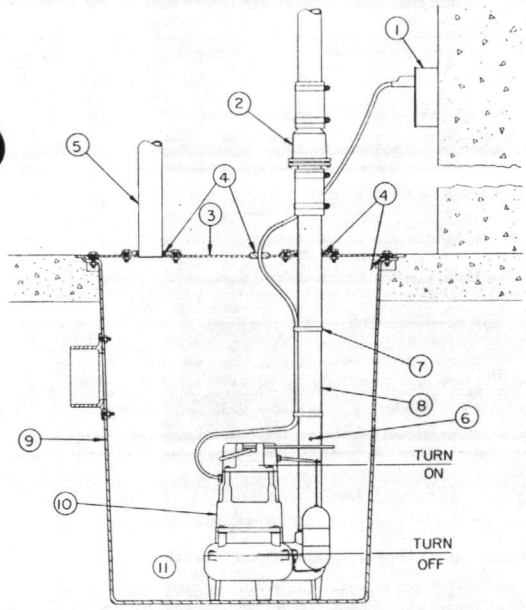
CAUTION: Installation and checking of electrical circuits and hardware should be performed by a qualified licensed electrician.

CAUTION: Repair and service should be performed by Zoeller Company Authorized Service Station only.

CAUTION: Dewatering sump pumps are not designed for use in septic tanks to handle sewage or effluent.

CAUTION: Maximum continuous operating temperature for standard model pumps must not exceed 130°F - 54°C.

All installations must comply with all applicable electrical and plumbing codes, including, but not limited to, National Electrical Code, local, regional, and/or state plumbing codes, etc.



TYPICAL SEWAGE INSTALLATION-RECOMMENDED INSTALLATION

(1) Electrical wiring and protection must be in accordance with National Electrical Code and any other applicable state and local electrical requirements.

(2) Install proper Zoeller unicheck (combination union and check valve), preferably just above the basin to allow easy removal of the pump for cleaning or repair. On sewage, effluent or dewatering, if high head installation is required, use Zoeller 30 Series PVC type check valve with compression end fittings on 1½" and 2" installation; on 3" use 30-0160. See (6) below.

(3) All installations require a basin cover to prevent debris from falling into the basin and to prevent accidental injury.

(4) Gas tight seals are required in all sewage installations to contain gases and odors.

(5) Vent gases and odors to the atmosphere through vent pipe.

(6) When a Unicheck is installed, drill a 3/16" dia. hole in the discharge pipe even with the top of the pump. The 50 Series pumps have a built in vent hole. NOTE: The hole must also be below the basin cover.

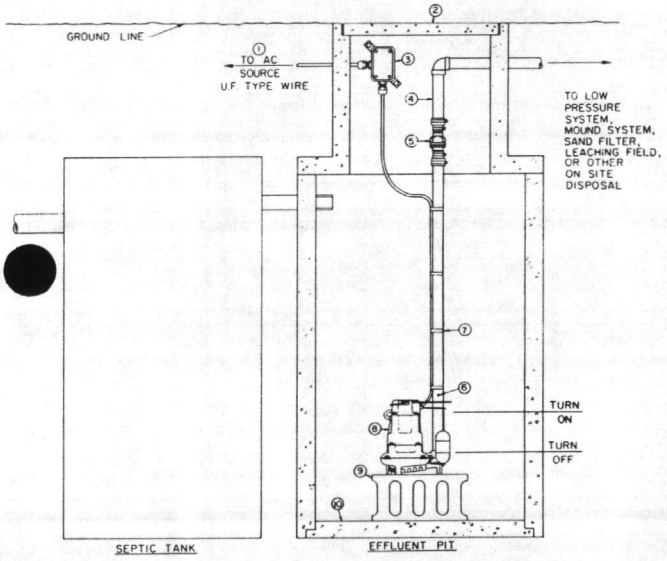
(7) Securely tape or clamp power cord to discharge pipe clear of the float mechanism.

(8) Use full-size discharge pipe.

(9) Basin must be in accordance with applicable codes and specifications.

* (10) Pump must be level and float mechanism clear of sides of basin before starting pump.

(11) Basin must be clean and free of debris after installation.



TYPICAL EFFLUENT INSTALLATION-RECOMMENDED INSTALLATION

(1) Electrical wiring and protection must be in accordance with National Electrical Code and any other applicable state and local electrical requirements.

(2) All installations require a basin cover to prevent debris from falling into the basin, and to minimize accidental injury.

(3) Wire pump to power through a Zoeller J-Pak; watertight junction box or watertight splice. NOTE: Watertight enclosure is a must in damp areas.

(4) Use full-size discharge pipe.

(5) Install proper Zoeller unicheck (combination union and check valve), preferably just above the basin to allow easy removal of the pump for cleaning or repair. On sewage, effluent or dewatering, if high head installation is required, use Zoeller 30 Series PVC type check valve with compression end fittings on 1½" and 2" installation; on 3" use 30-0160. For below cover installation use Zoeller model 30-0200 on 1½" pipe, and PVC compression end check valve on 2 or 3 inch pipe. See (6) below.

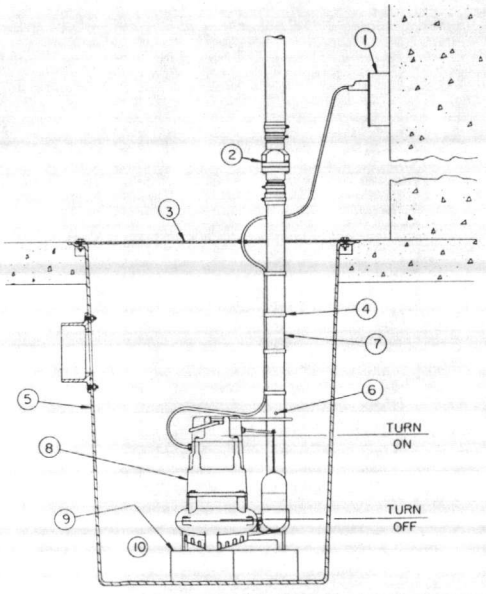
(6) When a Unicheck is installed, drill a 3/16" dia. hole in the discharge pipe even with the top of the pump. The 50 Series pumps have a built in vent hole. NOTE: The hole must also be below the basin cover.

(7) Securely tape or clamp power cord to discharge pipe clear of the float mechanism.

* (8) Pump must be level and float mechanism clear of sides of basin before starting pump.

(9) Install blocks or bricks under pump to provide a settling basin.

(10) Basin must be clean and free of debris after installation.



TYPICAL DEWATERING INSTALLATION-RECOMMENDED INSTALLATION

(1) Electrical wiring and protection must be in accordance with National Electrical Code and any other applicable state and local electrical requirements.

(2) Install proper Zoeller unicheck (combination union and check valve), preferably just above the basin to allow easy removal of the pump for cleaning or repair. On sewage, effluent or dewatering, if high head installation is required, use Zoeller 30 Series PVC type check valve with compression end fittings on 1½" and 2" installation; on 3" use 30-0160. For below cover installation use Zoeller model 30-0200 on 1½" pipe, and PVC compression end check valve on 2 or 3 inch pipe. See (4) below.

(3) All installations require a basin cover to prevent debris from falling into the basin and to prevent accidental injury.

(4) Securely tape or clamp power cord to discharge pipe clear of the float mechanism.

(5) Minimum 18" dia. x 24" deep basin.

(6) When a Unicheck is installed, drill a 3/16" dia. hole in the discharge pipe even with the top of the pump. The 50 Series pumps have a built in vent hole. NOTE: The hole must also be below the basin cover.

(7) Use a full-size discharge pipe.

* (8) Pump must be level and float mechanism clear of sides of basin before starting pump.

(9) Install blocks or bricks under pump to provide a settling basin.

(10) Basin must be clean and free of debris after installation.

*Check specific control installation instruction for other type control usage.

SERVICE CHECK LIST

WARNING: ELECTRICAL PRECAUTIONS — Before servicing a pump, always shut off the main power breaker and then unplug the pump - making sure you are not standing in water and are wearing insulated protective sole shoes. Under flooded conditions, contact your local electric company or a qualified licensed electrician for disconnecting electrical service prior to pump removal.

WARNING: Submersible pumps contain oil which becomes pressurized and hot under operating conditions- **allow 2½ hours after disconnecting before attempting service.**

CONDITION	COMMON CAUSES
A. Pump will not start or run.	Check fuse, low voltage, overload open, open or incorrect wiring, open switch, impeller or seal bound mechanically, defective capacitor or relay when used, motor or wiring shorted. Float assembly held down. Switch defective, damaged, or out of adjustment.
B. Motor overheats and trips overload or blows fuse.	Incorrect voltage, negative head (discharge open lower than normal) impeller or seal bound mechanically, defective capacitor or relay, motor shorted.
C. Pump starts and stops too often.	Float tight on rod, check valve stuck or none installed in long distance line, overload open, level switch(s) defective, sump pit too small.
D. Pump will not shut off.	Debris under float assembly, float or float rod bound by pit sides or other, switch defective, damaged or out of adjustment.
E. Pump operates but delivers little or no water.	Check strainer housing, discharge pipe, or if check valve is used vent hole should be open. Discharge head exceeds pump capacity. Low or incorrect voltage. Incorrect motor rotation. Capacitor defective. Incoming water containing air or causing air to enter pump.
F. Drop in head and/or capacity after a period of use.	Increased pipe friction, clogged line or check valve. Abrasive material and adverse chemicals could possibly deteriorate impeller and pump housing. Check line. Remove base and inspect.

If the above check list does not uncover the problem, consult the factory - Do not attempt to service or otherwise disassemble pump.

LIMITED WARRANTY

Zoeller Company warrants, to the purchaser and subsequent owner during the warranty period, every new Zoeller Company product to be free from defects in material and workmanship under normal use and service, when properly installed, used, and maintained, for a period of one year from date of installation or 18 months from date of manufacture, whichever comes first. Part(s) that fail (within one year of installation or 18 months from the date of manufacture, whichever comes first) that inspection determine to be defective in material or workmanship, will be repaired, replaced, or remanufactured at Zoeller Company's option provided, however, that by so doing we shall not be obligated to replace an entire assembly, the entire mechanism or the complete unit. No allowance will be made for shipping charges, damages, labor or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material which has been disassembled without prior approval of Zoeller Company, subjected to misuse, misapplication, neglect, alteration, accident or act of God; that have not been installed, operated or maintained in accordance with Zoeller Company installation instructions; that has been exposed to but not limited to the following: sand, gravel, cement, mud, tar, hydro carbons or hydro carbon derivatives (oil, gasoline, solvents, etc.) or other abrasive or corrosive substances, is in lieu of all other warranties expressed or implied; and we do not authorize any representative or other person to assume for us any other liability in connection with our products.

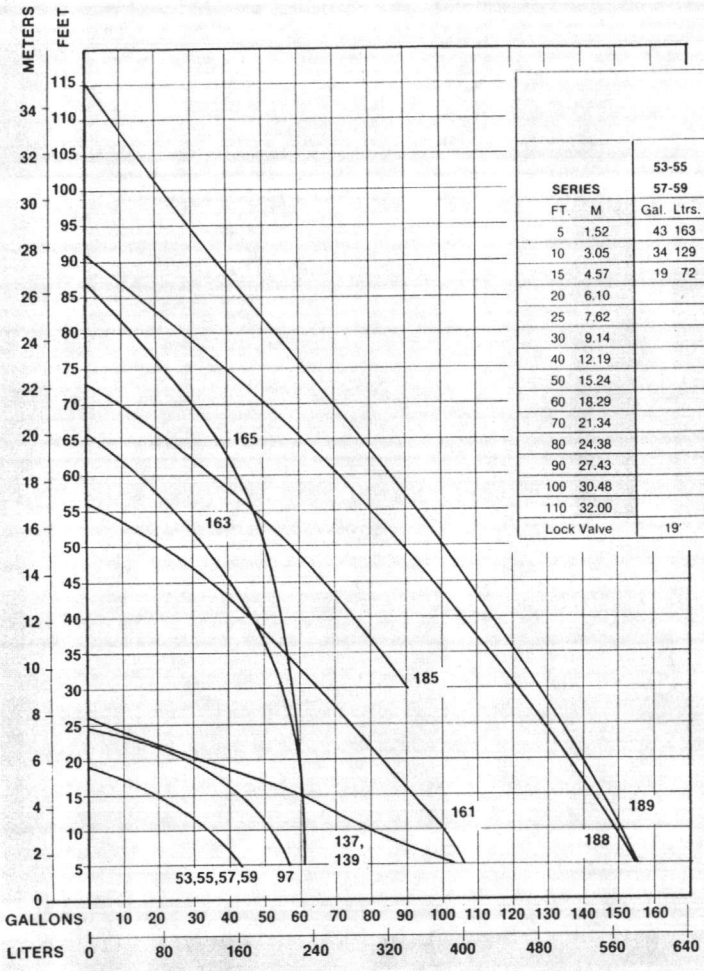
Contact an authorized service station to obtain any needed repair or replacement parts. For additional information pertaining to our warranty or if service cannot be obtained locally, contact Zoeller Company, 3280 Old Millers Lane, Louisville, Kentucky 40216, Attn: Customer Service.

ZOELLER COMPANY EXPRESSLY DISCLAIMS LIABILITY FOR SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES OR BREACH OF EXPRESSED OR IMPLIED WARRANTY; AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICLUAR PURPOSE AND OF MERCHANTABILITY SHALL BE LIMITED TO THE DURATION OF THE EXPRESSED WARRANTY.

Some states do not allow limitations on the duration of an implied warranty, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEAD/CAPACITY CURVE



TOTAL DYNAMIC HEAD/CAPACITY PER MINUTE
EFFLUENT AND DEWATERING

SERIES		53-55 57-59	97	137-139	161	163	165	185	188	189
FT.	M	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.
5	1.52	43 163	57 216	104 394	106 401	61 231	61 231		155 587	155 587
10	3.05	34 129	51 193	79 300	100 378	61 231	61 231		148 560	151 572
15	4.57	19 72	43 163	64 242	91 344	60 227	60 227		142 537	145 549
20	6.10		27 104	36 136	82 310	59 223	60 227		136 515	140 530
25	7.62			8 30	74 280	57 216	59 223		128 484	133 503
30	9.14				65 246	55 206	58 220	90 340	121 458	127 481
40	12.19				46 174	46 172	55 206	75 283	105 397	114 431
50	15.24				21 80	33 125	51 191	58 219	90 341	100 379
60	18.29					15 57	43 161	36 136	71 269	85 322
70	21.34						30 114	10 38	51 193	70 265
80	24.38						14 53		28 106	54 204
90	27.43								2 8	37 140
100	30.48									21 79
110	32.00									8 30
Lock Valve		19'	24.5'	26'	56'	66'	87'	73'	91'	110'

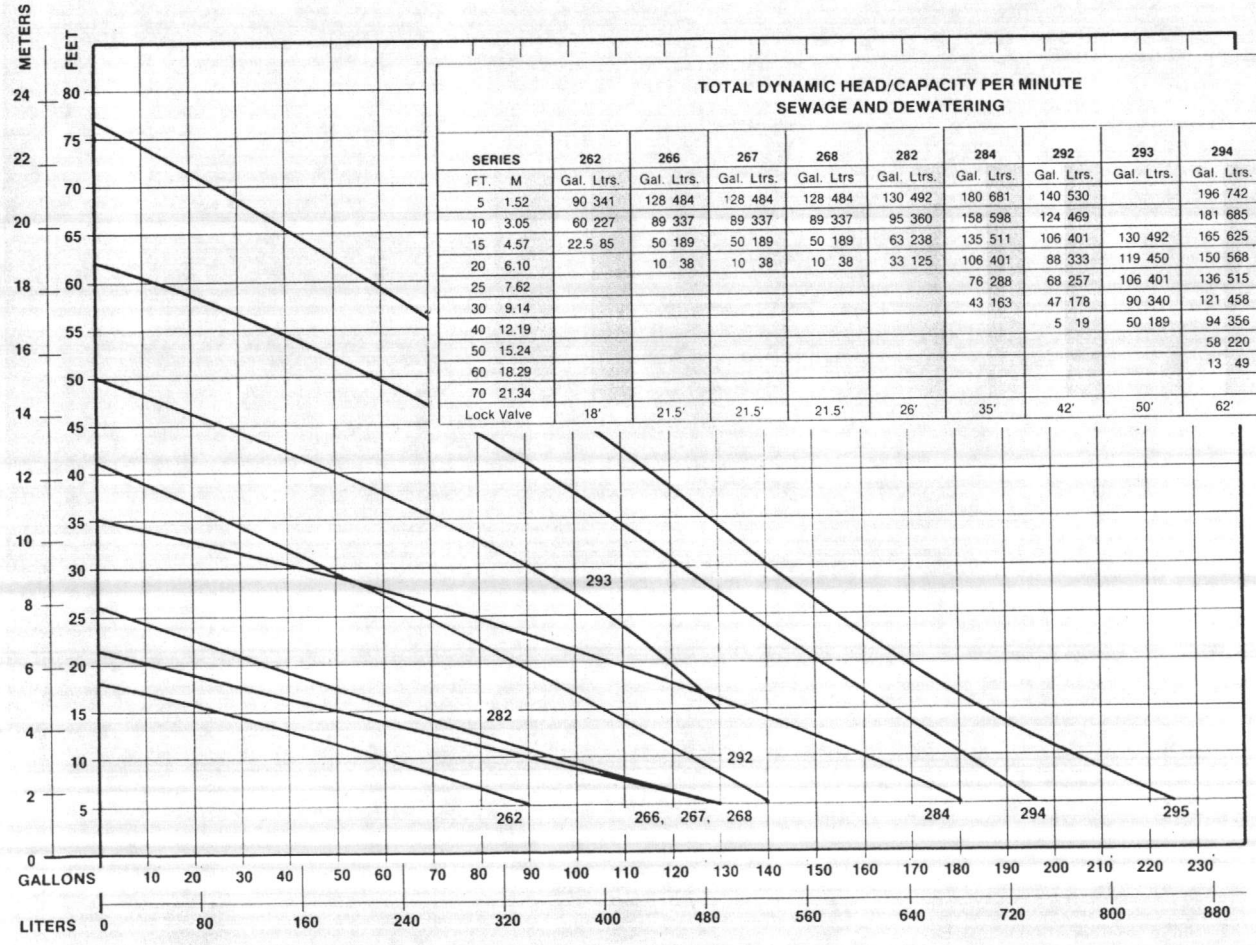
EFFLUENT & DEWATERING

Warning: Model 185 should not be subjected to less than 30 feet TDH.

Note: For Head Capacity on Model 112, industrial column-explosion proof pump, see FM 219.

SEWAGE & DEWATERING

WARNING: Model 293 should not be subjected to less than 15 feet TDH.



TOTAL DYNAMIC HEAD/CAPACITY PER MINUTE
SEWAGE AND DEWATERING

SERIES		262	266	267	268	282	284	292	293	294	295
FT.	M	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.	Gal. Ltrs.
5	1.52	90 341	128 484	128 484	128 484	130 492	180 681	140 530		196 742	225 852
10	3.05	60 227	89 337	89 337	89 337	95 360	158 598	124 469		181 685	205 776
15	4.57	22.5 85	50 189	50 189	50 189	63 238	135 511	106 401	130 492	165 625	185 700
20	6.10		10 38	10 38	10 38	33 125	106 401	88 333	119 450	150 568	168 636
25	7.62						76 288	68 257	106 401	136 515	153 580
30	9.14						43 163	47 178	90 340	121 458	140 530
40	12.19							5 19	50 189	94 356	115 435
50	15.24									58 220	89 337
60	18.29									13 49	59 223
70	21.34										25 95
Lock Valve		18'	21.5'	21.5'	21.5'	26'	35'	42'	50'	62'	77'

"EXTRA PROTECTION SYSTEMS"

THE BASEMENT SENTRY

12 Volt back-up sump pump system model 505

Application
For clear water, emergency back-up usage when power is off or primary pump fails.

Extra Protection - When the primary AC pump fails due to power outages or system problems.

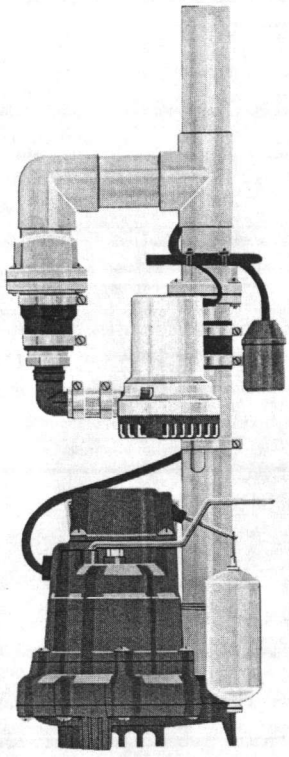
- Storms
- Brownouts
- Wiring or electrical problems

Extra Protection - When the primary pump fails to keep up with excessive water due to rain or overloading.

Ft. Head	Capacity GPH
5	1500
10	1000
15	450
18	Lock Valve

Includes:

- Pump and control
- Charger
- Fittings
- Battery Case (Battery Not Included)



For submersible or pedestal installations.

See FM0844 for information.

TWO PUMP SYSTEM

The "Extra Protection" Two-Pump system is an economical solution to the costly duplex alternating pump system and it's easy to install.

The "Extra Protection" Two Pump System consists of:

a. The two automatic pumps of your choice
b. One Alarm System
c. Two Unicheck Valves as required

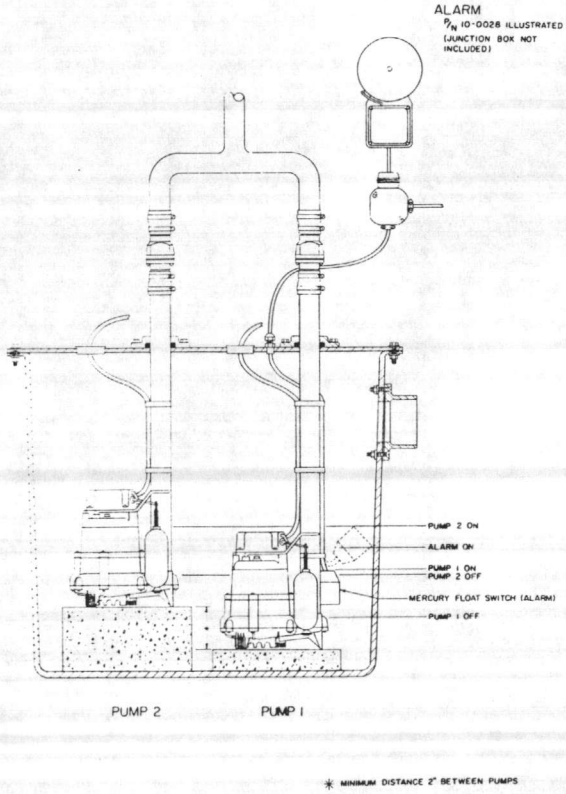
ADVANTAGES

(1) The two-pump system offers high pump performance without the high price. It is a system that fits your needs and your budget.

(2) Delivers more dependability than a single pump system and greatly reduces the chance of costly and time consuming problems associated with wear out or damages and the resulting system failures.

(3) Affords greater satisfaction and peace of mind to all concerned by providing state of the art protection for costly and expensive surroundings.

(4) Easy and economical to install.



SSPMA MEMBER
SUMP AND SEWAGE PUMP MFRS. ASSN.

YOUR ASSURANCE OF QUALITY

EASY DO'S & DON'TS FOR INSTALLING A SUMP PUMP

1. **DO** read thoroughly all installation material provided with the pump.
2. **DO** inspect pump for any visible damage caused by shipping. Contact dealer if pump appears to be damaged.
3. **DO** clean all debris from the sump. Be sure that the pump will have a hard, flat surface beneath it. **DO NOT** install on sand, gravel or dirt.
4. **DO** be sure that the sump is large enough to allow proper clearance for the level control switch(es) to operate properly.
5. **DO Always Disconnect Pump From Power Source Before Handling.**
   DO always connect to a separately protected and properly grounded circuit.
   DO NOT ever cut, splice, or damage power cord.
   DO NOT carry or lift pump by its power cord.
   DO NOT use an extension cord with a sump pump.
6. **DO** install a check valve and a union in the discharge line.
   DO NOT use a discharge pipe smaller than the pump discharge.
7. **DO NOT** use a sump pump as a trench or excavation pump, or for pumping sewage, gasoline, or other hazardous liquids.
8. **DO** test pump immediately after installation to be sure that the system is working properly.
9. **DO** cover sump with an adequate sump cover.
10. **DO** review all applicable local and national codes and verify that the installation conforms to each of them.
11. **DO** consult manufacturer for clarification or questions.
12. **DO** consider a Two Pump System with an alarm (Page 5) where an installation may become overloaded or primary pump failure would result in property damages.
13. **DO** consider a D.C. Backup System (See the Basement Sentry page 5) where a sump or dewatering pump is necessary for the prevention of property damages from flooding due to A.C. Power disruptions, mechanical or electrical problems or system overloading.

ZOELLER CO.
3280 Old Millers Lane
P.O. Box 16347
Louisville, Kentucky 40216
(502) 778-2731

Manufacturers of . . .
"Quality Pumps Since 1939"

TAB PLACEMENT HERE

DESCRIPTION:

None

☑ **Tab page did not contain hand written information**

☐ **Tab page contained hand written information**
***Scanned as next image**

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Renovation of Building M231
Marine Corps BAse
Camp Lejeune, NC
Contract: N62370-88-C-3764

HOT WATER STORAGE GENERATOR

General Contractor:

CBC Enterprises, Inc.
1312 E. Little Creek Road
Norfolk, Virginia
Phone: (804) 588-6100

Mechanical Contractor:

G.R. Michaels & Co.
331 32nd Street
Newport News, Virginia
Phone: (804) 622-3099
Mr. Terry Gregston

Wholesaler and Supplier:

Ferguson Enterprise
P.O. Box 2778
Newport News, Virginia 23609
Phone: (804) 874-7400
Mr. Steve Saunders

Adamson Company, Inc.
13200 Ramblewood Drive
Chester, Va. 23831
(804) 748-6453

OPERATING AND MAINTENANCE INSTRUCTIONS FOR HOT WATER STORAGE HEATERS, TANKS, CONVERTORS AND INSTANTANEOUS HEATERS

OPERATION: INITIAL START-UP

Prior to initial start-up all steam and condensate lines or boiler water circulation lines should be blown down or flushed out to prevent any dirt, weld slag, solder balls, etc., from entering the heating coil, temperature control valves or other apparatus connected to the heater.

Upon initial start-up the main steam globe or gate valve should be cracked slightly to allow the heating surface to come up to operating temperature. If cracking noises occur in the heating element on start-up do not be alarmed. This cracking noise should stop when the heating surface gets warm.

Do not fully open a steam hand valve on initial start-up, as this may cause internal damage to the heating element.

Once the heater is in operation and all valves are adjusted, water temperature control should be done by means of the automatic temperature control valve.

The following controls and accessories are recommended for safe and efficient operation:

1. Steam line strainer
2. Steam temperature control valve. (self-contained, pilot operated, air operated or electric motor operated are all in use today.)
3. Condensate line strainer.
4. Condensate trap (sized to handle 3 times the condensing rate is accepted practice.)
5. Relief valve (ASME approved and set at a pressure not in excess of the design pressure of the shell section.)
6. Thermometer.
7. Pressure gauge.
8. Vacuum breaker (this should be installed on the steam inlet side of the heating coil.)
9. Air Vent. (This should be installed on the steam outlet side of the heating coil.)
10. By-pass piping around the steam control valve and trap assembly are optional and not always used.)

A dirt leg should also be provided ahead of the trap to collect any foreign matter from entering the trap assembly.

OPERATING AND MAINTENANCE INSTRUCTION
FOR
HOT WATER STORAGE HEATERS, TANKS, CONVERTORS
AND INSTANTANEOUS HEATERS

MAINTENANCE:

In any water system, the storage water heater acts as a settling basin for any foreign matter in the water which will deposit itself on the bottom of the storage section. For this reason it is recommended to drain the shell section down once a year, refill it and drain it again. The heating element should be inspected and cleaned of any scale or mineral deposits that may attach themselves to the heating surface. The heating surface may be cleaned by means of wire brushing and hosing or chemically cleaned when possible. (Contact your local chemical supply house for their recommendations and proper cleaning procedures).

The internal shell should be inspected for any rusting or pitting and corrected if possible. Maintenance of this nature will provide cleaner water and more efficient operation.

RELIEF VALVE:

The relief valve should be inspected at least once a month. This is done by merely tripping the arm of the valve to make sure it is in operating condition. Should the valve be inoperable it should be replaced immediately. Any corrosion collecting on this valve may cause it to malfunction and can create a hazardous piece of equipment. Maintenance of this valve is extremely important.

SOME POSSIBLE CAUSES AND CURES TO PROBLEMS OCCURING WITH WATER STORAGE HEATERS

PROBLEM: Slow or inadequate heat recovery.

Cause: Dirty or fouled heating surface.
Cure: Clean the heating surface.
Cause: Improperly sized steam control valve.
Cure: Check size of control valve & piping.
Cause: Coil rated at higher than its actual operating pressure.
Cure: Increase pressure to design condition.
Cause: Condensate may be held in coil.
Cure: Check trap, air vent & vacuum breaker on heating coil.
Cause: Water draw in excess of design capacity.
Cure: Increase steam pressure if possible, at the same time check piping and valves, traps, etc., to make sure additional load can be handled safely. Contact manufacturer for his recommendations on increasing coil heating surface.

PROBLEM: Water hammer in tube bundle.

Cause: Flooded tube bundle. (Improper condensate drainage. This will reduce coil capacity and service life.)
Cure: Check trap size and capacity, also the condensate piping to make sure it is not operating at a pressure greater than that in the heater.

PROBLEM: Overheating of water in storage.

Cause: Oversized steam control valve or cut-of-calibration.
Cure: Check valve sizing and adjustment.
Cause: Valve may not be seating itself completely.
Cure: Check valve.
Cause: Valve may not close all the way due to loss of charge in thermostatic bulb. (Ruptured bulb)
Cure: Check valve and contact manufacturer of same.
Cause: A vacuum is created when the steam control valve closes. This vacuum may be strong enough to hold valve open and allow steam to bleed through and overheat stored water.
Cure: Check vacuum breaker on heating section, to make sure it is operating.
Cause: Thermostatic bulb or aquastat may be located too low in the vessel.
Cure: Re-locate thermostatic bulb or aquastat if possible.

PROBLEM: Excessive pressure causing relief valve to pop.

Cause: Relief valve top too small or undersized.
Cure: Check pressure rating and valve operation.
Cause: Expansion of water from heating may cause excessive pressure. As temperature increases so does pressure.
Cure: Check steam valve for bleeding, relief valve setting and make sure all outlet valves are open. If the cold water inlet is furnished with a check valve, drill a 1/8" or so hole in its flap to allow the pressure to be relieved.

The initial start-up operation and maintenance of Convertors and Instantaneious Heaters is basically the same as those outlined above for Hot Water Storage Heaters.

All causes and cures to some of the problems outlined will be the same.

OPERATING AND MAINTENANCE INSTRUCTIONS
FOR
CONVERTORS-STEAM TO WATER, WATER TO WATER
INSTANTANEOUS HEATERS-STEAM TO WATER
WATER TO WATER

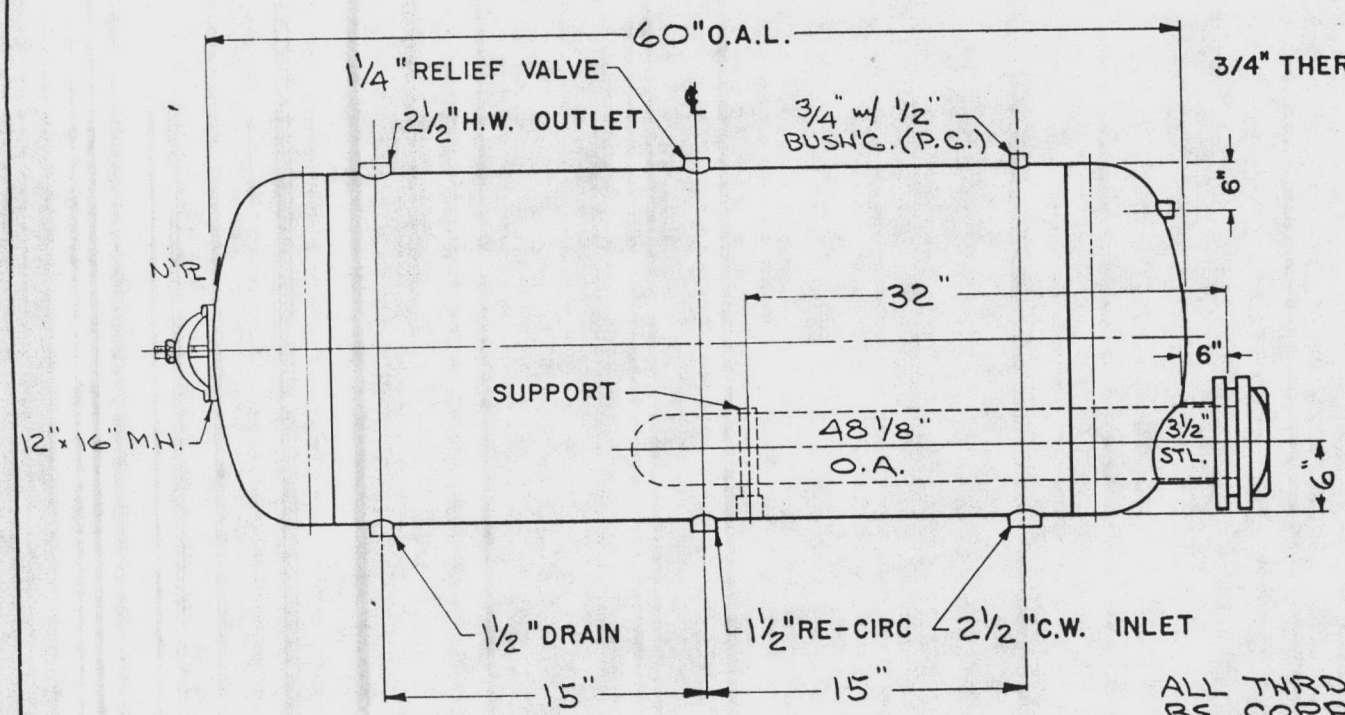
One major difference in maintenance is the cleaning of the heating element. This is generally always chemically cleaned due to scale or mineral content build-up inside the tubes.

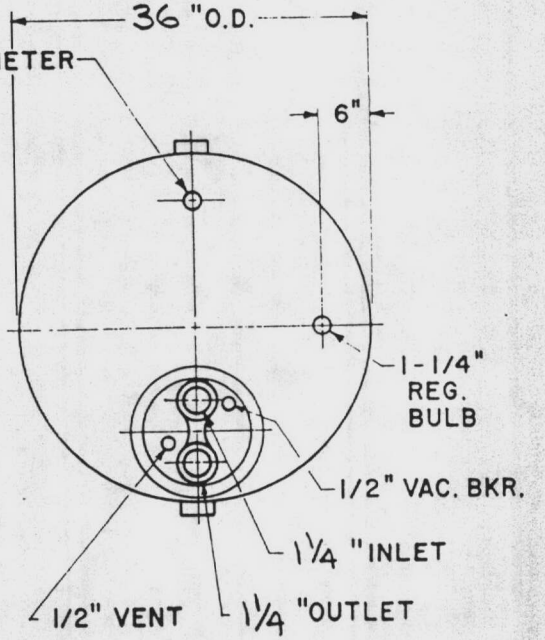
It is possible to clean internally, if the scale or mineral content is soft and can be hosed out with water at a higher pressure than normally flows through the tubes.

For chemical cleaning, we again recommend contacting a local chemical supply house for their recommendations on the type of solvent, preparation and procedures to follow in the cleaning process.

Adamson Company, Inc. will be happy to assist with any of these or other problems occurring in relation to Adamson equipment.

ADAMSON COMPANY INC.



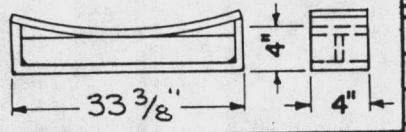


ALL THRD. CPLG'S. TO BE COPPER ALLOY

HEATING ELEMENT SPECIFICATIONS:

ELEMENT NUMBER	WB-03.5-4.7
WORKING PRESSURE	150# TEST PRESSURE 300#
HEATING SURFACE REQUIRED	4.7 SQ. FT.
ELEMENT NECK	CARBON STL. (PLASITE LINED)
SEAMLESS COPPER TUBES	¾" OD x 20 GA.
TUBE SHEET	( ) STEEL (✓) COPPER ALLOY
ELEMENT HEAD	(✓) CAST IRON ( )
ELEMENT SUPPORT	( ) NOT REQ. (✓) CU. ALLOY
HTG. CAP.	89 G.P.H. WATER 40 °F. TO 140 °F.
HTG. MED.	15 P.S.I. STEAM
CIRC. BOILER WATER IN AT	°F. OUT AT °F.

SADDLE SPECIFICATION:



Nº. REQUIRED	TWO
(✓) PLAIN SADDLES	
( ) WITH PIPE FLANGES	
CONSTRUCTION	WELDED STEEL
PAINTED	RED OXIDE

REVISION	1	2	3	4	5
DATE					

CUSTOMER: FERGUSON ENTERPRISE
NEWPORT NEWS, VA.
P.O. Nº. A-4-2327
PROJECT: USMC BLDG. M-231
CAMP LEJUNE, N.C.
ARCHITECT:
ENGINEER:
AGENT: R.L. BROWN SALES

TANK SPECIFICATIONS:

Nº. UNITS REQ. ONE

DESIGN WORKING PRESSURE	125 P.S.I. TEST PRESSURE 188 P.S.I.
CONSTRUCTION	(✓) A.S.M.E. INSPECTED AND STAMPED
'89 E. & '89 A.	( ) MFG. STANDARD 20° F./ 220° F.
MATERIAL: SHELL	SA-455
HEADS	SA-455 STD. LIFT LUGS (2) REQ'D. TP.1
PAINT OR LINING	
EXTERIOR	RED OXIDE
INTERIOR	S/B (SP-10) & (2) CTS. PLASITE #7156 (10-12) MILS.

WATER STORAGE HEATER

ADAMSON

ADAMSON CO. INC.

SCALE	CHECKED	DRAWN BY	DATE	JOB Nº.
NONE	BZ	JK	4-29-91	293-GG

DWG. 1121 EH

AI. WIT. HOLD PTS.	* **	Q.C. WIT. HOLD PTS.	Q.C. INSPECTION BY	Q.C. INSPECTION DATE	AI. INSPECTION BY	AI. INSPECTION DATE
	MATERIAL CHECK					
	PIECE PART FABRICATION					
	BURN/SHEAR SHELL					
	ROLL & TACK SHELL					
	WELD STR. SEAM					
	SPOT X-RAY LONG SEAM					
	N.D.E. OFFSET INSPECTION					
	L/O & INSTALL FITTING HD.WELD					
	F&T HEAD TO SHELL					
	GIRTH SEAM F/U					
	WELD GIRTH SEAM					
	X - RAY GIRTH SEAM					
	LAYOUT SHELL					
	INSTALL FITTINGS SHELL WELD					
	INSTALL ATTACHMENTS					
	CLEAN					
**	FINAL INSPECTION	**				
**	HYDRO S/S	**				
**	HYDRO T/S	**				
**	VERIFICATION OF NAMEPLATE	**				
	YARD					
	SHIPMENT					

EFF. 70%	X-RAY NONE
SHELL 7/32"	HEADS .226" MIN
R.D. 2:1	K.R. —
TEMP: 220°F.	NO. COURSES 1
SHELL HT. NO.	
MIC. THICKNESS	
HEAD HEAT NO.	
MIC. THICKNESS	
HEAD CIRCUM.	
HEAD DEPTH	
SCH. SHOP COMPL.	
SCH. SHIP DATE	

USE WELDING PROCEDURE												
NOS.	1-A	13	15	17-A	21							
REV.		2	1	1	1							

REMARKS:

TAB PLACEMENT HERE

DESCRIPTION:

4

☑ **Tab page did not contain hand written information**

☐ **Tab page contained hand written information**
***Scanned as next image**

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Renovation of Building M231
Marine Corps BAse
Camp Lejeune, NC
Contract: N62370-88-C-3764

Fans

General Contractor:

CBC Enterprises, Inc.
1312 E. Little Creek Road
Norfolk, Virginia
Phone: (804) 588-6100

Mechanical Contractor:

G.R. Michaels & Co.
331 32nd Street
Newport News, Virginia
Phone: (804) 622-3099
Mr. Terry Gregston

Wholesaler and Supplier:

Air Distribution Sales of Virginia
742 East 25th Street
Norfolk, Virginia 23508
(804)623-7345
Mr. Greg Cherry.

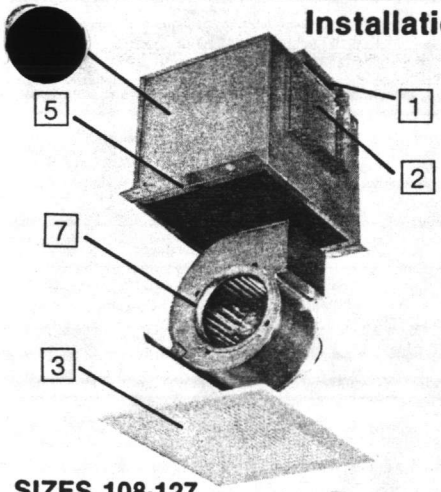
READ AND SAVE THESE INSTRUCTIONS

PART NO. 452441

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

Models SP and CSP 108-158

Installation Instructions and Maintenance Recommendations

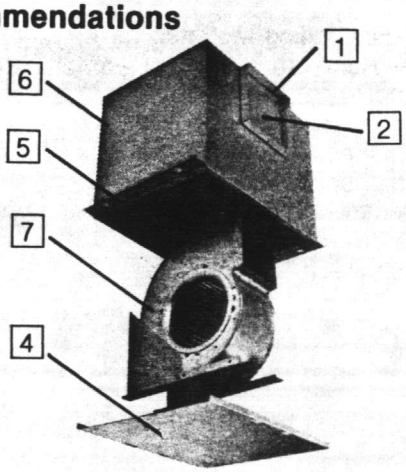


SIZES 108-127

COMPONENTS

1. Duct Connector
2. Backdraft Damper
3. Grille (SP)
4. Bottom Panel (CSP)
5. Mounting Angles
6. Housing
7. Power Assembly

   Power Assembly Consists Of:
   - A. Scroll with Venturi
   - B. Forward curved centrifugal wheel
   - C. Motor
   - D. Drive frame



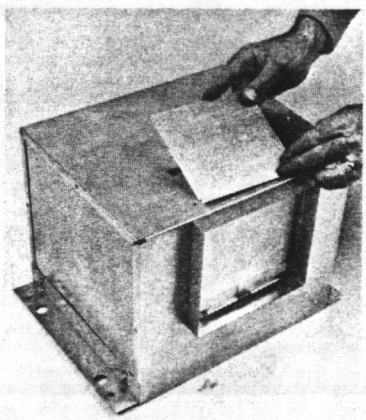
SIZES 150-158

Tools required — Medium Phillips head screwdriver and 3/8" wrench

IF SP OR CSP UNITS ARE TO BE INSTALLED WITH STANDARD HORIZONTAL DISCHARGE, PROCEED DIRECTLY TO STEP 4 FOR INSTALLATION INSTRUCTIONS. STEPS 1 THRU 3 APPLY ONLY TO DISCHARGE CONVERSIONS FROM HORIZONTAL TO VERTICAL.

STEP 1. Converting Duct Connector to Vertical Discharge

Remove duct connector and cover plate. Exchange their positions and secure with fasteners. (See versatile mounting arrangements on page 4.)

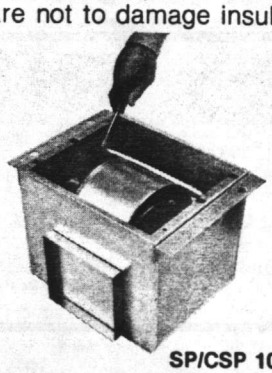


STEP 2. Converting Power Assembly to Vertical Discharge

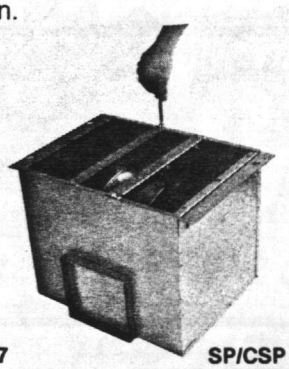
A. Remove grille (SP) or bottom panel (CSP). To remove power assembly, unplug the power cord from the internal receptacle.

B. With unit unplugged, remove fasteners connecting power assembly bracket to housing. (2 fasteners in SP/CSP 108-127; 4 in SP/CSP 150-158).

C. Remove power assembly from housing. Take care not to damage insulation.



SP/CSP 108-127



SP/CSP 150-158

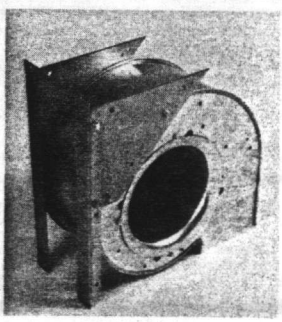
STEP 3. Converting Power Assembly (cont.)

For SP/CSP 108-127 — Proceed directly to Step 3C.

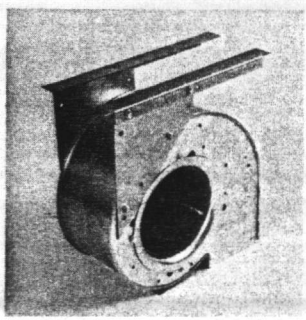
A. For SP/CSP 150-158 — Remove both gusset and bracket assemblies from fan scroll by removing two fasteners from each side. (Do not disassemble gusset/bracket assembly).

B. Replace gusset/bracket assemblies (position on opposite sides of scroll from their original positions) with fan scroll in position as shown in Photo B.

C. For All SP/CSP Sizes — Re-install power assembly in housing so that scroll discharge matches vertical discharge duct connector. Refer to photo's C or D. Replace and tighten bracket fasteners. Plug power cord into internal receptacle.

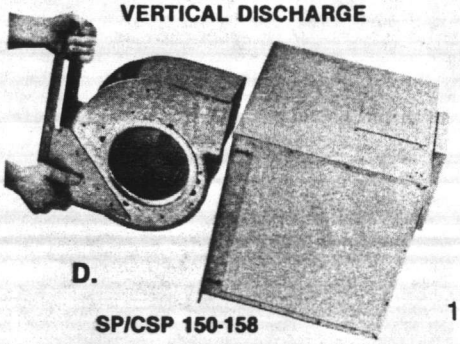


A. HORIZONTAL DISCHARGE



B. VERTICAL DISCHARGE

C. SP/CSP 108-127

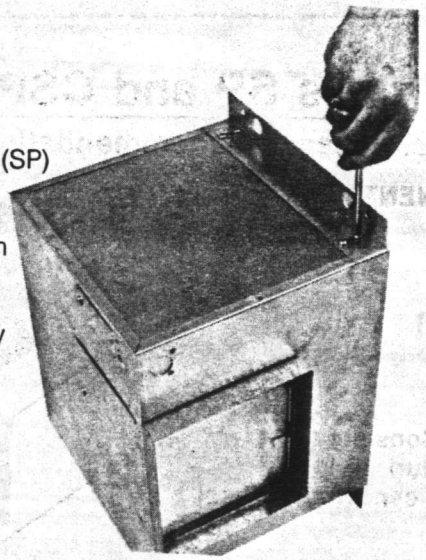


D. SP/CSP 150-158

STEP 4. Ceiling or Duct Installation

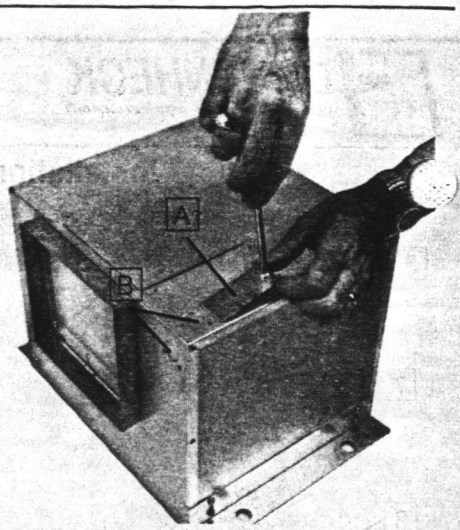
For suspended mounting installations, see Fig. A.

For ceiling mounted (SP) - Adjust mounting angles to allow fan housing to fit flush with finished ceiling. Be sure unit's backdraft damper operates freely after ductwork is installed.



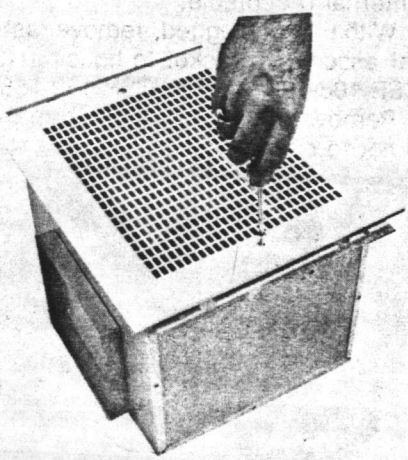
STEP 5. Electrical Connections

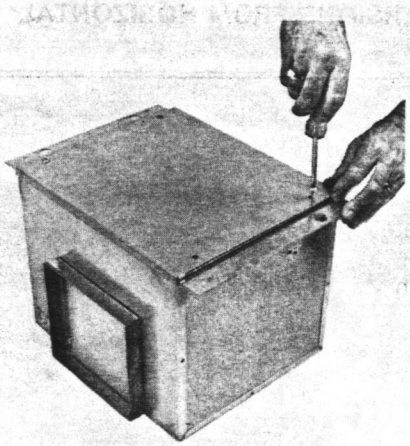
Remove external electrical outlet cover (A). Connect supply conduit thru one of the two 7/8" dia. knockouts (B). Electrical connections are made directly to black and white leads. A separate green fastener is provided for ground wire connection. Replace outlet cover.



STEP 6. Installing SP Grille and CSP Bottom Panel

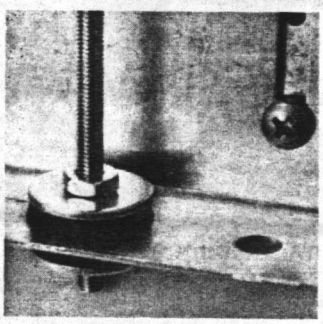
Position the grille (SP) or bottom panel (CSP) over the housing opening. Secure fasteners. (2 for SP; 4 for CSP)





Hanging Vibration Isolators

Vibration isolator kits are available for suspended installations. Kits include all hardware necessary to mount one unit, with the exception of 10-32 threaded rod supplied by others. Fan mounting brackets include prepunched holes for ease of installation.



UNIT SIZE	A	B
108	4½	11⅝
115, 117	5½	14⅝
125, 127	6¾	15½
150, 152, 155, 158	9¼	19⅝
160, 162, 165	9¼	25⅜
170, 175	9¼	36¾

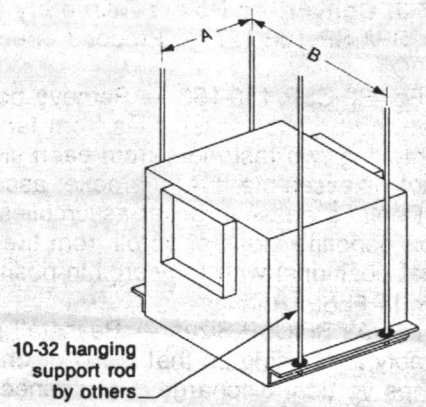
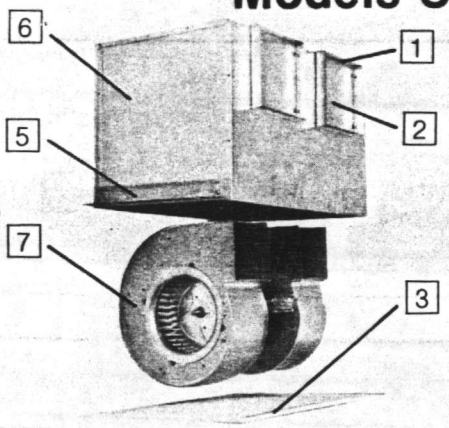


FIG. A

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

Models SP/CSP 160-165 and CSP 170/175

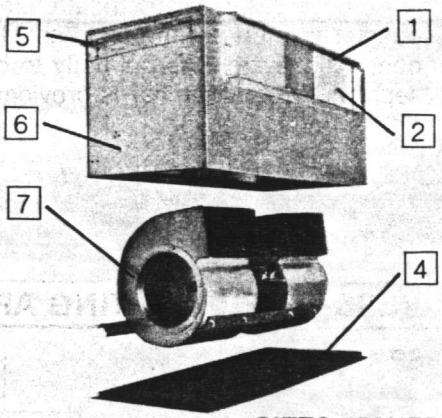


SIZES 160-165

COMPONENTS

1. Duct Connector
2. Backdraft Damper
3. Grille (SP)
4. Bottom Panel (CSP)
5. Mounting Angles
6. Housing
7. Power Assembly

   Power Assembly Consists Of:
   - A. Scroll with Venturi
   - B. Forward curved centrifugal wheel
   - C. Motor
   - D. Drive frame



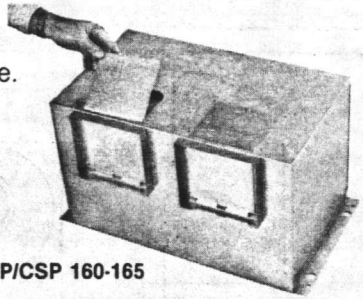
SIZES 170/175

Tools Required — Medium Phillips head screwdriver, 3/8" wrench and 9/16" wrench.

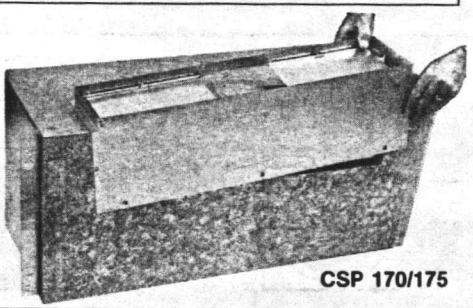
IF SP OR CSP UNITS ARE TO BE INSTALLED WITH STANDARD HORIZONTAL DISCHARGE, PROCEED DIRECTLY TO STEP 4 FOR INSTALLATION INSTRUCTIONS. STEPS 1 THRU 3 APPLY ONLY TO DISCHARGE CONVERSIONS FROM HORIZONTAL TO VERTICAL.

STEP 1. Converting Duct Connector to Vertical Discharge

Remove duct connector and cover plate. Exchange their positions and secure with fasteners. (See versatile mounting arrangements on page 4.)



SP/CSP 160-165



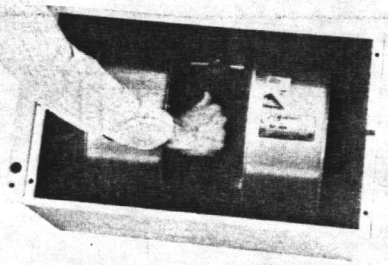
CSP 170/175

STEP 2. Converting Power Assembly to Vertical Discharge

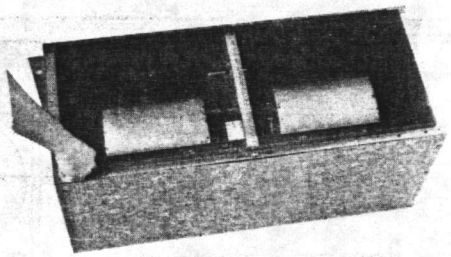
A. Remove grille (SP) or bottom panel (CSP). To remove power assembly, unplug the power cord from the internal receptacle.

B. With unit unplugged, remove fasteners connecting power assembly bracket to housing. (1 fastener in SP/CSP 160-165 or 3 fasteners in CSP 170/175).

C. Remove power assembly from housing. Take care not to damage insulation.



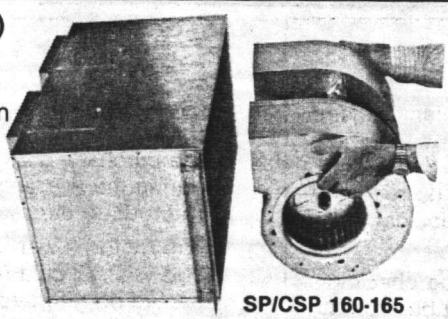
SP/CSP 160-165



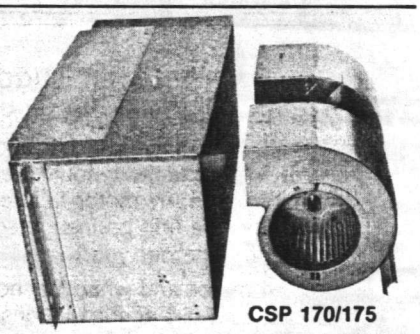
CSP 170/175

STEP 3. Converting Power Assembly (cont.)

Re-install power assembly in housing so that scroll discharge matches vertical discharge duct connector. Replace and tighten all fasteners. Plug power cord into internal receptacle. Replace and secure grille or bottom panel.



SP/CSP 160-165

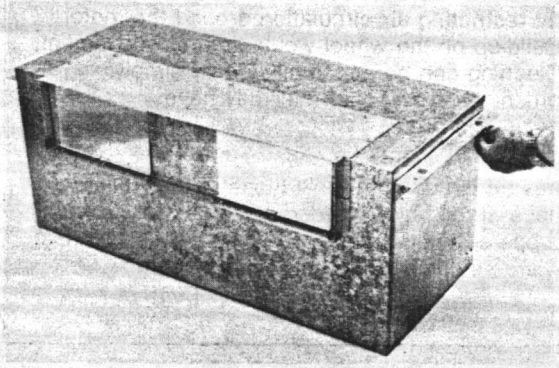


CSP 170/175

STEP 4. Ceiling or Duct Installation

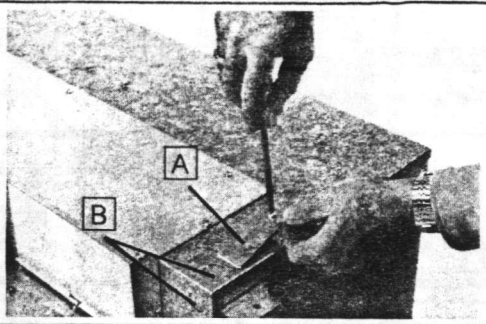
For suspended mounting installations, see Fig. A.

For ceiling mounted (SP) — Adjust mounting angles to allow fan housing to fit flush with finished ceiling. Be sure unit's backdraft damper operates freely after ductwork is installed.



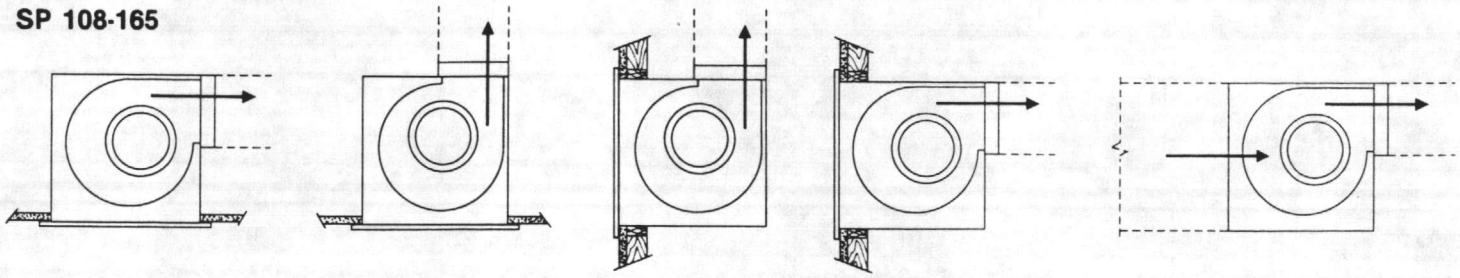
STEP 5. Electrical Connections

Remove external electrical outlet cover (A). Connect supply conduit thru one of the two 7/8" dia. knockouts (B). Electrical connections are made directly to black and white leads. A separate green fastener is provided for ground wire connection. Replace outlet cover.

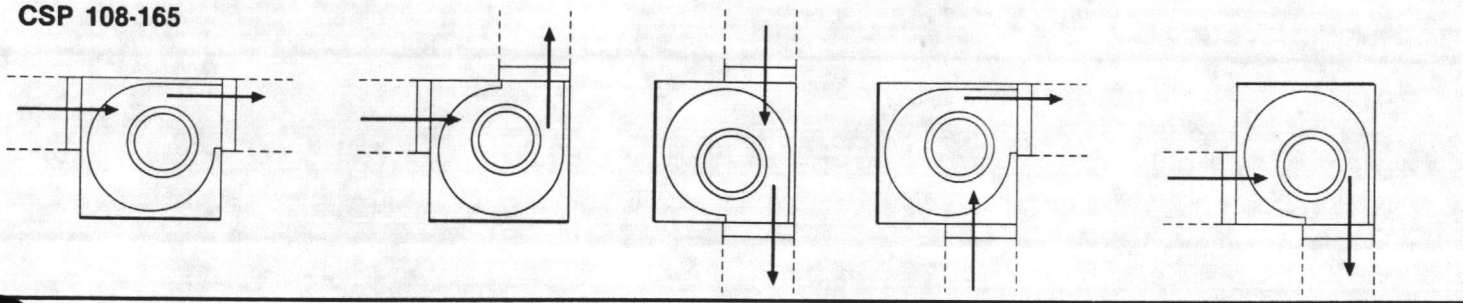


VERSATILE MOUNTING ARRANGEMENTS

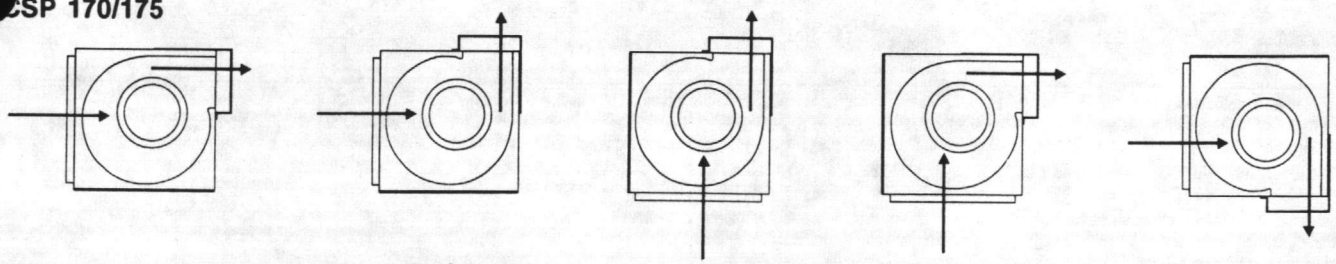
SP 108-165



CSP 108-165



CSP 170/175



MAINTENANCE SUGGESTIONS

Models SP and CSP ceiling exhaust fans require very little maintenance. But because a small problem, left unchecked, could lead to loss of performance or early motor failure, we do recommend that the unit be inspected periodically (Once or twice per year).

The fan motor and wheel(s) should be checked for dust and dirt accumulations. Dirt build-up on the drive frame could cause motor overheating by restricting air circulation around the motor. Build-up on the wheel would limit air movement. Cleaning can be accomplished by simply brushing off any dust that may have accumulated.

The motor should be checked for lubrication at this time. Lubricate only those motors which have an oil hole provided on the motor. A few drops of all purpose oil (SAE 20 viscosity rating) will be sufficient. Do not over-lubricate.

WARRANTY

Greenheck Fan Corporation warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove to be defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid.

The motor is warranted by the motor manufacturer for a period of one year. Should the motor prove defective during this period, it should be returned to the nearest authorized motor service station.

Greenheck Fan Corporation will not be responsible for any installation or removal costs.

CSP models shown are UL listed E 33599 Maximum airstream temperature not to exceed 95°F.

CSP models shown are CSA certified LR-34470 Models CSP 108-175

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171

10M SP/CSP FS
MAY 1989

BROAN®
the fresh air people

LO-SONE VENTILATORS INSTALLATION INSTRUCTIONS

This unit is designed to adapt to many different installation requirements. Plan your installation carefully. For various ducting, mounting, and wiring options, see pages 2 and 3. This page shows the most common installation.

NOTE
DO NOT INSTALL THE 362 or 363 LO-SONE VENTILATOR OVER A COOKING SURFACE. THE 383 LO-SONE VENTILATOR MAY BE INSTALLED OVER A COOKING SURFACE. TO AVOID MOTOR BEARING DAMAGE AND/OR UNBALANCED OR NOISY IMPELLERS, KEEP DRYWALL SPRAY, CONSTRUCTION DUST, ETC. OFF POWER UNIT.

TYPICAL MOUNTING

1. Provide Frame - This unit is designed to fit within joists on 16" centers. If ceiling joists are on larger centers, frame in housing location. Provide a solid frame to assure lowest sound levels. See Figure 1 for typical installation.

Brackets are factory set for ½" ceiling thickness. Make sure that housing will be flush with finished ceiling.

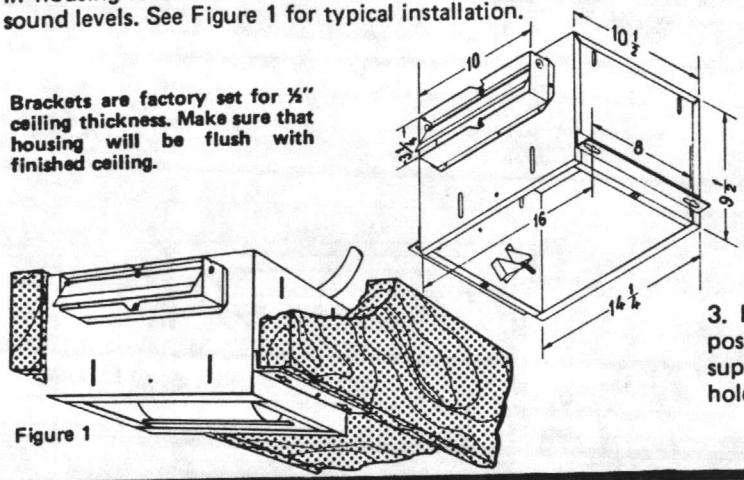


Figure 1

2. Trace Keyhole Slots - Hold unit against joists and trace keyhole slots in mounting brackets onto joists. Start wood screws provided in same end of all traced keyhole openings. Leave about 3/8" of screws projecting from joists. (Fig. 2)

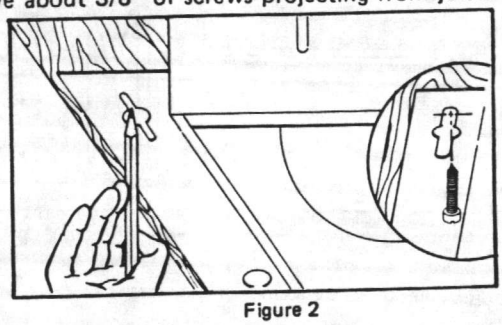


Figure 2

3. Hang Unit - Tighten mounting screws as firmly as possible to assure lowest sound levels. For additional support, fasten unit to joists with nail or screw through hole in center of each mounting bracket.

TYPICAL WIRING

SAFETY WARNING
TURN OFF PROPER 120 VOLT CIRCUIT AT THE SERVICE ENTRANCE BEFORE WIRING THE VENTILATOR.
ALL ELECTRICAL CONNECTIONS MUST BE MADE IN ACCORDANCE WITH LOCAL CODES, ORDINANCES, AND NATIONAL ELECTRICAL CODE. IF YOU ARE UNFAMILIAR WITH METHODS OF INSTALLING ELECTRICAL WIRING, SECURE THE SERVICES OF A QUALIFIED ELECTRICIAN.

4. Wire Unit - Remove wiring adapter plate, which is located on top of housing (See Fig. 9), and attach electrical cable with appropriate electrical connector. Fasten incoming ground wire (bare or green wire) to adapter plate with green ground screw provided. Connect white wire to white, black wire to black. (Fig. 3) Replace wiring adapter plate so that tab on housing slides through slot on plate. (See Fig. 9)

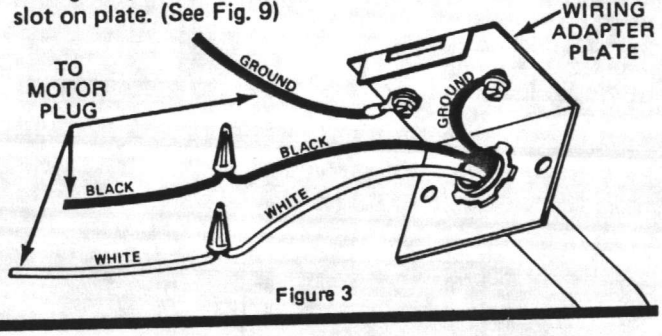


Figure 3

TYPICAL DUCTING

5. Connect Ductwork - Connect ductwork to damper/duct connector. Tape all joints with duct tape. (Fig. 4)

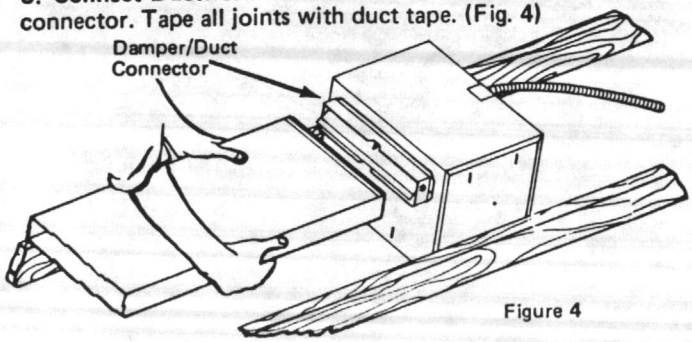


Figure 4

NOTE
MAKE SURE THAT BLOWER DISCHARGE OPENING MATCHES DAMPER POSITION ON VENTILATOR HOUSING.
HOUSING SHOULD BE FLUSH WITH FINISHED CEILING. SEE "To adjust brackets" IN "INSTALLATION OPTIONS" SECTION.

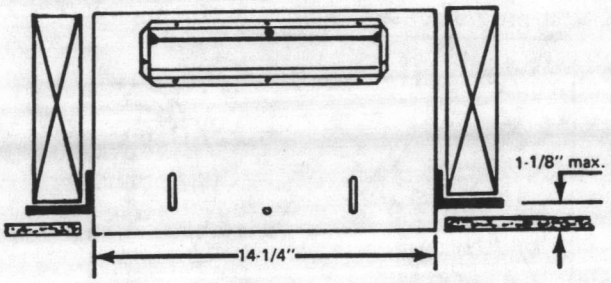
GRILLE MOUNTING

6. Install grille using screws provided. Do not over-tighten.

INSTALLATION OPTIONS

Mounting brackets may be adjusted and/or moved for various types of installations shown below.

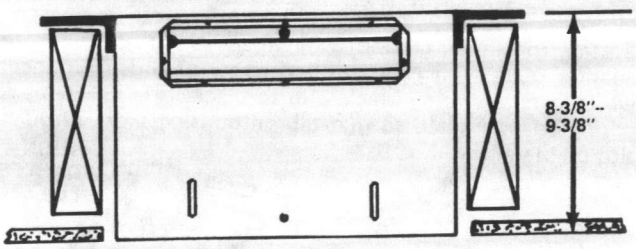
To adjust bracket position, loosen 7/16" hex nuts and move brackets up or down. Re-tighten hex nuts securely. (Fig. 5)



Adjustable for various ceiling thicknesses.

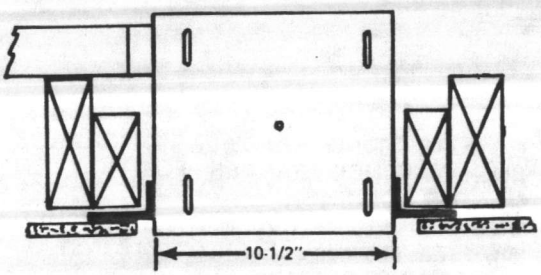
Figure 5

To move brackets, remove 7/16" hex nuts. Re-position brackets on different set of slots. Replace hex nuts and tighten securely. (Fig. 6)



Installation from above finished ceiling.

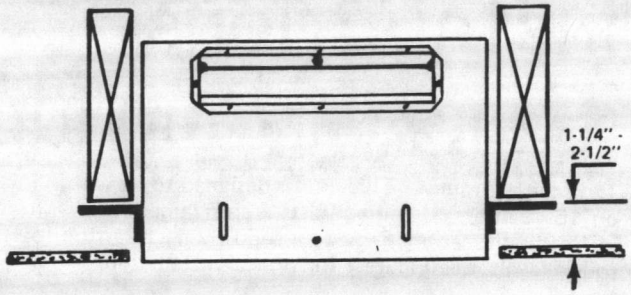
Figure 6A



Installation with ductwork running across joists.

Figure 6B

Reverse brackets to give approximately 1" more clearance. Remove hex nuts, flip brackets over, and replace hex nuts. Tighten nuts securely. (Fig. 7)



Installation with suspended ceiling.

Figure 7A

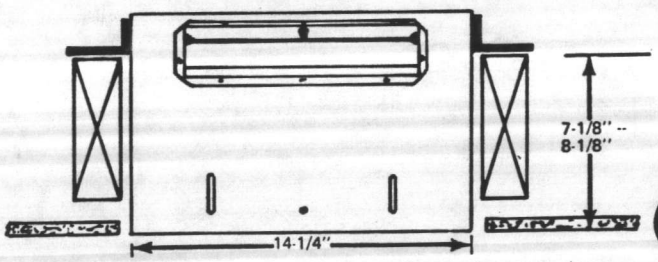


Figure 7B

For in-line installations, remove 7/16" hex nuts. Re-position brackets so that housing opening is at the side instead of the bottom. (Fig. 8)

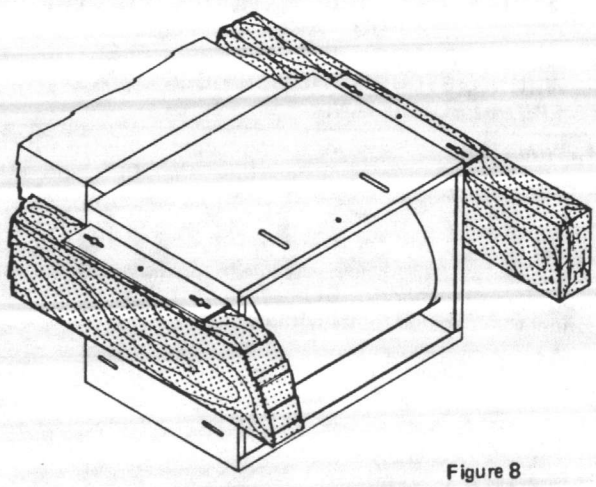


Figure 8

TAB PLACEMENT HERE

DESCRIPTION:

None

☑ **Tab page did not contain hand written information**

☐ **Tab page contained hand written information**
***Scanned as next image**

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

YORK
LEADER IN NEW TECHNOLOGY
FOR AIR CONDITIONING

INSTALLATION, OPERATION AND MAINTENANCE

REFERENCE INSTRUCTIONS

PROJECT:	**BLDG. M-231** **MARINE CORPS BASE** **CAMP LEJEUNE, NC**
PURCHASER:	G. R. MICHAELS AND COMPANY 331 32nd Street Newport News, Virginia 23607 ATTN: Carl Knapp
EQUIPMENT:	QTY. 1 - PACKAGED AIR-COOLED CHILLER MODEL #W1LC530A25 TAG: ACC-1
MANUFACTURER:	YORK INTERNATIONAL CORPORATION 11635 BUSY STREET RICHMOND, VIRGINIA 23236
PURCHASE ORDER #	1290
YORK ORDER NO.	90-819826
YORK CONTRACT NO.	0-15258
SALES MANAGER :	LARRY J. BUNK
DATE:	APRIL 12, 1991

Enclosure: 4 sets

cc: Sales Dept (1)
Service Dept. (2)

Applied Systems
York International Corporation
11635 Busy Street
Richmond, Virginia 23236
Telephone (804) 379-1800
Toll Free (800) 552-YORK
Fax (804) 379-1418

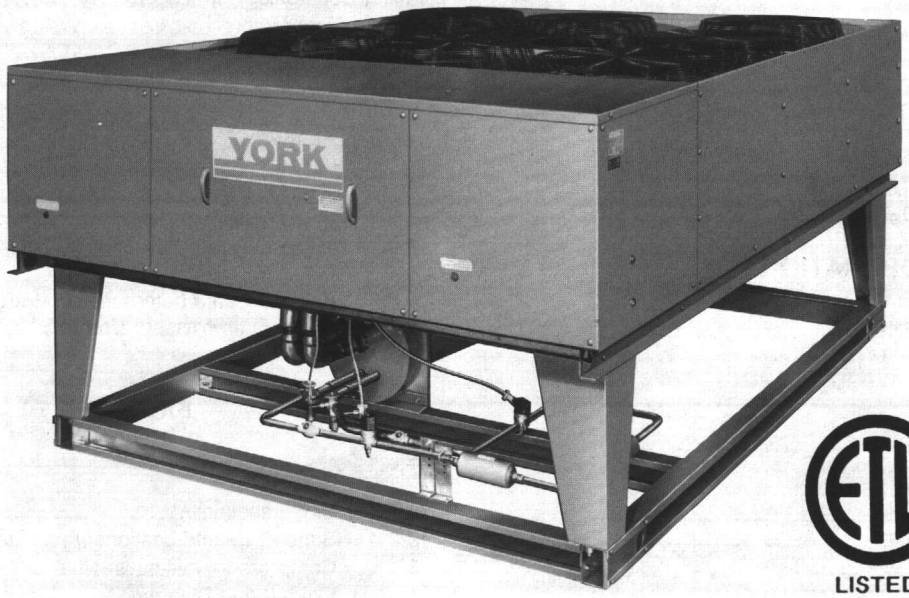
YORK®

LIQUID CHILLER (AIR-COOLED)

INSTALLATION INSTRUCTION	Supersedes: Nothing	570.05-N2Y (1287)

035-07818

MODELS W1LC420 AND 530 STYLE A



ETL® LISTED

Only –25 and –46 voltage codes

GENERAL

YORK's W1LC Packaged Air-Cooled Liquid Chillers provide chilled liquid for all air conditioning applications. They are completely self contained chilling systems utilizing an accessible hermetic compressor, liquid cooler, air cooled condenser coils and electrical control panel all mounted on a steel base. They are factory piped, wired, dehydrated, evacuated, leak tested, pressure tested, functionally tested and fully charged with Refrigerant-22.

Most controls are located on the front of the unit and are readily accessible for maintenance, adjustment and service. All wiring, (power and control) can be made through the bottom of the compressor compartment.

REFERENCE

Additional information on the design, installation, operation and service of air conditioning equipment is available in the following reference material.

Form 55.70-N1	– General Installation
Form 55.70-N2	– Pre-start & Post-start Check List
Form 55.70-N3	– General Service Information

Renewal Parts: Refer to Parts Microfiche or Parts Manual for complete listing of replacement parts on this equipment.

The above forms and all other forms referenced in this instruction may be ordered from:

Publications Distribution Center
Central Environmental Systems
P.O. Box 1592, York, Pa. 17405

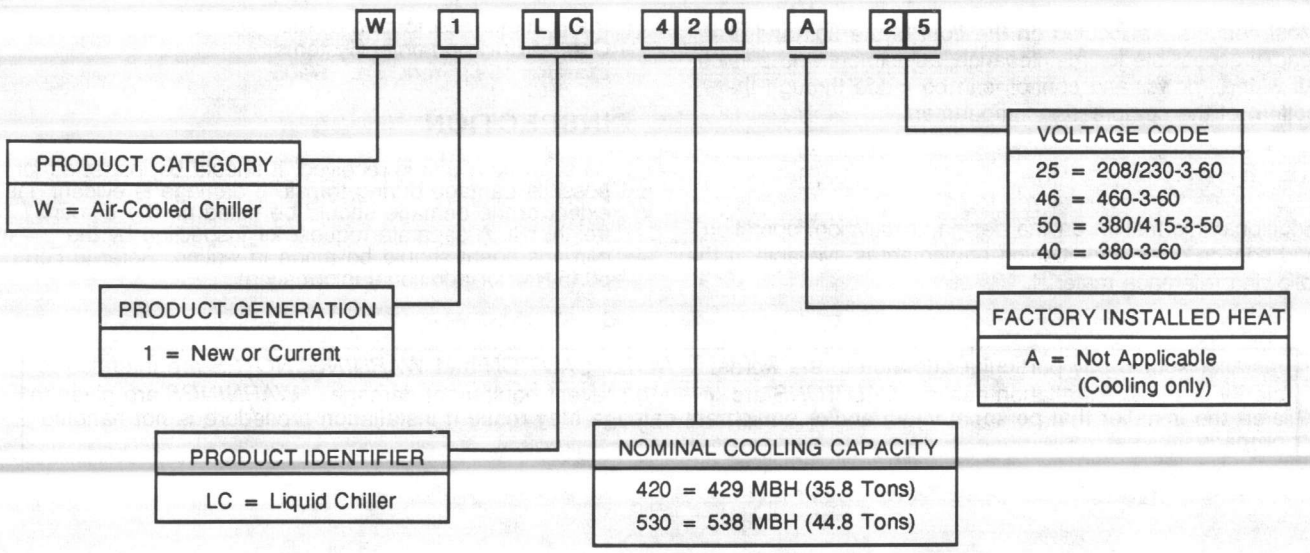
INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing. Refer to Form 50.15-NM for additional information.

Installer should pay particular attention to the words: *NOTE, CAUTION* and *WARNING. NOTES* are intended to clarify or make installation easier. *CAUTIONS* are given to prevent equipment damage. *WARNINGS* are given to alert the installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

TABLE OF CONTENTS

PRODUCT NOMENCLATURE



INSTALLATION

LIMITATIONS

These units must be installed in accordance with all national and local safety codes. If no local codes apply, installation must conform with the appropriate national codes. See Table 1 for application data. Units with voltage codes 25 and 46 are certified by the Electrical Testing Laboratory (ETL) as meeting the requirements of the ANSI/UL 465 Central Cooling Air Conditioner Standard. If components are to be added to a unit to meet local codes, they are to be installed at the dealer's and/or the customer's expense.

TABLE 1 – APPLICATION DATA

UNIT POWER SUPPLY	VOLTAGE VARIATION	
	MIN. VOLTS	MAX. VOLTS
208/230-3-60	187	253
460-3-60	414	506
380/415-3-50	342	440
380-3-60	355	415

LIMITATIONS		MODEL	
		W1LC420	W1LC530
Cooler Liquid (GPM)	Min.	55	70
	Max.	150	160
Leaving Liquid Temp. (°F)	Min.[1]	32	32
	Max.	50	50
Air Entering Condenser (°F)	Min.[2]	20	20
	Max.	115	115

[1] For applications below 40°F leaving liquid temperature, a mixture of ethylene glycol and water must be used.
[2] Water in the cooler is protected from freeze-up to 0°F ambient by a heater under the insulation.

HANDLING

These chillers are shipped as completely assembled units with a full operating charge. Care should be taken to avoid damage due to rough handling.

CAUTION: Units are not designed for stacking.

A unit should be lifted by inserting hooks through the holes in the base rails.

CAUTION: Spreader bars of greater width than the unit must be used to avoid crushing the unit frame or panels with lifting chains or cables.

When preparing to move the unit, always determine the center of gravity in order to equally distribute the weight. Slings connected to the compressor end of the unit will usually have to be made shorter than those to the rear of the unit, so the unit will lift evenly. Refer to Figure 1.

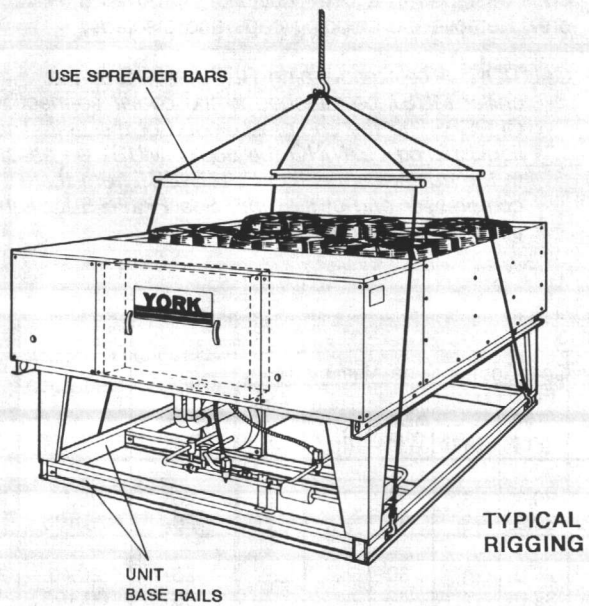
LOCATION

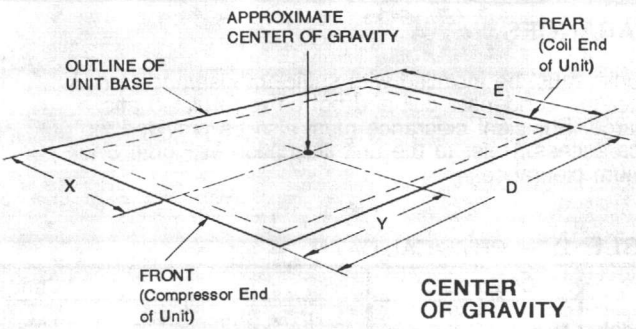
These units are designed for outdoor installations on ground or rooftop. The location should be selected for minimum sun exposure and to insure an adequate supply of fresh air for the condenser. Avoid locations beneath windows or between structures where normal operating sounds may be objectionable. The condenser fans are propeller type and are not suitable nor intended for use with duct work in the condenser air stream.

On either rooftop or ground level installations, rubber padding can be applied between the base rails of the unit and its support to lessen the transmission of vibration.

Ground Level Locations

It is important that the units be installed on a substantial base that will not settle. See Table 2 for unit weights. Settling could cause strain on the refrigerant or water lines resulting in leaks. A one piece concrete slab with footers extended below the frost line is highly recommended.





MODEL	DIMENSIONS (IN.)			
	D	E	X	Y
W1LC420	118-5/8	86-7/8	43	46
W1LC530	118-5/8	86-7/8	41	46

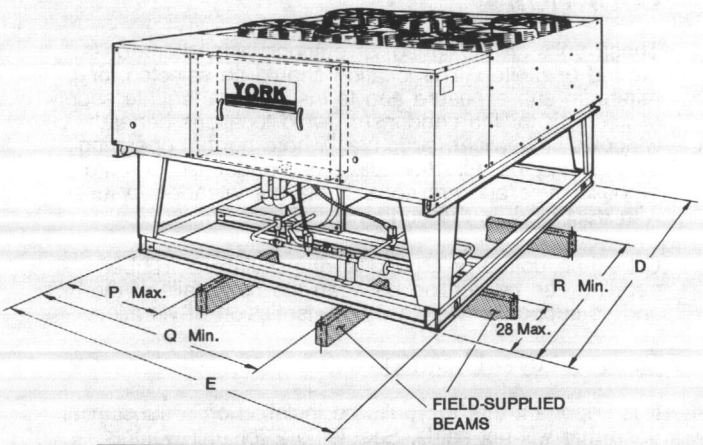
FIG. 1 – UNIT HANDLING

Additionally, the slab should NOT be tied to the main building foundations as noise due to vibration may be transmitted.

For ground level installations, precautions should be taken to protect the unit from tampering or to prevent injury to unauthorized persons. Screws on access panels will prevent casual tampering. However, further safety precautions such as a fenced-in enclosure or locking devices on the panels may be advisable. Check local authorities for safety regulations.

Rooftop Locations

Choose a spot with adequate structural strength to safely support the entire weight of the unit and service personnel. Care must be taken so as not to damage the roof. Consult the building contractor or architect if the roof is bonded. The unit must be mounted level on a minimum of two beams. The beams should (1) be positioned perpendicular to the roof joists, (2) extend beyond the dimensions of the section to distribute the load of the roof, (3) be capable of supporting the weight of the unit and (4) be positioned parallel to the longer base rails of the unit OR parallel to the shorter base rails of the unit as shown in Figure 2.



MODEL	DIMENSIONS (IN.)				
	D	E	P	Q	R
W1LC420	118-5/8	86-3/4	30	70	76
W1LC530	118-5/8	86-3/4	30	70	76

FIG. 2 – SUPPORT BEAM LOCATIONS

CLEARANCES

The units must be installed with sufficient clearance for air to enter the condenser coil and not be recirculated after discharge. Sufficient clearance must also be provided for service access. Refer to the unit illustration in Figure 5 for minimum clearances.

The area within the clearances and the area under the unit must be kept clear of all obstructions that would impede free air flow to the unit. In installations where low ambient operation is intended and snow accumulation is expected, additional unit height must be provided to insure full air flow.

COMPRESSOR HOLD-DOWN NUTS

For shipping, the hold-down nuts are tightened, drawing the compressor mounting feet down to the shipping stops.

CAUTION: After the unit is in its final position, remove the compressor hold-down nuts and shipping spacers. Install rubber grommets (shipped in bag tied to compressor). Replace hold-down nuts and tighten until they begin to bind the rubber grommets. Continue to tighten 1/2 turn. See Figure 3.

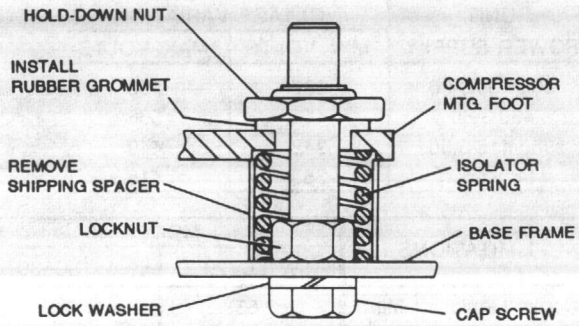


FIG. 3 – COMPRESSOR HOLD-DOWN NUTS

DISCHARGE LINE HOLD-DOWN BRACKET

CAUTION: Do NOT remove the discharge line support brackets located within the compressor compartment. It reduces vibration during unit operation.

CHILLED LIQUID PIPING

The cooler inlet and outlet liquid connections are 4 inch nominal pipe size. The connections are made with grooved ends designed to accept Victaulic® grooved pipe couplings only. Remove the shipping caps and discard.

CAUTION: The liquid piping RETURNING to the chiller MUST be attached to the cooler connection CLOSEST to the compressor end of the unit. The liquid piping LEAVING the cooler MUST be attached to the cooler connection FURTHEST from the compressor end of the unit. See Figure 5 for liquid inlet and outlet connections.

TABLE 2 – PHYSICAL DATA

Model	Compressor[1]			Condenser											Operating Charge Lbs. (R-22)	Capacity Reduction (%)	Unit Weight Lbs.	
				Fans (Propeller)				Fan Motors[3]		Coil (Copper Tube-Aluminum Fin)								
	Nom. Cap. (Tons)	No. of Cyl.	Stages of Cap.	Qty.[2]	Dia. (In.)	Pitch (Deg.)	Nom. CFM	HP	RPM	Face Area (Ft.²)	Rows Deep	Rows Wide	Tube OD (In.)	Fins Per In.			Ship.	Oper.
W1LC420																		
System 1	20	4	2	3	24	30	16,050	3/4	1075	30.0	3	36	3/8	12	26	25,50	3380	3480
System 2	20	4	2	3			16,050			30.0	3	36			26	75,100		
W1LC530																		
System 1	20	4	2	3			14,400			25.0	4	30			26	20,40	3720	3820
System 2	30	6	2	4			19,400			35.0	4	42			35	60,100		

[1] All compressors are semi-hermetic.

[2] During low ambient conditions, one of the fan motors will operate at 450 RPM.

[3] These PSC motors are directly connected to the condenser fans and have inherent protection, ball bearings and a 48 frame. Their rotation is clockwise when viewing the shaft end of the motor.

The chilled liquid lines that are exposed to outdoor ambient should be wrapped with supplemental heater cable and insulated to protect against freeze-up during low ambient periods and to prevent formation of condensation on lines in warm humid climates. The unit provides electrical contact closure when the outdoor ambient is low and cooler water is not flowing to energize these supplemental heaters but power must be supplied from a separate power source. Refer to Field Wiring, Figure 4.

A water flow switch is installed on the leaving water connection of the cooler. For proper operation, there should be a straight horizontal run of at least 5 pipe diameters down stream of the switch.

The chilled liquid piping system must be laid out so that the circulating pump discharges into the cooler. Hand stop valves are recommended for use in all lines to facilitate servicing. Drain connections should be provided at all low points to permit complete drainage of the cooler system and piping. The cooler barrel is provided with a 3/4 inch drain connection on the bottom of the cooler and a 1/4 inch air purge connection on the top of the cooler. A strainer (40 mesh) is recommended for use on the inlet to the cooler.

NOTE: When filling the piping system with liquid, purging the system of air is essential for the unit to achieve design capacity. Be sure to slowly fill the system with liquid and to open all purge connections in the system including the 1/4 inch connection on top of the cooler. Close all connections after all air has been purged from the system.

As an aid to servicing, thermometers and pressure gauges are recommended in the inlet and outlet water lines. A 1/4 inch plugged connection is provided on each connection for the field to install these devices.

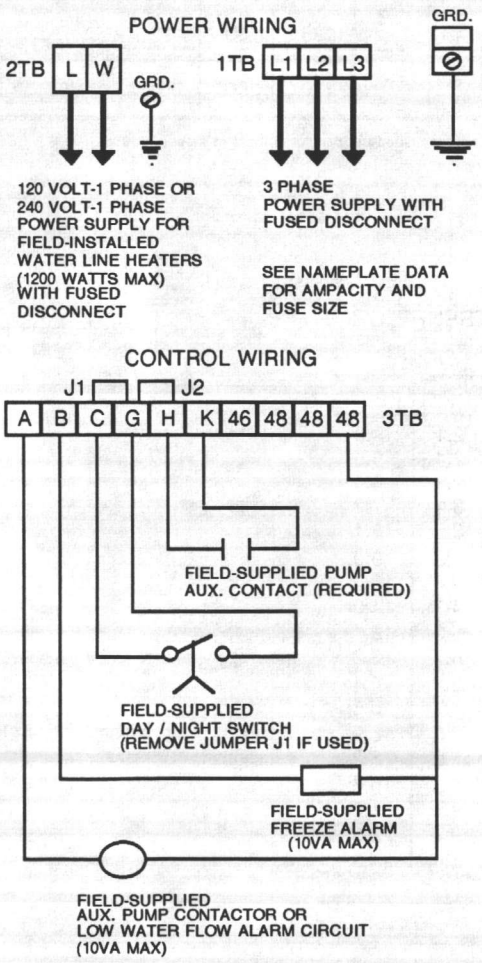


FIG. 4 – FIELD-WIRING DIAGRAM

ELECTRICAL WIRING

WARNING: All power and control wiring must be in accordance with national and local electrical codes.

POWER WIRING

These units are designed for single point power source. Check the available power and unit nameplate to see if the voltages are the same. Run the necessary number of properly sized wires to the unit. Provide a disconnect switch and fusing as required. Route the conduit to the large knockout located on the bottom of the electrical box. Remove the plastic plug from the knockout and discard. See Table 3 or 4 for electrical data.

The disconnect switch may be bolted to the side of the unit but not to any of the removable panels; this would interfere with access to the unit. Make sure that no refrigerant lines or coils will be punctured when mounting the disconnect switch, and note that it must be suitable for outdoor installation.

CONTROL WIRING

All control wiring is connected to the field wiring terminal block, 3TB, located in the bottom of the control box. A more detailed description of operating controls is given in the Operation Section.

WARNING: All control wiring is 120 volts single phase. Properly sized and insulated wiring should be used.

An indoor room thermostat is not required to operate these units. Each unit contains an automatic temperature control which maintains a constant return liquid temperature to the cooler. Several recommended and optional field hookups are connected to the 3TB terminal strip. They are:

1. Chilled Water Pump Starting Circuit – terminals K and H. (Recommended, not to be used for normal start)
2. Day/Night Switch Contacts for Cycling Unit On and Off with Unit Pumpdown – terminals G and C. Remove jumper J1. (Recommended)
3. Low Leaving Liquid Temperature Alarm – terminals B and 48. (Optional)
4. Loss of Liquid Flow Alarm/Aux Pump Start – terminals A and 48. (Optional)

MULTIPLE UNITS

For increased compressor protection and to reduce power inrush at start-up on multiple chiller installations, provisions must be made to prevent simultaneous start-up of two or more units. Also, some method may be employed to automatically cycle on or off one or more of the units to permit more efficient operation at part load conditions.

WIRING TO EXTERNAL WATER LINE HEATERS

When the outdoor ambient drops below 36°F and there is no water flow, a contact in the unit closes across terminals W and L on the 2TB terminal block located in the bottom of the control box. This contact closure may be used to energize field installed heaters located on water lines to the unit. (See Figure 4)

WARNING: The unit contact closure does NOT provide power for the heaters. Single phase 120 or 240 volt power must come from a separate, field installed fused disconnect. Heater power must not exceed 1200 watts.

TABLE 3 – ELECTRICAL DATA

Unit Model Designation		Compressors				Condenser Fan Motors				Unit Ampacity, Amps	Max. Fuse Size, Amps	Min.[3] Wire Size (AWG)	Max.[4] Wire Lg. (Feet)
		Power Supply	Qty.	RLA	LRA	Power Supply	HP	Qty.	FLA (each)				
W1LC420A	25	208/230-3-60	2	88.5 each	428[1] each	208/230-1-60	3/4	4 2	4.2 4.5	225	250	0000	212@208 227@230
	46	460-3-60	2	44.3 each	214 each	460-1-60	3/4	4 2	2.3 2.5	114	125	2	374
W1LC530A	25	208/230-3-60	1 1	88.5 135	428[1] 565[2]	208/230-1-60	3/4	5 2	4.2 4.5	288	300	350	226@208 237@230
	46	460-3-60	1 1	44.3 67.5	214 283	460-1-60	3/4	5 2	2.3 2.5	146	175	0	424

[1] 250 Amps on part winding start.
[2] 340 Amps on part winding start.
[3] Based on three, 75°C insulated copper conductors in steel conduit.
[4] Based on a 3% voltage drop.

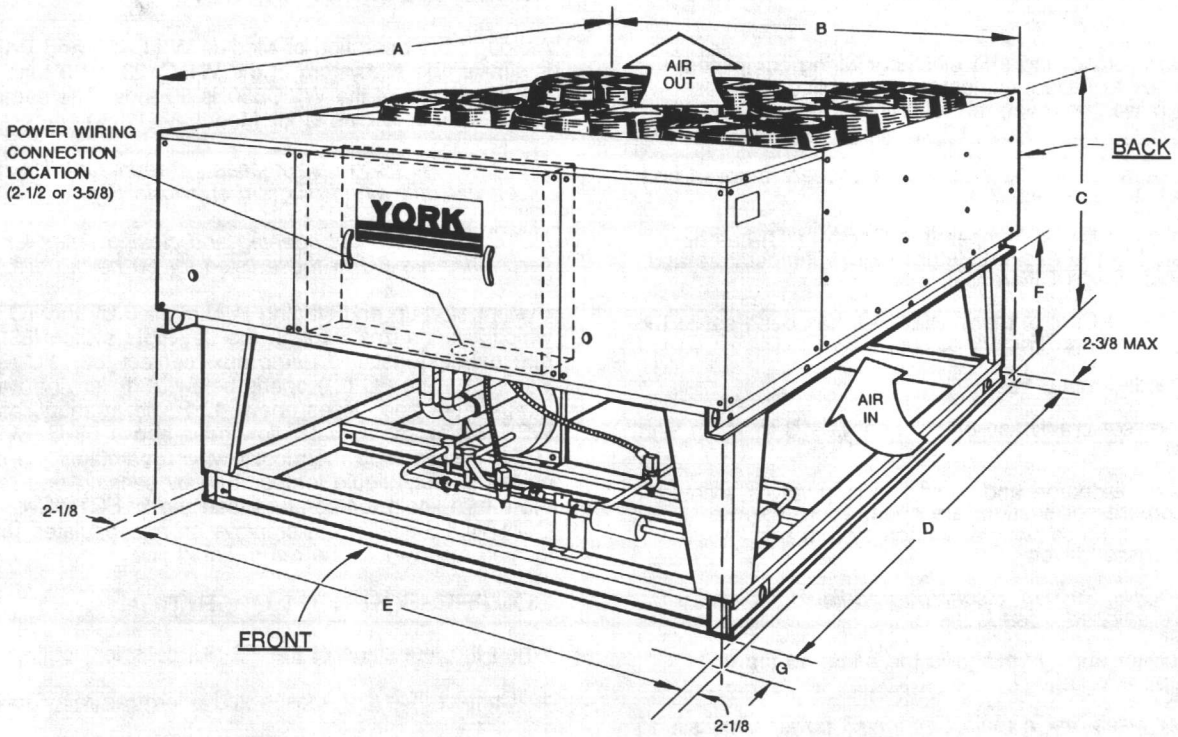
TABLE 4 –ELECTRICAL DATA (International Models)

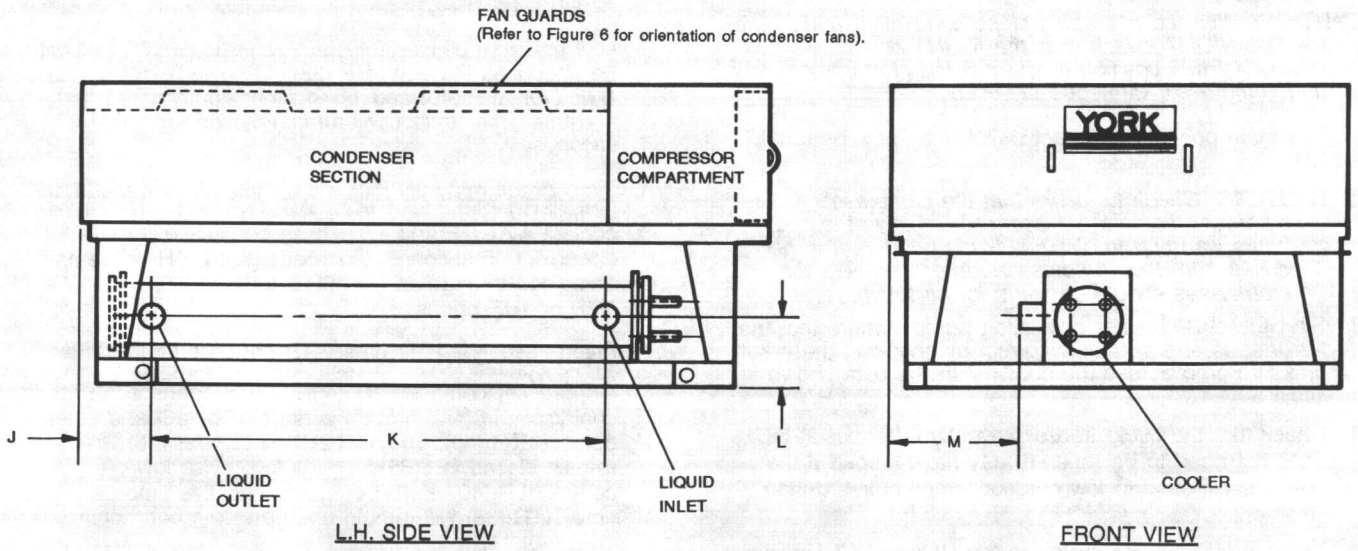
Unit Model Designation		Compressors				Condenser Fan Motors				Unit Ampacity, Amps	Max. Fuse Size, Amps	Min.[3] Wire Size (AWG)	Max.[4] Wire Lg. (Feet)
		Power Supply	Qty.	RLA	LRA	Power Supply	HP	Qty.	FLA (each)				
W1LC420A	50	380/415-3-50	2	38 each	165[1] each	380/415-1-50	3/4	4 2	2.3 2.5	105	110	2	320@380 368@415
	40	380-3-60	2	52.1 each	208 each	460-1-60	3/4	4 2	2.3 2.5	135	150	0	377
W1LC530A	50	380/415-3-50	1 1	38.0 62.7	165[1] 225[2]	380/415-1-50	3/4	5 2	2.3 2.5	135	150	0	369@380 412@415
	40	380-3-60	1 1	52.1 77.8	208 307	460-1-60	3/4	5 2	2.3 2.5	170	200	00	357

[1] 100 Amps on part winding start.
[2] 150 Amps on part winding start.
[3] Based on three, 75°C insulated copper conductors in steel conduit.
[4] Based on a 3% voltage drop.

TABLE 5 – WATER SIDE PRESSURE DROP

W1LC420			W1LC530		
GPM	PSIG	FEET	GPM	PSIG	FEET
55	2.2	4.9	70	2.1	4.9
60	2.5	5.8	75	2.4	5.6
65	2.9	6.7	80	2.7	6.4
70	3.3	7.6	85	3.1	7.2
75	3.7	8.5	90	3.5	8.1
80	4.1	9.5	95	3.9	9.0
85	4.6	10.6	100	4.3	10.0
90	5.1	11.7	105	4.7	11.0
95	5.6	12.9	110	5.2	12.1
100	6.1	14.1	115	5.7	13.2
105	6.7	15.4	120	6.2	14.4
110	7.3	16.8	125	6.7	15.6
115	7.9	18.3	130	7.3	16.9
120	8.6	19.9	135	7.9	18.2
125	9.3	21.5	140	8.5	19.6
			145	9.1	21.0
			150	9.7	22.5
			155	10.4	24.0





BASIC UNIT DIMENSIONS

MODEL	A	B	C	D	E	F	G
W1LC420	127-1/4	91-1/8	51-5/8	118-5/8	86-7/8	22-1/2	6-1/4
W1LC530	127-1/4	91-1/8	55-5/8	118-5/8	86-7/8	26	6-1/4

CLEARANCES

FRONT	36″
BACK	24″ *
LEFT SIDE	24″ *
RIGHT SIDE	24″ *
TOP	120″

* One side only.

NOTE: The area within the clearances shown above and area under the unit must be kept clear of all obstructions that would impede free air flow to the unit. In installations where winter operation is intended and snow accumulations are expected, additional unit height must be provided to insure full air flow.

COOLER DIMENSIONS & WEIGHTS

UNIT MODEL	COOLER SIZE (Dia x Lg)	WATER CONN'S.* (Inlet & Outlet)	J	K	L	M	COOLER WEIGHT (Lbs)	
							Oper.	Dry
W1LC420	10″ x 7′	4″	13	72-1/2	12-7/8	26	800	700
W1LC530	10″ x 7′	4″	13	72-1/2	12-7/8	26	800	700

* Nominal pipe size – victaulic type.

All dimensions are in inches. They are subject to change without notice. Certified dimensions will be provided upon request.

FIG. 5 – UNIT DIMENSIONS AND CLEARANCES

OPERATION

CHECKING THE SYSTEM PRIOR TO INITIAL START UP

With the system piping and electrical wiring completed, the unit is ready to have electrical power applied. Before applying power, however, the following checks should be made:

1. Compressor shipping brackets have been removed and rubber isolators installed.
2. The Return Liquid Temperature Control (TC) has been adjusted to the desired Return Liquid Temperature and Between Stage Differential.
3. The Freeze Control thermostat (FC) has been set to the proper setting. (Factory setting is 36°F)
4. Fan blades rotate freely.
5. Compressor crankcase oil level shows 1/3 to 1/2 in sight glass.
6. Suction, discharge and liquid line king valves, located in the compressor section, are open. There are two systems in these units and each system employs one set of these valves.

   CAUTION: Suction, discharge and liquid line valves are shipped closed.
7. The power supply voltage is the same as the unit nameplate voltage.
8. Proper fuses are in main disconnect power circuits.

APPLYING POWER TO THE UNIT

CAUTION: With the preceding steps completed, make sure the DAY/NIGHT switch is in the NIGHT or UNOCCUPIED position or the unit will start immediately and compressor damage may occur.

1. The main power disconnect switch may now be turned ON.

   CAUTION: Check to insure that the compressor crankcase heaters are energized. Allow at least 24 hours warm-up to allow all liquid refrigerant to be driven from the compressors. After warm-up, the crankcases should be warm to the touch.
2. Start the chilled water circulating pump. Assure that the flow rate is approximately correct by checking the water pressure drop across the cooler with the data shown in Table 5.
3. Check that the liquid freeze prevention thermostat (FC) does not need to be reset. It may have tripped if the unit was exposed to low outdoor temperatures during shipment.
4. Turn the DAY/NIGHT switch to the DAY or OCCUPIED position. If the water flow switch is closed, the unit will start after the required time delays built into the control circuit, provided the return liquid temperature is warm and the temperature control (TC) is calling for cooling.
5. Allow the unit to operate, but be ready to stop the unit should any unusual noise or other adverse condition develop.

   NOTE: Opening the DAY/NIGHT switch will only shut the unit off after completion of the pumpdown cycle. Turning OFF the main power supply will stop the unit immediately.
6. To determine if the unit is operating properly, the refrigerant subcooling and superheat should be checked.

SEQUENCE OF OPERATION

Although the operation of Models W1LC420 and W1LC530 is similar, the #2 system of the W1LC420 is 20 tons while the #2 system of the W1LC530 is 30 tons. The sequence of operation that follows is for Model W1LC530.

NOTE 1: Figures in parentheses ( ) represent line numbers on the unit wiring diagram shown in Figure 6.

NOTE 2: The contact opening and closing times for 50 hertz units are 6/5 of those listed for 60 hertz units.

System start-up and staging is controlled by the TC (81) which is energized through the day-night switch (83), optional field installed pump aux. contact (83), FC (81) and WFS (81). The FC (81) opens below 36°F leaving water temperature and closes above 42°F with manual reset. The WFS (81) closes at water flow rates above 55 GPM. The TC (81) is a solid state thermostat which maintains the desired chilled (supply) liquid temperature by sensing and regulating the return liquid temperature (see the ELECTRICAL CONTROLS section). It employs an encapsulated thermistor located in a well in the return liquid line.

COMPRESSOR NO. 1 OPERATION

When the first stage of the TC (81) calls for cooling:

1. Contact TC-1 (53) closes and energizes relay 16R (53).
2. Liquid line solenoid valve 1LLS (52) will be energized through 16R-2 (52), and liquid refrigerant will flow to the 20 ton expansion valve.
3. Low pressure bypass/anti-short-cycle timer 1TR (38) will be energized through 1HP (38), 18R-1 (38), 16R-1 (42), 1MP (40), 1LP (40) and 1TR-1 timer contact B2-B (39 and 38). This contact will remain closed for 150 seconds.
4. Time circuit relay 6R (50) will be energized through 1HP (38), 18R-1 (38), 16R-1 (42), 1MP (40), and 1TR-2 timer contact A-A1 (46 and 47). These contacts will remain closed for 15 seconds. Once energized, 6R will remain energized through its own 6R-2 contact (50) until 16R-1, 1MP or 1HP opens.

   Fifteen seconds after timer 1TR (38) is energized, its 1TR-2 contact A-A2 (46) will close to energize compressor contactor 1M (43), and condenser fan motor contactor 5M (44) through contact 6R-1 (46) and timer contact 2TR (40). The 1TR-2 contact A-A2 (46) will remain closed for 135 seconds to bypass low pressure control 1LP (40). If 1LP opens during this time period, timer 1TR (38) will remain energized through contact 1R-3 (40).

   When the compressor and condenser fan contactors are energized, relays 1R (45) and 20R (46) will also be energized. Contact 1R-3 (40) will close to keep the No. 1 system operating after the 1TR-2 timer contact A-A2 (46) opens, providing the low pressure control 1LP (40) is satisfied. Contact 1R-1 (38) will close to keep the condensing section operating after the first stage of the TC is satisified. Contact 20R (30) opens to de-energize compressor no.1 crankcase heater 1CCH (30) while the compressor runs.

When the second stage of the TC (81) calls for cooling:

1. Contacts TC-3 (55) will close to energize relay 4R (55), and condenser fan no. 2 will start up, providing the temperature of the outdoor air is above the 45°F set point of thermostat 2TH (19).

2. Contact TC-4 (56) will open tc de-energize compressor solenoid valve 2SOL (56), and the 20 ton compressor will operate at full capacity.

PART-WINDING START (SYSTEM #1)

208/230 and 380/415 volt compressors have two contactors and include part winding start. On start-up, timer 4TR (47) prevents contactor 2M (47) from being energized until 1 second after contactor 1M (43) is energized. This 1-second delay reduces the LRA of the compressor substantially. Refer to the electrical data in Table 3 or 4.

PUMPDOWN (SYSTEM #1)

When the compressor is running at part load and when the liquid cooling requirement becomes satisfied, contact TC-1 (53) will open to de-energize relay 16R (53). Contact 16R-2 (52) will open to de-energize liquid line solenoid valve 1LLS (52), and no refrigerant will flow to the 20 ton side of the cooler. Contact 16R-1 (42) will open but contact 1R-2 (40) will keep the 20 ton compressor in operation until the low side of the system is pumped out and low pressure control 1LP (40) opens to shut the No. 1 system down.

ANTI-SHORT CYCLING (SYSTEM #1)

When low pressure control 1LP (40) opens to de-energize the 20 ton compressor and the condenser fans, relay 1R (45) will also be de-energized. Timer 1TR (38) will now be energized through contact 1R-1 (38) and its own contact B1-B (38). 1TR timer will continue to run through this path for 350 seconds before the 20 ton compressor can restart.

OIL FAILURE (SYSTEM #1)

If the oil to suction pressure differential drops below 14 psig (±2), 1 OPA (41) in the oil pressure control will close and energize timer 2TR (41). If this low pressure condition exists for more than 90 seconds, 2TR contact (40) will open to shut down the compressor and condenser fans.

HIGH PRESSURE LOCKOUT (SYSTEM #1)

If the 20 ton compressor discharge pressure exceeds 395 psig, 1HP (38) will open to shut down the compressor and condenser fans. At the same time, lockout relay 18R (42) will energize and hold itself in through its own 18R-2 (44) contact. Contact 18R-1 (38) opens and prevents the unit from restarting when 1HP (38) closes. The unit can be reset by momentarily opening the unit disconnect switch provided 1HP (38) has closed. After reset, the unit will start in 350 seconds provided there is a call for cooling.

COMPRESSOR NO. 2 OPERATION

When the third stage of the TC (81) calls for cooling:

1. Contact TC-5 (72) closes and energizes relay 17R (72).

2. Liquid line solenoid valve 2LLS (71) for pumpdown will be energized through 17R-2 (71), and liquid refrigerant will flow to the 30 ton expansion valve.

3. Low pressure bypass/anti-short-cycle timer 5TR (58) will be energized through 3HP (58), 19R-1 (58), 17R-1 (62), 2MP (60), 2LP (60) and 5TR-1 timer contact B2-B (59 and 58). This contact will remain closed for 150 seconds.

4. Time circuit relay 14R (70) will be energized through 3HP(58), 19R-1 (58), 17R-1 (62), 2MP (60), and 5TR-2 timer contact A-A1 (66 and 67). These contacts will remain closed for 15 seconds. Once energized, 14R will remain energized through its own 14R-2 contact (70) until 17R-1, 2MP or 2HP opens.

   Fifteen seconds after timer 5TR (58) is energized, its 1TR-2 contact A-A2 (66) will close to energize compressor contactor 3M (63), and condenser fan motor contactor 6M (64) through contact 14R-1 (66) and timer contact 6TR (60). The 5TR-2 contact A-A2 (66) will remain closed for 135 seconds to bypass low pressure control 2LP (60). If 2LP opens during this time period, timer 5TR (58) will remain energized through contact 7R-3 (60).

   When the compressor and condenser fan contactors are energized, relays 7R (65) and 21R (66) will also be energized. Contact 7R-3 (60) will close to keep the No. 2 system operating after the 5TR-2 timer contact A-A2 (66) opens, providing the low pressure control 2LP (60) is satisfied. Contact 7R-2 (60) will close to keep the condensing section operating after the third stage of the TC is satisfied.

When the forth stage of the TC (81) calls for cooling:

1. Contacts TC-7 (55) will close to energize relays 11R (74) and 12R (75).

2. When relay 11R is energized condenser fan no. 5 will start up – providing the temperature of the outdoor air is above the 45°F set point of thermostat 4TH (20). When relay 12R closes, condenser fan no. 6 will start. Note, if the temperature of the O.D. air is above the 75 °F set point of 5TH (25), condenser fan no. 6 will already be in operation.

3. Contact TC – 8 (77) will open to de-energize compressor solenoid valves 4SOL and 5SOL and the 30 ton compressor will operate at full capacity.

PART-WINDING START (SYSTEM #2)

208/230 and 380/415 volt compressors have two contactors and include part winding start. On start-up, timer 8TR (67) prevents contactor 4M (67) from being energized until 1 second after contactor 3M (63) is energized. This 1-second delay reduces the LRA of the compressor substantially. Refer to the electrical data in Table 3 or 4.

PUMPDOWN (SYSTEM #2)

When compressor 2 is running at part load and when the third stage of the TC (81) becomes satisfied, contact TC-5 (72) will open and de-energize relay 17R (72). Contact 17R-2 (71) will open to de-energize liquid line solenoid valve 2LLS (71), and no refrigerant will flow to the 30 ton side of the cooler. Contact 17R-1 (62) will open but contact 7R-2 (60) will keep the 30 ton compressor in operation until the low side of the system is pumped out and low pressure control 2LP (60) opens to shut the unit down.

ANTI-SHORT CYCLING (SYSTEM #2)

When low pressure control 2LP (60) opens to de-energize the 30 ton compressor and the condenser fans, relay 7R (65) will also be de-energized. Timer 5TR (58) will now be energized through contact 7R-1 (58) and its own contact B1-B (58). 7TR timer will continue to run through this path for 350 seconds before the 30 ton compressor can restart.

OIL FAILURE (SYSTEM#2)

If the oil to suction pressure differential drops below 14 psig (±2), 2 OPA (61) in the oil pressure control will close and energize timer 6TR (61). If this low pressure condition exists for more than 90 seconds, 6TR contact (60) will open to shut down the compressor and condenser fans.

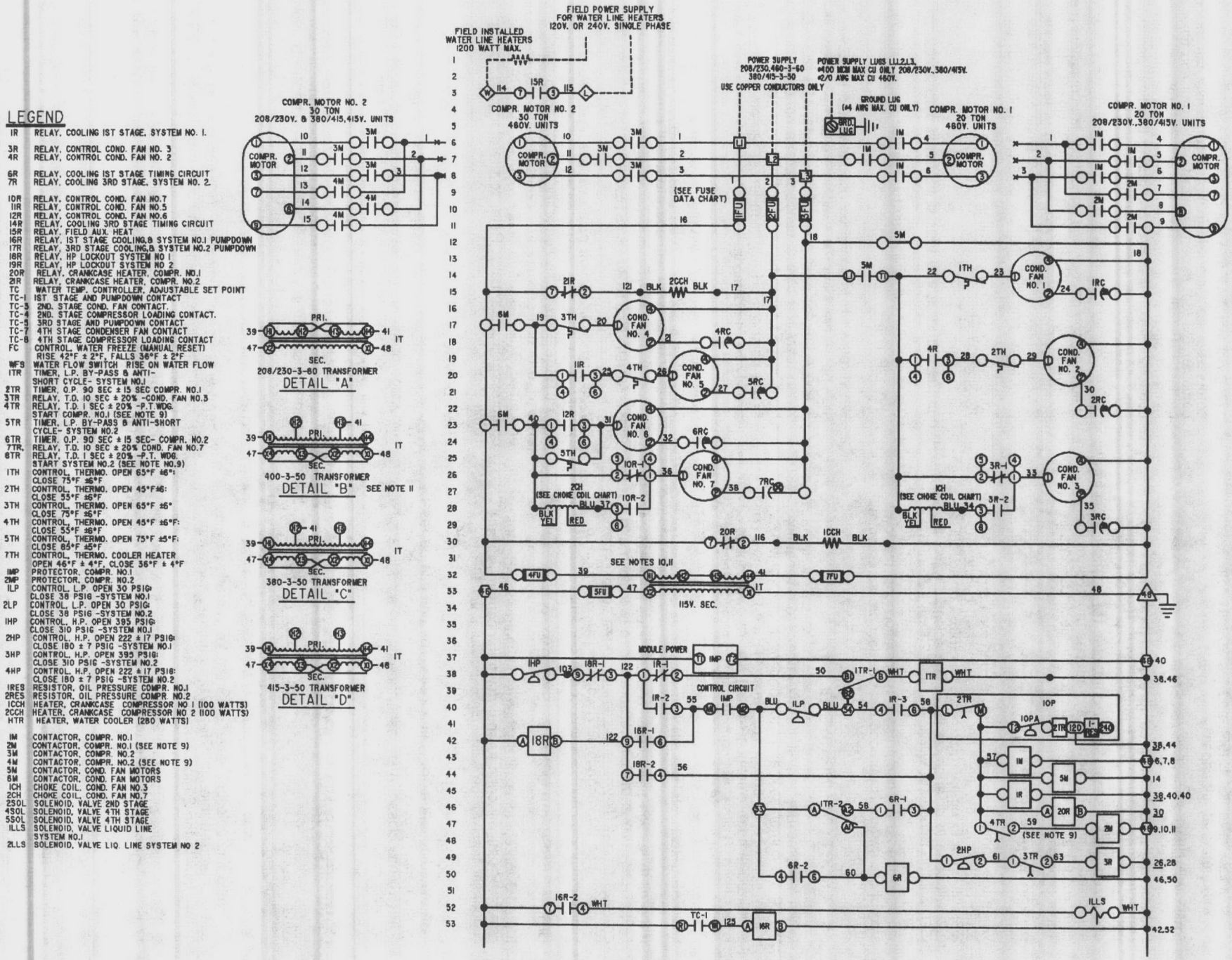


FIG. 6 — UNIT WIRING DIAGRAM (W1LC530 ELEMENTARY)

10P CONTROL, OIL PRESSURE -COMPR. NO.1
20P CONTROL, OIL PRESSURE -COMPR. NO.2
10PA SWITCH, O.P. CLOSE 8-10 PSI; OPEN 12-16 PSI DIFFERENTIAL
20PA SWITCH, O.P. CLOSE 8-10 PSI; OPEN 12-16 PSI DIFFERENTIAL
1-3FU FUSE, DUAL ELEMENT (SEE CHART)
4,7FU FUSE, TRANSFORMER PRI (SEE CHART)

5FU FUSE, CONTROL CIRCUIT (SEE CHART)
1-7RC CAPACITOR, RUN FAN MOTORS
1T TRANSFORMER, CONTROL CIRCUIT 500VA

□ 1TB TERMINAL BLOCK POWER SUPPLY
◇ 2TB TERMINAL BLOCK WATER LINE HEATERS

○ 4TB & 5TB TERMINAL BLOCK CONTROL CIRCUIT 120V
△ 3TB TERMINAL BLOCK, 120V., FIELD WIRING
——— FACTORY WIRING
- - - - - - - - - - FIELD WIRING
● DOT INDICATES TERMINAL NEAREST GROUND

CHOKE COIL CHART (1CH & 2CH)			
LEAD COLOR	208/230-60HZ INPUT VOLTAGE	460-60HZ INPUT VOLTAGE	380/415-50HZ INPUT VOLTAGE
YEL	187 - 210	414 - 444	360 - 390
BLUE	210 - 240	444 - 474	390 - 420
RED	240 - 255	474 - 506	420 - 440

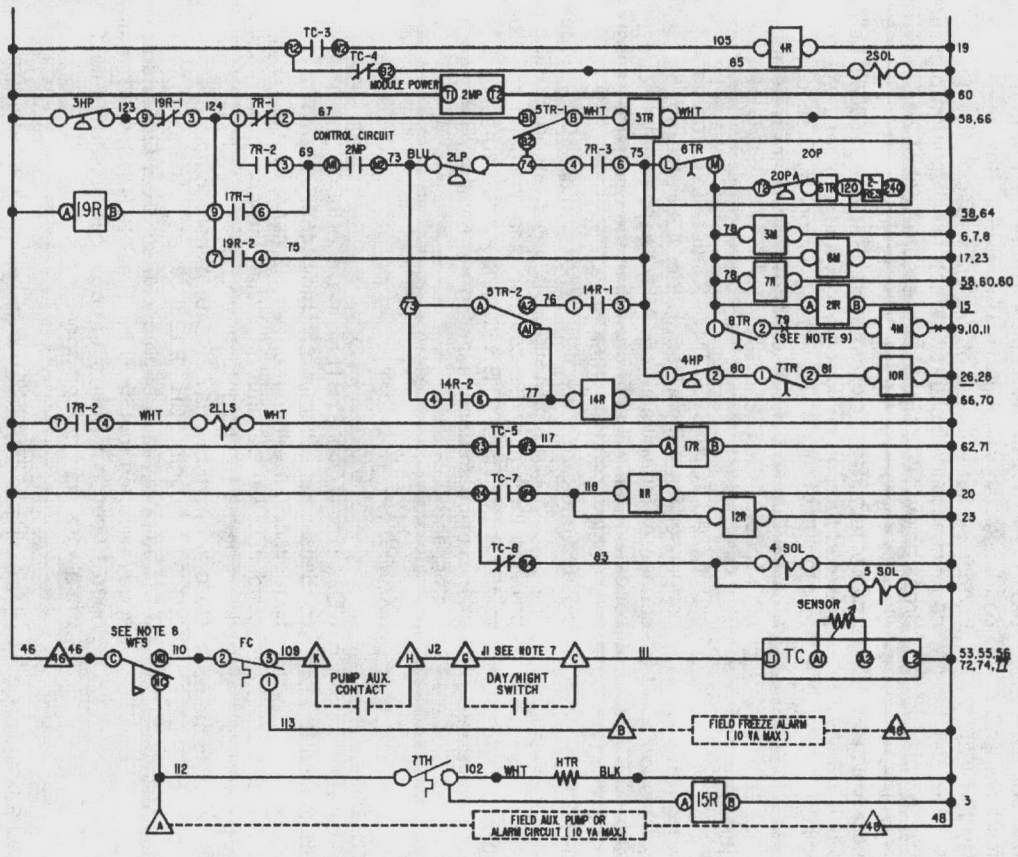
FUSE SIZE (AMPS)			
	60HZ		50HZ
FUSE	208/230	460	380/415
1-3FU	30	20	20
4,7FU	3	3	3
5FU	5	5	5

ITR & 5TR TIMING
CONTACTS ON DIAGRAM ARE SHOWN WITH UNIT READY TO START. 50HZ. TIMES ARE 6/5 OF TIMES SHOWN

CONTACT	TERMINAL	TIMER SWITCH (TIME-SEC)	
1TR-1	B B1	OPEN	
5TR-1	B B2		OPEN
1TR-2	A A1		OPEN
5TR-2	A A2	OPEN	OPEN

0 15 150 500

NOTES:
1. ALL FIELD WIRING PER
   A. NATIONAL ELEC. CODE (NEC) AND/OR
   B. LOCAL OR CITY CODES.
2. DRAFTING PRACTICES & SYMBOLS PER ARI. STANDARDS.
3. ALL MOTORS INHERENTLY PROTECTED.
4. IF ANY ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REMOVED, IT MUST BE REPLACED WITH TYPE AWM 90°C. WIRE OR ITS EQUIVALENT.
5. THREE PHASE MOTORS IN THIS UNIT ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
6. SEE UNIT NAME PLATE FOR MAXIMUM FIELD UNIT POWER SUPPLY FUSE SIZE.
7. WHEN DAY/NIGHT SWITCH IS USED REMOVE JUMPER J1
8. SEE INSTALLATION INSTRUCTIONS FOR ADJUSTMENT OF WATER FLOW SWITCH.
9. TIMERS 4TR & 8TR AND CONTACTORS 2M & 4M USED WITH 208/230V-60 HZ AND 380/415V-50HZ UNITS ONLY.
10. 1T TRANSFORMER (500VA)
    SHOWN WIRED FOR 460-3-60
    FOR 208/230-3-60 SEE DETAIL "A"
    FOR 380/415-3-50
    SEE DETAIL "B" AND NOTE 11.
11. IF LOCAL VOLTAGE IS 380 VOLTS
    REWIRE DETAIL "B" TO DETAIL "C"
    IF LOCAL VOLTAGE IS 415 VOLTS
    REWIRE DETAIL "B" TO DETAIL "D".



HIGH PRESSURE LOCKOUT (SYSTEM #2)

If the 30 ton compressor discharge pressure exceeds 395 psig, 3HP (58) will open to shut down the compressor and condenser fans. At the same time, lockout relay 19R (62) will energize and hold itself in through its own 19R-2 (64) contact. Contact 19R-1 (58) opens and prevents the unit from restarting when 3HP (58) closes. The unit can be reset by momentarily opening the unit disconnect switch provided 3HP (58) has closed. After reset, the unit will start in 350 seconds provided there is a call for cooling.

WATER COOLER FREEZE PREVENTION

Off-cycle cooler freeze protection is provided when liquid is not flowing to the cooler and the outdoor ambient is low. Under these conditions, water flow switch contact WFS (81) is relaxed, and the cooler heater HTR (86) and 15R (87) relay are energized through the 7TH (86) thermostat which closes below 36°F. The cooler heater is a pad type heater fixed to the cooler under the insulation. The 15R contact (3) closes to energize field installed water line heaters. The power for these heaters comes from a separate disconnect switch. See Figure 4.

COMPRESSOR MOTOR PROTECTION SYSTEM

The solid state motor protection system consists of a solid state overload protector module and three sensors embedded in the compressor motor windings. The sensors are connected to the solid state overload protector module 1MP and 2MP. Refer to the wiring label on the inside of the compressor terminal box cover. This system provides 2 minute off-time delay before the compressor can restart.

CONDENSER FAN MOTOR CONTROL

Condenser fans motors cycle with the temperature of the outdoor air to maintain sufficient head pressure for stable operation over a wide range of conditions. One condenser fan motor per compressor can operate at a reduced speed without overheating. Motor speed is reduced from 1075 to 450 RPM when the discharge pressure of a system drops below 180 psig. The motors will return to full speed when the pressure rises above 222 psig. This speed reduction is accomplished by using a choke coil to reduce the voltage to the motor. 10 second time delay relays are included in the control circuit so these motors will always start at high speed. Refer to Figure 7.

EXAMPLE – W1LC420

NO. 1 (20 – TON) SYSTEM – Under 65°F, the no. 1 condenser fan will shut off. Under 45°F, the no. 2 condenser fan will shut off. At 1/2 capacity, the no. 2 condenser fan will shut off. When the discharge pressure drops below 180 psig, high pressure control 2HP will close to energize relay 3R. When contact 3R – 1 opens and contact 3R – 2 closes, condenser fan no. 3 will be powered through choke coil 1CH and its speed will drop to 450 RPM. Timer 3TR will remain open 10 seconds after start-up so condenser fan no. 3 will always start at high speed.

NO. 2 (20 – TON) SYSTEM – Under 65°F, the no. 4 condenser fan will shut off. Under 45°F, the no. 5 condenser fan will shut off. At 1/2 capacity, the no. 5 condenser fan will shut off. When the discharge pressure drops below 180 psig, high pressure control 4HP will close to energize relay 10R. When contact 10R – 1 opens and contact 10R – 2 closes, condenser fan no. 6 will be powered through choke coil 2CH and its speed will drop to 450 RPM. Timer 7TR will remain open 10 seconds after start-up so condenser fan no. 6 will always start at high speed.

EXAMPLE – W1LC530

NO. 1 (20 – TON) SYSTEM – Under 65°F, the no. 1 condenser fan will shut off. Under 45°F, the no. 2 condenser fan will shut off. At 1/2 capacity, the no. 2 condenser fan will shut off. When the discharge pressure drops below 180 psig, high pressure control 2HP (49) will close to energize relay 3R (49). When contact 3R – 1 (26) opens and contact 3R – 2 (28) closes, condenser fan no. 3 will be powered through choke coil 1CH (28) and its speed will drop to 450 RPM. Timer 3TR (49) will remain open 10 seconds after start-up so condenser fan no. 3 will always start at high speed.

NO. 2 (30 – TON) SYSTEM – Under 65°F, the no. 4 condenser fan will shut off. Under 45°F, the no. 5 condenser fan will shut off. At 1/3 capacity, the no. 5 condenser fan will shut off and the no. 6 condenser fan will shut off if the ambient temperature is below 75°F. When the discharge pressure drops below 180 psig, high pressure control 4HP (69) will close to energize relay 10R (69). When contact 10R – 1 (26) opens and contact 10R – 2 (28) closes, condenser fan no. 7 will be powered through choke coil 2CH (28) and its speed will drop to 450 RPM. Timer 7TR (69) will remain open 10 seconds after start-up so condenser fan no. 7 will always start at high speed.

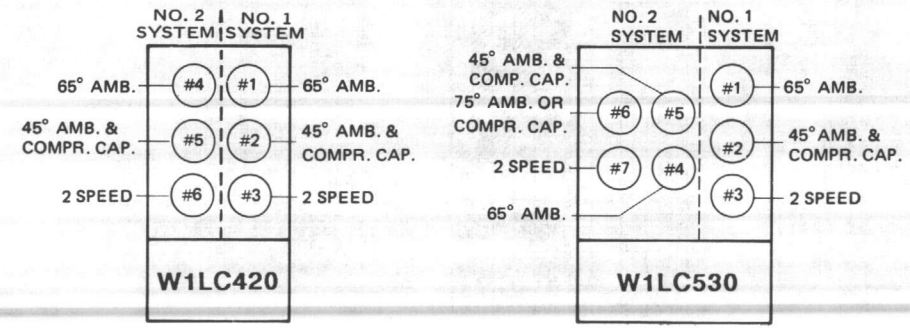


FIG. 7 – CONDENSER FANS ORIENTATION

ELECTRIC CONTROLS

RETURN LIQUID TEMPERATURE CONTROL (TC)

The YORK model TC-6A return liquid temperature control is a 4 stage solid state thermostat that maintains the desired chilled liquid temperature by sensing and regulating the liquid temperature returning to the cooler. The control is mounted in the compressor compartment, to the left of the main control box in front of the system 2 compressor. The return water temperature is sensed by a thermistor (SENSOR) located in the return liquid line. Its resistance varies with changes in return liquid temperature. Changes in the thermistor resistance are interpreted by the controller and are amplified to energize output relay contacts. The circuitry is such that the controller shuts down the compressor in the event the thermistor is disconnected or accidentally cut. The return water temperature is adjustable between 4°F and 70°F. This adjustable range is much greater than applicable to this chiller. See Table 1 for limitations in leaving liquid temperatures. The Between Stage Differential is adjustable between 1°F and 3.75°F.

On both the W1LC420 and 530, the control is factory adjusted to 54°F Return Liquid Temperature with the Between Stage Differential set at 2.5°F which results in a 44°F (10° Range) leaving liquid temperature at nominal conditions. Check that these settings are still correct or change the setting as required but do not exceed the application limitations in Table 1.

If the factory temperature control settings which provide 44°F leaving liquid temperature with a 10°F liquid temperature range are not desired for the W1LC420 or 530 installation, the required leaving liquid temperature and liquid temperature range must be specified before the new temperature control settings can be determined. To determine the Between Stage Differential setpoint on the temperature control for the W1LC420/530, divide the specified range by 4. The Return Liquid Temperature setpoint on the control is calculated by adding the specified liquid temperature range to the specified leaving liquid temperature.

EXAMPLE:

(W1LC420/530) Specified 45°F leaving liquid temperature with an 8°F liquid temperature range.

Calculate Between Stage Differential Setpoint.
8°F – 4 = 2°F

Calculate Return Liquid Temperature Setpoint.
45°F + 8°F = 53°F

As an example of how the TC-6A control works in application, consider the W1LC420 chiller with the control set to maintain a 54°F return water temperature with a 2.5°F Between Stage Differential. The flow rate is set to 2.4 GPM/measured TON (10°F range), and the working fluid is water. The W1LC420 is a 4 stage machine with stages at 25%, 50%, 75%, and 100% capacity. All temperatures considered are for a TC-6A control and thermistor working at design conditions. Allowable tolerances could change the actuation temperatures by ±1.25°F.

With the RETURN water temperature to the cooler rising due to increasing cooling load for the application, the No. 1 compressor will start at part load when the RETURN water temperature reaches 47.75°F. The LEAVING water temperature will quickly drop to 45.25°F. If the cooling load continues to increase, the No. 1 compressor will be fully loaded by the controller when the RETURN water temperature reaches 50.25°F. With increasing load, the controller will start the No. 2 compressor at 52.75 °F RETURN water temperature and fully load it at 55.25 °F. Under increasing load, the minimum LEAVING water temperature will be 45.25 °F and the maximum 47.75 °F. As the demand for cooling load decreases, the controller will unload compressor stages in reverse order to the way they were loaded at 52.75, 50.25, 47.75 and 45.25°F RETURN water temperature. During decreasing load, the minimum LEAVING water temperature will be 42.75°F and the maximum 45.25°F.

FREEZE CONTROL PREVENTION THERMOSTAT (FC)

The leaving liquid freeze prevention thermostat is designed to prevent the liquid temperature in the cooler from dropping below the freezing point of the fluid while the unit is running.

CAUTION: Freezing fluid in the cooler can cause damage which can lead to total replacement of the cooler.

If the temperature of the liquid leaving the cooler drops below its set point, the control shuts the compressor down with a pumpdown cycle. The control must be manually reset when the bulb temperature rises to 6°F above the setpoint cutout temperature. The body of the control is in the compressor compartment attached to the left hand side of the control box. The sensing bulb is the capillary type located in a well in the leaving water connection at the far end of the cooler. This is a cross ambient sensing device that is not effected by changes in ambient temperature.

The freeze control is factory set to shut down the unit at 36°F (±2) and is manually reset when the bulb temperature reaches 42°F. This setting is for a working liquid of pure water and many light brine applications. In heavy brine applications, the control may be field adjusted using the adjustment screw at the top of the control.

CAUTION: It is recommended that the adjusted cutout temperature be at least 4°F above the freezing point of the fluid. In no brine application should the setpoint be adjusted below 30°F.

If during delivery to the job site or during non-operational periods when the ambient temperature of the freeze control bulb drops below 36°F, the freeze control may have tripped and needs to be manually reset before the unit will start.

MAINTENANCE

GENERAL

It is good practice to include the W1LC chiller in the routine schedule of daily or weekly operational checks. This should include but not be limited to checking compressor crankcase oil level, checking refrigerant liquid line sight glass for proper charge and signs of moisture, and checking for obstructions on the condenser coil such as leaves or paper that would reduce normal air flow.

WARNING: Prior to performing any service or maintenance, disconnect all electrical power to the unit.

CLEANING CONDENSER SURFACE

Dirt should not be allowed to accumulate on the condenser coils. The underside of the coils will collect dirt and other foreign matter first. Cleaning should be as often as necessary to keep the condenser coils clean. Use a brush, vacuum cleaner attachment, or other suitable means. Take care so as not to damage or bend the condenser fins.

LUBRICATING FAN MOTORS

The condenser fan motors are equipped with factory lubricated and sealed ball bearings, requiring no maintenance.

COMPRESSOR REPLACEMENT

Obtain replacement compressors or parts from your local Copeland Wholesaler. See Instruction Form 55.72-RD2.2 for replacement compressor reference data.

SECURE OWNER'S APPROVAL

WHEN THE SYSTEM IS FUNCTIONING PROPERLY, EXPLAIN THE OPERATION OF THE UNIT TO THE OWNER OR DESIGNATED REPRESENTATIVE. EXPLAIN THE FUNCTION OF THE LOCKOUT PROTECTION FEATURES AND HOW TO RESET THEM. SHOW HIM THE LOCATION OF ALL DISCONNECT SWITCHES. INSTRUCT HIM HOW TO STOP AND START THE UNIT.

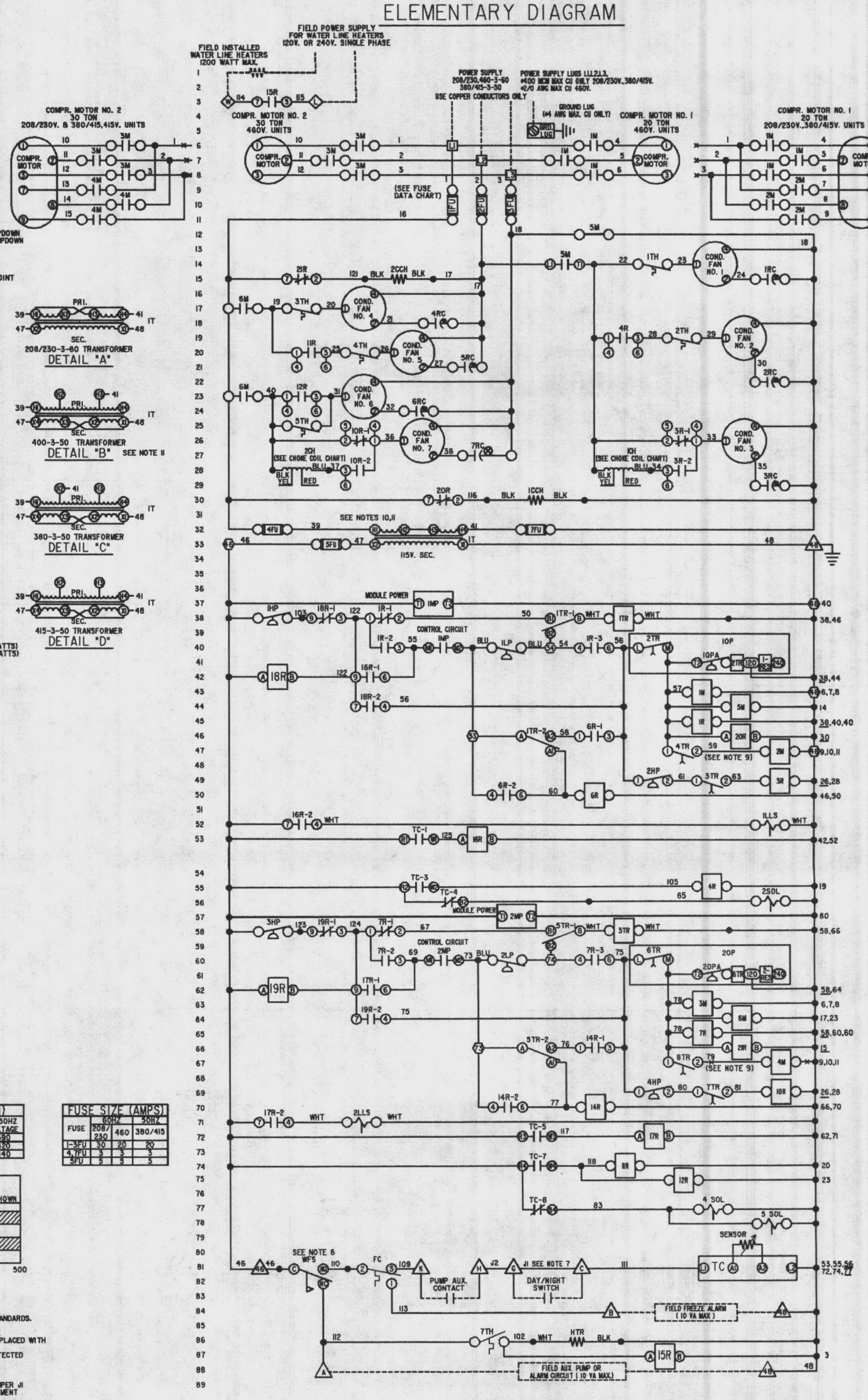
BE SURE THE WARRANTY REGISTRATION CARD HAS BEEN FILLED OUT AND RETURNED TO THE FACTORY.

 CRG 15M 588 .64 Codes: SBY, ERR 570.05-N2Y

Central Environmental Systems **Post Office Box 1592** **York Pennsylvania 17405-1592**

YORK®
Heating and Air Conditioning

ELEMENTARY DIAGRAM



LEGEND

1R	RELAY, COOLING 1ST STAGE, SYSTEM NO. 1.
3R	RELAY, CONTROL COND. FAN NO. 3
4R	RELAY, CONTROL COND. FAN NO. 2
6R	RELAY, COOLING 1ST STAGE TIMING CIRCUIT
7R	RELAY, COOLING 3RD STAGE, SYSTEM NO. 2.
10R	RELAY, CONTROL COND. FAN NO.7
11R	RELAY, CONTROL COND. FAN NO.5
12R	RELAY, CONTROL COND. FAN NO.6
14R	RELAY, COOLING 3RD STAGE TIMING CIRCUIT
15R	RELAY, FIELD AUX. HEAT
16R	RELAY, 1ST STAGE COOLING,& SYSTEM NO.1 PUMPDOWN
17R	RELAY, 3RD STAGE COOLING,& SYSTEM NO.2 PUMPDOWN
18R	RELAY, HP LOCKOUT SYSTEM NO 1
19R	RELAY, HP LOCKOUT SYSTEM NO 2
20R	RELAY, CRANKCASE HEATER, COMPR. NO.1
21R	RELAY, CRANKCASE HEATER, COMPR. NO.2
TC	WATER TEMP. CONTROLLER, ADJUSTABLE SET POINT
TC-1	1ST. STAGE AND PUMPDOWN CONTACT
TC-3	2ND. STAGE COND. FAN CONTACT.
TC-4	2ND. STAGE COMPRESSOR LOADING CONTACT.
TC-5	3RD STAGE AND PUMPDOWN CONTACT
TC-7	4TH STAGE CONDENSER FAN CONTACT
TC-8	4TH STAGE COMPRESSOR LOADING CONTACT
FC	CONTROL, WATER FREEZE (MANUAL RESET) RISE 42°F ± 2°F, FALLS 36°F ± 2°F
WFS	WATER FLOW SWITCH RISE ON WATER FLOW
1TR	TIMER, L.P. BY-PASS & ANTI-SHORT CYCLE- SYSTEM NO.1
2TR	TIMER, O.P. 90 SEC ± 15 SEC COMPR. NO.1
3TR	RELAY, T.D. 10 SEC ± 20% -COND. FAN NO.3
4TR	RELAY, T.D. 1 SEC ± 20% -P.T.WDG. START COMPR. NO.1 (SEE NOTE 9)
5TR	TIMER, L.P. BY-PASS & ANTI-SHORT CYCLE- SYSTEM NO.2
6TR	TIMER, O.P. 90 SEC ± 15 SEC- COMPR. NO.2
7TR,	RELAY, T.D. 10 SEC ± 20% COND. FAN NO.7
8TR	RELAY, T.D. 1 SEC ± 20% -P.T. WDG. START SYSTEM NO.2 (SEE NOTE NO.9)
1TH	CONTROL, THERMO. OPEN 65°F ±6°: CLOSE 75°F ±6°F
2TH	CONTROL, THERMO. OPEN 45°F±6: CLOSE 55°F ±6°F
3TH	CONTROL, THERMO. OPEN 65°F ±6° CLOSE 75°F ±6°F
4TH	CONTROL, THERMO. OPEN 45°F ±6°F: CLOSE 55°F ±6°F
5TH	CONTROL, THERMO. OPEN 75°F ±5°F: CLOSE 85°F ±5°F
7TH	CONTROL, THERMO. COOLER HEATER OPEN 46°F ± 4°F, CLOSE 36°F ± 4°F
1MP	PROTECTOR, COMPR. NO.1
2MP	PROTECTOR, COMPR. NO.2
1LP	CONTROL, L.P. OPEN 30 PSIG: CLOSE 38 PSIG -SYSTEM NO.1
2LP	CONTROL, L.P. OPEN 30 PSIG: CLOSE 38 PSIG -SYSTEM NO.2
1HP	CONTROL, H.P. OPEN 395 PSIG: CLOSE 310 PSIG -SYSTEM NO.1
2HP	CONTROL, H.P. OPEN 222 ± 17 PSIG: CLOSE 180 ± 7 PSIG -SYSTEM NO.1
3HP	CONTROL, H.P. OPEN 395 PSIG: CLOSE 310 PSIG -SYSTEM NO.2
4HP	CONTROL, H.P. OPEN 222 ± 17 PSIG: CLOSE 180 ± 7 PSIG -SYSTEM NO.2
1RES	RESISTOR, OIL PRESSURE COMPR. NO.1
2RES	RESISTOR, OIL PRESSURE COMPR. NO.2
1CCH	HEATER, CRANKCASE COMPRESSOR NO 1 (100 WATTS)
2CCH	HEATER, CRANKCASE COMPRESSOR NO 2 (100 WATTS)
HTR	HEATER, WATER COOLER (280 WATTS)
1M	CONTACTOR, COMPR. NO.1
2M	CONTACTOR, COMPR. NO.1 (SEE NOTE 9)
3M	CONTACTOR, COMPR. NO.2
4M	CONTACTOR, COMPR. NO.2 (SEE NOTE 9)
5M	CONTACTOR, COND. FAN MOTORS
6M	CONTACTOR, COND. FAN MOTORS
1CH	CHOKE COIL, COND. FAN NO.3
2CH	CHOKE COIL, COND. FAN NO.7
2SOL	SOLENOID, VALVE 2ND STAGE
4SOL	SOLENOID, VALVE 4TH STAGE
5SOL	SOLENOID, VALVE 4TH STAGE
1LLS	SOLENOID, VALVE LIQUID LINE SYSTEM NO.1
2LLS	SOLENOID, VALVE LIQ. LINE SYSTEM NO 2

DETAIL "A" — 208/230-3-60 TRANSFORMER

DETAIL "B" — 400-3-50 TRANSFORMER — SEE NOTE 11

DETAIL "C" — 380-3-50 TRANSFORMER

DETAIL "D" — 415-3-50 TRANSFORMER

1OP	CONTROL, OIL PRESSURE -COMPR. NO.1
2OP	CONTROL, OIL PRESSURE -COMPR. NO.2
1OPA	SWITCH, O.P. CLOSE 8-10 PSI: OPEN 12-16 PSI DIFFERENTIAL
2OPA	SWITCH, O.P. CLOSE 8-10 PSI: OPEN 12-16 PSI DIFFERENTIAL
1-3FU	FUSE, DUAL ELEMENT (SEE CHART)
4,7FU	FUSE, TRANSFORMER PRI (SEE CHART)
5FU	FUSE, CONTROL CIRCUIT (SEE CHART)
1-7RC	CAPACITOR, RUN FAN MOTORS
1T	TRANSFORMER, CONTROL CIRCUIT 500VA

□ 1TB TERMINAL BLOCK POWER SUPPLY
◇ 2TB TERMINAL BLOCK WATER LINE HEATERS

○ 4TB & 5TB TERMINAL BLOCK CONTROL CIRCUIT 120V
△ 3TB TERMINAL BLOCK, 120V., FIELD WIRING

——— FACTORY WIRING
- - - - - - FIELD WIRING

● DOT INDICATES TERMINAL NEAREST GROUND

CHOKE COIL CHART (1CH & 2CH)

LEAD COLOR	208/230-60HZ INPUT VOLTAGE	460-60HZ INPUT VOLTAGE	380/415-50HZ INPUT VOLTAGE
YEL	187 - 210	414 - 444	360 - 390
BLUE	210 - 240	444 - 474	390 - 420
RED	240 - 253	474 - 506	420 - 440

FUSE SIZE (AMPS)

FUSE	60HZ 208/230	60HZ 460	50HZ 380/415
1-3FU	30	20	20
4,7FU	3	3	3
5FU	5	5	5

1TR & 5TR TIMING

CONTACTS ON DIAGRAM ARE SHOWN WITH UNIT READY TO START. 50HZ. TIMES ARE 6/5 OF TIMES SHOWN

CONTACT	TERMINAL	TIMER SWITCH (TIME-SEC)	
1TR-1	B B1	OPEN	
5TR-1	B B2		OPEN
1TR-2	A A1	OPEN	
5TR-2	A A2	OPEN	OPEN

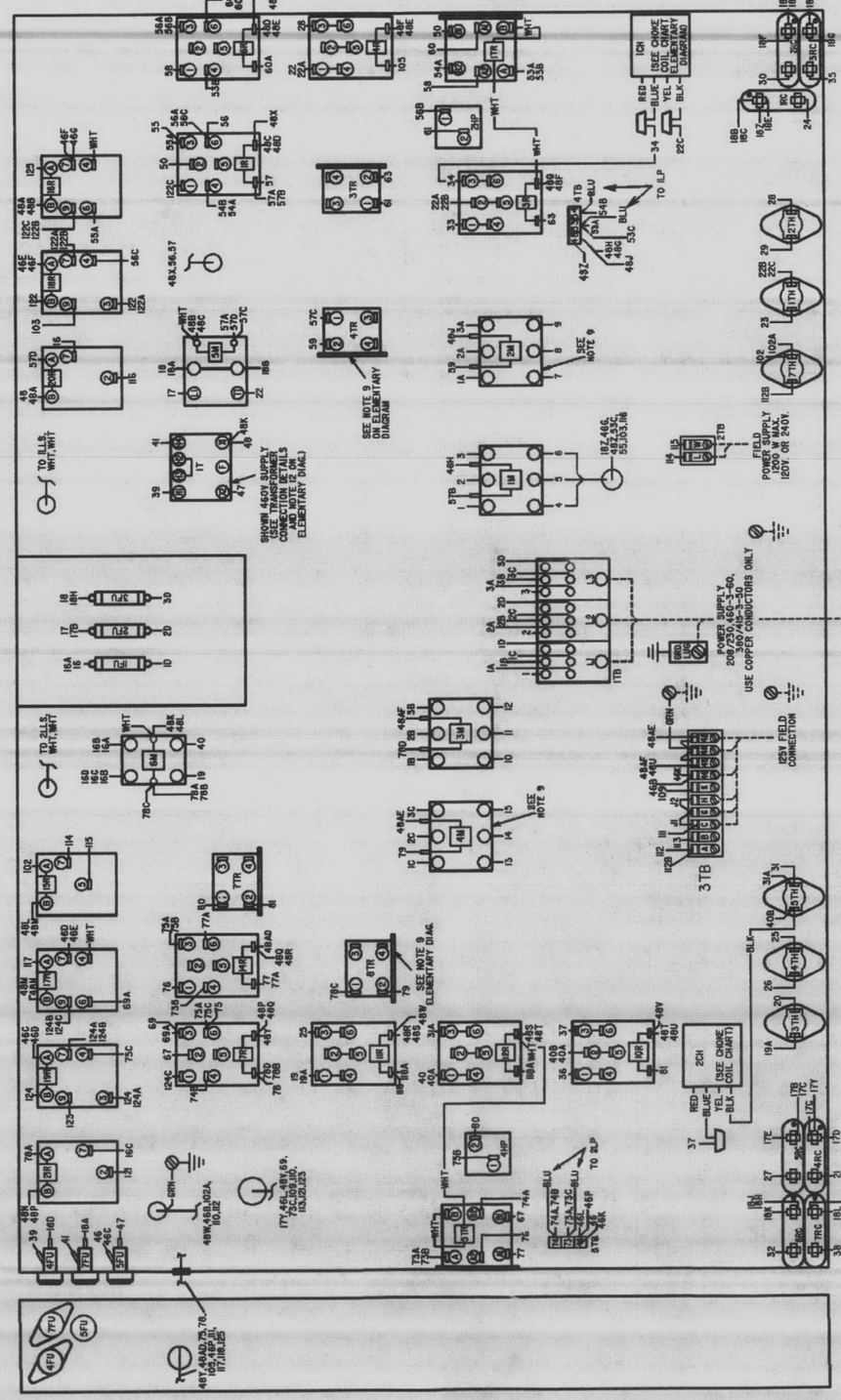
0 15 150 500

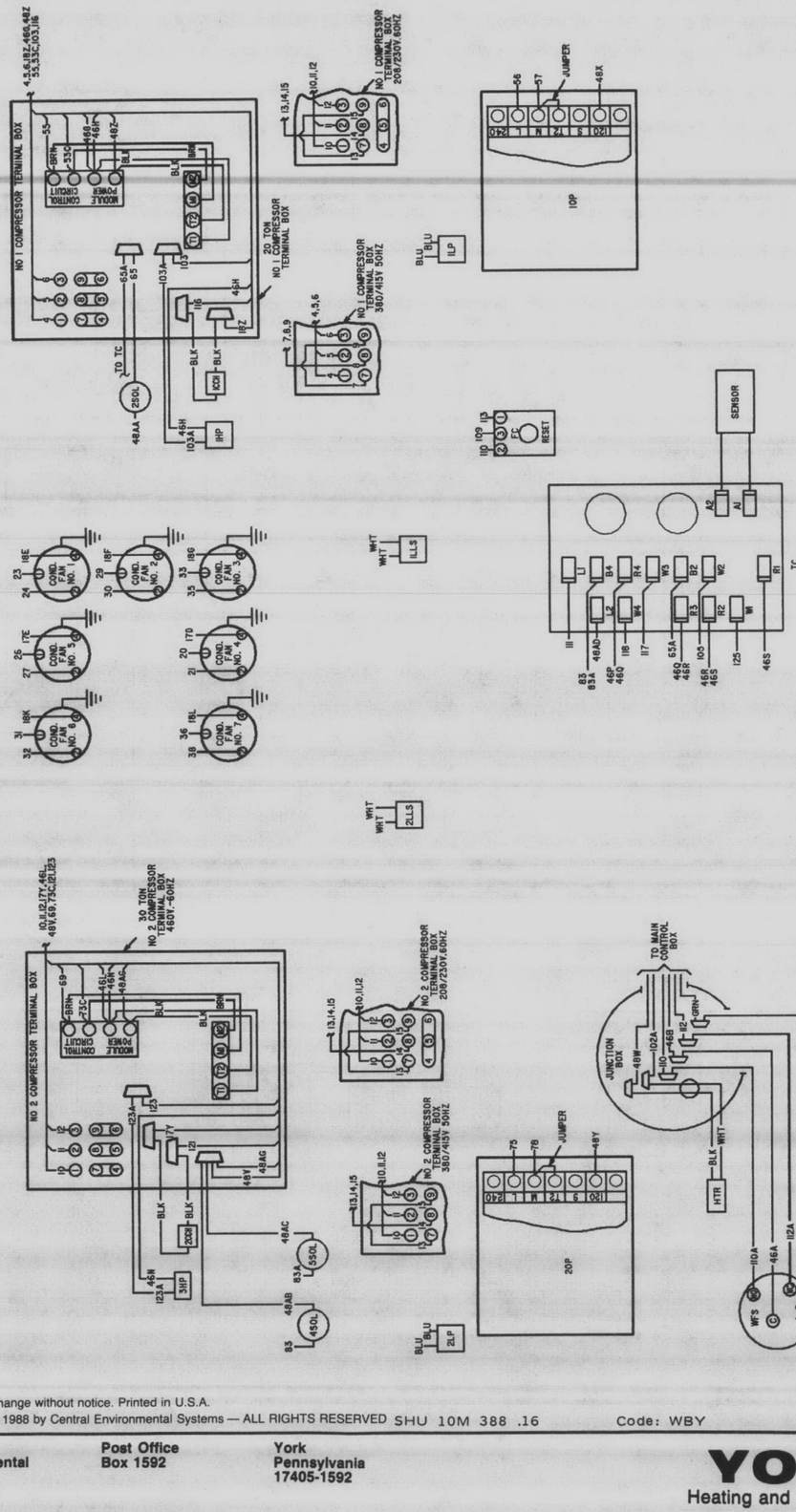
NOTES:
1. ALL FIELD WIRING PER
   A. NATIONAL ELEC. CODE (NEC) AND/OR
   B. LOCAL OR CITY CODES.
2. DRAFTING PRACTICES & SYMBOLS PER ARI. STANDARDS.
3. ALL MOTORS INHERENTLY PROTECTED.
4. IF ANY ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REMOVED, IT MUST BE REPLACED WITH TYPE AWM 90°C. WIRE OR ITS EQUIVALENT.
5. THREE PHASE MOTORS IN THIS UNIT ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
6. SEE UNIT NAME PLATE FOR MAXIMUM FIELD UNIT POWER SUPPLY FUSE SIZE.
7. WHEN DAY/NIGHT SWITCH IS USED REMOVE JUMPER J1
8. SEE INSTALLATION INSTRUCTIONS FOR ADJUSTMENT OF WATER FLOW SWITCH.
9. TIMERS 4TR & 8TR AND CONTACTORS 2M & 4M USED WITH 208/230V-60 HZ AND 380/415V-50HZ UNITS ONLY.
10. IT TRANSFORMER (500VA)
    SHOWN WIRED FOR 460-3-60
    FOR 208/230-3-60 SEE DETAIL "A"
    FOR 380/415-3-50
    SEE DETAIL "B" AND NOTE 11.
11. IF LOCAL VOLTAGE IS 380 VOLTS
    REWIRE DETAIL "B" TO DETAIL "C"
    IF LOCAL VOLTAGE IS 415 VOLTS
    REWIRE DETAIL "B" TO DETAIL "D".

W1LC 530
LIQUID CHILLER
208/230, 460-3-60 & 380/415-3-50

035-07413
REV. B (1287)

CONNECTION DIAGRAM





SHU 10M 388 .16 Code: WBY 035-07413

Central Environmental Systems
Post Office Box 1592
York Pennsylvania 17405-1592

YORK®
Heating and Air Conditioning

GENERAL INSTALLATION

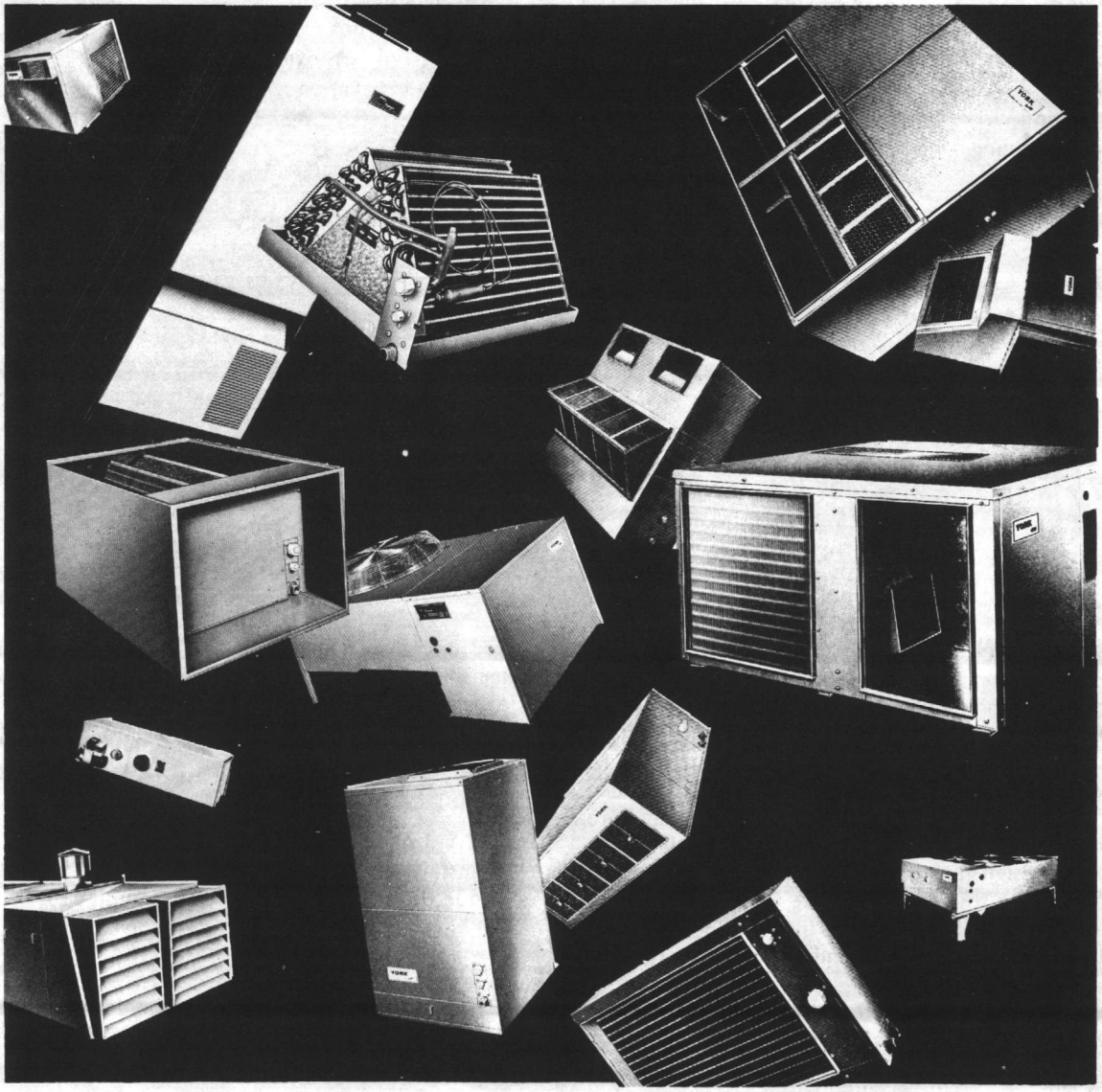


TABLE OF CONTENTS

INTRODUCTION

The purpose of this publication is to give the installer a quick reference of general information he must be aware of when installing YORK Packaged Products. Information for both Residential and Commercial equipment is included. The instruction begins with dealer's responsibilities and proceeds through installation procedures, up to the start-up of the unit. It is designed to help the inexperienced installer as well as to act as a source of reference for the experienced installer. Cross references to other instructions containing basic installation skills are also found in this instruction.

The specific instructions packed with the unit are designed to give the installer a step-by-step procedure of what to do next, along with all information peculiar to the unit. This type of specific instructions will relieve the experienced installer of the burden of reading through general information which has become common knowledge to him.

DEALER'S RESPONSIBILITIES

APPLICATION – The manufacturer supplying the packaged unit must depend on the dealer to apply and install the unit so that it will provide a satisfactory air conditioning system. The total system must satisfy the customers' needs and operate within the manufacturers published application limitations.

INSTALLATION – Dealer should be sure that his installers are installing the units in accordance with procedures outlined in this publication as well as the unit's specific installation instruction.

SERVICE – If a problem arises, the dealer should see to it that the customer's difficulties are resolved by a qualified repairman.

The repairing agency should be authorized by YORK for hermetic system repair and must follow YORK recommended procedures. "General Service Information for the Repairman", in the 55 section, includes typical testing and servicing for various problems which could arise.

INSPECTION

Immediately upon receiving the unit it should be inspected for possible external damage incurred during transit. If damage is evident it should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing. See Instruction 50.15-NM for additional information.

Protective crating or packaging and skids should not be removed until the unit is at the point of installation. When removing packaging or crating, be careful not to scratch and dent the unit. After removal of packaging or crating, all access panels should be removed to inspect the interior compartments for damage.

LIMITATIONS

Air Conditioning Units must be installed in accordance with:

1. Regulations of the National Fire Protection Association, local utility or other authorities having jurisdiction.
2. Standard for the Installation of Air Conditioning and Ventilating Systems non-residential (National Fire Protection Association – Publication No. 90A).
3. National Warm Air Heating (NWAH) and Air Conditioning Association (ACA) manuals, whichever are applicable.
4. Application, Installation and Servicing of Unitary Systems (ARI Standard 260).
5. Application of Sound Rated Outdoor Unitary Equipment (YORK Publication 1505.30-AD1).
6. Wiring must conform to provisions of the National Electric Code (National Fire Protection Association – Standard No. 70) and local ordinances.

FURNACES LIMITATIONS

Furnaces must be installed in accordance with:

1. National Fire Protection Association (NFPA) Standard No. 90B – "Warm Air Heating and Air Conditioning Systems – Residence Type".
2. National Fire Protection Association (NFPA) Standard No. 54 — National Fuel Gas Code.
3. ANSI Z223.1 1984 — National Fuel Gas Code.
4. National Fire Protection Association (NFPA) Standard No. 31 – "Residential Oil Piping".

LOCATION

Air Conditioning Systems should be located to achieve optimum performance, taking the following items into consideration.

LOCATE INDOOR UNITS

1. Within the building in the conditioned space or with the use of duct work, in an adjacent room. Units are not weatherized for outdoor installation. Units installed in unheated spaces must be protected from freezing.
2. Near a drain facility.
3. Near the proper electrical supply.
4. Considering availability of condenser water so that it can easily be piped to the unit. (Embassy & Triton only)
5. Considering that horizontal evaporator blowers may be ceiling suspended.
6. Applications requiring extreme quiet should be located outside the conditioned space.
7. Consider connection of condensate trap and piping, supply and return air ducts and outdoor air duct if required. Heating coil piping if required should also be considered.

LOCATE OUTDOOR UNITS (Ground level or rooftop)

1. Outside the building structure for the following reasons:
   a. Since air is the condenser cooling medium, the air flow should be unrestricted. The condenser fans are not suitable for ductwork on either the air intake or discharge.
   b. Method of venting heating sections (Sunline and Multizone Series only).
      NOTE: Altering or adding to either gravity or power venting systems will void A.G.A. Design Certification of the unit.
2. Considering the availability of the correct electrical supply.
3. Making sure there is adequate structural strength to support the unit on roof locations.
4. Selecting a place with minimum sun exposure (inlet air to the condenser coil must be drawn from as cool a location as possible). If there is a choice, the East or North sides of the buildings are preferable.
5. Considering that in a split system the sections (condensing and evaporator) should be placed so that connecting refrigerant lines can be made with as few bends and as short as possible.

6. Avoiding locations beneath windows or between structures where normal operating sounds may be objectionable.

LOCATING EVAPORATOR COILS

Upflow coils are located in ductwork or coil casings on top of matching upflow furnaces.

Counterflow coils are located beneath a matching counterflow furnace. The coils are supplied with a decorative casing capable of supporting the weight of a counterflow furnace.

Duct coils are located in horizontal ducts having a blower system available such as in forced hot air heating systems. Duct coils should be as centralized with the air distribution ducts as possible. See "Duct Installation" on page 8.

LOCATING FURNACES

Furnaces should be located:

1. As near to the chimney or flue as possible to reduce the horizontal run of the flue pipe.
2. As centralized with the air distribution ducts as possible.
3. Usually in the basement but may be installed in a closet or similar enclosure.
4. In an area where ventilation facilities provide:
   a. Satisfactory combustion of fuel.
   b. Proper venting.
   c. Safe limits of ambient temperature under normal usage.
5. In such a manner as not to interfere with proper circulation of combustion air within the confined space. When normal infiltration does not meet combustion air requirements, outside air should be introduced.

   See specific furnace service instructions for more information concerning combustion air and ventilation of confined and unconfined spaces.

CLEARANCE

It is important to abide by the specific clearances listed in the specific unit installation instructions. In general, the clearances listed are given to: supply an adequate flow of air to the unit, remove and replace worn parts or dirty filters, or provide enough room for servicing the unit.

The following must be considered on most units:

1. Air intake and air discharge
2. Condenser water piping
3. Power connections
4. Condensate drain piping
5. Maintenance and servicing
6. Heating coil piping and connections
7. Refrigerant connections
8. Filter removal

FOUNDATION

Before installing the unit, the dealer should give careful consideration to the foundation on which the unit is to be installed. All foundations should be level and have sufficient strength to support the weight of the unit.

FOUNDATIONS FOR INDOOR UNITS

1. FLOOR MOUNTING – Units should be placed and leveled on a floor, pedestal, platform, or shelf, designed to support the weight of the unit. On most units, it is advisable to place material such as rubber isolator pads or fiber glass insulation under the unit. This will eliminate sounds due to transmission of vibration.
2. CEILING SUSPENSION – Evaporator blowers may be suspended from joists with isolation type hangers, hooks or suspension accessories.

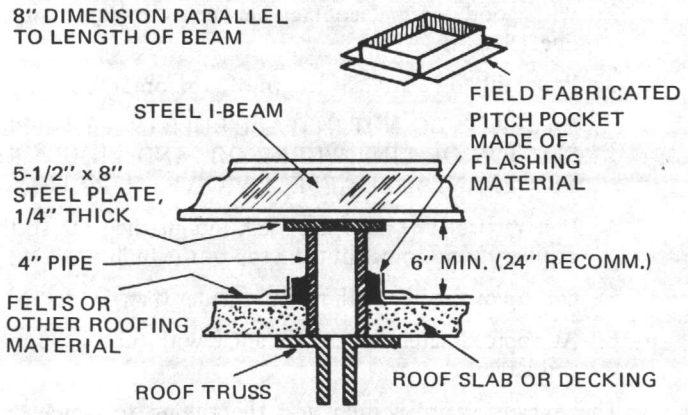
FOUNDATIONS FOR OUTDOOR UNITS

1. GROUND LEVEL – Installations should be on concrete slabs with footers extending below the prevailing frostline. This is required to prevent shifting or settling of the unit which will result in strain on the refrigerant lines or ductwork, causing possible refrigerant or air leaks. The slab should extend 6 inches beyond the casing dimensions. It is important that the slab IS NOT tied into the foundation of the building as noises may telegraph through. Rubber padding may be applied bebetween the legs and the slab to lessen transmission of vibration.
2. ROOF-TOP – Units should be placed on hardwood strips, angle iron, channel iron, or any other material capable of carrying the unit's weight and on something which will not deteriorate rapidly. Refer to Figs. 1 and 2. The beams should be; (1) positioned perpendicular to the roof joists, (2) extend beyond the dimensions of the section to distribute the load on the roof, (3) be capable of supporting the concentrated loads at the corner legs. NOTE: ON BONDED ROOFS CONSULT THE BUILDING CONTRACTOR OR ARCHITECT FOR SPECIAL INSTALLATION REQUIREMENTS. The

units are placed on beams to give more efficient operation by raising the unit above the layer of hot air usually found on a dark colored sun-exposed roof.

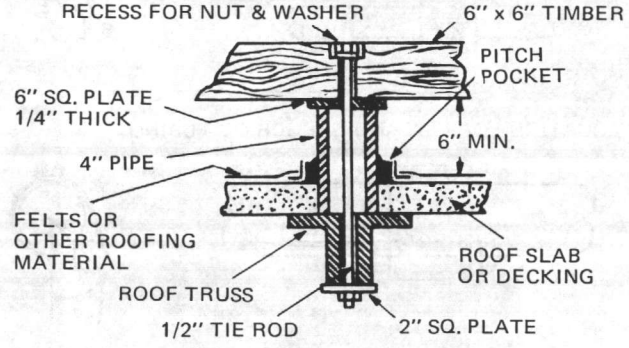
NOTE: In all installations where snow accumulates and winter operation is expected, additional height must be provided to insure normal condenser air flow.

Supporting structures such as: steel I-beams, steel plates, piping and timbers; should be painted or treated to prevent rust, corrosion and decay. Units supported as shown in Figures 1 and 2 must be fastened to the supporting structure by tack welding or bolting.



1. PLATE WELDED TO PIPE, CONTINUOUS WELD.
2. PIPE TACK WELDED TO ROOF TRUSS.
3. I-BEAM BOLTED OR WELDED TO PLATE.
4. I-BEAM LEVELED BEFORE TACK WELDING TO TRUSS.

FIG. 1– ROOF INSTALLATION USING STEEL I-BEAM



1. PLATE WELDED TO PIPE, CONTINUOUS WELD.
2. PIPE TACK WELDED TO ROOF TRUSS.
3. TIMBER LEVELED BEFORE TACK WELDING TO TRUSS.
4. TIMBER BOLTED AS SHOWN.

FIG. 2– ROOF INSTALLATION USING TIMBER

Sunline and Multi-zone units may be installed on factory or field supplied roof curbs. The curb provides a convenient way of making a water-tight duct penetration thru the roof.

UNIT HANDLING

Care must be taken when moving the unit to the place of installation. Do not remove any crating until the unit is near the place of installation. SPREADERS SHOULD BE USED BETWEEN SLINGS TO PREVENT CRUSHING THE FRAME OR PANELS. When preparing to move the unit, always determine the center of gravity of the unit in order to equally distribute the weight. Slings connected to the compressor end of a unit will usually have to be made shorter, so the unit will lift evenly (See Fig. 3).

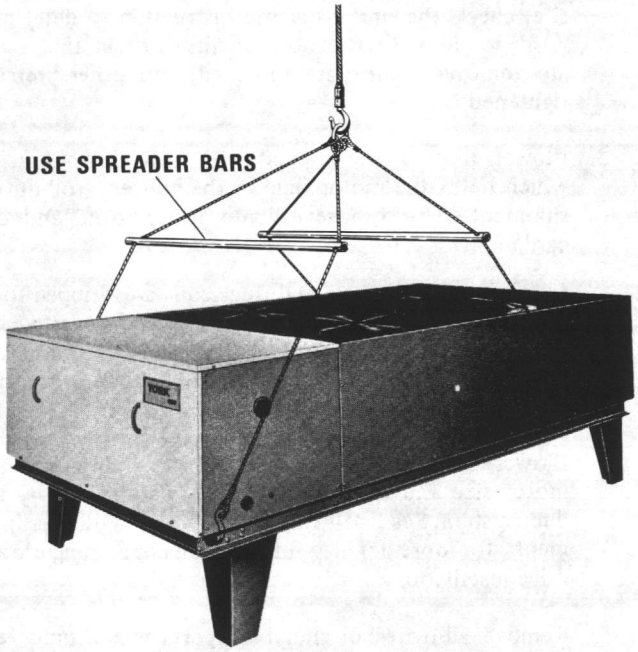


FIG. 3– TYPICAL RIGGING TO LIFT UNITS

Rig units by attaching chain or cable slings to the holes or lifting lugs provided on the base rail.

Spreaders, whose length exceeds the largest dimension across the unit, should be used across the top of the unit. On units which have skids attached, the slings should be placed around the bottom skid.

To move a unit with a fork lift, extreme caution must be used to avoid damage to the unit. Proceed as follows:

1. Give careful consideration to the unit's center of gravity.
2. Determine the compressor's location within the unit. This will usually be the heaviest end of the unit.
3. Distribute the weight equally on both forks. Use a 2 x 4 TO SPAN ACROSS THE UNIT PANELS OR FRAME MEMBERS. DO NOT ALLOW EITHER FORK TO COME IN CONTACT WITH A UNIT COIL.
4. Test the load to see if the weight is equally distributed. Do this by lifting the unit a few inches off the floor and holding it there before lifting any further or before transporting the unit.

UNIT PREPARATION

After moving the unit to its final position and before startup, check the following:

1. Remove shipping blocks and supports from the units.

2. Units are shipped with hold-down or tie-down nuts which hold the compressor tight to the base plate to reduce damage which may occur in transit. On the job site, check the unit's specific instruction to determine what to do with the bolts. Units vary in that some are removed, some are loosened, and others remain tightened.

3. Blower motors are shipped with a tie-down bracket which holds the motor rigid to the blower scroll during shipment. This bracket should be removed and discarded.

   All evaporator blowers and duct coils are shipped for a specific air flow operation, but may be converted for other illustrated air discharge patterns. In order to change the air discharge pattern, refer to the procedure given in the unit specific instruction.

4. Blower belts are tied to the blower. Pulley settings, motor size and belt adjustment are determined by the duct system. See "Belt Installation" and "Pulley Adjustment" for more detailed information concerning blower drive installation.

5. Remove all wires or metal supports which hold fans and prevent rotation, and remove all bands holding shipping blocks in place.

6. Shipping supports come in various forms: clamps, brackets, bands, straps, wedges, spacers, bolts, ferrules, wire, and tape. A list of shipping supports, their location, and how to remove them will be given under the "Unit Preparation" section of the unit's installation instruction. Refer to the instruction and remove supports.

SHIPPING RESTRICTIONS

Due to shipping restriction, some units require hoods, legs, etc., to be field installed. These parts are located in various unit compartments. Remove them and refer to the specific unit instruction packed with the unit, and install them.

REFRIGERANT-22 PIPING

A majority of service troubles are caused by lack of adequate precautions to provide an internally clean and dry system. It is of extreme importance that materials used conform with established standards.

For information concerning refrigerant-22 piping refer to the current publication, Form 1505.05-AD and two future publications, Forms 55.70-NS2 on Working with Copper Tubing; and 55.70-NS3 on Working with Refrigerants.

EXPANSION VALVE BULB LOCATION

On most units the expansion valve bulbs are factory installed. The location has been determined by the design engineer to meet certain design conditions. On this type of unit, the installer need only check to make sure the bulb is tightly secured in place.

On most large split-system evaporators the expansion valve bulb must be installed after the refrigerant piping is completed.

The location of the expansion valve bulb is extremely important for proper valve operation. Attach bulb securely to the suction line in the following manner.

1. As near evaporator outlet as possible.
2. With good thermal contact between the bulb and the line. (See Fig. 4.)
3. Preferably on a straight length of horizontal tubing.

   CAUTION: DO NOT INSTALL BULB IN A TRAPPED SECTION OF LINE WHERE OIL AND LIQUID REFRIGERANT WILL AFFECT VALVE OPERATION.
4. If a vertical line must be used, mount the bulb so the capillary tube comes out the top of the bulb.
5. On top of the line with tubing smaller than 7/8 inch.
6. At approximately 45 degree angle with tubing 7/8 inch and larger.

The expansion valve bulb and the tubing to which it is attached should be well insulated with moisture proof material.

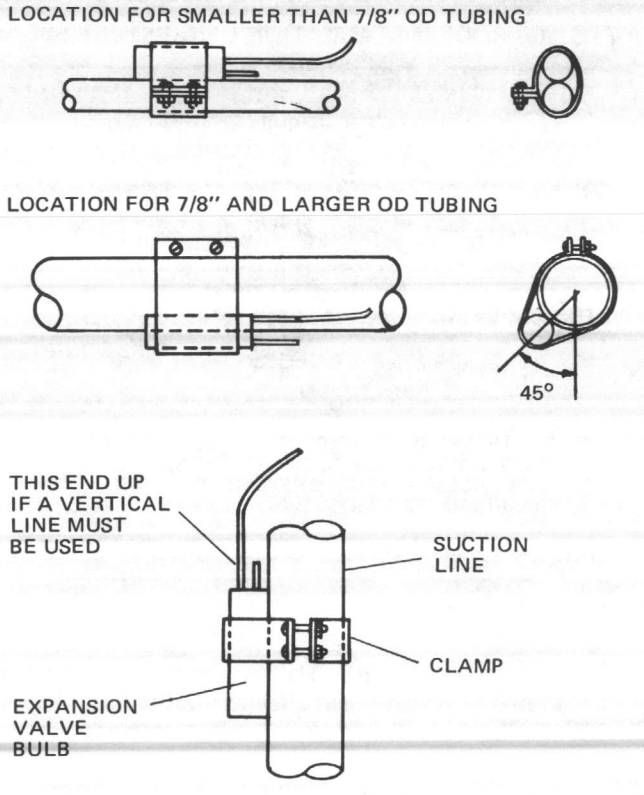


FIG. 4– EXPANSION VALVE BULB LOCATION

WATER CONNECTIONS

On all units utilizing water cooled condensers, it will be necessary to make water piping connections. Supply water line is connected to the inlet connection and the waste-water line is connected to the outlet connection of the unit. Units may be field altered for right side piping connections. The inlet water connection is usually the lowest connection of the condenser. Consult unit installation instruction for proper identification of connections. A field supplied water strainer should be installed in the inlet water piping.

Water regulating valves are offered as accessories for most water cooled condensing units. YORK recommends the use of a water regulating valve on applications using city water. If one is used, it should be installed in the inlet water piping preferably inside the unit. Setting should be adjusted according to unit installation instructions.

PRECAUTIONS AGAINST FREEZING

Warranties do not cover frozen condensers. Units installed in locations subject to freezing should be protected from freezing by one of the following two methods. One way to protect a water cooled condenser is by using strip heaters. Another way is to install a connection that will permit the condenser and water piping to be drained and blown out. Blowing out of condenser water is necessary because the condenser's shape does not permit complete drainage by gravity.

GAS AND OIL PIPING

Detailed information regarding gas and oil connections may be found in the future publication, Form 55.70-NS5.

CONDENSATE DRAIN CONNECTIONS

All evaporators remove water from the air they are cooling. It is therefore necessary for the installer to provide the unit with a properly installed drain line and trap.

Drain lines must be as large or larger than the fitting to which the line is being connected. When lines are exposed to freezing temperatures or when they are subject to the formation of condensation, the drain lines should be insulated. Horizontal lengths of drain line must be pitched towards the nearest drain facility. If drain lines are to be run from an indoor unit to the outside, they must be extended beyond the walls of the building. This will eliminate the possibility of damage caused by condensate running down the exterior surface of the buildings walls. Outdoor unit's drain line may be discharged directly onto the ground or roof or connected to an open drain.

If a unit has optional side drain connections, connect the drain line to the connection nearest the drain facility. The remaining connection must be plugged. Some types of units are provided with dual drain connections to meet code requirements. In this case CONNECT BOTH DRAINS.

Installing a trap in the drain line is a "MUST" on all draw-thru evaporator fan type units to insure proper drainage. Although a trap on a blow-thru type unit is not a necessity, YORK recommends installing one. A trap on this type unit would eliminate the possibility of insects, rodents or odors from entering the supply air stream through an untrapped drain line. Some units are provided with a trap as part of the unit. If unit does not include one, install a trap of proper design (See Fig. 5).

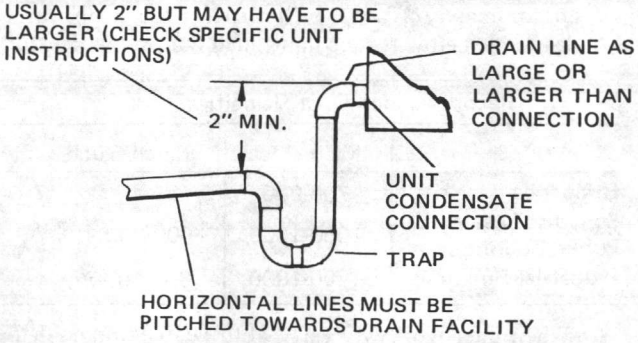


FIG. 5– PROPERLY DESIGNED TRAP

CAUTION: AVOID CREATING A DOUBLE TRAP. This condition would occur most often when a flexible drain line is being run (See Fig. 6).

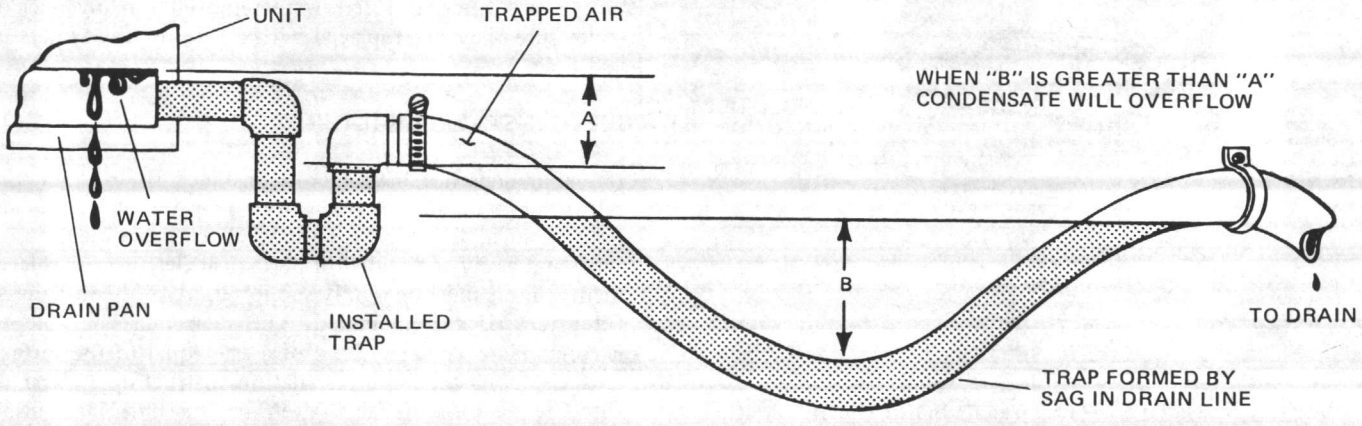


FIG. 6– DOUBLE TRAP – SOMETHING TO AVOID

DUCT INSTALLATION

Air supply and return may be handled in one of several ways best suited to the installations. Supply and return may be:

1. Conventional duct system with both supply and return air.
2. Conventional duct system with supply air and no ductwork for return air.
3. Single combination ceiling supply and return grille where ceiling heights are sufficient and unobstructed.
4. Use of plenum with direct supply into conditioned area and return air with or without ductwork.

The following general rules should be followed:

1. All ducts should be made in accordance with all local and/or national codes and in line with good duct installation practices.
2. Ducts should be sized no smaller than the duct flanges on the casing. Increase the duct size to keep the air at recommended velocities for the type of installation. Cooling units are normally designed to handle 400 to 500 CFM per ton. Most forced warm air units are designed to produce a temperature rise between 70 and 105 degrees which results in air quantities between approximately 10 to 13 CFM per 1000 Btuh output. See Table below for recommended duct velocities, FPM.

Recommended Duct Velocities, fpm

	Main Duct	Branch Duct
Residence	700-900	600
Schools, Theaters & Public Buildings	1000-1300	600-900
Industrial Buildings	1200-1800	800-1000

3. When duct work will carry both heated and cooled air, the ducts should be sized for whichever requires the greater CFM.
4. Asbestos cloth collars or other non-flammable material should be used to connect the unit to prevent transmission of noise and vibration. (See Fig. 7.)

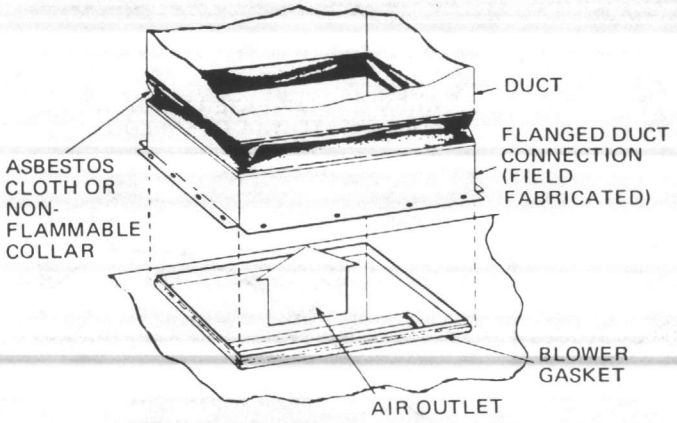


FIG. 7– SUGGESTED METHOD FOR CONNECTING DUCTWORK

5. Ducts should be suspended with flexible hangers.
6. They should not be fastened directly to the building or structure.
7. Clearance should be allowed around ducts for insulation and safety in handling heated air.
8. Ducts should be brought through the building immediately adjacent to the unit with as short a run as possible.
9. Ducts should be sealed with flashing and caulked where it passes through the roof or wall to prevent leakage. DO NOT FLASH THE ENTIRE UNIT.
10. When a matching Borg-Warner furnace is not used, properly seal any areas where the coil and furnace mate to prevent air bypassing the coil.
11. Return air ducts must include provisions for filters. Locate filters where they will be convenient to inspect, and change.
12. When outdoor or fresh air is used, the air temperature limitations on the evaporator must be observed.
13. Ducts passing through roof should be installed as shown in Fig. 8.

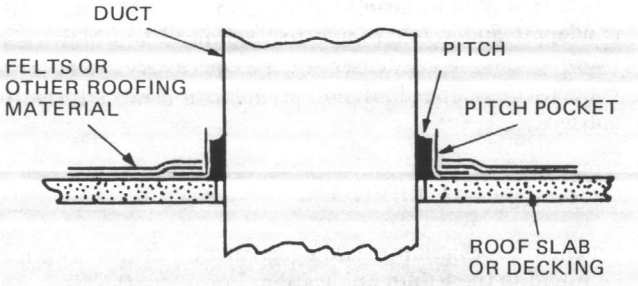


FIG. 8– RECOMMENDED THRU-THE-ROOF DUCTING

More detailed information may be found in instructions 1610.05-AD, Residential Air Distribution and 1660.05-AD, Commercial Air Distribution.

FILTER INSTALLATION

FACTORY INSTALLED FILTERS

Most units are factory supplied with filter racks and the proper size filter. If filters were removed for any reason, make sure they are replaced with a filter of the same size and type.

FIELD INSTALLED FILTERS

If a unit does not have factory installed filters, then the return air duct must include provisions for filters. Locate field supplied filters where they will be convenient to inspect and easily accessible for periodical cleaning or replacement. Filters must be rigidly supported. A field constructed filter rack is recommended. The rack must be able to accommodate enough filters of a size equal to the surface area listed in the unit installation instructions. Type of filter to be used is also given in the unit installation instruction.

INSULATION

Interconnecting refrigerant lines on split-systems, inlet and outlet water lines for water cooled condensing units, and supply and return air ductwork require insulation as follows:

1. Interconnecting refrigerant lines – The suction line should be insulated, especially when exposed to high ambient temperatures. Do not solder suction and liquid lines together. If it is desirable to tape or wire these lines together for support purposes, they must be completely insulated, one from the other.

NOTE: Residential Split System air conditioners have interconnecting tubing available with insulated suction line.

When refrigerant lines pass through a wall, it is advisable to pack fiber glass insulation and a sealing material such as permagum around the lines to reduce vibration and also retain some flexibility in the lines.

2. Water lines – When water lines are exposed to freezing conditions, they should be insulated against freezing. Insulation is a must where moisture forming on the water lines will be objectionable or will cause damage to the area.

3. Ductwork (Supply & Return) – Where ductwork passes through an unconditioned space during the cooling or heating season, insulation is required. Insulation should include a vapor barrier to prevent absorption of moisture. Ductwork, when exposed to outside air, should be insulated with 2 inches thick weatherproof material.

FLUE PIPING

All gas-fired and oil-fired furnaces must be vented through flue piping and a chimney. Before securing the flue piping to the chimney, be sure that the chimney flue servicing the furnace is:

1. At least 2 feet higher than the ridge of the house. If it is only as high as the ridge it should be 10 feet from the nearest ridge.

2. Cleaned of any dirt or debris and obstructions.

3. Not serving an open fireplace.

4. Large enough to properly handle the products of combustion. Table 1 lists the required chimney area for various size flue pipes.

If more than one flue is to be connected to a chimney, the opening area of the largest flue plus 50% of the opening area of any additional flue must be less than the opening area of the chimney.

NOTE: If chimney opening area is less than flue opening area, an induced draft system of venting must be used.

TABLE 1– REQUIRED OPENING AREA OF CHIMNEY

Flue Pipe Size (Diam. Inches)	Required Chimney Area* (Square Inches)
3	7.1
4	12.6
5	19.7
6	28.3
7	38.5
8	50.4

*Find the area of the chimney opening – area must be equal to or greater than figure listed.

Aluminum or galvanized pipe is satisfactory for most gas applications, but local practice will generally determine material to use.

The following design conditions must be met.

1. The diameter of the flue piping must be the same as the collar at the furnace outlet, or the round equivalent of the oval collar, typical flue piping is shown in Fig. 9.

2. A barometric draft control damper and collar must be installed on the flue piping of all oil-fired furnaces. Special instructions to install the damper on the flue piping are included with the damper. NOTE: Do NOT use a damper with a gas-fired furnace.

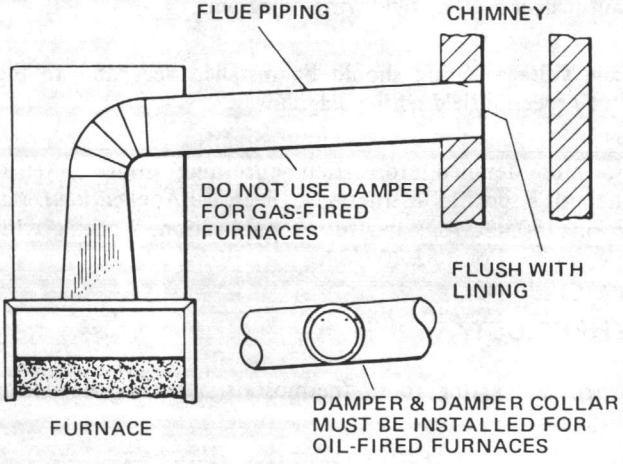


FIG. 9– TYPICAL FLUE PIPING

3. A minimum clearance of 6" must exist between the flue and any combustible surface.

4. When passing through a combustible wall the flue connector must be protected with a ventilated metal thimble or sleeve two inches larger in diameter than the connector pipe.

5. Install connector with an upward slope of at least 1/4" per foot of length from the furnace to the chimney.

6. Avoid sharp turns and sags.

7. Keep as short and as direct as possible.

8. Join pipes tightly. Check for leaks.

9. Support piping securely.

ELECTRICAL CONNECTIONS

All electrical wiring should be installed in accordance with National Electrical Code (NFPA Standard No. 70) and/or local regulations.

Check the available current and nameplate for like voltage. Run the necessary number of wires of proper size from a fused disconnect switch or circuit breaker to the unit. Route the wiring through the knockouts provided. See the tables in the unit's specific instructions for Electrical Data and minimum wire sizes. All outdoor wiring must be weatherproof. Flexible metallic conduit should be used where local codes permit.

The disconnect switch may be bolted to the side of the unit if it is weatherized. Avoid locations where refrigerant lines are located. It may also be remotely installed in accordance with National or local codes. For convenience of servicing, the switch should be reasonably close to the unit. NOTE: Split-systems should have separate power supply and fused disconnect switch for condensing and evaporator blower sections. Electrical heating sections on single-package units may also require separate power supplies. Check specific unit instructions or field wiring diagrams.

Low voltage wiring should be installed according to the unit's specific field wiring diagrams.

For more detailed information concerning wiring – refer to the unit's specific instructions; Electrical Application Data, Form 1505.20-AD; and future publication, Working with Electricity, Form 55.70-NS4.

THERMOSTAT

When connecting room thermostats, refer to the wiring diagrams.

Thermostats should be:

1. Located approximately 5 feet above the floor.

2. Exposed to normal room air circulation.

3. Not on outside walls.

4. Not exposed to effects from:

   a. Sunlight

   b. Glass

   c. Drafts from outside doors

   d. Cooling or heating ducts within the walls

   e. Locations subject to vibrations

   f. Supply air grilles

5. Enclosed in protective case and locked when exposed to tampering or damage.

Temperature settings:

1. Normally the temperature setting for:

   a. Cooling is 75-80 F

   b. Heating is 70–75 F

   c. Automatic changeover differential between cooling or heating operation cannot be less than 4 F due to design of conventional electro-mechanical thermostats.

Cooling/Heating thermostats have an "AUTO-ON" fan switch which allows for either intermittent (AUTO) or continuous (ON) blower operation when cooling or heating.

Continuous blower operation is:

a. Recommended for good cooling operation except where high relative humidities are common. Continuous fan operation will permit some re-evaporation off the moist coil.

b. Desirable during heating season if cold drafts can be avoided.

Adjust the thermostat heat anticipator to the ampere rating of the automatic gas valve, given on the gas valve. For electric heat measure the ampere load in the heat control circuit.

Cooling-only thermostats have a "Cool-Off-Fan" switch. In the "Cool" position, the evaporator blower operates continuously and the compressor and condenser fans are controlled by the thermostat. In the "Fan" position, the evaporator blower operates continuously but the compressor and condenser fans are shut off at all times.

The cooling thermostat is equipped with a fixed cooling anticipator. No change or adjustment is required.

BELT INSTALLATION

Before installing or replacing belts, check pulley sheave grooves for side-wall wear, defects, pitmarks, burrs or anything that would shorten the life of the belt. All rust, dirt and grease should also be removed.

If belt(s) are not factory installed, install them as follows:

1. Adjust the blower motor in its mount so that the motor pulley can be moved towards the blower pulley.

2. Slip belt(s) over the pulley. DO NOT FORCE BELTS OVER PULLEY BY PRYING OR ROLLING THEM ON TO THE PULLEYS. This shortens the life of belts by breaking or weakening the fibers within the belts.

MATCHED BELTS

The two belts needed for a two groove pulley drive must be a matched set. Belt code number and manufacturer must match. NOTE: Used belts should never be used with new belts. Save old belts for use as spares.

SEATING BELTS

To seat belts the blower motor pulley should be set with both movable portions of the pulley set at the same number of turns open.

Before blower motor is moved back to tension belts, the belts should be pulled on loose side firmly and uniformly. See Fig. 10. NOTE: Slack in both belts must be on same side of the drive.

Operating the drive for a few minutes will help belts to seat.

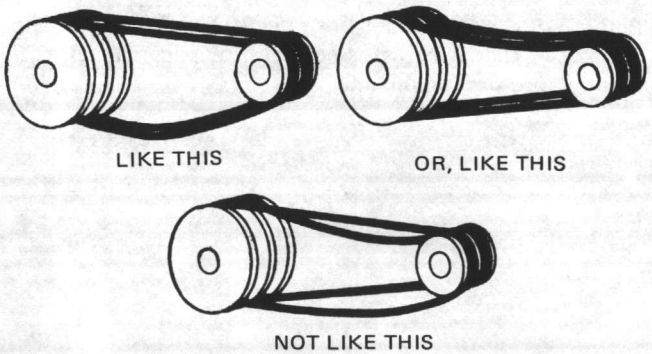


FIG. 10– BELT SLACK

ADJUSTING BELT TENSION (FIBERGLASS ONLY)

To adjust belt tension first measure the span between blower motor pulley and blower wheel pulley.

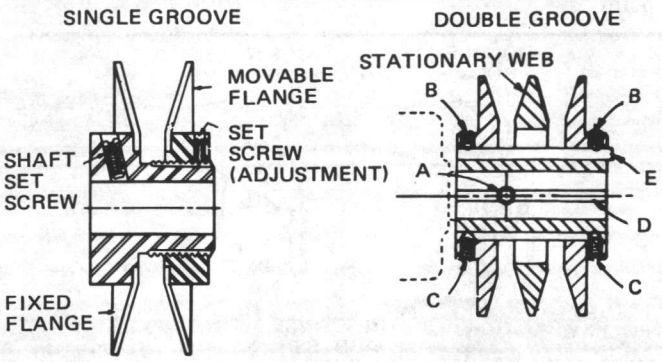
The belt should deflect 3/16" per foot of belt span with 2-3 pounds of force.

If deflection is more than 3/16" per foot span, move blower motor pulley away from blower wheel pulley.

If deflection is less than 3/16" per foot span, move blower motor pulley towards the blower wheel pulley.

PULLEY ADJUSTMENT

A single groove motor pulley is aligned by using its fixed flange (see Fig. 11) and the corresponding flange of the blower pulley.



NOTE: THERE ARE 2 FLATS ON THE PULLEY HUB AT 180 DEGREES AGAINST WHICH THE SET SCREWS "B' AND "C" MAY BE TIGHTENED.

FIG. 11– ADJUSTABLE PITCH PULLEYS

Always align twin groove pulleys using the stationary web of the motor pulley and the center web of the blower pulley. CAUTION: Improper alignment will cause excessive noise and belt wear.

Twin groove blower motor pulleys install with the shaft set screw "A" towards motor. See Fig. 11. If necessary to align pulleys, twin groove motor pulley housing may extend 25% of its length beyond the end of the motor shaft.

Align the fan and motor pulleys with a straight edge (see Fig. 12). Tighten set screw "A". If a straight edge is not available, an alternate method of alignment should be used (see "Aligning with String").

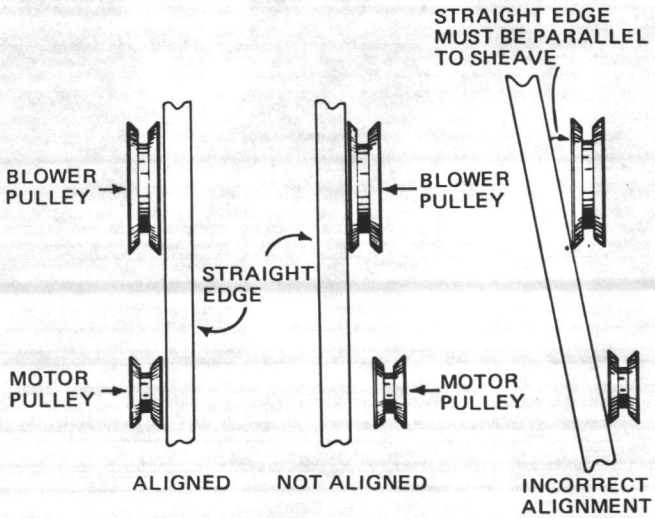


FIG. 12– PULLEY ALIGNMENT WITH STRAIGHT EDGE

ALIGNING WITH STRING

The string should be longer than the distance across the drive as shown in Fig. 13. Hold string to sheave of the blower pulley as shown. Pull string taut. Move string in direction indicated by arrow. String should touch evenly across the face of the motor pulley as the string makes contact with the opposite side of blower pulley face at point "A".

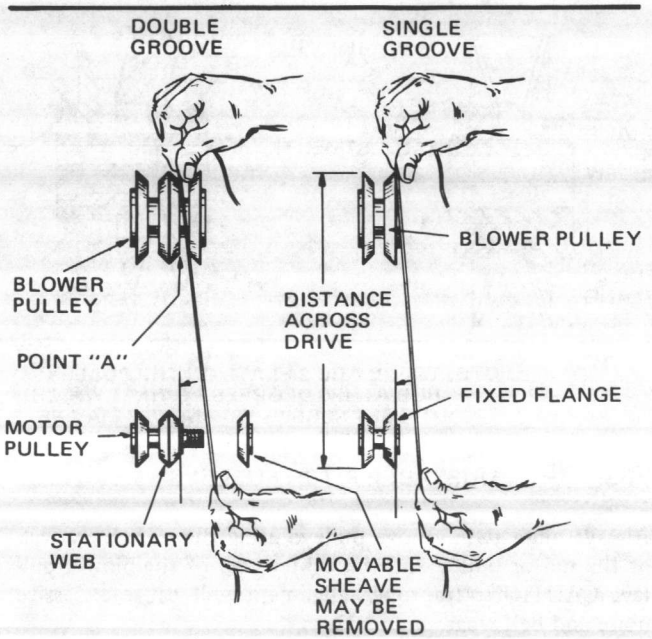


FIG. 13– PULLEY ALIGNMENT WITH STRAIGHT EDGE

ADJUSTING TWIN GROOVE PULLEYS

THE 2 GROOVE BLOWER MOTOR PULLEY REQUIRES EQUAL ADJUSTMENT OF BOTH MOVABLE PORTIONS TO AVOID UNEQUAL LOAD ON THE BELTS AND INSURE THE SAME PITCH DIAMETER IN EACH GROOVE.

Check to see if both belts drive at the same speed. Do this by making a mark across both belts and turning the drive several revolutions by hand. If the mark hasn't separated, the belts are traveling at the same speed. If the mark has separated, make the necessary adjustments.

See specific unit instruction and Form 55.70-N3 for air system adjustment.

ACCESSORY INSTALLATION

Be sure all accessory items provided for use with the installation are installed before starting the unit. Some accessories are very important to proper operation of the unit. Accessory items are provided with their own installation instructions.

CLEAN-UP

After installation of unit and before all panels are replaced, an inspection of the units interior is recommended. Be sure to remove all foreign matter such as tools, construction and packaging materials, and instruction packets which may have been left inside the unit. Paper, plastic and cardboard could restrict air flow thru unit preventing proper operation of unit.

Besides satisfying the customer with a neat looking installation, cleaning up around the unit could prevent injury to the installer as well as others. Debris left laying on roof-tops becomes very dangerous. Installer could trip, high winds could easily lift metal bands and strips of wood and deposit them on persons below.

START-UP

Before initial start-up, see Form 55.70-N2 for an installer's check list. The check list is helpful in making sure all is in order before starting the unit.

Central Environmental Systems
Post Office Box 1592
York Pennsylvania 17405-1592

YORK®
Heating and Air Conditioning

YORK®

GENERAL SERVICE INFORMATION
INSTALLER'S CHECK LIST
(PRE-START & POST-START)

INSTALLATION

Supersedes: Form 55.70-N2 Coded 573 | 776 | Form 55.70 N2

PURPOSE This check list is published as an aid to the installer. It should be filled out at the point of installation. After making the suggested checks, put a "✓" mark in each block that is applicable to the unit being installed; also record data as needed to complete checks. The second row of blocks may be used as a double check or for indicating completion of checks to single package units with more than one refrigerant system. Fill out a separate check list for both parts of a split system. For additional information concerning each check, see reference column.

FILING INFORMATION

Owner's Name _____

Owner's Address _____

City _____ State _____ Zip _____

Job Name or Location _____

_____

Unit Model No. _____ Serial No. _____

Split System Evaporator Model No. _____

Serial No. _____

Installers Name _____ Date Installed _____

REFERENCE FORM NO. (PAGE)	PRE-START CHECKS	✓	✓✓
	GENERAL		
55.70-N3*	1. On units which have crankcase heater(s), check to see if power has been supplied to the crankcase heater(s) for at least 8 hours before attempting to start unit	☐	☐
55.70-N1 (P.2)	2. Proper clearances were considered Record clearances: Top _____ Front _____ Rear _____ Sides _____ (For minimum clearances see unit installation instruction.)	☐	☐
55.70-N1 (P.6)	3. Shipping supports have been removed (See unit instructions for location.)	☐	☐
55.70-N1 (P.7)	4. Condensate drain trapped properly	☐	☐
55.70-N1 (P.12)	5. All necessary accessories are installed	☐	☐
55.70-N1 (P.5)	6. Supporting structure painted and secured to unit	☐	☐
55.70-NS4*	7. Terminal screws are tight and no loose wiring connections	☐	☐
55.70-NS4*	8. Record stand-by voltage _____. Available current and unit nameplate voltage are alike	☐	☐
WIRING LABEL	9. Fuse and wire sizes are correct	☐	☐
UNIT INSTRUCTION	10. Check the settings of all controls to make sure they are the same as listed in the specific installation instructions	☐	☐
55.70-N1 (P.6)	11. Expansion valve bulb located properly and tight	☐	☐
55.70-N1 (P.7)	12. (WATER COOLED ONLY) Water piping is hooked-up properly	☐	☐
55.70-N3*	13. (SPLIT-SYSTEM ONLY) Suction and liquid valves are open	☐	☐
55.70-N1 (P.6)	14. Fans rotate freely (rotate manually) ☐ Condenser fan(s) ☐ Exhaust fan(s) ☐ Blower wheel(s)	☐	☐
55.70-N1 (P.11)	15. Check belt driven blowers or fans for: ☐ Proper belt tension ☐ Proper pulley alignment ☐ Tightness of all set-screws and other fastening devices	☐	☐
55.70-N1 (P.8)	16. Filters of the proper size are installed correctly	☐	☐
_____	17. All ductwork is in place and return and supply grills are unobstructed	☐	☐
55.70-N1 (P.8)	18. Thru-the-roof ductwork is installed properly	☐	☐
55.70-N1 (P.12)	19. All foreign matter has been removed from the interior of the unit (Tools, construction materials, instruction packet, etc.)	☐	☐
_____	20. All panels effecting proper operation of unit have been replaced	☐	☐

REFERENCE FORM NO. (PAGE)		✓	✓✓
	GAS HEATING ONLY		
	1. Type of gas being supplied agrees with nameplate gas type	☐	✓✓
55.70-NS5*	Record nameplate gas type _____ Record gas being supplied _____		☐
55.70-NS5*	2. Record manifold gas pressure _____"W.C. Reading agrees with nameplate gas pressure	☐	☐
	Altitude (over/under) 2000 Ft _____ Furnace equipped for high altitude _____		
55.70-N1 (P. 9)	3. Flue piping is installed properly and is unobstructed	☐	☐
55.70-N3*	4. Gas lines are leak checked and purged of air	☐	☐
UNIT INSTRUCTION	5. Flame sensor is plugged into combination gas valve		

POST-START CHECKS

		✓	✓✓
	GENERAL		
55.70-N3*	1. Record and check the following data against nameplate	☐	☐
	Running voltage at unit _____ Evaporator Blower amps _____		
	Condenser fan amps _____ Compressor amps _____		
55.70-N3*	2. Ambient conditions are recorded below	☐	☐
	Outdoor ambient temp _____		
	Condenser air temp (ON) _____ (OFF) _____		
	(Water Cooled Condensers Only) Water temp (ON) _____ (OFF) _____		
	Air temp "ON" evaporator: W.B. _____ D.B. _____		
	Air temp "OFF" evaporator: W.B. _____ D.B. _____		
55.70-N3*	3. The following are recorded for indications of proper operation . . . . . (Select method used in specific unit instruction.)	☐	☐
	Condenser Temp Difference _____, Inrush voltage _____,		
	GPM or CFM _____, Discharge Temp or Pressure _____,		
	Sub-cooling _____, Super Heat _____.		
55.70-N3*	4. All motors start	☐	☐
	☐ Exhaust fan(s) ☐ Damper ☐ Evaporator blower(s)		
	☐ Condenser fan(s) ☐ Compressor(s)		
55.70-N3*	5. Fan or blower rotation is correct	☐	☐
55.70-N3*	6. Compressor Oil is at proper level in sight glass	☐	☐
UNIT INSTRUCTION	7. Dampers and linkage move freely	☐	☐
UNIT INSTRUCTION	8. Dampers close tightly	☐	☐
55.70-NS3*	9. Refrigerant piping connections are leak tested	☐	☐
UNIT INSTRUCTION	10. All controls function properly	☐	☐
	☐ Operational controls ☐ Safety Controls		
ACCESS. INSTRUCT.	11. Accessories operate properly	☐	☐
_____	12. Instructed owner and/or operator on how to operate the unit	☐	☐
_____	13. Replaced all panels	☐	☐
_____	14. Installer's Signature		
	GAS HEATING ONLY		
55.70-N3*	1. Gas connections have been checked for leaks . . . . . (WARNING-DO NOT USE AN OPEN FLAME OR OTHER SOURCES OF IGNITION)	☐	☐
55.70-N3*	2. Fan control is adjusted for proper blower operation	☐	☐
55.70-N3*	3. Limit control shuts off burners at proper setting	☐	☐
55.70-N3*	4. Flame sensor operates properly	☐	☐
55.70-N3*	5. Glow coil functions properly	☐	☐
55.70-N3*	6. Pilot flame adjusted to proper size	☐	☐

* Future publication to be issued.

DRW 8M 488 .08 Code: SBY 55.70-N2

Central Environmental Systems **Post Office Box 1592** **York Pennsylvania 17405-1592**

YORK®
Heating and Air Conditioning

INTRODUCTION

The purpose of this instruction is to provide general information for the initial start-up and check-out of the applicable YORK equipment. The installer must be aware of the many local codes and must have much basic trade knowledge regarding practical matters related to actual unit installation and start-up.

All information in this instruction (Form 55.70-N3) plus (Form 55.70-N1) GENERAL SERVICE INFORMATION INSTALLER and (Form 55.70-N2) INSTALLER'S CHECK LIST is intended to supplement the basic installation instruction provided with each unit.

Installers should be aware of the previously mentioned general instructions and understand the information they contain before attempting actual installation and start-up of YORK air conditioning equipment.

PRE-START-UP

1. Energizing Crankcase Heaters

   Compressors are equipped with crankcase heaters to prevent liquid refrigerant migration to the compressor crankcase. The crankcase heater must be energized for a minimum of 8 hours before starting the unit. This will allow sufficient time for all liquid refrigerant to be driven out of the oil in the crankcase and will help prevent damage to the compressor on start-up.

2. Electrical Check

   a. Voltage – It is important that the voltage supplied to the unit matches the voltage shown on the unit nameplate. A voltage check must be taken to assure that the available voltage is within the minimum and maximum voltage as indicated on the unit. Also the voltage imbalance (variation) between phases of 3 phase current should not exceed 1 or 2 volts.

   b. Conductors – Conductors of adequate size and material must be used to assure full voltage at the unit. Check that all wiring complies with local and national electrical codes. Copper wiring must be run from the disconnect switch to the unit. Check that all wires are connected tightly.

   c. Thermostat – Be sure that the proper thermostat is installed and connected.

3. Piping Check

   The complete installation should be piped in agreement with all applicable codes and the specific unit Installation Instruction.

4. Fan Drive Alignment

   Check that all fan belts are properly aligned and tensioned. Inspect tightness of set screws on sheaves.

5. Field Selected Equipment

   All field selected equipment must be properly installed and connected. Be sure power supply voltage matches the unit nameplate voltage. All interconnecting wiring between YORK equipment and field supplied equipment must be done in such a way as to prevent any possible damage to the equipment.

6. Gas Heating

   a. Piping – All piping must comply with all local and national codes. Check with the local Gas Co. for recommendations.

CAUTION – THE YORK AUTOMATIC GAS VALVE IS LIMITED TO 1/2 PSI LINE PRESSURE. IF THE CODE REQUIRES TESTING THE GAS PIPING AT PRESSURES ABOVE 1/2 PSI, THE AUTOMATIC GAS VALVE MUST BE ISOLATED DURING THE TEST TO AVOID DAMAGING THE VALVE. REDUCE THE PRESSURE IN THE LINE AFTER THE TEST BEFORE APPLYING PRESSURE AGAIN TO THE GAS VALVE.

   b. Flame Sensor – Check that the flame sensor is properly located and that all connections are tight..

   c. Power Vents – All power driven vents should be checked to see that they operate properly. Inspect operation of power vent to see that the switch works properly (centrifugal switch or air switch).

7. Electric Heat

   Check that the nameplate voltage and supply voltage match. Also be sure that the fuses and wiring are sized according to the applicable electrical codes.

8. Water Heat

   Check all piping to be sure it complies with local codes and that it is free of leaks. Also check the unit instruction for piping details that are unique to that unit.

9. After unit inspection is completed be sure to remove all foreign matter such as tools, construction and packaging materials, and instruction packets which may have been left inside the unit. Paper, plastic and cardboard could restrict air flow thru unit preventing proper operation of unit. Besides satisfying the customer with a neat looking installation, cleaning up around the unit could prevent damage to the unit and prevent injuries.

10. Check Valve Positions

    Be sure that suction stop valve, discharge stop valve, and liquid line stop valve are fully open.

11. Crankcase Oil Level

    Check that the oil level is visible in the compressor crankcase sightglass.

START-UP

After the above points have been checked, set the unit thermostat to the "Off" position. Close the fused disconnect switches. Set the thermostat dial to a position to secure unit operation. Turn the switch from "OFF" to "COOL" (or "HEAT").

Observe all components to see that they operate properly. Be ready to stop the unit immediately if any unusual operating condition develops.

POST-START CHECK LIST

1. Is unit expected to, or is it operating beyond its application limitations? Yes_____ No_____

   In order to answer this, refer to the application limitation section (or table) included in the service instructions for the particular unit involved and check No's 2, 3, 4, & 5. Also check No's 6, 7, & 8 on split systems.

2. Check unit nameplate voltage against power supply. Is voltage beyond the maximum or minimum allowable variation? Yes_____ No_____

   (Check stand-by voltage – unit not running), then inrush voltage (when unit starts), then normal running voltage.

3. Is ambient air temperature on condenser below minimum? Yes_____ No_____

   Or above maximum? Yes_____ No_____

   If below minimum, is proper low ambient kit installed? Yes_____ No_____

   If above maximum, answer the following:

   – Is condenser air being recirculated? Yes_____ No_____

   – Is there duct work being used on condenser air circuit? Yes_____ No_____

   – Is unit located approximately 12 inches above reflective surface such as roof, concrete patio, etc., to prevent reflective heat from causing high head pressure? Yes_____ No_____

   – Is condenser fan motor up to full speed? _____ Is rotation correct? Yes_____ No_____

4. Check air on the cooling coil? WB_____ DB_____. Is it beyond maximum or minimum limitations? Yes_____ No_____

5. What is CFM across evaporator? _____ Is it below minimum or above maximum? Yes_____ No_____

   (There should be a nominal 400 CFM per ton.) To find CFM on a cooling only unit one must know the blower RPM and the external static pressure – IWG – then find the CFM from the blower performance tables in the service instruction for the particular unit involved. (On some units one only needs to check the static pressure drop across the coil.) On heating units or a unit which has a heat section use the heating unit formulas shown on page 11.

6. Check maximum suction lift. Does it exceed 30 ft? Yes_____ No_____

7. Check drain line design and operation. All unit drains must be properly trapped. For the proper method of designing drain traps refer to Form 55.70-N1, page 7. All piping must comply with local and national codes and should be leak checked. Yes_____ No_____

8. Check the oil level in the compressor sight glass. On start-up the oil level may drop for a short time but should soon return to normal. Do not run the compressor with low oil level. Yes_____ No_____

9. Motor Check

   Make sure all motors are running and check that fan rotation is in the correct direction. If not, try changing motor leads to reverse direction of rotation on 3 phase motors. Check capacitor hookup on single phase motors if rotation is incorrect. Yes_____ No_____

10. Check Expansion Valve Bulb (s) for Tightness

    The thermal expansion valve bulb must be securely attached to the suction line in order to provide good heat transfer. Loose or improperly mounted bulbs may cause unstable unit operation. Refer to Form 55.70-N1, page 6 for more detailed information on bulb mounting. Yes_____ No_____

11. Check Air Filters

    Check that filters are installed properly in the filter sections and that there is no bypassed air around the filters. Yes_____ No_____

12. Check Air Ducts for Leaks

    Discharge or return air ducts must be in place. Ducts must be tight so that there is no air leakage. It is recommended that joints be taped or gasketed. Check return and discharge grills to see that they are not obstructed. Yes_____ No_____

13. Roof Mounted Units

    Thru-the-roof ducts must be properly flashed so that rain, snow, etc. cannot enter the building or ducts. Check with local roofing codes to be sure all work complies with these codes. Rooftop unit(s) should be mounted per local codes and the specific installation instructions provided with the unit. Yes_____ No_____

14. Remove compressor tie-down bolts <u>if</u> recommended in the unit instruction. Yes_____ No_____

15. Leak check all refrigerant piping connections. Yes_____ No_____

16. Put unit through its paces by operating it from the room thermostat. Do all motors and any other components, such as a liquid line and compressor unloading solenoids, start and stop in sequence and by proper thermostat control? Yes_____ No_____

    Is thermostat mounted solidly in a good location to prevent short cycling due to slamming doors, accidential bumping, direct exposure to supply air, etc. On mercury bulb thermostat, thermostat must be mounted <u>level</u> to insure the proper setpoint. Yes_____ No_____

17. On 24 volt control circuits, do you have 24 volts (+ or – 10%) during start-up and operation? Yes_____ No_____

    If answer is "no" check for such things as thermostat wire too small for length of run or that 208 volt tap is used on units with 208 volt power supply.

18. All YORK equipment is furnished with certain safety controls which stop the unit if an unsafe operating condition develops. It is important that these controls operate properly and under no circumstances should they be bypassed in the field. YORK will accept no liability for equipment damage if the safety controls have been bypassed or disconnected. Safety controls should be operated to see that they operate at their proper settings. (See unit instruction for specific set points.) Controls may be reset in the field within the limits shown in the unit instruction. Yes_____ No_____

19. On large split systems with condensing units having some type of capacity reduction and a circuited evaporator, or two or more evaporators, or multi-zone evaporator, check the following:

– Are suction lines designed to insure oil return to the compressor under all operating conditions? Yes_____ No_____

– Are evaporator suction headers designed to prevent oil draining into an idle evaporator under reduced load operating conditions? Yes_____ No_____

– Are double suction risers used where required to insure oil return under reduced load operating conditions? Yes_____ No_____

– Are evaporators trapped to prevent liquid refrigerant draining out of them on the "off" cycle? Yes_____ No_____

– Are liquid line solenoid valves installed on the first stage _____ and second stage _____ evaporator? Yes_____ No_____

– If hot gas bypass is used, does the hot gas enter the low side ahead of the liquid distributor _____ or into the suction line? _____ Yes_____ No_____

Refrigerant Mains – Are recommended pipe sizes being used? Yes_____ No_____

Liquid Line filter drier installed? Yes_____ No_____

Sight Glass installed near the evaporator? Yes_____ No_____

Is suction line insulated? Yes_____ No_____

Are long runs of suction (or discharge) and liquid lines separated to prevent heat exchange? Yes_____ No_____

20. Are crankcase heaters installed? Yes_____ No_____

Do they operate when compressor is off? Yes_____ No_____

Do they operate when compressor is operating? Yes_____ No_____

After the system has been installed a qualified person who is familiar with the operation of the system should test the equipment under all modes of operation to insure that it is functioning correctly. When the system is functioning properly, the owner's approval should be secured. The owner should be shown the location of the fused disconnect switch and controlling thermostat, instructed how to start, operate and stop the unit.

USING TEST READINGS AND POST-START CHECK LIST

Test readings give a very complete description of the way the job is working. Recorded test readings are valuable as a comparison if trouble should develop in the future.

If a serviceman is seeking advice from a more experienced person regarding a difficult trouble job, complete data is needed for an intelligent discussion that permits sound conclusions to be drawn.

After a test run is completed test readings should be recorded in spaces provided below. Study the results carefully and make an evaluation. Either decide the job is in good condition or that it has one or more conditions that need to be remedied.

Observe and log the following Test Readings:

TEST READINGS

Record and check the following data against nameplate:

Running voltage at unit _____

Evaporator Blower amps _____

Condenser fan amps _____

Compressor amps F.L.A. _____

Compressor Suction Pressure Psig _____

Compressor Discharge Pressure Psig _____

Operating conditions are recorded below:

Outdoor ambient temp _____

Condenser air temp (ON) _____

(Water Cooled Condensers Only) Water temp

(ON) _____ (OFF) _____

A compressor amperage draw 10% above normal should allow continuous operation without tripping the overload and therefore the compressor should not be changed.

Voltage

Compare the voltage reading to that shown on the nameplate for the unit. If the voltage is within 10% of nameplate it should be considered satisfactory, except where the nameplate specifies a higher minimum voltage.

If the voltage is more than 10% below nameplate, the wire used in running the line to the unit should be checked to make sure it is not undersized.

If a low-voltage condition exists, the serviceman should notify the owner and shut the equipment down. He should also notify the electric company and ask for a check on the adequacy of electric service to the property. This is actually the responsibility of the owner, but the serviceman can be helpful to the owner by taking added responsibility to insure long life for the equipment.

Compressor amperage

The nameplate on the unit will show an amperage rating for the compressor called Full Load Amperes, abbreviated FLA.

Rated load conditions are 95°F air entering the condenser, 80°F air at 50% rh entering the evaporator at a flow rate of 400 cfm per ton of cooling capacity. Under these conditions the amperage measured should be close to the FLA rating, somewhat lower on some older units.

Obviously a serviceman rarely sees a test under exactly rated conditions. Therefore the amperage draw can vary widely both because of load conditions and the condition of the system.

If the amperage is running high but not high enough to cause the unit to cut out on the current overload, possible causes are as follows:

- Voltage that is high or low by 10% or more.
- In a new installation a tight compressor can make the amperage run above normal.

If the amperage is running so high as to cause the compressor to cut out on its current overload, possible causes are as follows:

- On capacitor start, capacitor run, or PSC single-phase units, an open run capacitor will cause a very substantial increase in the amperage. An incorrectly sized run capacitor can increase amperage also.

If the amperage is running low, it helps confirm a problem such as a low refrigerant charge, low air flow over the evaporator or damaged compressor valves, short circuiting of air to the evaporator, or a restricted refrigerant line.

Pressure Readings

The question of how far from normal can the readings go before action is required continually confronts the serviceman. Lacking specific information, he must make a judgment based on general information and knowledge.

Discharge Pressure

If information is not at hand for the equipment being worked on, refer to Table 1 for the discharge pressure corresponding to various condenser inlet air temperatures for R-22 refrigerant. This table is based on general design considerations and can be used as a general guide.

TABLE 1 — HEAD AND SUCTION PRESSURES

CONDENSER ENTERING AIR (DEGREES F)	HEAD PRESSURE (PSI)	SUCTION PRESSURE (PSI)
60	170	62
65	180	63
70	195	64
75	210	65
80	225	66
85	245	67
90	260	68
95	280	69
100	300	70
105	315	71
110	330	72
115	350	74

Some adjustment has been made in the table for a lighter load on the evaporator that normally accompanies the lower outside air temperatures.

High Head Pressure

If the head pressure is running higher than table values by more than 20 psi, possible causes are:

Condenser air recirculating. Obstructions may deflect hot discharge air in such a way that it is pulled into the inlet and this makes the condensing pressure and temperature higher.

A dirty condenser will increase head pressure because there is less cooling of the hot gas. Airborne weed seeds can very severely block the condenser. Some dirt will show up readily on the surface of the condenser coil. Fine dust may collect between the fins of the coil. A close examination is necessary to detect it.

A heavy refrigerant overcharge will increase head pressure because it reduces condenser surface. If this is suspected, bleed off some refrigerant. If the pressure drops, bleed off more refrigerant until the reading comes into line.

If there is a large amount of air in the system it will make the head pressure go up because it reduces the effective condenser surface. This is in addition to the other harmful effects of air in the system.

A pull-down period caused by having the unit off for an extended period of time in extremely warm weather will temporarily increase head pressure.

If the head pressure rises, there will also be a very slight increase in suction pressure, particularly on capillary tube systems.

If the head pressure is running low, it will probably be the result of low suction pressure and will be discussed under that heading.

Suction pressure

If the specific unit information is not available on suction pressure, refer to Table 1.

If the suction pressure is high, possible causes are as follows:

The unit requires a pull-down period. In extremely warm weather the warmer air flowing over the evaporator boils off refrigerant faster which raises the suction pressure.

A unit that is undersized and cannot properly cool the space will consistently run a higher than normal suction pressure.

A system that moves too much air over the evaporator will have a higher than normal suction pressure. This can normally be corrected by slowing down the blower. If this is not possible, resistance must be added to the system. This can be done by blocking off part of register openings, blocking part of the duct area, or putting expanded metal across the duct.

A mix-match application in which the evaporator has larger capacity than the condensing unit will run a higher suction pressure. Table 1 does not apply to such systems.

Bad valves or gaskets in the compressor will cause the suction pressure to run high, usually by a large amount which sets it apart from other causes of high suction pressure.

The suction pressure may run low and possible causes are as follows:

A low refrigerant charge, ordinarily the result of a leak, is the most common cause of low suction pressure. Every effort must be made to find and repair the leak, or leaks, and then charge the system. Until this is done refrigerant must be added periodically to keep the system in operation.

Short circuiting of air from the supply registers to the return grilles returns cold air to the evaporator. This condition does not add enough heat to the evaporator to keep the suction pressure up where it should be. Directional registers or deflectors added to existing registers are used to make the supply air mix with the room air.

If too little air is flowing over the evaporator, even though it is at normal return-air temperature, the heat added to the coil will not keep the suction pressure up to normal.

A restricted refrigerant line can cause varying degrees of low suction pressure. A severe restriction can easily cause the suction pressure to fall as low as half its normal value. A complete blockage can cause the suction pressure to pull down to zero and then go into a vacuum.

A restriction, not a complete blockage, means that refrigerant is flowing. At the point of restriction a high pressure drop occurs. The high pressure drop will cause a refrigerating effect and the line will be very cold at this point. This will be especially true if the restriction is in the liquid line, and less sharply defined if in the suction line.

Carefully examine all exposed portions of the liquid line, and then the suction line for a cold spot. Look for condensation, or frost, and run the fingers along the line to detect a temperature difference. Give special attention to all joints, both soldered and mechanical.

Where lines are totally concealed so that inspection is impossible, it will be necessary to install access valves on each end of the liquid line, and in turn the suction line, to measure the pressure drop in the line.

Condenser Entering-Air Temperature

The air temperature entering the condenser does not have a simple meaning by itself, but it has a bearing on most of the other readings. It is tied into the head pressure in Table 1 and into the superheat in Table 2.

Ordinarily the air temperature entering the condenser and the outdoor air temperature are the same. Therefore this temperature relates to the cooling load the system is required to handle. The other readings move with changes in outdoor temperature.

Superheat

The suction-line temperature and the saturation suction temperature calculated from compressor suction pressure are only a means to an end; that is the superheat. Superheat tells us when the flow of refrigerant is metered and controlled so that the full capacity of the cooling coil is being utilized, and also that all of the liquid refrigerant is being boiled off inside the cooling coil. Calculating superheat is explained on page 9.

If the superheat is less than 6°F there is risk that liquid refrigerant is being returned in the suction line. If this occurs, it means cooling is taking place outside the conditioned space. This is inefficient. It also means there is risk of liquid slugging of the compressor which may damage it so as to make a replacement necessary.

If the superheat is high there is a reduction in capacity (because the cooling coil is not fully utilized) which, if severe enough, may result in insufficient cooling of the space and overheating of the compressor.

The most frequent cause of high superheat is a low refrigerant charge. Check this by adding a small but carefully measured amount of refrigerant (4 oz) for the smaller systems and (8 oz) for the larger systems. If this test confirms a low charge, charge the system to the correct amount.

On systems in which the refrigerant is metered by a thermal expansion valve, the ideal superheat should be 6°F to 12°F at evaporator outlet. If the superheat is outside this range and the valve is adjustable, make a change and check the result. If the valve is not adjustable, or adjustment does not help, and the superheat is less than 6°F or more than 25°F, the cage assembly and power bellows assembly or complete valve must be replaced.

On systems in which the refrigerant is metered by capillary tubes the superheat will vary over a wider range depending on the outside temperature. Table 2 is an approximation of the way superheat changes with weather.

TABLE 2 – EXPECTED SUPERHEAT READINGS, (ON CAPILLARY TUBE SYSTEMS)

OUTDOOR TEMP °F	SUPERHEAT °F
60–80	20–30
80–95	10–20
95–115	6–10

Return-Air Temperature

The temperature drop (evaporator return air minus supply air) is related to quantity of air passing through evaporator. Increasing blower speed will reduce the temperature drop; decreasing blower speed will increase the temperature drop. The air quantity to be circulated through evaporator is determined by the design requirements of the installation and the unit.

NOTE: CFM SHOULD BE SET BY DESIGN CONDITIONS. TEMPERATURE DIFFERENCE SHOULD NOT BE USED TO SET CFM.

In drier climates, with a given air quantity, more of the unit's total capacity will be used doing sensible cooling and will result in greater dry bulb reduction (temperature split).

In the more humid coastal areas more of the unit's total capacity will be used doing more latent cooling, and will result in less dry bulb reduction and greater wet bulb reduction.

Too much reduction of air flow will cause the cooling coil to start building up ice and begin a vicious cycle that will either shut the system down or bring an insufficient cooling complaint. Obviously this condition must not be brought about deliberately.

On belt-drive systems the air flow and blower speed can be changed by adjusting the motor pulley, or changing the size of the motor pulley. If the blower speed has to be increased by a substantial amount it may be necessary to increase the motor size. The blower speed can be decreased by adjusting, or reducing, the size of the motor pulley.

On direct-drive systems equipped with multitap motors there is some flexibility in obtaining the best blower speed and air flow.

A method of reducing the air flow is to add resistance to the duct system in the most convenient manner. Pinching down on volume dampers, blocking off part of the register opening, or inserting expanded metal in the duct will all add resistance and cut down on air flow and increase temperature difference.

Lack of maintenance in the form of dirty filters and loose and slipping belts will bring on poor operation in a system initially in good shape.

After blower speed has been correctly set initially on a new installation it will never need to be changed. If the temperature drop goes out of bounds it is an indication of other problems such as plugged filters, too many ducts closed, or a low refrigerant charge due to a leak.

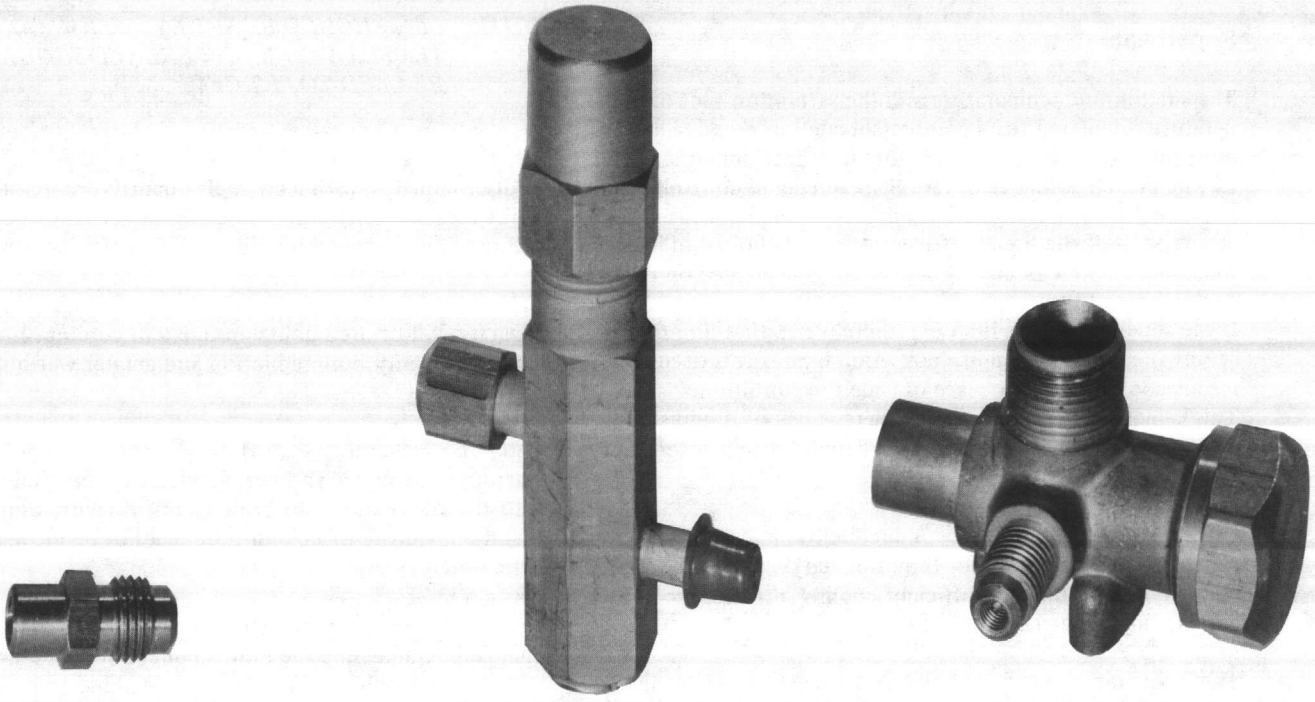
Using YORK Specific Testing and Service Information

The YORK instruction Form 55.05-NM9 provides specific information regarding the checking of unit performance using temperature/pressure service curves. Always use the specific service and performance data when it is available.

The first necessary fact to permit checking unit performance is air quantity off the indoor coil. The easiest field method of measuring this is by static pressure. Using this method, it is necessary to measure only the total static pressure of the unit to determine the CFM.

A good instrument to use is a "Dwyer" No. 172 portable manometer with a range of 0 to 1.0 inch of water. The service instructions include charts of total static pressure vs. CFM which can be used to find CFM after total static pressure has been determined. In order to measure total static pressure: (1) Insert the negative tip of the manometer in the return-air duct; (2) Insert the positive tip of the manometer in the supply-air duct. This gives one direct reading. Since an allowance is made for air filters in the total static pressure vs. CFM chart, the filters need not be removed when taking this measurement. However, the filters must be clean.

NOTE: TO ASSURE EFFICIENT OPERATION OF THE UNIT, CHECK THE PRESSURES (MOST YORK UNITS CURRENTLY PRODUCED ARE EQUIPPED WITH HIGH AND LOW SIDE ACCESS VALVES OR FITTINGS). EXCEPTION: UNITS WHICH DO NOT HAVE ACCESS VALVES OR FITTINGS: "EW" UNITS (OLDER UNITS HAVE A DISCHARGE VALVE ONLY, A LOW SIDE ACCESS VALVE MUST BE ADDED; CURRENT MODELS ARE EQUIPPED WITH BOTH HIGH AND LOW SIDE VALVES. ICE MAKERS & ROOM AIR CONDITIONERS – NO ACCESS VALVES.



Schrader Access Valve (Mounted either in the line itself or on a pigtail)

Typical Backseating Type Valve With Gauge Port

Typical Angle Type Access Valve

FIG. 1 – ACCESS VALVES

After the unit has been operating for 15 minutes, record the necessary data to check the unit performance.

(a) Evaporator coil air "ON" _____°F wb.

(b) Evaporator coil air "OFF" _____°F db.

(c) Condenser coil air "ON" _____°F db.

(d) Suction line temp at evaporator outlet _____ °F (Superheated Gas Temp)

(e) Compressor suction pressure _____ psig. Corresponding saturation temp _____°F.

(f) Liquid line temp at condenser outlet _____ °F (Liquid Temp)

(g) Compressor discharge pressure _____ psig. Corresponding saturation temp _____°F.

Before these readings can be evaluated, the liquid subcooling and the superheat must be determined.

Calculating Sub-Cooling:

Liquid subcooling is the difference between the condenser saturation temperature, [temperature corresponding to the compressor discharge pressure (f)] and the temperature of the liquid leaving the condenser (e).

Liquid Sub-Cooling = (Saturated Condensing Temp) – (Condenser Outlet Temp)
Example: (122) – (115) = 7 Degrees Liquid Sub-Cooling

Calculating Superheat:

Superheat is the difference between the suction temperature and the evaporator saturation temperature, [temperature corresponding to the suction pressure (d)]. The condenser saturation temperature and the evaporator saturation temperature can be read from Refrigerant-22 tables. The values of the liquid cooling and the superheat are calculated:

Superheat = (Suction Temp) – (Saturated Evaporating Temp)
Example: (62) – (37) = 25 Degrees

Compare unit test data with the service curve for the unit. The performance of the unit will fall into one of four categories:

(a) The first is that the unit is performing satisfactorily.

(b) The second possibility is that the unit has low suction pressure and low discharge pressure. This could be caused by one of two things:

1. Low refrigerant charge.
2. Faulty expansion device.

(c) The third possibility is that the unit has high suction pressure and low discharge pressure. This would be caused by:

1. Poor compressor performance.

(d) The fourth possibility is that the unit has high suction pressure and high discharge pressure. This could be caused by:

1. Too much refrigerant charge.
2. Air in system.
3. Dirty condenser coil, obstructed condenser, etc.

GAS HEATING ONLY

1. Gas connections have been checked for leaks.

WARNING – DO NOT USE AN OPEN FLAME OR OTHER SOURCES OF IGNITION.

2. Fan control is adjusted for proper blower operation.
3. Limit control shuts off burners at proper setting.
4. Flame sensor operates properly.
5. Glow coil functions properly.
6. Pilot flame adjusted to proper size.

Control Check Out

Before leaving, installer should check to see that all controls are functioning properly as follows:

1. Light pilot burner following instructions on rating plate. Leave main control knob on automatic gas valve in "pilot" position and raise room thermostat temperature setting above room temperature. Burners should not ignite.
2. Turn automatic valve to "on" position. Burners should now ignite. Wait for blower to start. Cycle burners several times by interrupting electrical power, or by thermostat.
3. With burners operating, disconnect one lead at fan control. In a short period of time, the limit control should shut the furnace down. Replace fan lead. Blower should start and after a brief interval, burners will re-ignite.
4. Check safety pilot by turning off gas supply to pilot burner (turn pilot adjustment screw in until pilot is extinguished. In a few seconds, burners will go out). Return pilot adjustment screws to previous setting and relight pilot burner.
5. Turn automatic valve to "on" position and set thermostat to desired temperature.

Adjustment of Primary Air Shutters

In most cases adjustment of primary air shutters is not necessary when the furnace is piped to natural gas.

However, it may be necessary to adjust the primary air when the furnace is piped to L.P. Gas.

Burners should be in operation for 15 minutes before making a primary air adjustment.

The proper burner flame is one which burns blue. To obtain this, first close primary air shutter assemlby until a yellow flame is obtained. Then reopen shutter assembly slowly until yellow flame just disappears. When this is accomplished, lock the air shutter in position by tightening the locking screw.

Too much air permits the flame to burn entirely blue and somewhat noisely. Too little primary air produces a yellow tipped flame which burns very lazily and which may deposit carbon on the combustion chamber.

Adjust Fan Control Settings

"Fan on" setting of fan control must be high enough to assure that the air in the furnace is sufficiently heated that no cold air is blown into the heated space, but not so high that the furnace might be damaged by excessive heat.

To adjust "fan on" setting:

1. Turn furnace on.
2. Place thermometer in heated-air duct, about 6 feet from the furnace, where it will not be affected by radiant heat and read the thermometer when the blower starts.
3. If this temperature is too high when the blower starts, lower "fan on" setting. If this temperature is too low when the blower starts, raise "fan on" setting.
4. If adjustments are made to the "fan on" setting, repeat the previous steps.

"Fan off" setting of fan control must be low enough to adequately cool the furnace, but not so low that cold air is blown into the heated space.

To adjust "fan off" setting:

1. Turn furnace on.
2. Let furnace operate for 20 mintues.
3. Turn furnace off.
4. Place thermometer in heated-air duct, about 6 feet from the furnace, where it will not be affected by radiant heat and read the thermometer when the blower stops.
5. If this temperature is too high when the blower stops, lower the "fan off" setting. If this temperature is too low when the blower stops, raise the "fan off" setting.
6. If adjustments are made to the "fan off" setting, repeat the previous steps.

Usually the fan control is set so that the thermometer reads about 125 degrees when the blower starts, and about 100 degrees when the blower stops.

Check Gas Input (Natural Gas Only)

Gas pressure to the burners should be adjusted so that optimum performance is obtained. When there is an indication of overfiring or underfiring, it can easily be checked by reading the gas meter. Overfiring a furnace causes serious safety hazards, noisy ignition, flame roll-out and possible damage to the heat exchanger.

NOTE – TO FIND THE BTU INPUT, MULTIPLY THE NUMBER OF CUBIC FEET OF GAS CONSUMED PER HOUR BY THE BTU CONTENT OF THE GAS IN YOUR PARTICULAR LOCALITY. (CONTACT YOUR GAS COMPANY FOR THIS INFORMATION AS IT VARIES FROM CITY TO CITY.)

To determine the actual BTU input to a natural gas furnace is a relative easy task. First, check to make sure the only gas appliance in operation is the furnace. With the furnace in operation, measure the time in seconds it will take for one revolution of the smallest dial on the meter. One method of determining the actual BTU input to a natural gas furance is: To multiply a constant of 3600 (when using a one cubic foot dial) by the BTU per cubic foot rating of gas, then dividing that result by the time in seconds it required the one cubic foot dial to make one revolution. Use a constant of 1800 for a 1/2 cubic foot dial and 7200 for a two cubic foot dial.

Formula:

$$\text{Input BTU/HR} = \frac{\text{Heating Value of Gas (BTU/FT}^3\text{)} \times 7200}{\text{Time in Seconds (for 2 cu ft) of Gas}}$$

If the pilot flame of another gas appliance was burning during the furnace input test, it must be deducted from your total input calculation. A good rule of thumb is to deduct 800 BTU per hour for each pilot flame. If the BTU input of the gas is not within 95 to 100% of the furnace input raing, utilizing the permissible adjusting range of the regulator setting, it will be necessary to replace the orifice spuds with spuds of the proper size.

CAUTION: NEVER OVERFIRE A FURNACE.

Adjustment of Manifold Gas Pressure

Measure gas manifold pressure. Manifold pressure should be set approximately as follows: Natural gas – 3.5 and Propane gas – 10.5 inches water column.

For NATURAL gas application of furnaces the gas flow may adjusted by means of the pressure regulator adjustment.

Check Gas Input (Propane Gas Only)

The gas pressure regulator at the storage tank is normally adjusted to maintain an operating pressure of 10.5 inches of water column at the furnace manifold. This pressure will result in the correct gas input when the proper burner orifices are installed on the furnace.

Adjust Temperature Rise

The temperature rise, or temperature difference between the return-air and the heated-air from the furnace, must lie within the range shown on the A.G.A. rating plate. After temperature rise has been determined, the CFM can be calculated.

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return-air and the heated-air in the ducts, about 6 feet from the furnace, where they will not be affected by radiant heat. Increase the blower CFM to decrease the rise; decrease the blower CFM to increase the rise.

To measure temperature rise:

1. Let furnace operate for 20 minutes.
2. Measure return-air temperature.
3. Measure heated-air temperature about 6 feet from the furnace where it will not be affected by radiant heat.
4. Difference is temperature rise.

Check Air Quantity (CFM)

To convert temperature rise to CFM:

1. Indoor furnace

$$CFM = \frac{\text{BTU/Hr Input (Cu Ft Gas per Hr x BTU per Cu Ft*)}}{1.35 \times (^{\circ}\text{F temp rise})}$$

2. Outdoor furnace

$$CFM = \frac{\text{BTU/Hr Input (Cu Ft Gas per Hr x BTU per Cu Ft*)}}{1.44 \times (^{\circ}\text{F temp rise})}$$

Oil Furnace – determine amount of oil in gallons per minute and BTU per gallon.

$$CFM = \frac{\text{Gallons of oil per hour x BTU per gallon}}{1.45 \times \text{Temperature Rise}}$$

Determine the total KW that is turned on when getting the temperature rise.

$$CFM = \frac{\text{KW x 3410 BTU per KW}}{\text{Temperature Rise x 1.08}} \text{ OR } CFM = \frac{\text{BTUH Input}}{1.08 \times F^{\circ} \text{ Temp Rise}}$$

WHERE: BTUH = 5.92 x Volts x Amps (1ϕ)
5.92 x Volts x Amps x 1.73 (3ϕ)

To adjust temperature rise:

1. Increase blower CFM to decrease temperature rise.
2. Decrease blower CFM to increase temperature rise.

When changing drives on blowers:

For each 1" increase in pulley size – increase belt length by 2". For each 1" decrease in pulley size – decrease belt length by 2".

Increasing the RPM of the blower increases the Brake Horsepower (BHP) required.

Adjusting Blower Speed (CFM)

On belt-driven blowers, speed can be varied by changing the motor pulley ratio. Opening the pulley decreases speed. Closing the pulley increases speed.

After each adjustment, position and tighten the set screw on one of the flats of the pulley hub. Always align the fixed flange of the motor pulley with the blower pulley. Improper adjustment will cause noise and belt wear.

Adjust belt tension with the motor adjusting bolt until the belt can be depressed with the fingers about 1/2 inch at a point halfway between the two pulleys. Make speed adjustments as necessary until the desired temperature range is obtained.

On initial start-up or after increasing air flow, check fan motor amps and compare to full load amps listed on motor data plate. The panel on the fan section must be in place when checking fan motor amps. Should the current drawn by motor exceed the full load amps by more than 15%, unload motor by releasing belt tension or by reducing fan speed. This permissible increase of 15% above full load nameplate amps is the result of the motor being located in a cool area with increased air flow over the motor.

Direct Drive blowers have multi-speed motors. Variation in furnace temperature rise can be obtained by selecting the low, medium or high speed hookup as desired. Refer to the furnace wiring diagram.

Check the fan control settings to assure that air is being heated sufficiently but not excessively prior to blower operation. This check is made by placing a thermometer in the heated air duct about 6 feet from the furnace, and by measuring the air when the blower comes on and when it shuts off. It is usually desirable to set the fan control so that the thermometer will read 120 degrees when the blower comes on and about 90 degrees when the blower stops.

Permit the furnace to operate about 20 minutes prior to shutting it down and reading the duct air temperature when the blower stops. Repeat the temperature checks to assure satisfactory settings.

Complete the furnace installation by making a check to assure that all controls are functioning properly.

Supersedes: Nothing

TRI 3M 1087 .48 Code: SBY 55.70-N3

Central Environmental Systems
Post Office Box 1592
York Pennsylvania 17405-1592

YORK®
Heating and Air Conditioning

ADVANCE INFORMATION

FIG. TO BE SUPPLIED AT A LATER DATE

FIG. 1 – AIR COOLED WATER CHILLER

SECTION	FIG.	ITEM	DESCRIPTION	W1LC530A25A	W1LC530A40A	W1LC530A46A	W1LC530A50A
COMPRESSORS							
	1	1	COMPRESSOR, SEMI-HERMETIC (SYS. 1) (5)	4RK2-2500-TSK	4RK2-2500-ESX	4RK2-2500-TSK	4RK2-2500-FSD
	1	2	COMPRESSOR, SEMI-HERMETIC (SYS. 2) (5)	6RP2-3500-TSK	6RP2-3500-ESX	6RP2-3500-TSK	6RP2-3500-FSD
MOTORS							
	1	3	MOTOR, DIRECT DRIVE FAN	024-18396-900	024-18397-900	024-18397-900	024-18397-900
	1	4	MOTOR, DIRECT DRIVE FAN (7)	024-19879-000	024-19878-000	024-19878-000	024-19878-000
ELECTRICAL							
	1	5	BLOCK, TERMINAL (1TB)	025-20573-000	025-20710-000	025-20710-000	025-20573-000
	1	6	BLOCK, TERMINAL SECTION (2TB-3TB) (3)	025-20945-900	025-20945-900	025-20945-900	025-20945-900
	1	7	BLOCK, TERMINAL (4TB-5TB)	025-09469-000	025-09469-000	025-09469-000	025-09469-000
	1	8	BLOCK, TERMINAL END (2TB-3TB) (3)	025-20946-900	025-20946-900	025-20946-900	025-20946-900
	1	9	CAPACITOR, RUN (1RC THRU 7RC) (15MFD/370V)	024-20446-000	024-20446-000	024-20446-000	024-20446-000
	1	10	COIL, CHOKE (1CH, 2CH)	025-20704-001	025-20704-002	025-20704-002	025-20704-002
	1	11	COIL, SOLENOID (1LLS, 2LLS)	025-27514-000	025-27514-000	025-27514-000	025-27514-000
	1	12	CONTACTOR, ELECTRICAL (1M)	024-19889-000	024-19889-000	024-19889-000	024-20451-000
	1	13	CONTACTOR, ELECTRICAL (2M)	024-19172-000	—	—	024-20449-000
	1	14	CONTACTOR, ELECTRICAL (3M)	024-21777-000	024-21777-000	024-21777-000	024-20450-000
	1	15	CONTACTOR, ELECTRICAL (4M)	024-21778-000	—	—	024-18056-006
	1	16	CONTACTOR, ELECTRICAL (5M)	024-20423-000	024-20423-000	024-20423-000	024-20423-000
	1	17	CONTACTOR, ELECTRICAL (6M)	024-19633-000	024-20423-000	024-19633-000	024-19633-000
	*	18	CONTROL, PRESSURE (1HP, 3HP)	025-17620-009	025-17620-009	025-17620-009	025-17620-009
	*	19	CONTROL, PRESSURE (2HP, 4HP)	025-20709-000	025-20709-000	025-20709-000	025-20709-000
	*	20	CONTROL, PRESSURE (1LP, 2LP)	025-17620-005	025-17620-005	025-17620-005	025-17620-005
	*	21	CONTROL, PRESSURE (OIL, 10P, 20P)	025-21463-900	025-21463-900	025-21463-900	025-21463-900
	*	22	CONTROL, TEMPERATURE (FREEZE STAT) (4)	025-27499-000	025-27499-000	025-27499-000	025-27499-000
Contd.Page 2	*	23	CONTROL, TEMPERATURE (1TH, 3TH)	025-19499-001	025-19499-001	025-19499-001	025-19499-001

* NOT SHOWN

( ) NEW REPLACEMENT PARTS.

(3) TERMINAL BLOCKS ARE BUILT UP IN SECTIONS. EACH SECTION IS ONE CIRCUIT AND EACH BLOCK REQUIRES AN END PIECE.

(4) GENEROUSLY COAT BULB AND SENSOR WITH COMPOUND 013-00898-900 BEFORE INSTALLING IN WELL AND SEAL THE WELL WITH INSULATING TAPE.

(5) OBTAIN REPLACEMENT COMPRESSOR FROM LOCAL COPELAND WHOLESALER.

(7) MOTOR CAN OPERATE AT REDUCED SPEED

FIG. TO BE SUPPLIED AT A LATER DATE

FIG. 1 – AIR COOLED WATER CHILLER

SECTION	FIG.	ITEM	DESCRIPTION	W1LC530A25A	W1LC530A40A	W1LC530A46A	W1LC530A50A
ELECTRICAL			(Continued from page 1)				
	*	24	CONTROL, TEMPERATURE (2TH, 4TH)	025-19499-002	025-19499-002	025-19499-002	025-19499-002
	*	25	CONTROL, TEMPERATURE (5TH)	025-19499-005	025-19499-005	025-19499-005	025-19499-005
	*	26	CONTROL, TEMPERATURE (7TH)	025-27525-000	025-27525-000	025-27525-000	025-27525-000
	*	27	CONTROL, TEMPERATURE (TC) (4)	025-18752-000	025-18752-000	025-18752-000	025-18752-000
	*	28	CONTROL, WATER FLOW SWITCH	024-24609-000	024-24609-000	024-24609-000	024-24609-000
	1	29	FUSE (1FU-2FU-3FU)	025-04649-900	025-16670-000	025-12804-900	025-12804-900
	1	30	FUSE (4FU-7FU)	025-23069-000	025-17883-000	025-17883-000	025-17883-000
	1	31	FUSE (5FU)	025-17881-900	025-17881-900	025-17881-900	025-17881-900
	1	32	FUSE HOLDER (1FU-2FU-3FU)	025-18281-000	025-14213-900	025-18284-900	025-18284-900
	1	33	FUSE HOLDER (4FU-7FU)	025-17407-900	025-17407-900	025-17407-900	025-17407-900
	1	34	FUSE HOLDER (5FU)	025-13991-900	025-13991-900	025-13991-900	025-13991-900
	1	35	HEATER (COOLER SHELL)	025-22691-900	025-22691-900	025-22691-900	025-22691-900
	1	36	HEATER, CRANKCASE	025-18611-002	025-18611-003	025-18611-003	025-18611-003
	1*	37	LUG, GROUND	025-19282-000	025-19282-000	025-19282-000	025-19282-000
	1	38	RELAY, CONTROL (1R, 6R, 7R, 14R)	024-14519-900	024-14519-900	024-14519-900	024-14519-900
	1	39	RELAY, CONTROL (16R, 17R, 19R)	024-24608-000	024-24608-000	024-24608-000	024-24608-000
	1	40	RELAY, CONTROL (15R, 18R, 20R, 21R)	024-24607-000	024-24607-000	024-24607-000	024-24607-000
	1	41	RELAY, CONTROL (3R, 4R, 10R, 11R, 12R)	024-19866-000	024-19866-000	024-19866-000	024-19866-000
	1	42	RELAY, TIME DELAY (3TR, 7TR)	024-19865-000	024-19865-000	024-19865-000	024-19865-000
	1	43	RELAY, TIME DELAY (4TR, 8TR)	024-18220-900	024-18220-900	—	024-18220-900
	*	44	SENSOR, TEMPERATURE (FREEZE STAT) (4)	025-17896-001	025-17896-001	025-17896-001	025-17896-001
	1	45	TIMER (1TR, 5TR)	025-18477-001	025-18477-001	025-18477-001	025-18477-001
	1	46	TRANSFORMER (1T)	025-26309-000	025-26309-000	025-26309-000	025-26312-000
Contd.Page 3	1	47	TRANSFORMER (4T)	—	025-26305-000	—	—

* NOT SHOWN

( ) NEW REPLACEMENT PARTS.

(4) GENEROUSLY COAT BULB AND SENSOR WITH COMPOUND 013-00898-900 BEFORE INSTALLING IN WELL AND SEAL THE WELL WITH INSULATING TAPE.

FIG. TO BE SUPPLIED AT A LATER DATE

FIG. 1 – AIR COOLED WATER CHILLER

SECTION	FIG.	ITEM	DESCRIPTION	W1LC530A25A	W1LC530A40A	W1LC530A46A	W1LC530A50A
AIR MOVING			(Continued from page 2)				
	1	48	BLADE, FAN	026-21917-900	026-21917-900	026-21917-900	026-21917-900
REFRIGERANT							
CIRCUIT	1	49	COIL, CONDENSER (SYS. 1) (6)	363-82473-000	363-82473-000	363-82473-000	363-82473-000
	1	50	COIL, CONDENSER (SYS. 2) (6)	363-82474-000	363-82474-000	363-82474-000	363-82474-000
	1	51	CONNECTION, DISCHARGE LINE (SYS 1) (1)	063-67809-000	063-67809-000	063-67809-000	063-67809-000
	1	52	CONNECTION, DISCHARGE LINE (SYS 2) (1)	063-67808-000	063-67808-000	063-67808-000	063-67808-000
	1	53	COOLER, INSULATED	376-63813-905	376-63813-905	376-63813-905	376-63813-905
	*	54	FILTER DRIER	029-14777-909	029-14777-909	029-14777-909	029-14777-909
	1	55	HEADER (LIQUID)(SYS 1)	363-67797-000	363-67797-000	363-67797-000	363-67797-000
	1	56	HEADER (LIQUID)(SYS 2)	363-67782-000	363-67782-000	363-67782-000	363-67782-000
	1	57	HEADER (DISCHARGE)(SYS 1)	363-67786-000	363-67786-000	363-67786-000	363-67786-000
	1	58	HEADER (DISCHARGE)(SYS 2)	363-67789-000	363-67789-000	363-67789-000	363-67789-000
	*	59	INDICATOR, MOISTURE	026-15305-900	026-15305-900	026-15305-900	026-15305-900
	1	60	VALVE, EXPANSION (SYS. #1)	025-27535-000	025-27535-000	025-27535-000	025-27535-000
	1	61	VALVE, EXPANSION (SYS. #2)	025-27536-000	025-27536-000	025-27536-000	025-27536-000
	1	62	VALVE, LIQUID STOP	022-02992-000	022-02992-000	022-02992-000	022-02992-000
	1	63	VALVE, SOLENOID (2)	025-27513-000	025-27513-000	025-27513-000	025-27513-000
FABRICATED							
PARTS	1	64	BOX, ELECTRIC	363-94106-000	363-94106-000	363-94106-000	363-94106-000
	1	65	BRACKET (OIL PRESSURE SWITCH)	063-66899-000	063-66899-000	063-66899-000	063-66899-000
	1	66	COVER, TEMP. CONTROL	063-93946-000	063-93946-000	063-93946-000	063-93946-000
	1	67	DOOR, CONTROL BOX	363-67971-000	363-67971-000	363-67971-000	363-67971-000
	1	68	HINGE, CONTROL BOX DOOR	063-67970-000	063-67970-000	063-67970-000	063-67970-000
	1	69	LEG (1 PER UNIT)	063-32667-000	063-32667-000	063-32667-000	063-32667-000
	1	70	LEG (3 PER UNIT)	063-32666-000	063-32666-000	063-32666-000	063-32666-000
Contd.Page 4	1	71	ORIFICE, FAN (FANS NO. 1,2,3)	063-67813-000	063-67813-000	063-67813-000	063-67813-000

* NOT SHOWN (1) MADE TO ORDER ONLY. ( ) NEW REPLACEMENT PARTS.
(2) FURNISHED LESS COIL.
(6) THREE REQUIRED PER UNIT. COIL IS FURNISHED WITHOUT HEADERS.

FIG. TO BE SUPPLIED AT A LATER DATE

FIG. 1 – AIR COOLED WATER CHILLER

SECTION	FIG.	ITEM	DESCRIPTION	W1LC530A25A	W1LC530A40A	W1LC530A46A	W1LC530A50A
FABRICATED			(Continued from page 3)				
PARTS	1	72	ORIFICE, FAN (FANS NO. 4,5,6,7)	063-67812-000	063-67812-000	063-67812-000	063-67812-000
	1	73	PANEL, FRONT (CENTER)	363-68007-000	363-68007-000	363-68007-000	363-68007-000
	1	74	PANEL, FRONT (LH)	363-67847-000	363-67847-000	363-67847-000	363-67847-000
	1	75	PANEL, FRONT (RH)	363-67849-000	363-67849-000	363-67849-000	363-67849-000
	1	76	PANEL, REAR	063-67852-000	063-67852-000	063-67852-000	063-67852-000
	1	77	PANEL, SIDE (LH)	363-67833-000	363-67833-000	363-67833-000	363-67833-000
	1	78	PANEL, SIDE (RH)	363-67836-000	363-67836-000	363-67836-000	363-67836-000
	1	79	PANEL, SIDE (COMP. END,LH)	063-67845-000	063-67845-000	063-67845-000	063-67845-000
	1	80	PANEL, SIDE (COMP. END,RH)	063-94041-000	063-94041-000	063-94041-000	063-94041-000
	1	81	PANEL, TOP (COMPRESSOR)	063-67851-000	063-67851-000	063-67851-000	063-67851-000
MISC.							
	1	82	BRACKET (MOTOR SUPPORT)	026-17579-900	026-17579-900	026-17579-900	026-17579-900
	*	83	CAP, FLARE	023-11018-000	023-11018-000	023-11018-000	023-11018-000
	*	84	CAP, MOTOR SHAFT	028-07364-900	028-07364-900	028-07364-900	028-07364-900
	*	85	CATCH, MAGNETIC (DOOR)	029-15650-000	029-15650-000	029-15650-000	029-15650-000
	*	86	GASKET, PASS BAFFLE (FRONT)	076-61035-900	076-61035-900	076-61035-900	076-61035-900
	*	87	GASKET, PASS BAFFLE (BACK)	076-61036-900	076-61036-900	076-61036-900	076-61036-900
	1	88	GUARD, FAN	026-25365-000	026-25365-000	026-25365-000	026-25365-000
	*	89	GROMMET (RAIN SHIELD)	028-04209-900	028-04209-900	028-04209-900	028-04209-900
	*	90	GROMMET (COMP. MOUNT)	028-07362-000	028-07362-000	028-07362-000	028-07362-000
	*	91	GROMMET (FAN MOUNT)	028-04210-900	028-04210-900	028-04210-900	028-04210-900
	1	92	HANDLE, ACCESS PANEL	029-08701-900	029-08701-900	029-08701-900	029-08701-900
	1	93	PROTECTOR (RAIN SHIELD)	062-30549-000	062-30549-000	062-30549-000	062-30549-000
	*	94	SPRING, COMP. MOUNTING (BLACK)	029-11729-900	029-11729-900	029-11729-900	029-11729-900
	*	95	SPRING, COMP. MOUNTING (BLUE)	029-13662-000	029-13662-000	029-13662-000	029-13662-000
	*	96	SPRING, COMP. MOUNTING (GREEN)	029-10111-000	029-10111-000	029-10111-000	029-10111-000

* NOT SHOWN ( ) NEW REPLACEMENT PARTS.

Subject to change without notice. Printed in U.S.A. CPC 2500 690 .20 Code: RBY 570.05-RP5Y

Central Environmental Systems.
Post Office Box 1592
York Pennsylvania 17405-1592

YORK®
Heating and Air Conditioning

TAB PLACEMENT HERE

DESCRIPTION:

6

☒ **Tab page did not contain hand written information**

☐ **Tab page contained hand written information**
***Scanned as next image**

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Renovation of Building M231
Marine Corpos Base
Camp Lejeune, NC.
Conract: N62470-88-C-3764

Temperature Controls

General Contractor:

CBC Enterprises, Inc.
1312 E. Little Creek Road
Norfolk, Virginia 23518

Mechanical Contractor:

G.R. Michaels & Co.
331 32nd Street
Newport News, Va.
Phone: (804) 622-3099

Wholesaler and Supplier:

Environmental Control Service
833 St. Brides Road West
Chesapeake, Va. 23322

(804) 421-7775
Harper Powell

TEMPERATURE CONTROL SYSTEM

O & M SUBMITAL DATA
and
AS-BUILT DRAWINGS

PROJECT

BOQ Renovations
Marine Corps Base, Building M-231
Camp Lejeune, North Carolina
Contract No. N62470-88-B-3764

Submitted by

ENVIRONMENTAL CONTROL SERVICES
833 St. Brides Road West
Chesapeake, Virginia 23322

TEMPERATURE CONTROL SYSTEM
O & M SUBMITTAL DATA
and
AS-BUILT DRAWINGS

Job No.: ECS 90051 Date: July 29,1991

PROJECT

BOQ Renovations
Marine Corps Base, Building M-231
Camp Lejeune, North Carolina
Contract No. N62470-88-B-3764

Environmental Control Services is pleased to submit this Operation and Maintenance Data for the Temperature Control System. The as-built drawings are also incorporation into this section for documentation. The recommended spare parts listed for this project are indicated under the as-built drawings Bill of Material. All temperature control devices can be purchased from our local branch office by phoning (804) 421-7775.

Respectfully submitted,
ENVIRONMENTAL CONTROL SERVICES

J. Harper Powell
Project Manager

Environmental Control Services — SUBMITTING OFFICE
833 St. Brides Road West — ADDRESS
Chesapeake, Virginia 23322 — CITY/STATE/ZIP

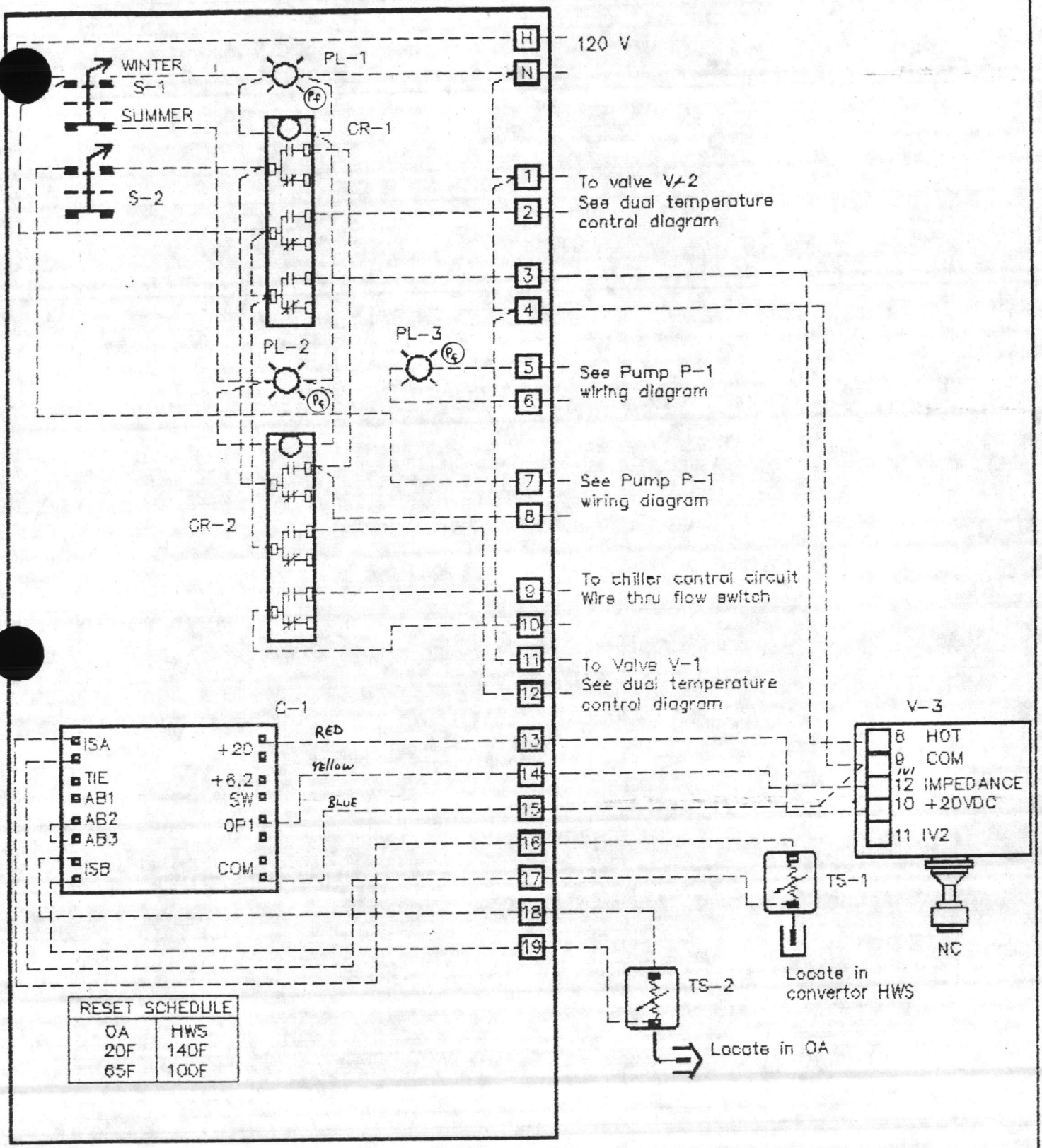
SEQUENCE OF OPERATION
FOR
CAMP LEJEUNE, NC

SUMMER-WINTER CHANGEOVER CONTROL:

The dual temperature water pump P-1 shall be manually controlled by an ON-OFF Switch S-2 located on the control panel.
The Summer- Winter Switch S-1 located on the control panel shall manually switch the heating or cooling mode of operation.
With S-1 in the winter position control relay CR-1 shall start dual temperature pump P-1 three way changeover V-1 shall remain normally closed to the chiller while CR-1 positions 3 way changeover valve V-2 open to the hot water loop. Aquastat A-2 located in the dual temperature return water prior to the steam convertor heating loop shall not allow changeover valve V-2 to be positioned opened to the hot water loop until the dual temperature return water is above 70F. Control relay CR-1 shall allow the normally closed steam convertor valve V-3 to operate. On a fall in water temperature as sensed by TS-1, located in the convertor hot water supply, controller C-1 will control to modulate valve V-3 to supply an increased amount of steam to the convertor. Controller C-1 will be inversely reset upon a rise in outside air temperature as sensed by TS-2 located in the outside air. On a fall in outside air temperature the reverse operation will occur.
With S-1 switched to the summer position control relay CR-2 shall start the dual temperature pump P-1. Changeover valve V-2 shall remain normally closed to the convertor hot water loop while CR-2 positions changeover valve V-1 open to the chilled water loop. Aquastat A-1 located in the dual temperature pump discharge water prior to the chilled water loop shall not allow changeover valve V-1 to position opened to the chilled water loop until dual temperature pump discharge water is below 90F. The chiller shall be energized by the control relay CR-2 but will not start until flow is proven by the chilled water flow switch. Chiller shall operate through controls furnished by the chiller manufacturer.

BILL OF MATERIAL FOR CAMP LEJEUNE

TAG	QTY	VENDOR	CODE NO.	DESCRIPTION
A1,2	2	BC	TC2974	Aquastat
C1	1	BC	CP8102	Controller
CP-1	1	APC	CPC-16	Control Panel
CR1,2	2	IDEC	RH3B/SH3B	Relay
PL1-3	3	IDI	I0520C5	Pilot Light (Green)
S1	1	CARLING	2X464	Switch
S2	1	CARLING	2X469	Switch
TS1	1	BC	AT201	Well
TS1	1	BC	TS8201	Temperature controller
TS2			AT211	Sun shield
TS2	1	BC	TS8501	Temperature sensor
V1,2	2	NELSON		Valve(See Valve List)
V3	1	BC	VS9223 353 4 10	Valve(See Valve List)



NOTE: Wiring diagrams are general guides only and are not intended for specific installations. Refer to equipment data sheets.

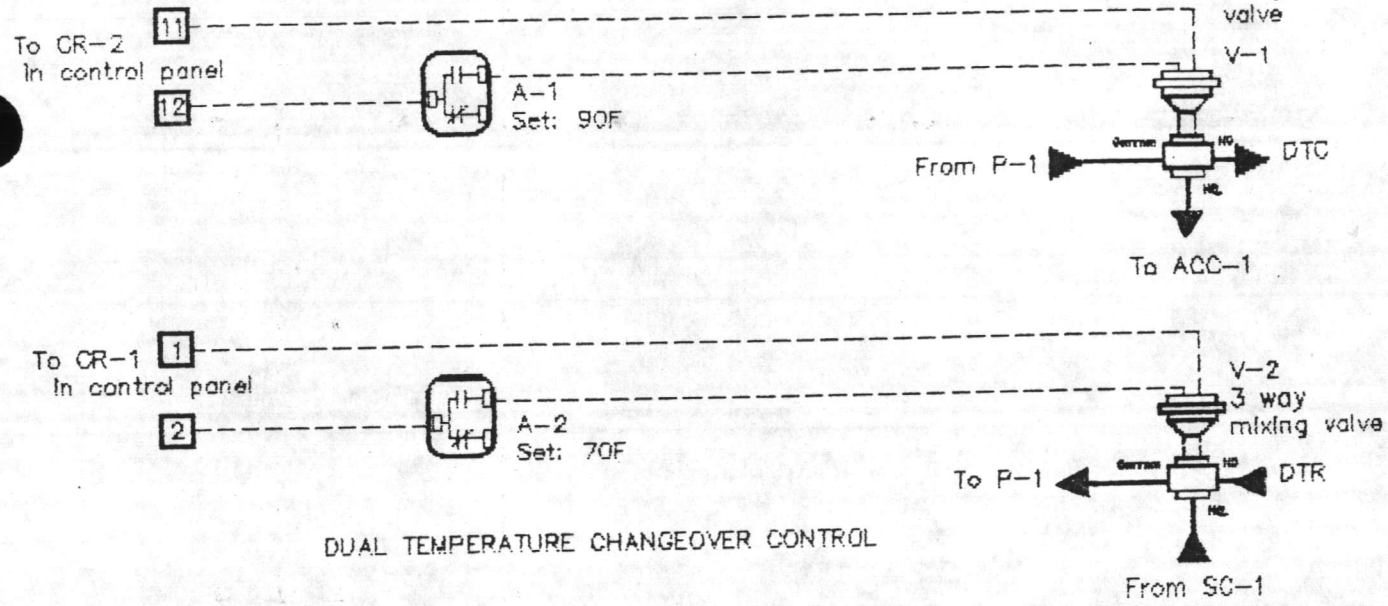
REVISIONS	
DATE	CHG

PROJECT

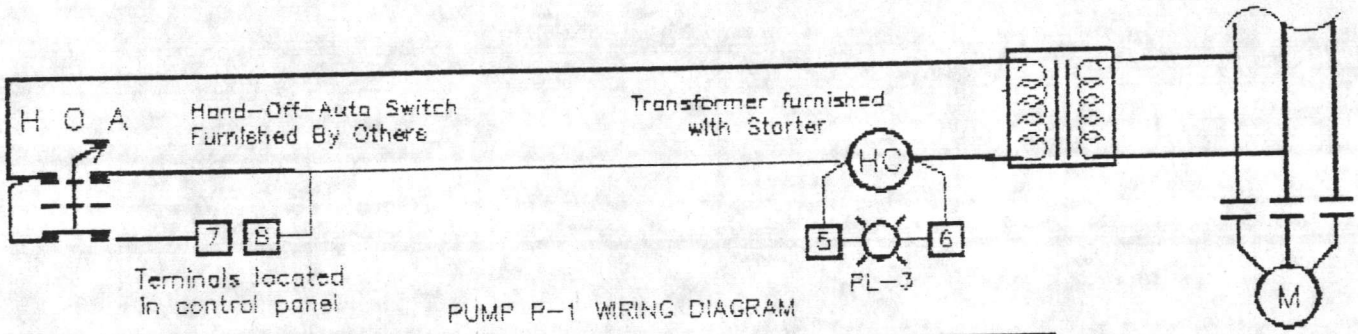
BUILDING M-231
CAMP LEJEUNE, NC

ECS CONTROLS INC.
833 ST. BRIDES RD. WEST
CHESAPEAKE, VA. 23322
804-421-7775

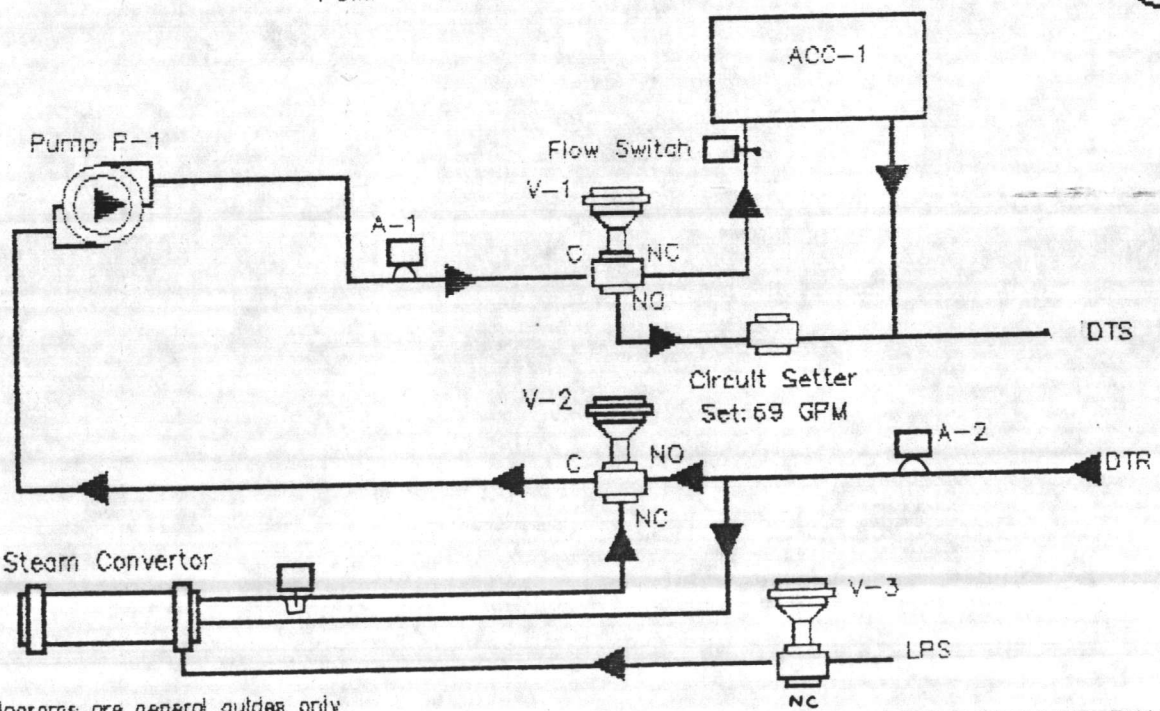
DRAWN BY: JHP
DATE: 11-30-90
SHT 1 OF 2
CONTRACT NO.: 90051



DUAL TEMPERATURE CHANGEOVER CONTROL



PUMP P-1 WIRING DIAGRAM



NOTE: Wiring diagrams are general guides only and are not intended for specific installations. Refer to equipment data sheets.

DUAL TEMPERATURE WATER SYSTEM SCHEMATIC

REVISIONS	
DATE	CHG

PROJECT

BUILDING M-231
CAMP LEJEUNE, NC

ECS CONTROLS INC.
833 ST. BRIDES RD. WEST
CHESAPEAKE, VA. 23322
804-421-7775

DRAWN BY: JHP
DATE: 11-30-90

SHT 2 OF 2
CONTRACT NO.: 90051

* at 50% open

SYSTEM NO.	SYSTEM & LOCATION	MODEL NO.	SIZE	QUANT.	SYSTEM PRESS.	FLOW GPM	FLOW LBS/HR	C.V.	ΔP (PSI)	ACTUATOR PILOT	ACTUATOR RANGE	BODY PATTERN	POST.	ACTUATOR NO.
V-1	CHANGEOVER VALVE	341-D	2½"	1		110	*	70	2.5			BTRFLY		E300-12
V-2	CHANGEOVER VALVE	341-C	2½"	1		110	*	70	2.5			BTRFLY		E300-12
V-3	CONVERTER VALVE	VS 9223-353-4-10	1½"	1	15		729	25	12			NC		MS 83010

ECS Controls, Inc.
833 St. Brides Rd. W. • Chesapeake, VA 23322

— REVISIONS —	
DATE	CHANGES

JOB NAME: BUILDING M-231
LOCATION: CAMP LEJEUNE
ENGINEER: PROF. ENG. ASSOC
CONTRACTOR: G.R. MICHAELS

VALVE LIST

SHEET 1 OF 1

CHECKED BY: TNP
DATE: 12-5-90
JOB NO.: 90051

VALVE PART NUMBERING SYSTEM

(Note: Does not include VA-1203, VA-1403, VA-3203 or VB-3403)

Always a Letter — Always a Number (Digit)

VXX-XXXX-XXX-X-XX

VALVE

B — VALVE BODY VALVE ASSEMBLIES

- **A** — 2-Position (SPST)
- **C** — 2-Position (SPDT)
- **K** — Pneumatic
- **M** — Modular Motor (order MMC control module separately)
- **P** — Multiple Electric/Electronic Inputs:
  1. 2-Position SPST
  2. 2-Position SPDT
  3. System 8000, 2-15 Vdc
  4. Slidewire (Series 90)
  5. Current Input
  6. Floating Control (Direct Digital)
  7. Pneumatic to Electric
- **S** — System 8000, 2-15 Vdc

- **4** — Positive Positioner on Pneumatic only
- **5** — 50 Hz
- **6** — Hazardous Location Housing 60 Hz
- **7** — Hazardous Location Housing 50 Hz

VALVE BODY DATA

- **111** — 2-Way, Union Angle, Stem Up Open, Brass Trim with Disc
- **222** — 2-Way Globe Body, Steel Body, Stainless Steel Trim
- **606** — 2-Way Butterfly Valve, Metal-to-Metal Trim
- **616** — 2-Way Butterfly Valve, Rubber Lined
- **666** — 3-Way Butterfly Valve, Metal-to-Metal Trim
- **676** — 3-Way Butterfly Valve, Rubber Lined
- **921** — 2-Way, Stem Up Open, Brass Trim with Disc
- **922** — 2-Way, Stem Up Closed, Brass Trim with Disc
- **925** — 2-Way, Stem Up Open, Stainless Steel Trim with Disc
- **926** — 2-Way, Stem Up Closed, Stainess Steel Trim with Disc
- **927** — 2-Way, Stem Up Open, Stainless Steel Trim
- **928** — 2-Way, Stem Up Closed, Stainless Steel Trim
- **931** — 3-Way Mixing
- **932** — 3-Way Diverting
- **933** — 3-Way Sequencing

TYPE OF END FITTING FOR VX-9XXX

- **1** — Union End
- **2** — Flared End
- **3** — Screwed or Flanged
- **4** — Union Sweat End

For VX-111, VX-6XX this digit is Actuator Series Type.
For VB-111 this digit is blank.

P CODE (Size, Cv Rating, Port Code)

- **1, 2, 3, 4** — 1/2"
- **5, 6** — 3/4"
- **7, 8** — 1"
- **9** — 1-1/4"
- **10** — 1-1/2"
- **11** — 2"
- **12** — 2-1/2"
- **13** — 3"
- **14** — 4"
- **15** — 5"
- **16** — 6"
- **17** — 8"
- **18** — 10"
- **19** — 12"
- **20** — 14"
- **21** — 16"
- **22** — 18"
- **23** — 20"
- **24** — 24"

PATTERN CODE OF VALVE BODY

- **1** — Straightway, High Temperature Water
- **2** — Globe Flanged, High Pressure Steam
- **3** — Angle
- **4** — Straightway
- **5** — Globe Flanged

- **0** — Valve Body
- **XXX** — Actuator Code (XXX) for Valve Assemblies

2-WAY VALVES, SCREWED (1/2" TO 3"), UNION SWEAT (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 1. Select **Valve Body** including **P Code** (Valve Size, Cv Rating, Port Code) or select **Valve Assembly** with correct Input Signal (See Table 3 also) less Actuator Code (XXX) including the **P Code** (Size, Cv Rating, Port Code). (See Pages 334-338 for Valve Sizing.)

		APPLICATION				
		Chilled or Hot Water 281°F Max. 35 psig Steam			Hot Water 300°F Max. 100 psig Steam	Hot Water 366°F Max. 150 psig Steam
		Screwed	Union Sweat	Flanged	Screwed	
						
Size*		1/2"—3"	1/2"—2"	2-1/2"—4"	1/2"—2"	1/2"—2"
Normally Open Valves	Valve Body	VB-9213-0-4-P	VB-9214-0-4-P	VB-9213-0-5-P	VB-9253-0-4-P	VB-9273-0-4-P
	Valve Assembly 2-15 Vdc Input, 4-20 mA	VS-9213-XXX-4-P	VS-9214-XXX-4-P	VS-9213-35X-5-P	VS-9253-XXX-4-P	VS-9273-XXX-4-P
	2-Position SPST Valve Assembly	VA-9213-2XX-4-P	VA-9214-2XX-4-P	—	VA-9253-2XX-4-P	VA-9273-2XX-4-P
Normally Closed Valves	Valve Body	VB-9223-0-4-P	VB-9224-0-4-P	VB-9223-0-5-P	VB-9263-0-4-P	VB-9283-0-4-P
	Valve Assembly, 2-15 Vdc Input, 4-20 mA	VS-9223-XXX-4-P	VS-9224-XXX-4-P	VS-9223-35X-5-P	VS-9263-XXX-4-P	VS-9283-XXX-4-P
	2-Position SPST Valve Assembly	VA-9223-2XX-4-P	VA-9224-2XX-4-P	—	VA-9263-2XX-4-P	VA-9283-2XX-4-P
Flow Type		Equal %	Equal %	Equal %	Equal %	Equal %
Material	Body	Bronze	Bronze	Cast Iron	Bronze	Bronze
	Seat	Bronze	Bronze	Bronze	Stainless Steel	Stainless Steel
	Stem	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
	Plug	Brass	Brass	Brass	Stainless Steel	Stainless Steel
	Packing	Spring Loaded Teflon Cone	Spring Loaded Teflon Cone	Spring Loaded Teflon Cone	Spring Loaded Teflon Cone	Spring Loaded Teflon Cone
	Disc	Composition	Composition	Composition	Teflon	None
STEAM						
Pressure (psig)	Static	250	250	125	250	250
	Inlet	35	35	35	100	150
	Recom. Diff.*	20	20	20	35	50
Fluid Temp. °F (°C)	Max.	281 (138)	281 (138)	281 (138)	340 (171)	366 (180)
WATER						
Pressure (psig)	Static	250	250	125	250	250
	Recom. Diff.*	35	35	35	35	50
Fluid Temp. °F (°C)	Min.	40 (4)	40 (4)	40 (4)	40 (4)	40 (4)
	Max.	281 (138)	281 (138)	281 (138)	300 (149)	366 (180)

NOTE: These charts are color coded as shown below to assist valve selection. Note it is possible to select either a valve assembly or component parts (actuator, valve linkage, valve body).

ORDERING EXAMPLES

1. **Valve Assembly:** VS-9223-211-4-8
2. **Valve Body:** VB-9223-0-4-8
   Actuator: MP-5210
   Linkage: AV-600

- **Valve Body** Data less P Code (Size, Cv Rating, Port Code) or **Valve Assembly** less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)
- **P Code** (Size, Cv Rating, Port Code)
- **Actuator** or **Actuator Code (XXX)** for Valve Assemblies
- **Valve Linkage**

TO SELECT A PORT CODE (P)

P Code	Valve Size†	Cv				
-1**	1/2"	0.4	0.4		0.4	0.4
-2**		1.3	1.3		1.3	1.3
-3**		2.2	2.2		2.2	2.2
-4		3.6	3.6		3.6	3.6
-5**	3/4"	5.0	5.0		5.0	5.0
-6		6.2	6.2		6.2	6.2
-7**	1"	8.2	8.2		8.2	8.2
-8		11.0	11.0		11.0	11.0
-9	1-1/4"	16.0	16.0		16.0	16.0
-10	1-1/2"	25.0	25.0		25.0	25.0
-11	2"	40.0	40.0		40.0	40.0
-12	2-1/2"	65		56		
-13	3"	85		85		
-14	4"			145		

*Maximum recommended differential pressure in full open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected.
NOTE: Do not exceed close-off rating.
**NOTE: Factory assemblies are not available for 2-position applications using reduced port valve bodies.
†Valve size refers to NPT on globe valves or nominal I.D. of copper tubing for union sweat valves.
CAUTION: Solder, tubing and/or pipe schedules must meet or exceed working static pressure requirements.

2-WAY VALVES, SCREWED (1/2" TO 3"), UNION SWEAT (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 2. Select **Actuator Type** or **Actuator Code (XXX)** series with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select **Valve Linkage.**



Input Signal					Two-Position SPST	Electronic	Electronic
Valve Linkage 1/2"—1-1/4" Valve					AV-600	AV-600**	
Valve Linkage 1-1/2"—2" Valve					—	—	AV-430
Valve Linkage 2-1/2"—4" Valve					—	—	AV-495
Actuator Code (XXX)					2XX	2XX	35X
Actuator					MA-521X-XXX	MP-5X1X MPR-561X MPR-571X MPR-581X	MS-8301X MSR-8601X MSR-8701X MSR-8801X
Normal Position	**Factory Avail. Valve Assembly**	**Valve Body**	**P Code**	**Size**	**CLOSE-OFF PRESSURE RATING***		
Normally Open	VA-9213-2XX-4-P VA-9214-2XX-4-P VA-9253-2XX-4-P VA-9273-2XX-4-P VS-9213-XXX-4-P VS-9214-XXX-4-P VS-9253-XXX-4-P VS-9273-XXX-4-P	VB-9213-0-4-P VB-9214-0-4-P VB-9253-0-4-P VB-9273-0-4-P	-1-2-3-4	1/2"	180	190	
			-5-6	3/4"	75	85	
			-7-8	1"	40	45	
			-9	1-1/4"	25	30	
			-10	1-1/2"			65
			-11	2"			35
	VS-9213-3XX-4-P	VB-9213-0-4-P	-12	2-1/2"			20
			-13	3"			12
	VS-9213-35X-5-P	VB-9213-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6
Normally Closed	VA-9223-2XX-4-P VA-9224-2XX-4-P VA-9263-2XX-4-P VA-9283-2XX-4-P VS-9223-XXX-4-P VS-9224-XXX-4-P VS-9263-XXX-4-P VS-9283-XXX-4-P	VB-9223-0-4-P VB-9224-0-4-P VB-9263-0-4-P VB-9283-0-4-P	-1-2-3-4	1/2"	250	220	
			-5-6	3/4"	140	90	
			-7-8	1"	75	50	
			-9	1-1/4"	45	30	
			-10	1-1/2"			65
			-11	2"			35
	VS-9223-3XX-4-P	VB-9223-0-4-P	-12	2-1/2"			20
			-13	3"			12
	VS-9223-35X-5-P	VB-9223-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6

*Close-off pressure ratings apply when valves are installed with pressure under the seat.

**MP-541X, MPR-5XXX use AV-600 and AV-601.

TABLE 3. Factory Assemblies, select exact **Actuator Code (XXX).** Any MA-52XX, MP-5XXX, MPR-5X1X can be assembled to 1/2"—1-1/4" valve bodies with the close-off pressure ratings listed in Table 2. Any MS-8XX1X and MSR-8X01X can be assembled to 1-1/2" & 2" valve bodies with the close-off pressure ratings listed in Table 2. Select below listed **Hydraulic Actuators** or **Actuator Codes (XXX)** for factory available assemblies. For applications that factory assemblies are not available, select actuator, linkage, valve body and field assemble.

Input Signal	Wiring Figure No.	Voltage Vac 50/60 Hz	VA	Aux. Switch	Actuator Part No.	Actuator Code (XXX) For Factory Available Assembly
Two-position SPST	See Figure 1 on Page 339	24	18	No	MA-5213	201
		120		No	MA-5210	211
		240		No	MA-5211	221
2-15 Vdc, System 8000, stroke occurs 6-9 Vdc approx., non-positive positioning	See Figure 10 on Page 341	24	18	No	MP-5213	201
		120		No	MP-5210	211
		240		No	MP-5211	221
2-15 Vdc, System 8000, start 6 Vdc factory set, adjustable 2-12 Vdc, 3 Vdc span, positive positioning	See Figure 10 on Page 341	24	18	No	MP-5413	247
		120		No	MP-5410	244
		240		No	MP-5411	245
	See Figure 10 on Page 341	24	36	No	MS-83013	351
		120	37	No	MS-83010	353
4 to 20 mA	See Figure 17 on Page 345	24	18	No	MPR-5613	267
		120		No	MPR-5610	264
		240		No	MPR-5611	265

2-WAY VALVES, SCREWED (1/2" TO 3"), UNION SWEAT (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 4. Dimensions (Inches)

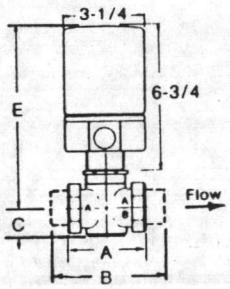
Valve Body					Actuator Series	
					MA/MP/MPR-5XXX*	MS/MSR-8XXXX
Part Number	Size	A	B**	C	E	E
VB-9213-0-4-P VB-9214-0-4-P VB-9253-0-4-P VB-9273-0-4-P	1/2"	3	4-1/4	1	8-3/16	
	3/4"	3-5/8	5-1/2	1-3/8	8-11/16	
	1"	4-5/8	6-3/4	1-1/2	9	
	1-1/4"	4-5/8	6-7/8	1-5/8	9	
	1-1/2"	6-1/8	9-1/8	2-1/2		19-1/8
	2"	6-1/8	9-3/8	2-1/2		19-1/8
VB-9213-0-4-P	2-1/2"	8-1/2		3-3/4		19-13/16
	3"	9-1/2		4-1/4		20
VB-9213-0-5-P	2-1/2"	8-1/2		3-1/2		19-13/16
	3"	9-1/2		3-3/4		20-3/16
	4"	11-1/2		4-1/2		21-7/16
VB-9223-0-4-P VB-9224-0-4-P VB-9263-0-4-P VB-9283-0-4-P	1/2"	3	4-1/4	1-7/16	8-3/16	
	3/4"	3-5/8	5-1/2	1-3/4	8-11/16	
	1"	4-5/8	6-3/4	2	9	
	1-1/4"	4-5/8	6-7/8	2	9	
	1-1/2"	6-1/8	9-1/8	3-3/16		18-5/8
	2"	6-1/8	9-3/8	3-3/16		18-5/8
VB-9223-0-4-P	2-1/2"	8-1/2		3-3/4		19-3/16
	3"	9-1/2		4-1/4		20
VB-9223-0-5-P	2-1/2"	8-1/2		4-1/8		19-7/16
	3"	9-1/2		4-1/8		19-13/16
	4"	11-1/2		5-1/16		20-7/16

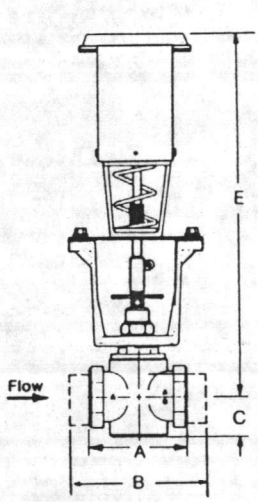
*Add 2-1/32" (52 mm) to the "E" dimension for a valve assembly using an AV-601 linkage extension.
**Use B dimension for VB-9214 and VB-9224 valve bodies.

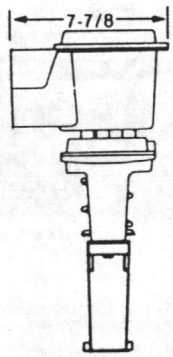
Dimensions in inches (metric conversion 25.4 mm = 1 inch)

NOTE: Allow 3 inches clearance above actuator for removal.
Mount MA/MP/MPR-5XXX actuators above the valve body at 45° from vertical on steam applications.

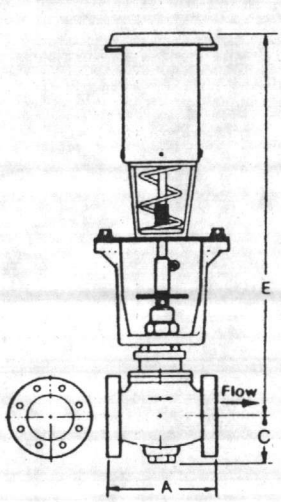
VB-9213-0-4-P
VB-9214-0-4-P
VB-9223-0-4-P
VB-9224-0-4-P
with MA/MP/MPR-5XXX

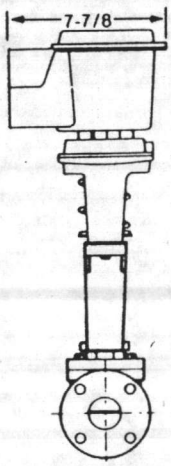




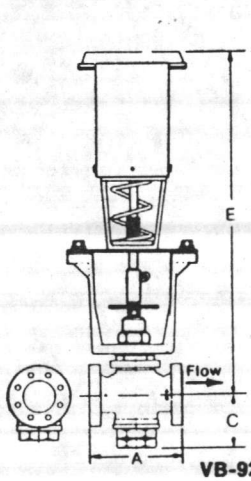


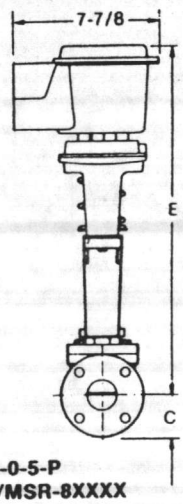
VB-9213-0-4-P
VB-9214-0-4-P
VB-9223-0-4-P
VB-9224-0-4-P
with MS/MSR-8XXXX





VB-9213-0-5-P
with MS/MSR-8XXXX



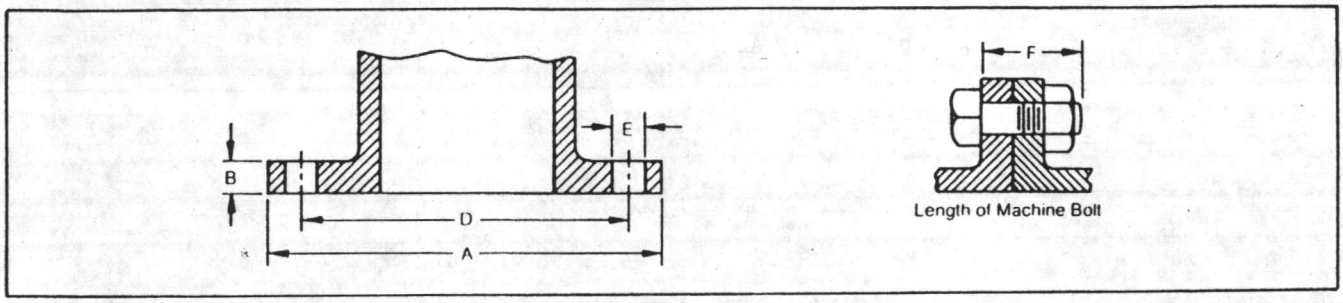


VB-9223-0-5-P
with MS/MSR-8XXXX

See Flange Detail Table on following page

2-WAY VALVES, SCREWED (1/2" TO 3"), UNION SWEAT (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

American Standard 125 lb. Cast Iron Pipe Flanges



Flange Detail

Dimensions in inches (metric conversion 25.4 mm = 1 inch)

Nominal Pipe Size	Flanges		Drilling		Bolting		Length of Machine Bolts
	Flange Diameter A	Flange Thickness B	Diameter of Bolt Circle D	Diameter of Bolt Holes E	Number of Bolts	Diameter of Bolts	F
2-1/2	7	11/16	5-1/2	3/4	4	5/8	2-1/2
3	7-1/2	3/4	6	3/4	4	5/8	2-1/2
4	9	15/16	7-1/2	3/4	8	5/8	3

TABLE 5. Restrictions on Maximum Ambient Temperature for Valve Actuators

		TEMPERATURES °F (°C)			
Actuator Code (XXX)		20X, 21X, 22X		24X, 26X	35X
Actuator Series		MA-521X-XXX MP-521X-XXX	MA-521X-XXX MP-521X-XXX w/AV-601 Linkage Extension	MPR-561X, MPR-571X, MPR-581X, MP-541X w/AV-601 Linkage Extension	MS-8XX1X MSR-8XX1X
Maximum Ambient		140 (60)	140 (60)	140 (60)	140 (60)
Max. Allowable Fluid		181 (83)	281 (138)	140 (60)	281 (138)
VB-9213 VB-9214-0-4-P VB-9223 VB-9224-0-4-P	Maximum Fluid	281 (138)	281 (138)	281 (103)	281 (138)
	Max. Allow. Ambient	115 (46)	140 (46)	103 (39)	140 (60)
VB-9253 VB-9263	Maximum Fluid	340 (171)	340 (171)	340 (171)	340 (171)
	Max. Allow. Ambient	100 (38)	100 (38)	93 (34)	122 (50)
VB-9273 VB-9283	Maximum Fluid	366 (180)	366 (180)	366 (186)	366 (180)
	Max. Allow. Ambient	90 (32)	90 (32)	88 (31)	114 (35)

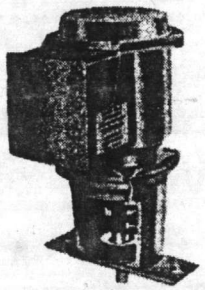
NOTE: With 40°F (4°C) water the minimum dew point temperature is 68°F (20°C).

Damper/Valve/Butterfly Valve, Spring Return Actuators

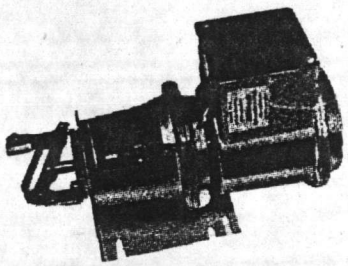
MS-83010 Series
MS-83040 Series
MS-83050 Series

APPLICATION

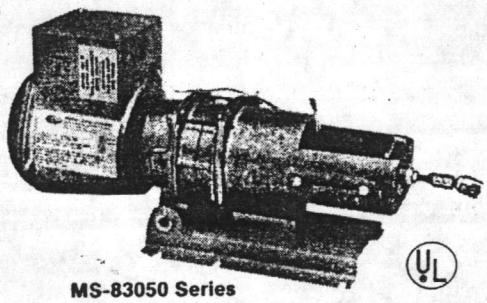
For electronic positive positioning proportional control of dampers, valves or butterfly valves which require the return to normal position on power interruption.



MS-83010 Series



MS-83040 Series



MS-83050 Series

SPECIFICATIONS

Controller Signal: 2 to 15 Vdc from System 8000 controller.
Stroke: Over a nominal 6 Vdc (fully retracted) to 9 Vdc (fully extended) input range. See Table 1.
Start Point: Factory set at 6 Vdc, adjustable 2 to 12 Vdc.
Input Impedance: 10,000 ohms or greater.
Spring Return: Damper linkage provides return to normal position on power interruption.
Power Requirements: See Table 1.
Power Supplies: 20 Vdc, 75 mA; 50 mA available when optional auxiliary switch (AM-158) is installed.
Environment:
Ambient Temperature Limits, Operating, Shipping and Storage
-40 to 140°F (-40 to 60°C).
Humidity, 5 to 95% RH, non-condensing.
Locations, NEMA Type 1 indoor only.
Connections: Color coded 6" (152 mm) leads.
Case: Die cast aluminum.
Mounting: Any position for damper actuators. In any upright position with actuator above the center of the valve body.
Dimensions:
MS-8301X, 10-1/2" high × 7-7/8" wide (267 mm × 200 mm).
MS-8304X, 10-1/8" high × 5-15/16" wide × 15-1/2" deep (257 mm × 151 mm × 394 mm).
MS-8305X, 8-3/8" high × 5-15/16" wide × 21-3/4" deep (213 mm × 151 mm × 552 mm).

ACCESSORIES

AM-158	Auxiliary switch kit; 175 VA @ 120/280 Vac, 35 VA @ 24 Vac
TOOL-201	Calibration kit for System 8000

Damper Linkage Accessories

AM-111	Crank arm for 5/16" diameter damper shaft
AM-112	Crank arm for 3/8" diameter damper shaft
AM-113	Crank arm for 1/2" diameter damper shaft
AM-115	Crank arm for 7/16" diameter damper shaft
AM-122	Linkage connector straight type
AM-123	Damper clip
AM-125	5/16" diameter × 20" damper rod
AM-125-048	5/16" diameter × 48" damper rod
AM-132	Ball joint connector
AM-161-3	Damper linkage kit

For MS-8301X Series Only

AV-430	Valve linkage
AV-495	Valve linkage

For MS-8305X Series Only

AM-301	90 degree mounting bracket for pivot mounting
AM-530	Crank arm for 1/2" dameter damper shaft holes for 3-1/2" stroke
AM-532	Bolt-on frame lug and damper blade clip kit
AM-533	Actuator shaft extension
AM-534	Pivot stud for pivot mounting
AM-535	Clevis for pivot mounting
AM-536	Mounting plates for pivot mounting on ducts or damper frame

TABLE 1. VALVE ACTUATOR SELECTION SPECIFICATIONS

Part Number	Supply Voltage 50/60 Hz (Vac) 10 Watts	VA Rating	Output Description	Force	Valve	Timing at 70°F (21°C)	
						No Load Stroke*	Retract
MS-83010	120 (+10%, -15%)	47	Proportional 1" (25 mm) stroke	150 pounds	VB-9XXX 1-1/2 thru 4". See Table 3.	2-1/4 min. ±25 sec.	1/2 min. ±10 sec.
MS-83011	240 (+10%, -15%)*	46					
MS-83013	24 (±10%)	44					

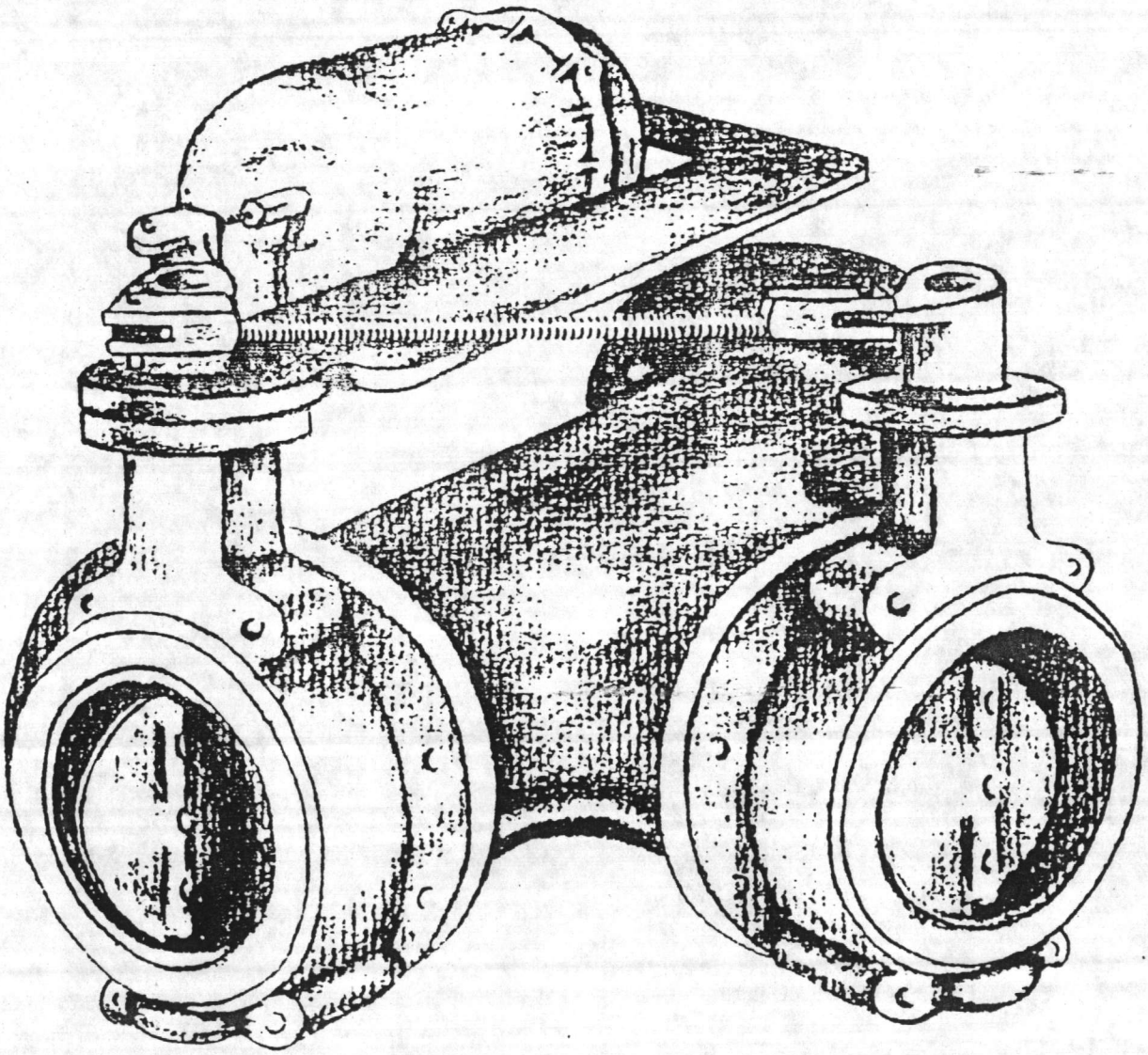
*220 Vac at 50 Hz (+10%, -15%) the power stroke is approximately 25% slower and the VA is 20% more.

Continued on next page

V-1, V-2 IP 14.1.a

NELSON

Controls, Inc.



"The Valve Automation Specialists"

2

POSITION AND MODULATING CONTROL VALVE ASSEMBLIES

The NCMA 2 position and modulating assembly package offers you versatility, dependability and long life with maximum economy!

BUTTERFLY VALVE CONSTRUCTION

Specifications for HVAC 150 psig W.O.G. Semi-lug

BODY — Cast Iron
DISC — Aluminum Bronze
STEM — Stainless Steel
SEAT — EPDM (for -40°F through 250°F)
STEM BUSHING — Acetal
STEM PACKING — Buna N

OPTIONS (Valve Trim)

DISCS
316 Stainless Steel
Ductile Iron

SEATS
Buna N (0°F through 212°F)
F.D.A. regulations for Food & beverage, and preferred sanitary service.

Teflon lined Buna N (0°F through 250°F)
Not suitable for abrasive service.

Teflon lined EPDM (-20° through 300°F)
Not suitable for abrasive service.

NOTE: For Teflon Seated Valves the body configuration will vary.

N C M A

ORDERING INFORMATION

2 - position and modulating Control Valve Arrangements

2 WAY	Style
N.C. _____	K
N.O. _____	L

3 WAY	Style
N.C. _____ N.O.	A
N.O. _____ N.C.	B
_____ N.C. N.O.	C
_____ N.O. N.C.	D
N.C. ___|___ N.O.	E
N.O. ___|___ N.C.	F

2—way 2—position or Modulating control			
Valve Size	Part No.	Actuator Model	Arrangement Style
2″	242	_____	_____
2½″	241	_____	_____
3″	243	_____	_____
4″	244	_____	_____
5″	255	_____	_____
6″	256	_____	_____
8″	268	_____	_____
10″	2610	_____	_____
12″	2612	_____	_____

3—way 2—position or Modulating control			
Valve Size	Part No.	Actuator Model	Arrangement Style
2″	342	_____	_____
2½″	341	_____	_____
3″	343	_____	_____
4″	344	_____	_____
5″	355	_____	_____
6″	356	_____	_____
8″	368	_____	_____
10″	3610	_____	_____
12″	3612	_____	_____

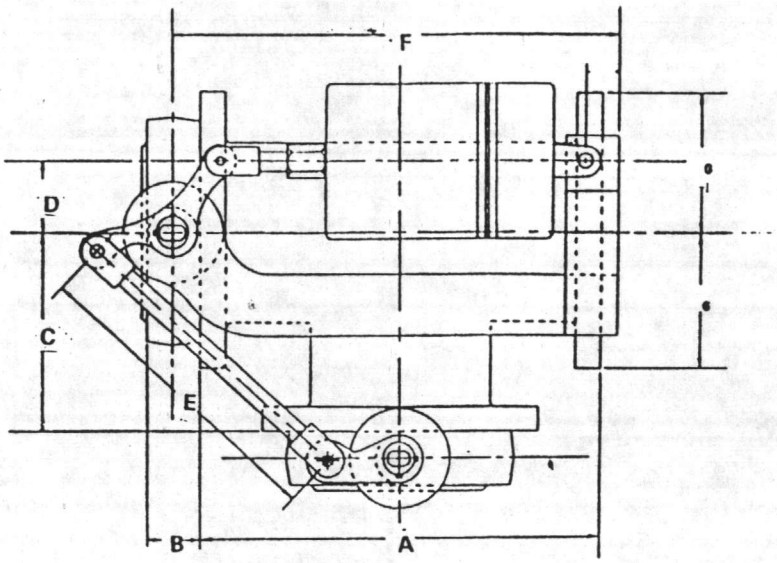
QUANTITY

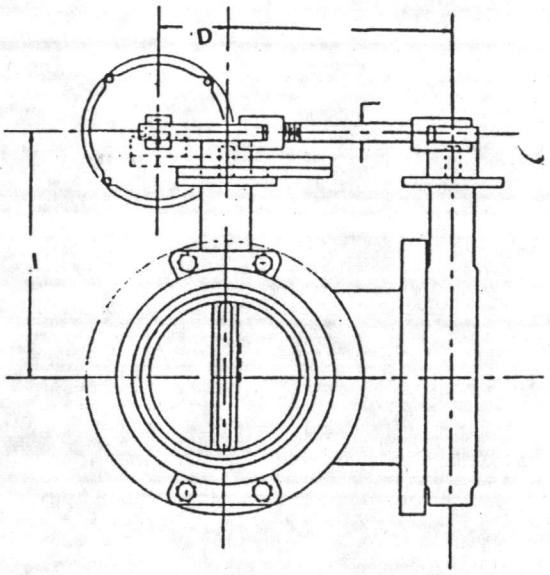
1

EXAMPLE DESCRIPTION

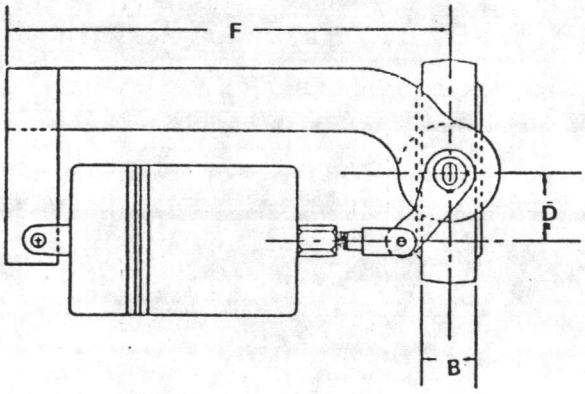
3″ — 243 — (Actuator Model #) — K

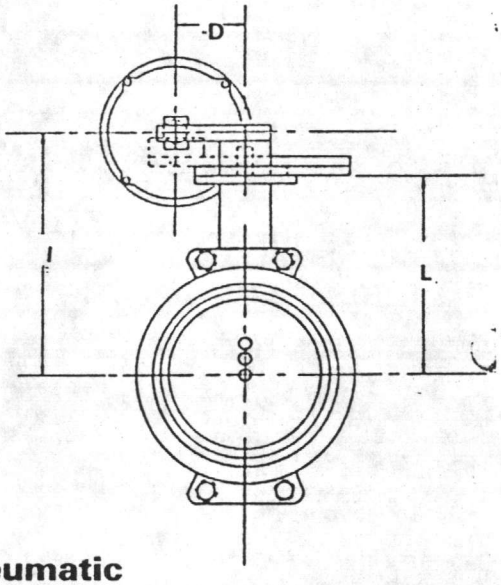
NOTE: 8″ - 12″ Order No.'s are based upon 50ΔP reduced disk diameter butterfly valves. For higher pressure applications actuators may need to be re-sized.





Pneumatic

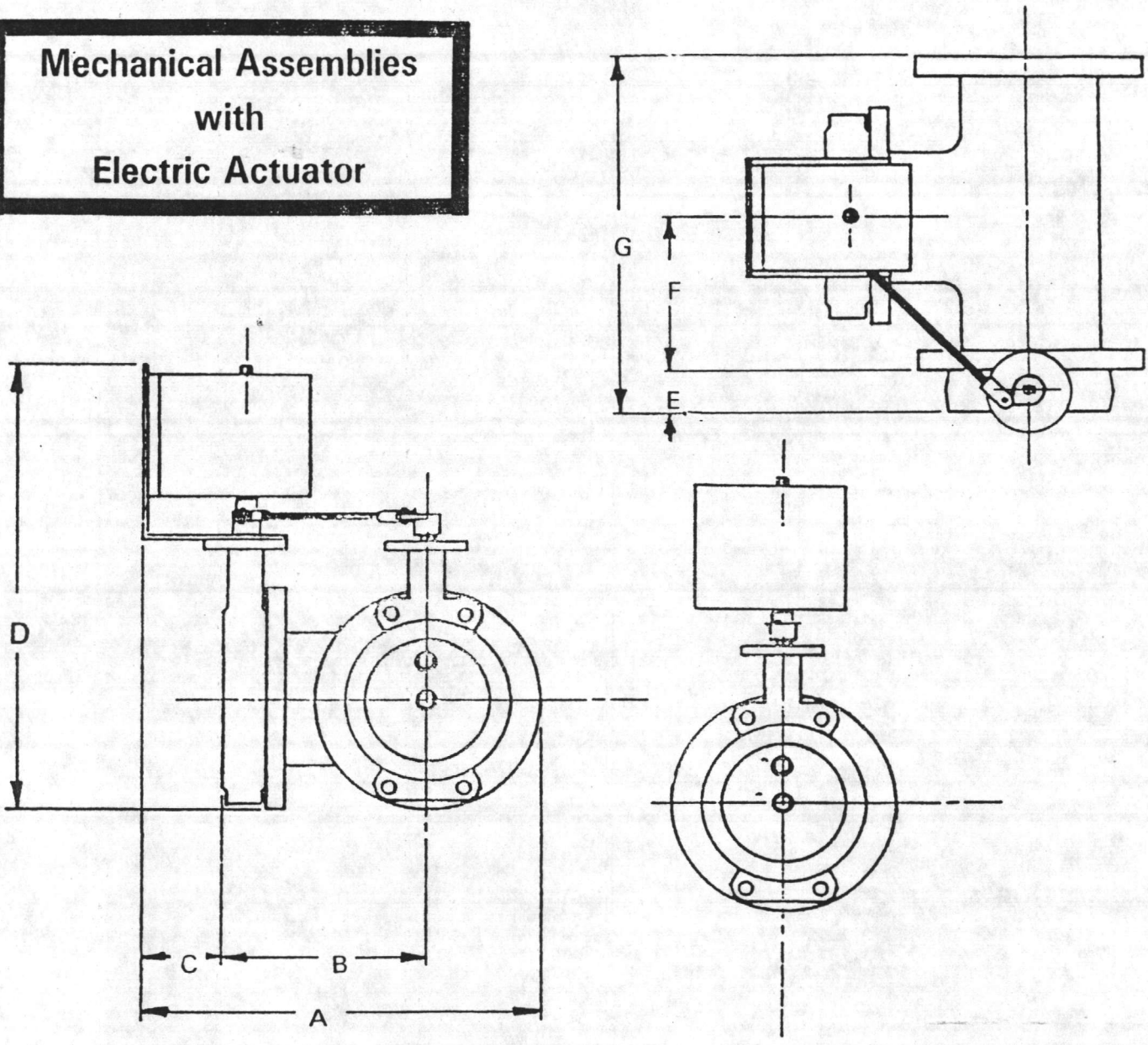




Assembly Dimensions/Pneumatic

SIZE	A	B	C	D	E	F	G	H	I	J	K	L
2''	9	1 5/8	4 1/2	2	7 15/16	14 1/2	3	3/4	7 1/8	5 5/16	1/4	5 1/2
2 1/2''	10	1 3/4	5	2	8 1/2	14 1/2	3 1/2	3/4	7 5/8	5 7/8	1/4	6
3''	11	1 3/4	5 1/2	2	9	14 1/2	3 3/4	3/4	7 7/8	6 3/8	1/4	6 1/4
4''	13	2	6 1/2	2	9 3/4	14 1/2	4 1/2	3/4	8 5/8	7 1/2	1/4	7
5''	15	2 1/8	7 1/2	2 3/4	12	17 3/4	5	1 1/4	9 1/4	8 9/16	3/4	7 1/2
6''	16	2 1/8	8	2 3/4	12 1/2	17 3/4	5 1/2	1 1/4	9 3/4	9 1/16	3/4	8
8''	18	2 1/2	9	3 7/16	15	22 3/4	6 3/4	1 1/4	11 1/2	10 1/4	3/4	9 1/2
10''	22	2 1/2	11	3 7/16	17	22 3/4	8	1 1/4	12 3/4	12 1/4	3/4	10 3/4
12''	24	3	12	3 7/16	19	22 3/4	9 1/2	1 1/4	14 1/4	13 1/2	3/4	12 1/4

Mechanical Assemblies with Electric Actuator



Assembly Dimensions/Electric						
Valve Size	2″	2½″	3″	4″	5″	6″
A	13 9/16	14 5/8	15 3/8	17 1/4	18 13/16	19 13/16
B	6 1/8	6 3/4	7 1/4	8 1/2	9 5/8	10 1/8
C	4 7/16	4 3/8	4 3/8	4 1/4	4 3/16	4 3/16
D	17 1/2	18 1/2	19	20 1/2	21 1/2	22 1/2
E	1 5/8	1 3/4	1 3/4	2	2 1/8	2 1/8
F	4 1/2	5	5 1/2	6 1/2	7 1/2	8
G	10 5/8	11 3/4	12 3/4	15	17 1/8	18 1/8

NCMA

Control Valves And Mechanical Assemblies

Rated Flow Coefficient
C_v

VALVE SIZE	ANGLE OF DISK OPENING							
	10	20	30	40	50	60	70	90
2	2	8	18	30	50	80	130	220
2½	3	11	25	44	70	110	180	320
3	4	16	38	68	110	170	280	500
4	6	28	63	110	180	280	460	820
5	10	44	100	180	280	460	740	1300
6	17	60	140	250	400	640	1100	1900
8	24	110	250	440	640	1100	1800	3200
10	38	180	400	710	1100	1800	3000	5100
12	57	260	590	1000	1700	2700	4400	8000

Cv = The volume of water in U.S.G.P.M. that will pass through a given valve opening with a pressure drop of 1 lb. per sq. in.

Torque

Seating and Unseating Torque Requirement for Standard Disk Diameter (150 psig W.O.G. bubble tight shut-off).

VALVE SIZE	ΔP 0	ΔP 50	ΔP 100	ΔP 150
2	110	120	130	140
2½	135	146	155	165
3	160	180	200	220
4	240	270	300	330
5	325	375	425	475
6	450	550	650	750
8	750	950	1150	1350
10	1150	1450	1760	2050
12	1550	2050	2550	3050

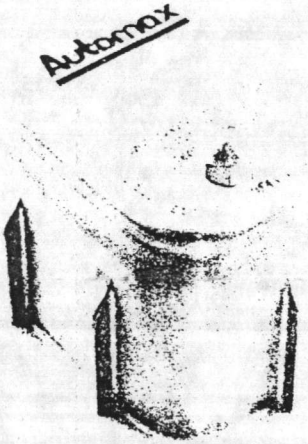
Torque Requirement for Reduced Disk Diameter (50 psig W.O.G. bubble tight shut-off.)

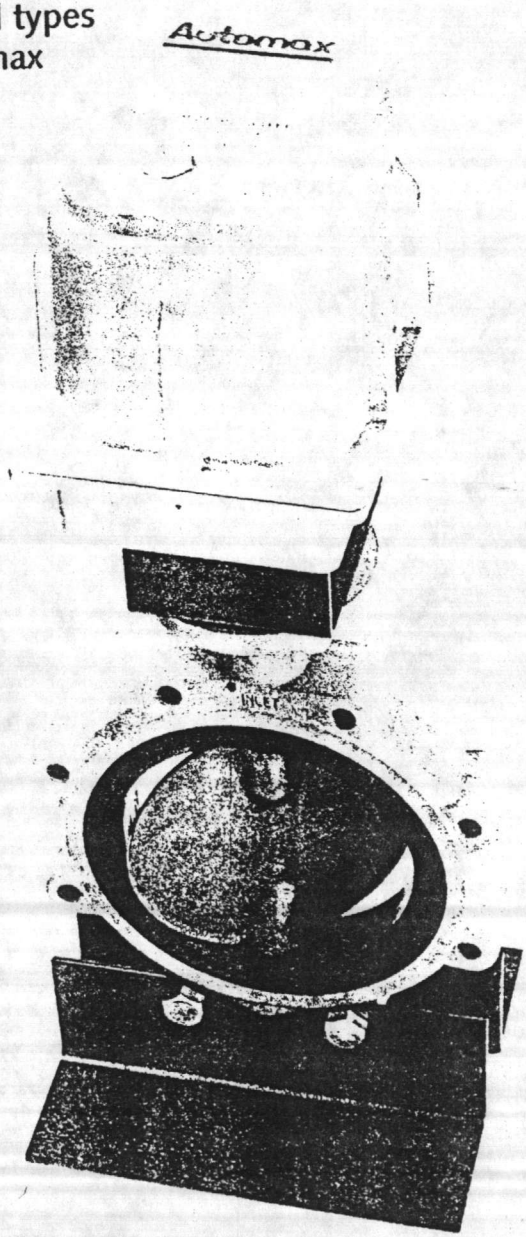
VALVE SIZE	ΔP 0	ΔP 50
4	165	195
5	220	270
6	305	405
8	500	700
10	750	1050
12	1000	1500

Automax ING.

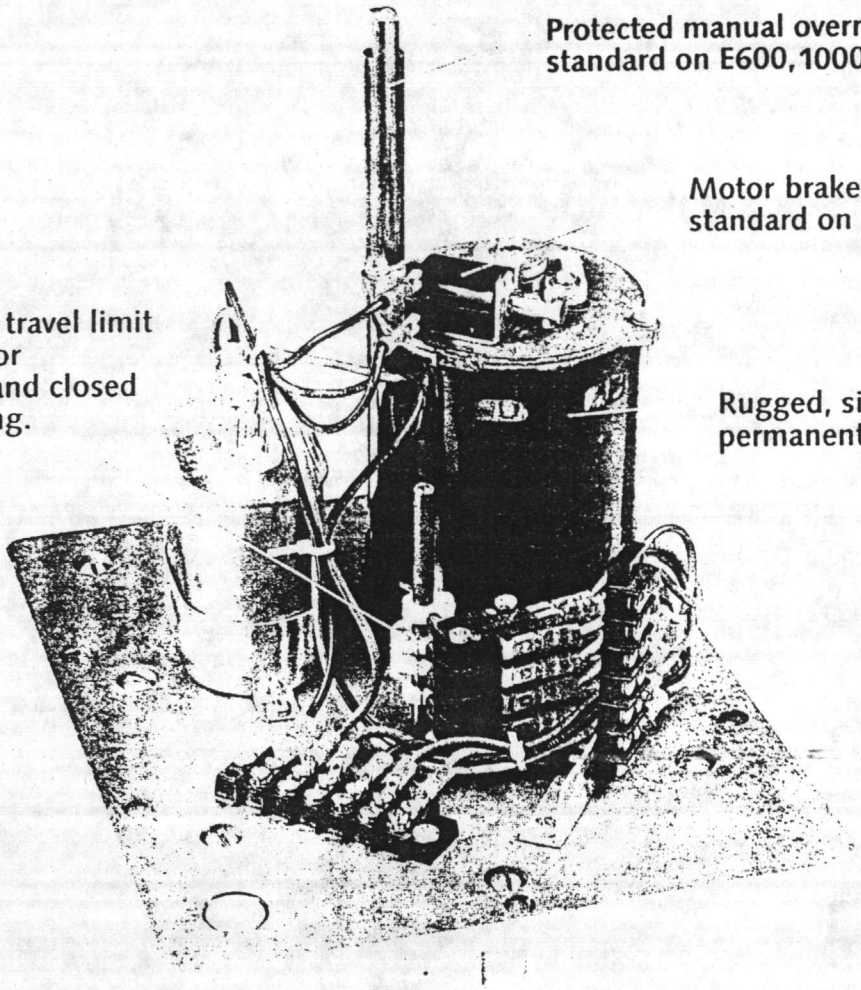
Electric Actuators

Automax Electric Actuators provide precise, dependable control of quarter-turn valves, dampers, flow controls and other rotary devices. Automax Actuators are used in all areas of industry including chemical processing, power, gas and oil, HVAC and marine. The simple, yet rugged design results in a compact package which produces torque up to 3500 inch pounds. Automax additionally designs electric actuator systems to customer specifications. And, our engineering department develops valve mounting hardware for all types of ball, butterfly and plug valves. Consult your Automax representative today for the best value in actuation!





Electric Actuator Features



Protected manual override is standard on E600, 1000, 1500, 3500.

Motor brakes– standard on all models.

Easy to adjust travel limit switch cams for precise open and closed position setting.

Rugged, single phase permanent split capacitor motor.

Zinc base, aluminum cover are polyurethane coated for superior corrosion resistance.

Reversible and unidirectional motors available.

Massive precision cut gears– not subject to breakage or premature failure.

Permanently lubricated, enclosed gear train on all models–protects gears from moisture and corrosion.

Technical Data

Model	Action	Torque (in lbs)	Cycle Time® (A) per 90°	Voltage® (B)	Locked Rotor Amps 115VAC	Switches	Motor Brake	Manual Override	Approx. Weight
E98.6*	Reversible	100	3.5 sec.	115VAC, 60Hz	.6	2 Spdt (Std) 5 Amps	Standard	N/A	3.7#
E300-12	Reversible	300	7.5 sec.	115VAC, 60Hz	1.0	2 Spdt (Std) 10 Amps	Standard	Optional	10#
E600-12	Reversible	600	15 sec.	115VAC, 60Hz	1.0	2 Spdt (Std) 10 Amps	Standard	Standard	14#
E1000-12	Reversible	1000	5 sec.	115VAC, 60Hz	3.0	2 Spdt (Std) 10 Amps	Standard	Standard	34#
E1500-12	Reversible	1500	6 sec.	115VAC, 60Hz	3.0	2 Spdt (Std) 10 Amps	Standard	Standard	36#
E3500-12	Reversible	3500	15 sec.	115VAC, 60Hz	3.0	2 Spdt (Std)	Standard	Standard	38#

NOTES:

(A) *These times are approximate under no load conditions and may vary slightly under actual load conditions.*

(B) *Optional voltages available*

**For further information, see E98.6 Compact Electric Rotary Actuator bulletin.*

Electric Actuator Options

Voltages
12 V.D.C.
24 V.D.C.
Other voltages, consult factory

Limit Switches (2 spdt standard)

Model	Additional Switches Available
E98.6	2
E300	1
E600	2
E1000	2
E1500	2
E3500	2

Feedback Potentiometer
0-135 Ohm (Over 90° Nominal)
0-1000 Ohm (Over 90° Nominal)
0-5000 Ohm (Over 90° Nominal)
1-10,000 Ohm (Over 90° Nominal)

Heater and Thermostat
25 Watt Heater
70°F Standard Thermostat

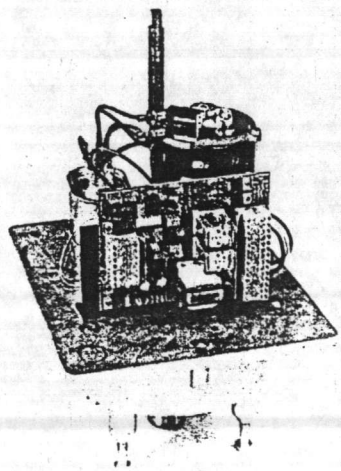
Control Relay
2 Wire Control
Pilot

Controls
Manual-Off-Auto
Local-Remote
Position Indication
Travel Indication
Potentiometer
Open-Close
Customized Controls Available

Speed Control
Variable Speed Control

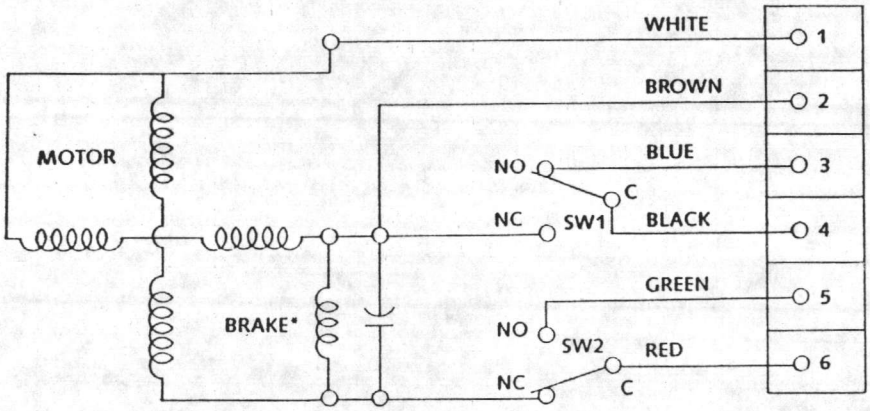
Positioner
ESP (Electronic Servo Positioner)
See Page 5

Housing
Nema 4—Weatherproof



Wiring Diagrams

Standard Reversible Permanent Split Capacitor Actuator with Position & Travel Indicator



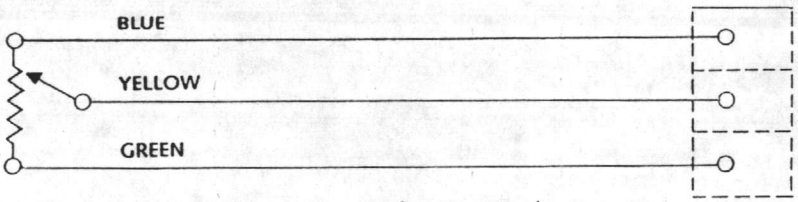
**Brake external to motor on E1000 thru E3500*

Symbols & Descriptions

1. **WHITE**
   Motor Common
2. **BROWN**
   Travel Indicator
3. **BLUE**
   Full CW
   Position Indicator
4. **BLACK**
   Power Will Turn Actuator CW
5. **GREEN**
   Full CCW
   Position Indicator
6. **RED**
   Power Will Turn Actuator CCW

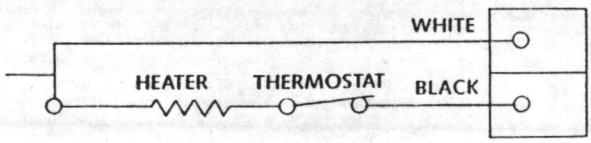
NO–Normally Open
NC–Normally Closed
C–Common

Potentiometers



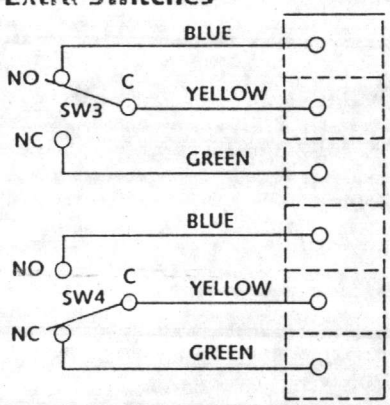
Will provide infinite position indication and other feedback functions . 5000 ohm standard, single or dual with other values available.

Heater and Thermostat



For high humidity or low temperature applications. Will reduce condensation. 25 Watt Heater with thermostat set for 70° F.

Extra Switches

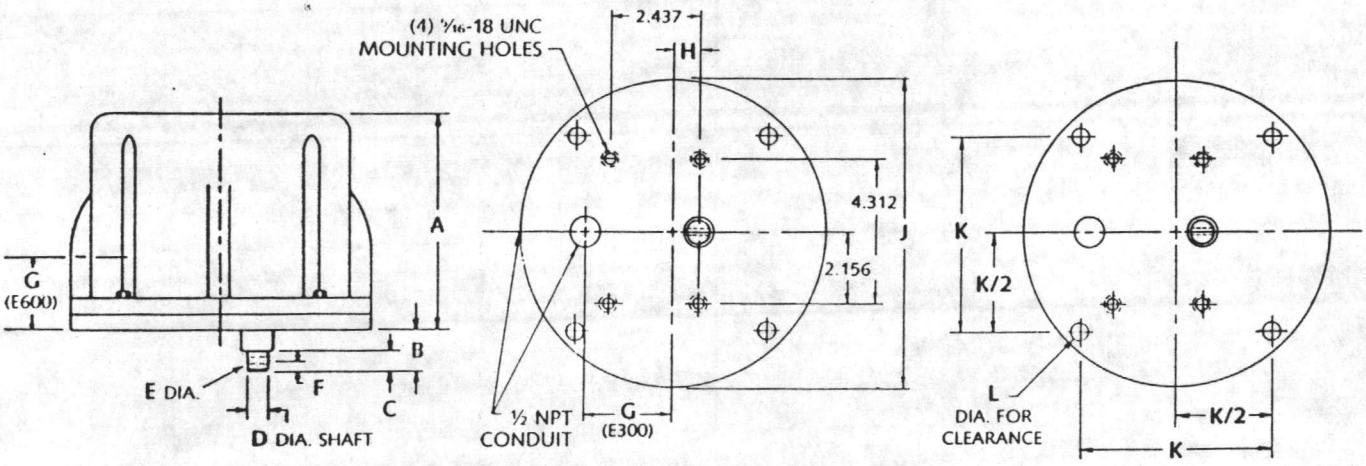


Individual mechanical adjustment will provide independent/isolated electrical control for alarms, lights, motor starters, etc.

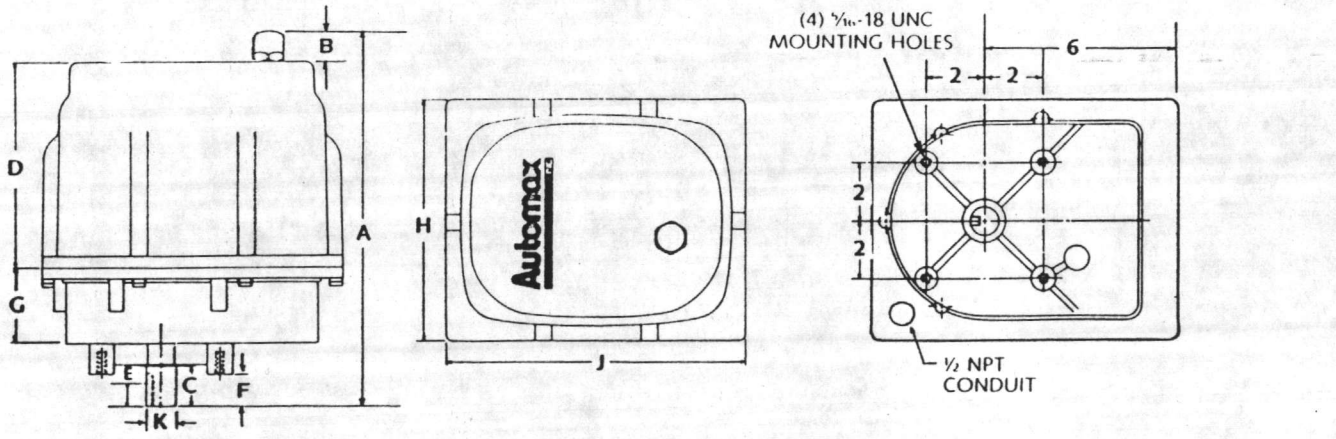
Other Options

- Modulating Controls
  ESP Positioner (see page 5)
- Adjustable Speed Controls
- DC Motors
- Shaded Pole Motors
- Unidirectional
- Wiring diagrams for specific applications available, consult factory.

Actuator Mounting Dimensions



Model No.	A	B	C	D	E	F	G	H	J	K	L
E98.6	See E98.6 Bulletin										
E300	5 1/8	1	1/2	1/2	3/16	3/16	2 1/4	29/32	7 1/4	4 11/16	3/8
E600	7 13/16	1	—	3/4	5/16	5/16	2 1/4	1 3/8	8 1/4	4 5/16	21/32



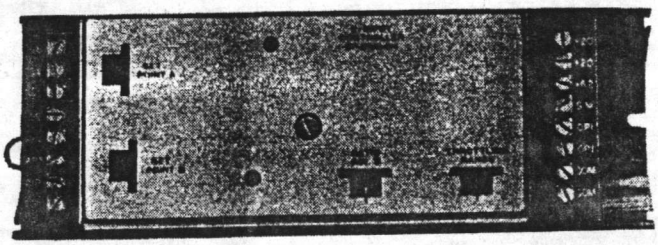
Model No.	A	B	C	D	E	F	G	H	J	K
E1000, E1500, E3500	12 15/16	1 3/16	1 3/8	7	1/4 x 3/4	1 1/16	2 5/8	8 1/4	10 3/16	1 1/4

Actuators shown in full clockwise (CW) position as viewed from top.

APPLICATION

CP-8102
CP-8102-116

Electronic two-input temperature or humidity controller for heating, cooling, humidification or dehumidification in HVAC systems.



SPECIFICATIONS

Features: Self-contained package incorporating an amplifier with two input bridges for TS-8XXX temperature sensors, humidity sensors or remote setpoint adjustor.

Sensors:

Temperature, TS-8XXX one or two; three sensors through a CN-8101.

Humidity, HS-8X01 or HSP-6X81.

Control Action: Direct (D.A.) or reverse (R.A.) selectable by jumper. Factory set D.A.

Authority Ratio Adjustment: 0.5:1 to 25:1, adjustable by dial.

Control Output Voltage: 1 to 15 Vdc, 10 mA maximum. Unit factory calibrated for 7.5 Vdc output with sensor at setpoint temperature.

Power Requirements: 20 Vdc (-1.5, +1), 23 mA.

Power Supply Available: 6.2 Vdc, 7 mA maximum; regulated and filtered power supply must not be connected to +6.2 of other supplies.

Remote Setpoints: Order separately AT-8122, AT-8155 or AT-8158.

Setpoints, Ratio and Throttling Potentiometers: Visible and accessible without removing controller cover.

Controlled Devices*: Maximum of six System 8000.

Environment:

Ambient Temperature Limits,

Shipping and Storage -40 to 160°F (-40 to 71°C).

Operating 40 to 135°F (4.4 to 57°C).

Humidity, 5 to 95% RH, non-condensing.

Locations, NEMA Type 1 indoor only.

Connections: Coded screw terminals for 14 to 20 AWG.

Cover: Aluminum.

Mounting: Unit is provided with plastic track for panel mounting. AD-8912 enclosure can be ordered separately for remote installations.

Dimensions: 4" high × 11" wide × 2-1/2" deep (102 mm × 279 mm × 64 mm).

***TYPICAL CONTROLLED DEVICES**

CC-8100 Series Relays
MMR-400 Series Modular Motors w/MMC-8000 Control Module
MMR-500 Series Modular Motors w/MMC-8000 Control Module
MP-300-600 Series Actuators
MP-400-600 Series Actuators
MP-5000 Series Actuators
MS-1233 Series Damper Actuators
MS-80000 Series Actuators
SP-40000 Series Step Controllers
VS-9000 Series Valve Assemblies

TABLE 1. SPECIFICATIONS

Part Number	Control Dial Range Setpoint "A"	Control** Dial Range Setpoint "B"	Throttling Range for 3 Vdc Output Change
CP-8102	20 to 120°F	20 to 120°F	Adjustable 2 to 10°F by dial*
CP-8102-116	-6 to 48°C	-6 to 48°C	Adjustable 1 to 6°C by dial*

*15, 25, 40 and 60°F by pin selection (use J9 jumper). With the use of AD-8969-901 (order separately), the following T.R.'s can be obtained: 55, 65, 75, 85, 100, 115, 125 and 140°F.

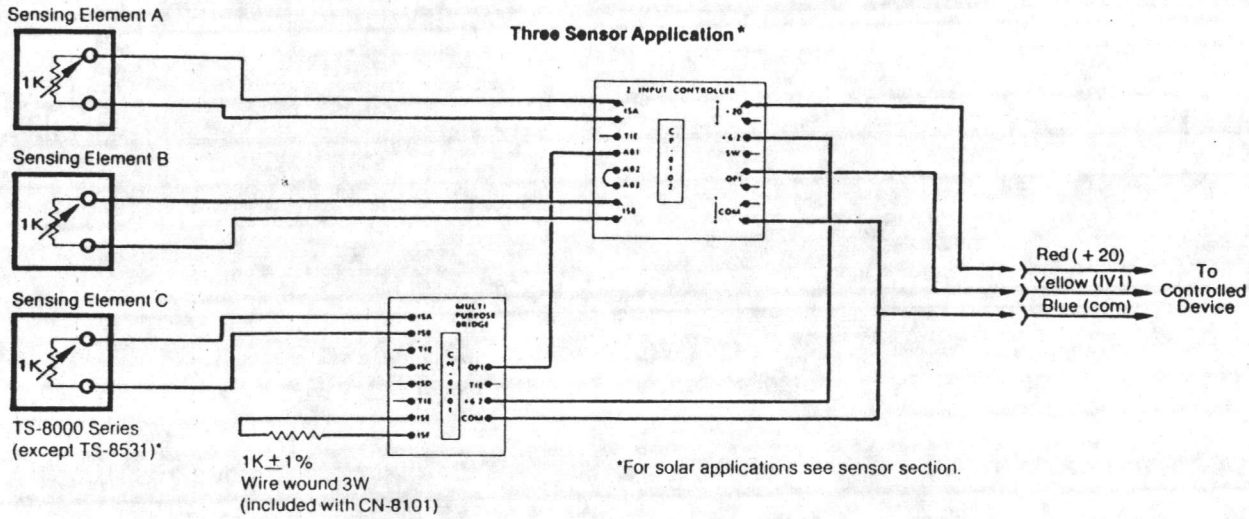
**For reset control, set setpoint "B" at zero reset point and setpoint "A" at control point desired with no reset action from sensor "B".

ACCESSORIES

AD-8122	Signal adaptor for dual outputs (two direct acting)
AD-8123	Signal adaptor for dual outputs (one direct, one reverse acting)
AD-8124	Signal adaptor for dual outputs (one reverse, one direct acting)
AD-8912	12" (305 mm) enclosure
AD-8969-201	Offset resistor kit: 5, 10, 15 & 20°F
AD-8969-901	Extended throttling range jumper
ASP-8301	Power supply
AT-8122	Remote setpoint adjuster, dual scale 20 to 120°F (-6 to 49°C)
AT-8155	Remote setpoint adjuster, dual scale 50 to 250°F (10 to 121°C)
AT-8158	Remote setpoint adjuster, dual scale 55 to 85°F (13 to 29°C)
AT-8222-101	Setpoint scale for humidity 20% to 100%
AT-8435	Remote setpoint adjuster, dual scale 50 to 450°F (10 to 232°C) for use with TS-8204 only
CN-8101	Multi-purpose bridge
HS-8000 Series	Humidity sensors
HSP-8000 Series	Humidity transmitters
TOOL-201	Calibration kit for System 8000
TS-8000 Series	Temperature sensors

Continued on next page

CP-8102, CP-8102-116 **Continued from preceding page**



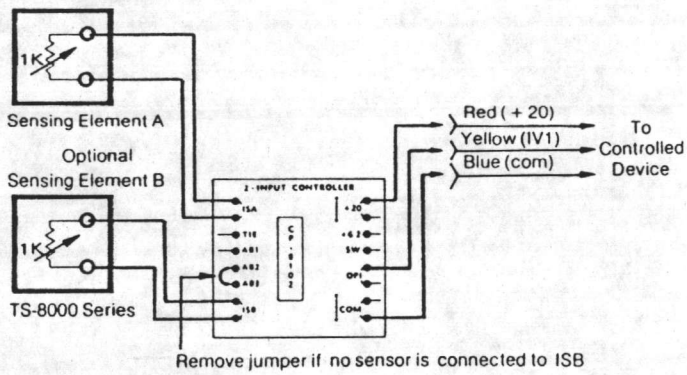


TABLE 2. JUMPER CONNECTIONS

Controller Function	Jumper Connections Required	
	Bridge "A"	Bridge "B"
Direct Acting†	J4 to JC6 J3 to JC5	J5 to JC5 J6 to JC6
Reverse Acting	J4 to JC5 J3 to JC6	J5 to JC6 J6 to JC5
Internal Setpoint Active†	J1 to JC1	J2 to JC3
Internal Setpoint Inactive for Remote Setpoint	J1 to JC2	J2 to JC4
Disable Bridge "B" for Single Sensor Input	Remove Jumper from AB2 to AB3	

†As supplied from factory

Figure 1. Typical Temperature Control Wiring

General Instructions

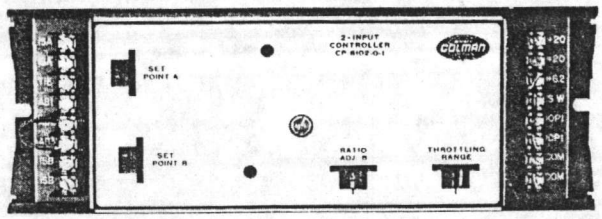
CP-8102 Electronic Two Input Temperature or Humidity Controller

FUNCTIONS

Electronic controller receives temperature or humidity sensor inputs and sends a variable electronic signal, 1 to 15 Vdc, to up to six System 8000® actuators or relays (controlled devices). Additional devices can be controlled with the use of adapters. These actuators or relays operate heating, cooling, humidification or dehumidification equipment in HVAC systems.

FEATURES AND BENEFITS

The reliable, easy to install CP-8102 electronic controller incorporates an amplifier with inputs for 1000ohm Balco® temperature sensors, humidity sensors or remote setpoint adjustor. Two setpoint dials, ratio authority dials, throttling range dials and calibration potentiometers are visable and accessible without removing controller cover allow for easy field adjustment. Coded screw terminals make sensor, remote setpoint, power supply and output signal wiring easy to install and change. The CP-8102 controller is used with other System 8000 devices.



CP-8102

Wiring Connections: Coded screw terminals for all control inputs and outputs.

Safe Ambient Temperature Limits:

Operation: 40 to 135°F (4.4 to 57°C)
Storage: -40 to 160°F (-40 to 71°C)

Dimensions: 4" (102 mm) high × 11" (279 mm) wide × 2-1/2" (64 mm) deep

Table 1. Specifications

Part Number	Control Dial Range Setpoint "A"	Control Dial Range Setpoint "B"	Throttling Range for 3 Vdc Output Change	Authority Ratio Adjustment Setpoint "A" Setpoint "B"	Control Output Voltage†	Power Required	Power Supply Available
CP-8102	20 to 120°F	20 to 120°F	Adjustable 2 to 10°F by Dial*	.5:1 to 25:1 Adjustable by Dial	1 to 15 Vdc 10 mA Max. Factory Set for D.A.	20 Vdc 23 mA	6.2 Vdc 7 mA Max.
CP-8102-116	-6 to 48°C	-6 to 48°C	Adjustable 1 to 6°C by Dial*				

* See ADJUSTMENTS for additional throttling ranges.

† Units factory calibrated for 7.5 Vdc output with sensor at setpoint temperature.

Options: None.

ACCESSORIES:

AD-8122	Signal adaptor for dual outputs (two direct acting)
AD-8123	Signal adaptor for dual outputs (one direct, one reverse acting)
AD-8124	Signal adaptor for dual outputs (one reverse, one direct acting)
AD-8912	12" enclosure
AD-8969-201	Off set resistor kit: 5, 10, 15 & 20°F
AD-8969-901	Extended throttling range jumper
ASP-301	Power supply required for HSP-6X81 humidity transmitter
ASP-581	Indication meter 20 to 80% RH
AT-8122	Remote setpoint adjuster, dual scale 20 to 120°F (-6 to 49°C)
AT-8155	Remote setpoint adjuster, dual scale 50 to 250°F (10 to 121°C)
AT-8158	Remote setpoint adjuster, dual scale 55 to 85°F (13 to 29°C)
AT-8222-101	Setpoint scale for humidity 20% to 100%
AT-8435	Remote setpoint adjuster, dual scale 50 to 450°F (10 to 232°C) for use with TS-8204 only
CN-8101	Multi-purpose bridge
HS-8101	Room humidity sensor
HS-8201	Duct humidity sensor
TS-8101	Room sensor
TS-8111	Room sensor with setpoint
TS-8131	Room button type sensor
TS-8201	Duct/immersion sensor
TS-8204	High temp. duct/immersion sensor requires AT-8435 remote setpoint for all applications except differential control
TS-8241	Diffuser sensor
TS-8261	Light fixture sensor
TS-8331	Lagged sensor (CN-8101 is required)
TS-8405	5' averaging sensor
TS-8422	22' averaging sensor
TS-8501	Outdoor sensor
TS-8531	Solar sensor (CN-8101 is required)
TS-8533	Econostat sensor
Tool-201	Calibration kit for system 8000

DEFINITIONS

Mode of Operation: Either direct-acting or reverse-acting.

Direct-acting (D.A.) means that an increase in temperature at the sensor(s) causes the voltage output (OP1) to increase.

Reverse-acting (R.A.) means that an increase in temperature at the sensor(s) causes the voltage output (OP1) to decrease.

Reset Control Action: The direction of reset determines whether input A setpoint is reset upward or downward on a temperature decrease at input B.

Direct reset: (D.R.) A temperature decrease on input B resets input A setpoint downward.

Reverse reset: (R.R.) A temperature decrease on input B resets input A setpoint upward.

LITHO IN U.S.A. 9-84

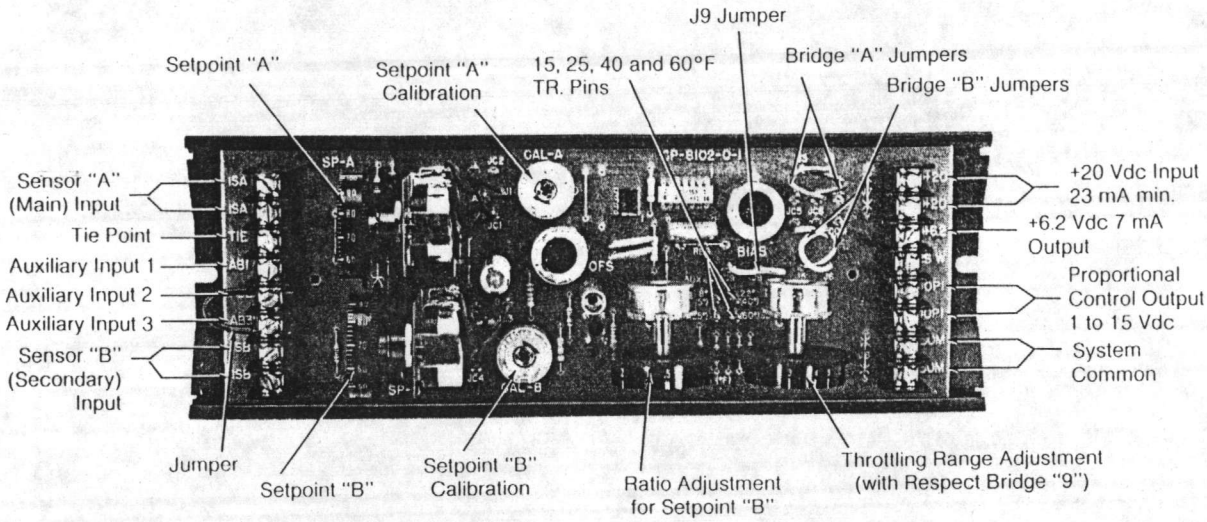


Figure 1. CP-8102

CONTROL TERMINAL INPUTS (See Figure 1)

ISA: Any TS-8000 Temperature Sensor (1000 ohm Balco)

ISB: Any TS-8000 Temperature Sensor (1000 ohm Balco)

AB1, AB2, AB3: Auxiliary inputs; any remote setpoint adjuster AT-8000 series, HS-8X01 humidity sensor, CN-8101 multipurpose bridge

CONTROL TERMINAL OUTPUT (See Figure 1)

OP1: 1 to 15 Vdc (10 mA maximum). Units factory calibration for 7.5 Vdc output with sensor at setpoint temperature.

ADJUSTMENTS: (See figure 1)

Temperature Setpoint "A": By dial 20 to 120°F (−6 to 48°C), or by remote setpoint adjuster (See Accessories).

Temperature Setpoint "B": By dial 20 to 120°F (−6 to 48°C), or by remote setpoint adjuster (See Accessories).

Setpoint "A" Calibration: By potentiometer.

Setpoint "B" Calibration: By potentiometer. For reset control, set Setpoint "B" at value where Setopint "A" will be reset. Adjust Setpoint "A" at control point required with no reset from sensor "B".

THOTTLING RANGE: By dial 2 to 10°F, 1 to 6°C. By pin selection 15, 25, 40 and 60°F (8, 14, 22, 33°C). Remove J9 jumper from JC9 and attach to required throttling range pin. By extended throttling range adjuster, AD8969-901 (order separately), 55, 65, 75, 85, 100, 115, 125 and 140°F (31, 36, 42, 47, 56, 64, 69 and 78°C). The throttling range is the sum of the T.R. pins connected.

AUTHORITY RATIO ADJUSTMENT: By dial .5 to 25:1. Ratio is the number of degrees change at Sensor "B" required to reset Setpoint "A" one (1) degree. Example: 25:1 means a 25°F (14°C) change at Sensor "B" will reset Setpoint "A" 1°F (.5°C).

Table 2

Controller Function	Jumper Connections Required	
	Bridge "A"	Bridge "B"
Direct Acting*	J4 to JC6 J3 to JC5	J5 to JC5 J6 to JC6
Reverse Acting	J4 to JC5 J3 to JC6	J5 to JC6 J6 to JC5
Internal Setpoint Active*	J1 to JC1	J2 to JC3
Internal Setpoint Inactive for Remote Setpoint	J1 to JC2	J2 to JC4
Disable Bridge "B" for Single Sensor Input	Remove Jumper from AB2 to AB3	

* As supplied from factory.

To Obtain Reverse Reset: Both bridges should have the same action. Example: both direct acting, or both reverse acting.

To Obtain Direct Reset: Bridges should have different action. Example: one direct and one reverse acting.

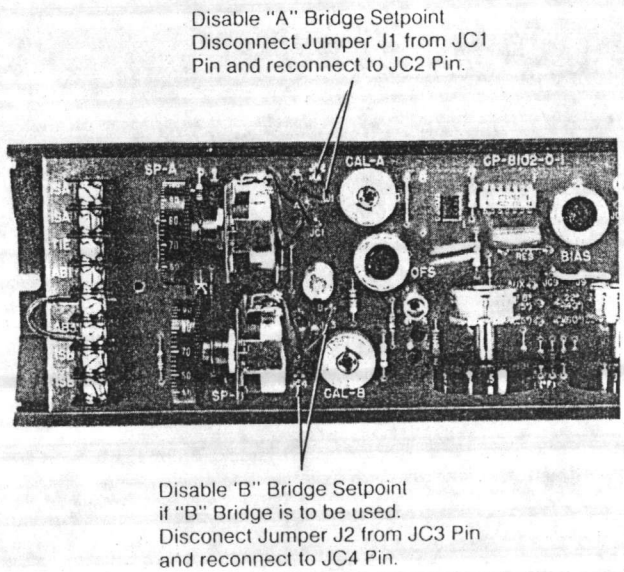


Figure 2. Disabling Setpoint "A" and/or Setpoint "B"

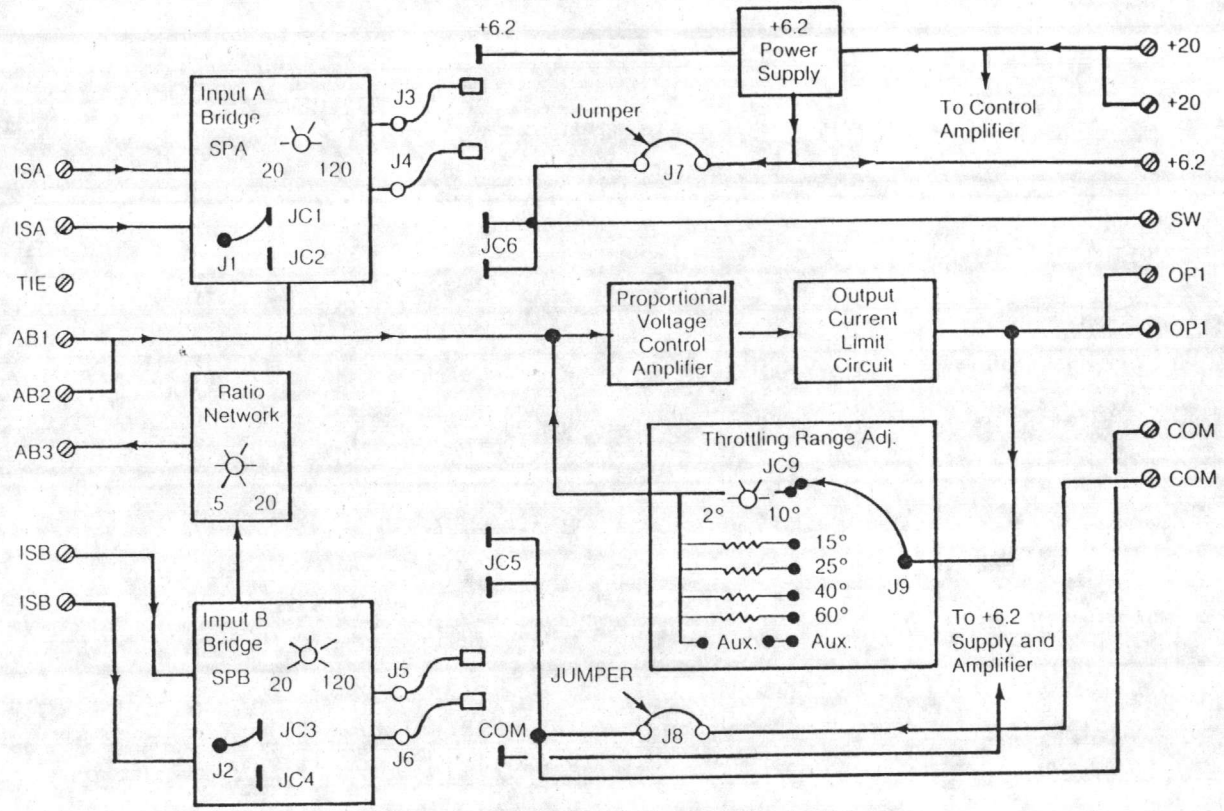


Figure 3. CP-8102 Controller Block Diagram

PRE-INSTALLATION: Open the carton and visually inspect the device for part number and obvious defects before proceeding with the installation.

NOTE

Mounting screws are not provided.

INSTALLATION: Device may be mounted, in any position, in an inside location near the controlled equipment using the two slots in the track. AD-8912 enclosures can be ordered separately for remote installations.

CAUTION

Avoid locations where excessive vibration, moisture, corrosive fumes or vapors are present, or where high radio frequency or electro-magnetic interference generating devices are near.

See Figure 4 for mounting dimensions.

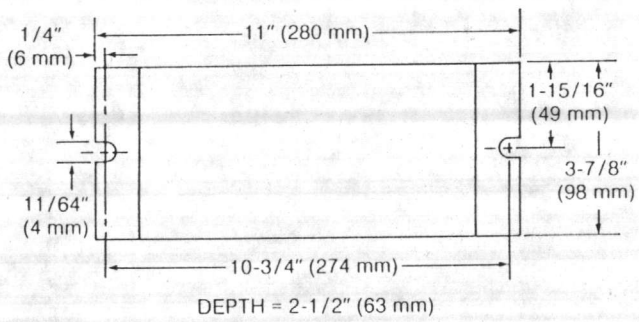


Figure 4. Mounting Dimensions

GENERAL WIRING INFORMATION

Make all connections according to job wiring diagrams and in compliance with national and local codes.

Two separate No. 18 twisted pair wires (six turns per foot [.3m]).
Class II, low voltage, are suitable for up to 1000 feet (300 m) for the sensor leads. See table 3 for longer runs.

CAUTION

Never run line voltage in the same conduit with unshielded sensing element leads. Use copper conductors only.

Shielded cable (Belden No. 8422 or equivalent) must be used when it is necessary to install the DC signal leads in the same conduit with power wiring, or when it is known that high RFI/EMI generating devices are near. Ground the shield at the controller only on the COM (-) terminal.

Table 3. Wiring Lengths

Wire Gauge	LENGTH OF RUN IN FEET**						
	"HS" Sensor To CP-8102	"TS" Sensor To CP-8102	CN-8101, AT-81X4 TS-8601 To CP-8102	"HSP" Transmitter To CP-8102	TSP-8101 To CP-8102	CP-8102 To Controlled Device	CP-8102 To Adaptor*
22	125	—	—	—	Should be	—	—
18	300	1,000	1,000	250	in Same	1,000	1,000
16	—	2,250	—	—	Panel as	2,250	2,250
14	—	4,000	—	—	Controller	4,000	4,000

* AD-8101, AD-812X, AD-8201, AD-8301, AD-8501
**1 Ft. approx. .3 meter

GENERAL RULES FOR WIRING CP-8102 TO CONTROLLED DEVICE(S)

1. Never connect red lead (or +20 terminal) of any controlled device which has a regulated power supply to the red lead (or +20 terminal) of any other controlled device (see Figure 5).
2. Controlled devices (MP-52XX) with unfiltered and unregulated power supplies must be filtered. CP-8102 will provide filtering for a maximum of two MP-52XX by connecting the two red leads together at the controller's +20 terminal (see Figure 6).
3. Controlled devices with filtered and unregulated supplies: Up to six controlled devices with the red leads (+20 terminals) can be connected together. Number of units paralleled depends on the current (mADC) requirements of the controller or adaptor.

Table 4. Controlled Device Power Supply Characteristics

Filtered & Regulated	Filtered & Unregulated	Unfiltered & Unregulated
CC-8101 CC-8102 CC-8103 CC-8111 Series CC-8118 Series CC-8218 Series CP-8161 Series CP-8301 Series* CP-8425 Series CP-8501 Series CP-8502 Series	MP-54XX MS-8XXX Actuators	MP-52XX Actuators

* Except CP-8301-101 which does not have a power supply.

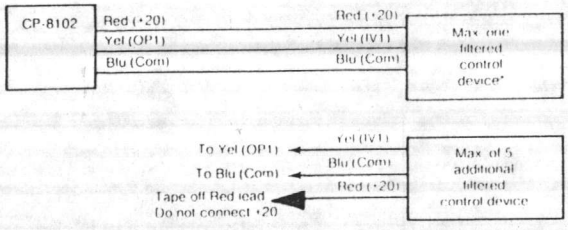


Figure 5. Controlled Devices All Filtered

FIELD CHECKOUT

Units are factory calibrated and tested and should not require field checkout. If required, proceed as follows (see Figure 1):

NOTE

The following procedures can be used for either reverse or direct acting connected CP-8102 controllers.

1. Initial Conditions for CP-8102
   A. Jumper between AB2 and AB3 disconnected.
   B. 20 Vdc +1 - 1.5 Vdc (23 mA) applied to the +20 and common terminals. This power is normally supplied by the controlled device.
2. Connect a 20,000 ohm/volt DC VOM meter between the OP1 (+) terminal and COM (-) terminal of the CP-8102. Use a 20 Vdc or less range.
3. Disconnect the temperature sensing element "A" from the ISA terminals of the CP-8102. Short ISA terminals together and VOM reading should be 1 Vdc or less if bridge "A" is direct acting and more than 15 Vdc if bridge A is reverse acting.
4. Open ISA terminals and VOM reading should be greater than 15 Vdc if bridge "A" is direct acting and less than 1 Vdc if bridge "A" is reverse acting.
5. The CP-8102 is a good unit if it passes tests in steps 3 and 4. Replace the unit if tests 3 and 4 are not met.

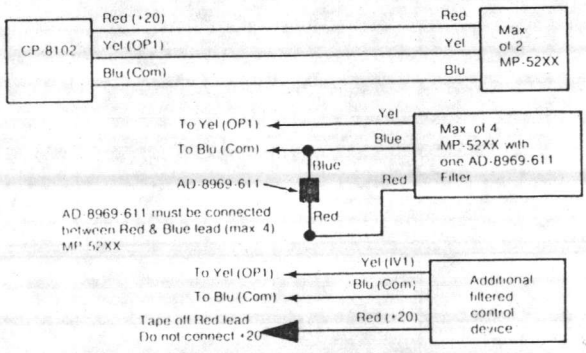


Figure 6. At Least One of the Controlled Devices in MP-52XX (Unfiltered)

FIELD CALIBRATION PROCEDURES FOR CONTROLLERS WITH ONE AND TWO INPUTS

(See Figures 7 and 9):

The following procedures can be used for either reverse or direct acting connected CP-8102 controllers.

The CP-8102 is factory calibrated and shipped with both inputs connected for direct acting output.

Normally, the CP-8102 (connected for either direct or reverse acting) requires no field calibration but if a field calibration check or recalibration becomes necessary, then proceed as follows:

1. Initial Conditions for CP-8102:
   - A. Setpoint "A" set for: 70°F.
   - B. Setpoint "B" set for: 70°F.
   - C. Ratio adjustment set for: 1:1.
   - D. Throttling range adjustment set for: 3°F.
   - E. Jumper between AB2 and AB3 disconnected.
   - F. 20 Vdc (23 mA) applied to the +20 and common terminals. This power is normally supplied by the controlled device.
2. Connect a 20,000 ohm/volt DC VOM meter between the OP1 (+) terminal and COM (-) terminal of the CP-8102. Use a 20 Vdc or less range.
3. Calibration of "A" input. Use one of the following two methods.
   - A. Temperature measurement methods:

     Accurately measure the temperature at the temperature sensing element "A". Adjust setpoint "A" until the dial reading agrees with the temperature measured. Rotate setpoint "A" calibration potentiometer (located just to the right of setpoint "A" dial) until a VOM reading of 7.5±.2 Vdc is obtained.
   - B. Sensing element substitution method:

     Disconnect the temperature sensing element "A" from the ISA terminals of the CP-8102. Reconnect a 1000 ohm ±.1% wire wound resistor (TOOL-203) to the ISA terminals. Adjust setpoint "A" for 70°F. Rotate setpoint "A" calibration potentiometer (located just to the right of setpoint "A" dial) until a VOM reading of 7.5±.2 Vdc is obtained.

NOTE

Method B above does not calibrate out any errors due to sensing element tolerances or wire lead resistance.

4. Calibration of "A" input complete.

   If "B" input is not being used (jumper between AB2 and AB3 removed) then proceed to step 7 below.
5. Reconnect jumper between AB2 and AB3.
6. Calibration of "B" input. Use one of the following two methods.
   - A. Temperature measurement method:

     Accurately measure the temperature at the temperature sensing element "B". Adjust setpoint "B" until the dial reading agrees with the temperature measured. Rotate setpoint "B" calibration potentiometer (located just to the right of setpoint "B" dial) until a VOM reading of 7.5±.2 Vdc is obtained.
   - B. Sensing element substitution method:

     Disconnect the temperature sensing element "B" from ISB terminals of the CP-8102. Reconnect a 1000 ohm ±.1%, wire wound resistor (TOOL-203) to the ISB terminals. Adjust setpoint "B" for 70°F. Rotate setpoint "B" calibration potentiometer (located just to the right of setpoint "A" dial) unti a VOM reading of 7.5±.2 Vdc is obtained.

NOTE

Method B above does not calibrate out any errors due to sensing element tolerances or wire lead resistance.

7. CP-8102 calibration is complete. Remove all test meters, test resistor, etc. Reconnect all elements, place setpoints, throttling range and ratio adjustments as required for the application.

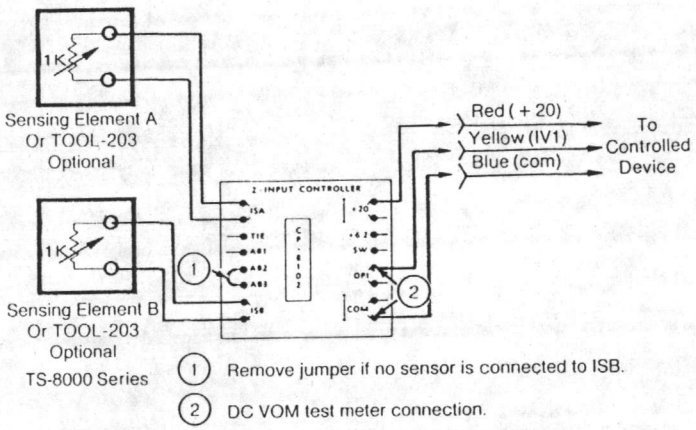


Figure 7. One or Two sensor Application

FIELD SERVICE

Units are factory calibrated and tested for direct acting control (D.A.) and reverse reset (R.R.) and should not require service. If required, proceed as follows (see Figure 8):

Power Supply

Apply +20; +1, -1.5 Vdc (23 mA) to the +20 and common terminals. Proper power supply is always required for unit to function properly. The +6.2 (±.3) Vdc should be available from the controller, if required.

Test

Connect a 20,000 ohm/volt DC VOM meter between +20 and common terminals. Controller power supply +20, +1 -1.5 Vdc (indicated by M1 in Figure 8) should be measured. Power supply is normally supplied by controlled device. Check +6.2 (±.3) Vdc power supply of controller with VOM.

Service

If the +20 Vdc level is not measured, service the (lead) controlled device, power supply or installation wiring as necessary to insure proper power supply.

Controller Output

See Field Calibration Procedures, on this page, for calibration of "A" setpoint using sensor element substitutes.

Test

With signal output measured between OP1 and COM at 7.5 ± .2 Vdc, rotate setpoint "A" dial several degrees (in increments of 1°F) each way from 70° setting to vary the M2 reading from 1 to 15 Vdc. The number of degrees that setpoint dial "A" is changed to vary the reading on M2 3 Vdc should be approximately 3°F (if T.R. is set at 5°F, 3 Vdc will change over 5°F).

Service

See Field Calibration Procedures, on page 5, for calibration of "B" setpoint using sensor element substitutes. (Make certain that jumper is connected to AB2 and AB3.)

Adjusting setpoint "B" several degrees from 70°F setting will cause the M2 reading to vary from 1 to 15 Vdc.

If output voltage cannot be made to vary over a 1 to 15 Vdc range, then replace the CP-8102 as defective.

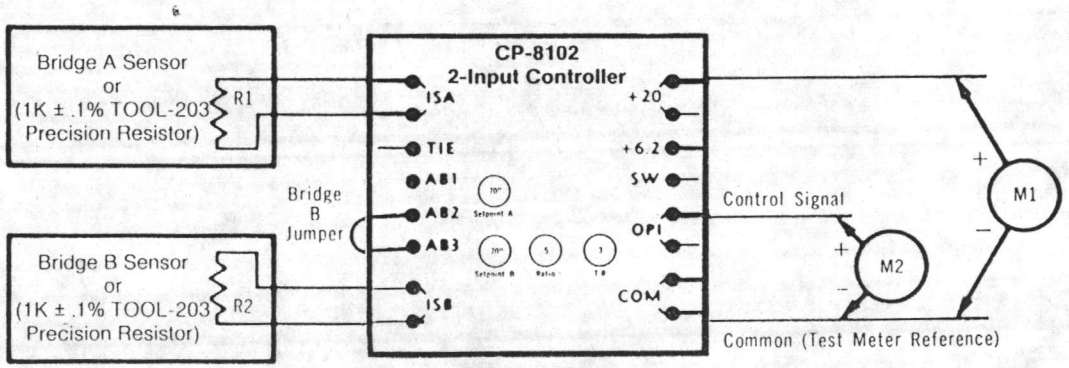


Figure 8.

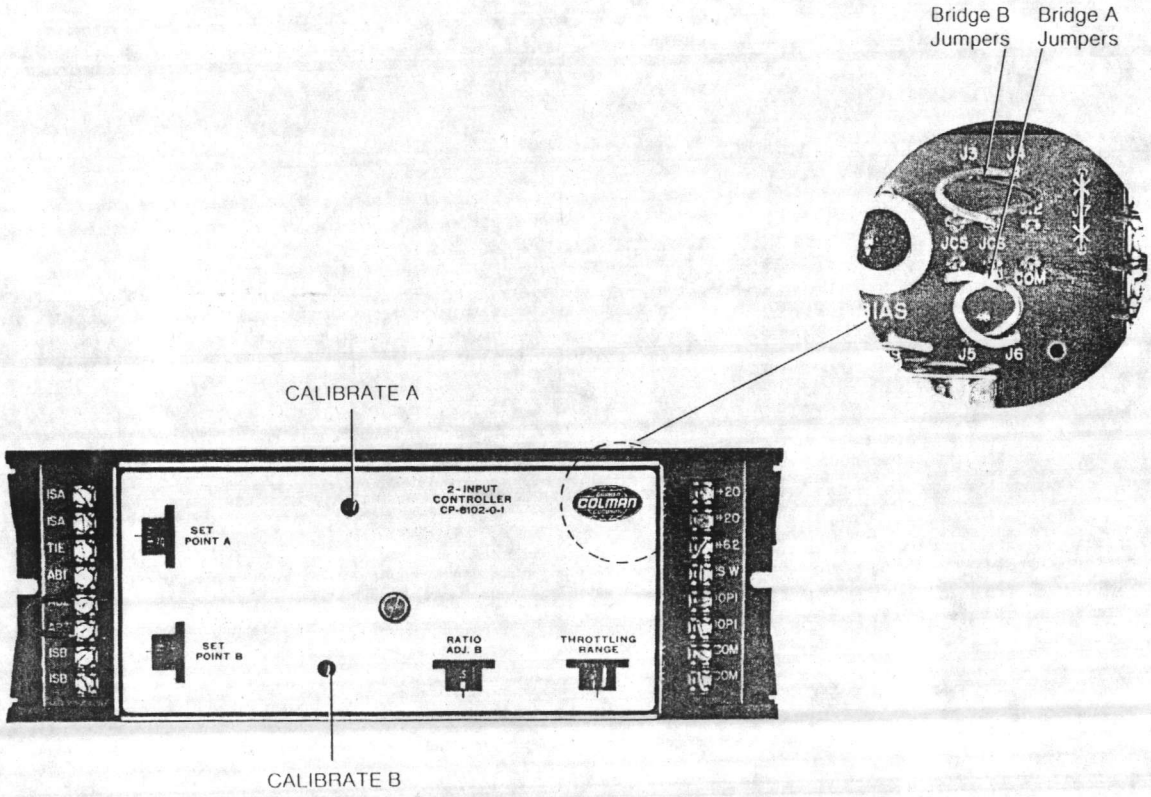


Figure 9.

MAINTENANCE

This is a quality product. Regular maintenance of the total system is recommended to assure sustained optimum performance.

TYPICAL APPLICATIONS

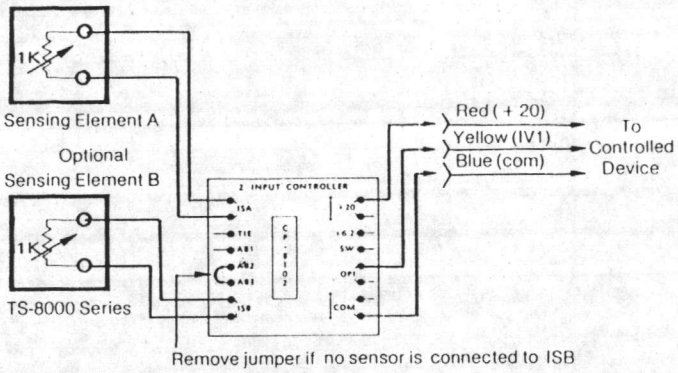


Figure 10. One or Two Temperature Sensor Application

Hot water reset is typical application for a two sensor application of the CP-8102. For example, perimeter radiation temperature, with hot water as a heating medium, is increased as the temperature of the outside air decreases. This method of control is known as reverse reset. A reset schedule shown below in table requires the hot water temperature to increase from 100° to 170°F, a change of 60°F, as the outside air temperature decreases from 60° to 0°F. If the throttling range of the CP-8102 controller is 10°F the setting of the CP-8102 will be as follows:

Setpoint "A": 110°
Setpoint "B": 60°
Ratio Adjustment: 1 (change in outside air temperature/ change in hot water temperature)
Throttling Range: 10°F
Note: Controller function is Direct Acting * (see table 2)
* Factory setting

Table 5. Reset Schedule

Outside Air Temp. (°F)	Water Temperature (°F)
60	110
0	170

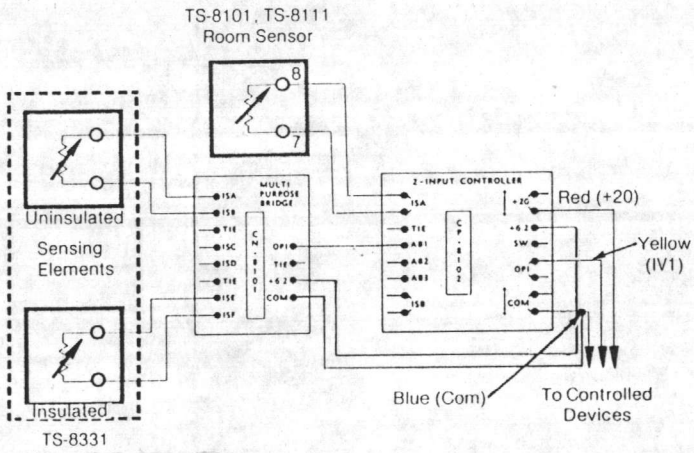


Figure 11. Derivative (Lagged) Sensor

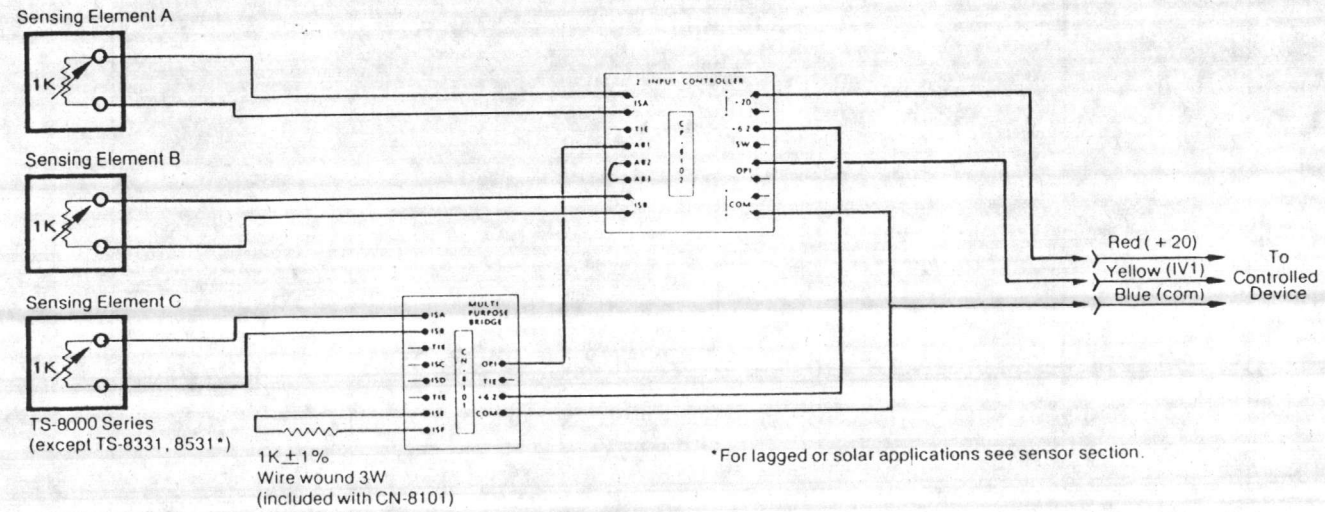


Figure 12. Three Temperature Sensor Application*

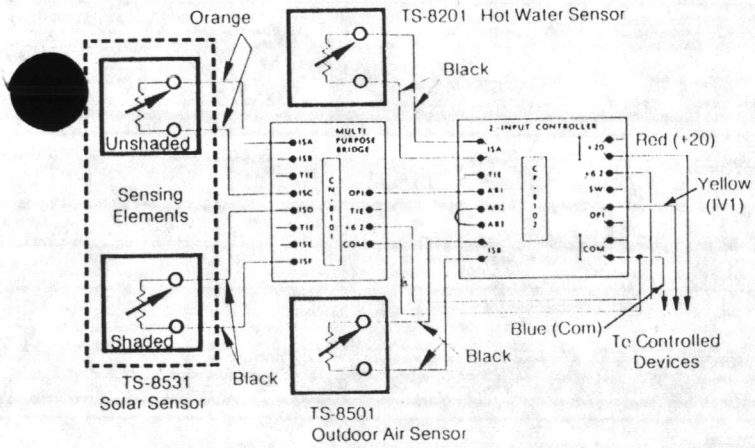
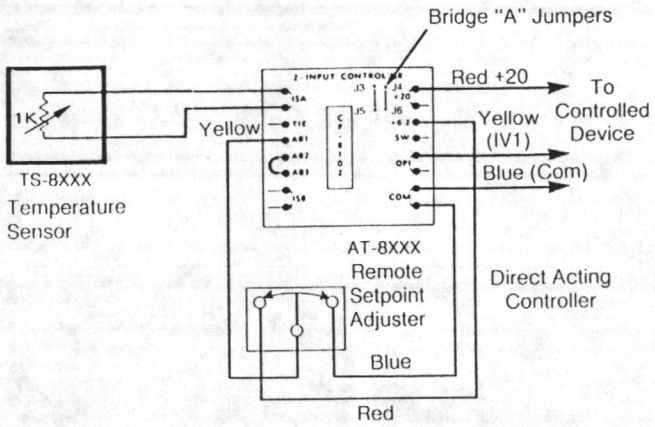


Figure 13. Solar and Outdoor Air Reset of Hot Water (Direct Acting Output)



NOTE: If the controller bridge is reverse acting, the red and blue wires at the AT-8XXX Series must be reversed (red to common, blue to +6.2).

Figure 14. Single Input with Remote Setpoint

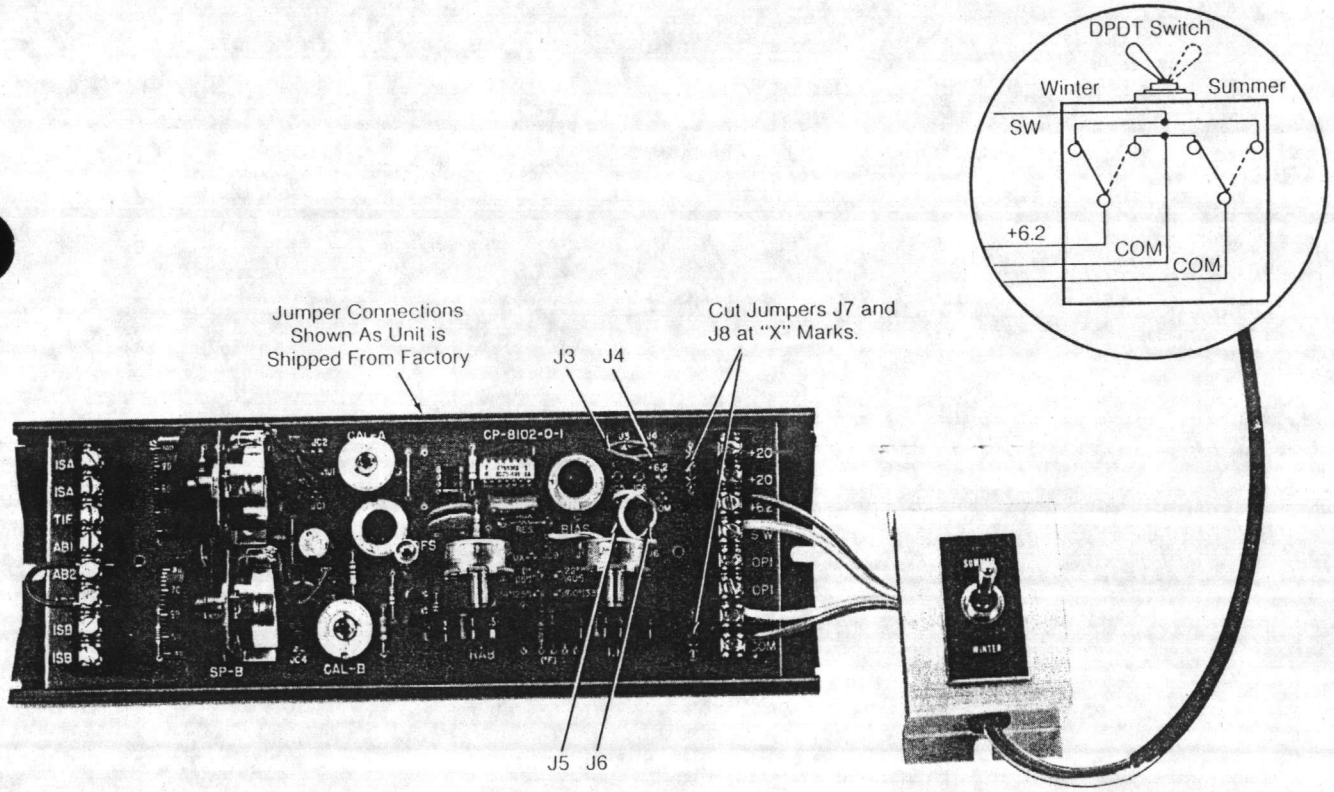


Figure 15. Single Unit Winter-Summer Switching

1. Cut both jumpers that are located between the terminal strip and cover on the left hand side of the device. (See Figure 15).
2. Connect D.P.D.T. Switch (CYZP-11 or equivalent) according to Figure 15.

NOTE

Switch contacts should have pilot duty ratings and maintain a 1 ohm or less contact rating over its normal life.

3. No recalibration of CP-8102 is required.

SINGLE UNIT SUMMER/WINTER SWITCHING (Continued):

Table 6. Bridge Connections for Summer/Winter (See Figure 15.)

BRIDGE "A" (MAIN SENSOR)		BRIDGE "B" (RESET SENSOR)		RESET OF SETPOINT "A"		JUMPER TO PIN CONNECTIONS			
						J3	J4	J5	J6
Winter	Summer	Winter	Summer	Winter	Summer				
D.A.	R.A.	D.A.		Reverse	Direct	JC5	JC6	COM	+6.2
R.A.	D.A.	D.A.		Direct	Reverse	JC6	JC5	COM	+6.2
D.A.	R.A.	R.A.		Direct	Reverse	JC5	JC6	+6.2	COM
R.A.	D.A.	R.A.		Reverse	Direct	JC6	JC5	+6.2	COM
D.A.		D.A.	R.A.	Reverse	Direct	COM	+6.2	JC5	JC6
R.A.		D.A.	R.A.	Direct	Reverse	+6.2	COM	JC5	JC6
D.A.		R.A.	D.A.	Direct	Reverse	COM	+6.2	JC6	JC5
R.A.		R.A.	D.A.	Reverse	Direct	+6.2	COM	JC6	JC5

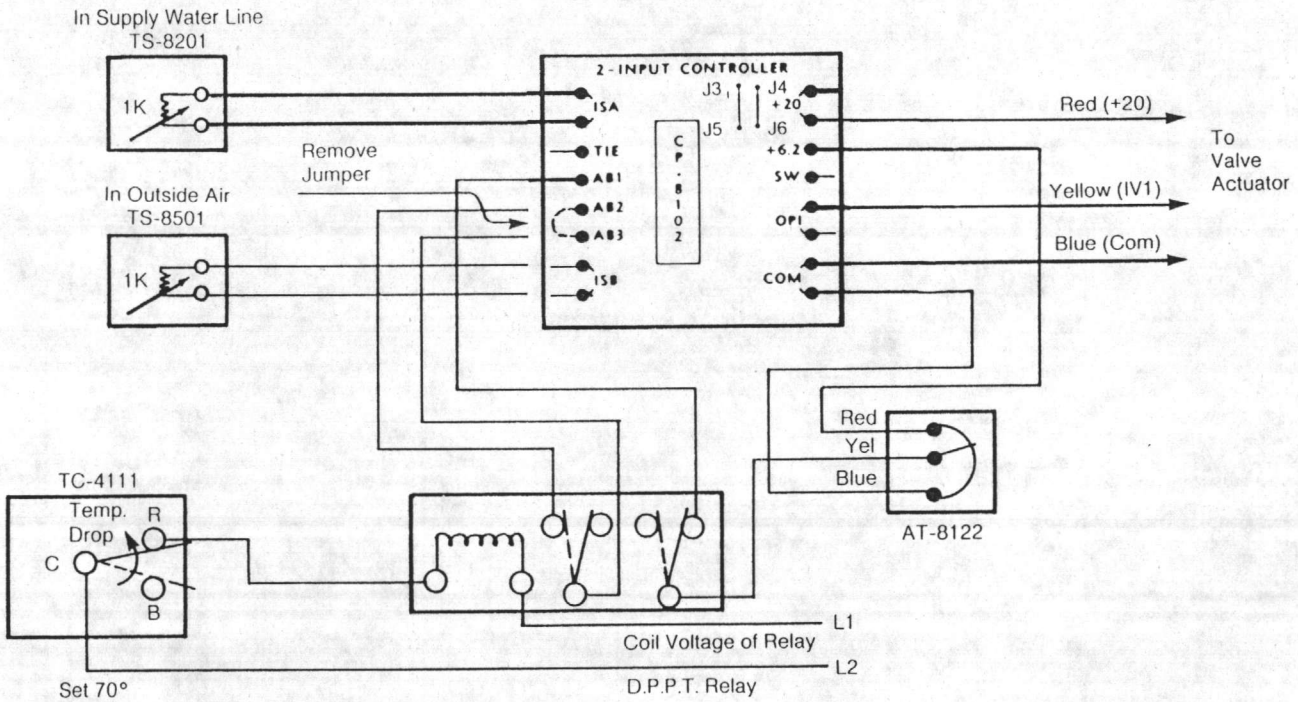


Table 7. Typical Reset Schedule

Outside Air Temp. (°F)	Water Temperature (°F)
70°	110°
0°	140°
Above 70°	85°

Outside air temperature reset of supply water temperature with fixed temperature of 85°F with outside air temperature of 70°F.

Setpoint "A": 110°F

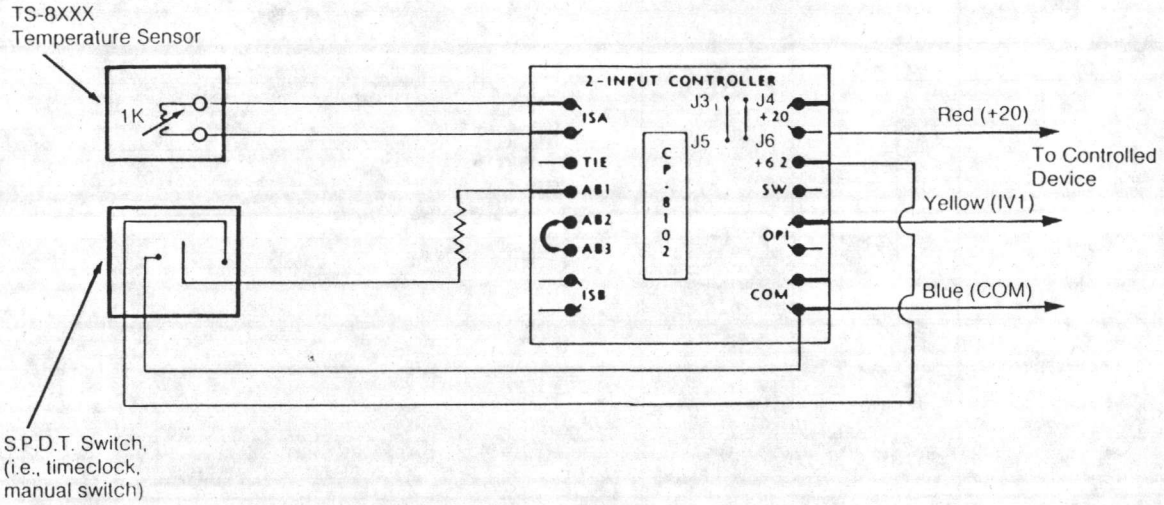
Setpoint "B": 70°F

Ratio Adjustment: 2.33

Throttling Range: 10°F

AT-8122: Set 45°F for S.P. of 85 where O.A. is above 70°F. Relay is energized with outside air temperature below 70°.

Figure 15. Outside Air Temperature Reset of Hot Water with Fixed Temperature with Outside Air Temperature Above Selected Value



Resistor (5, 10, 15, 20°F offset) use AD-8969-201 kit.

Offsetting setpoint for Direct Acting Controller:

Raise, connector resistor to +6.2 terminal.

Lower, connect resistor to COM terminal.

Offsetting setpoint for Reverse Acting Controller:

Raise, connect resistor to COM terminal.

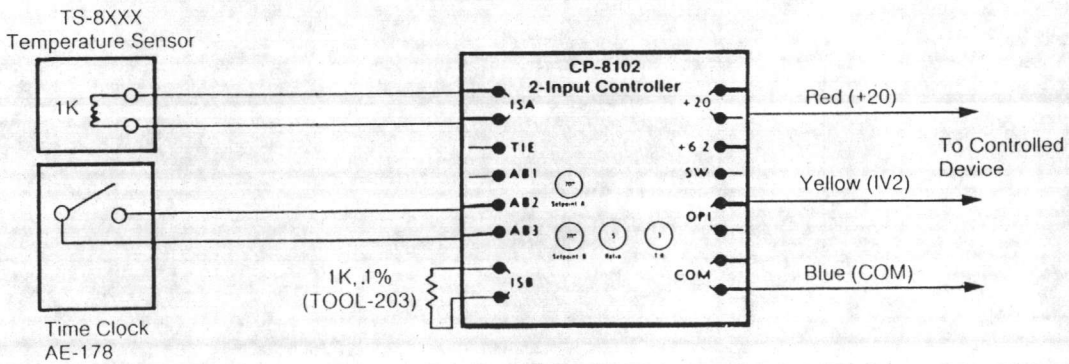
Lower, connect resistor to +6.2 terminal.

NOTE

Standard two conductor twisted wire should be used if remote switching is employed.

Resistor must always be located at stat.

Figure 16. Setpoint Offset

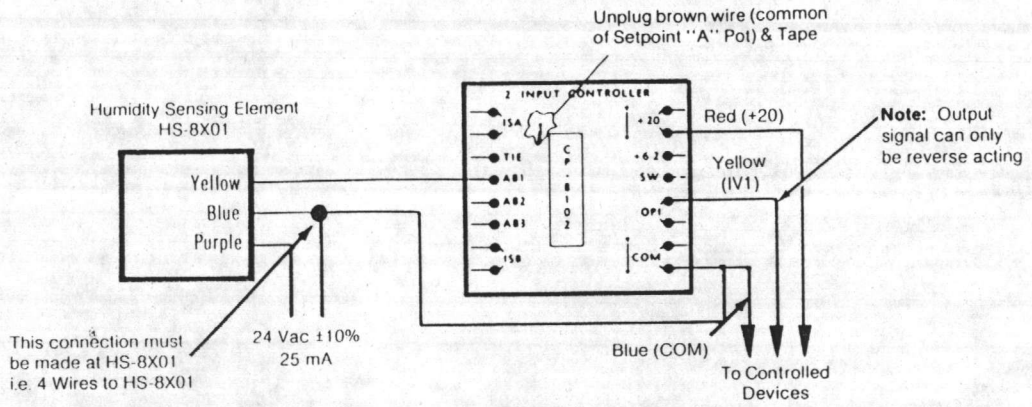


Install 1000 ohm 1% (TOOL-203) resistor in ISB. Install AE-178 7 day time clock. Set setpoint "B" as desired for night setback.

Table 8.

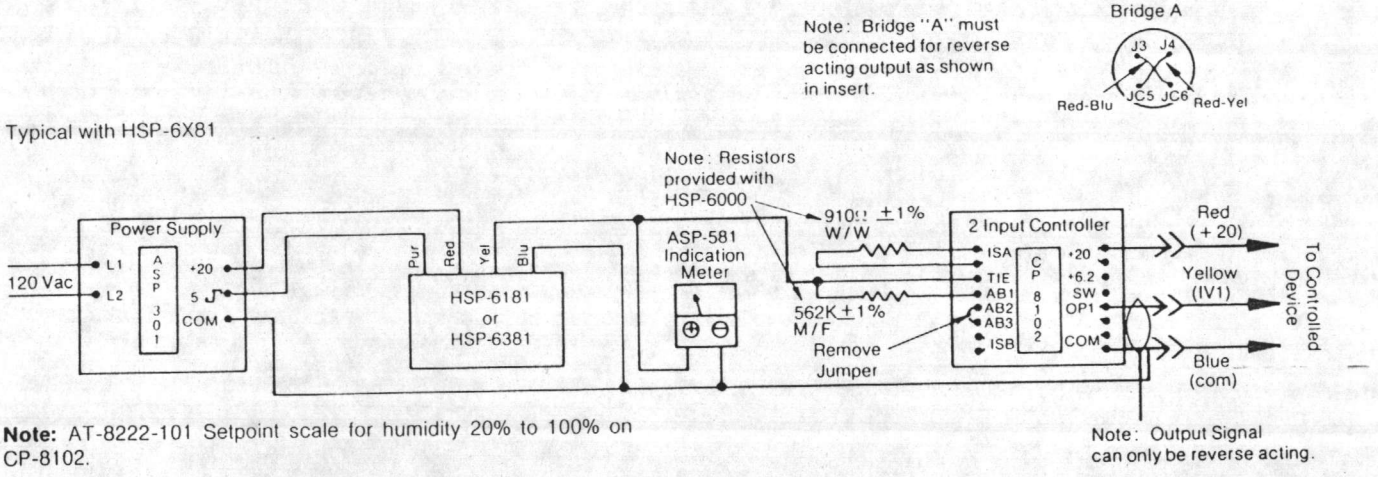
Setpoint "B"	Night Setback
70°F (21.1°C)	No Setback
65°F (18.3°C)	5°F (2.8°C) Setback
60°F (15.6°C)	10°F (5.6°C)Setback
55°F (12.8°C)	15°F (8.3°C) Setback

Figure 17. Night Setback



Note: Settings of 2-6 throttling range result in 2-6% RH throttling range for 3 Vdc output change. 6 TR is maximum setting.

Figure 18. Humidity Control



Note: AT-8222-101 Setpoint scale for humidity 20% to 100% on CP-8102.

Figure 19. Humidity Control & Indication

APPLICATION

Electronic sensing of temperature at remote room locations, ducts, plenum chambers, liquid lines, tanks, outdoor air, etc.

SPECIFICATIONS

Sensing Element: Balco resistance. 1000 ohms ±0.1% at 70°F (21°C); *TS-8405, TS-8422* — ±1% at 70°F (21°C). Changes 2.2 ohms per 1°F (0.5°C) at 70°F (21°C). *TS-8204 only* — 1657 ohms ±0.1% at 300°F (149°C); changes 2.5 ohms per 1°F (0.5°C) at 300°F (149°C).

NOTE

TS-8204 is not compatible with internal setpoints of controllers (except for differential control), TSP-8101 or TSP-8111 temperature transmitters. Order AT-8435, 200 to 400°F (93 to 204°C) when setpoint is required.

See Tables 1 and 2 for additional specifications.

ACCESSORIES

AT-208	Duct mounting kit for TS-8201-105 (included with TS-8204)
AT-215	Stainless steel bulb well for TS-8201 or TS-8204
AT-225	Stainless steel bulb well for TS-8201-106
AT-8435	Remote setpoint adjuster, dual scale 200 to 400°F (93 to 204°C); required for all TS-8204 applications except differential control

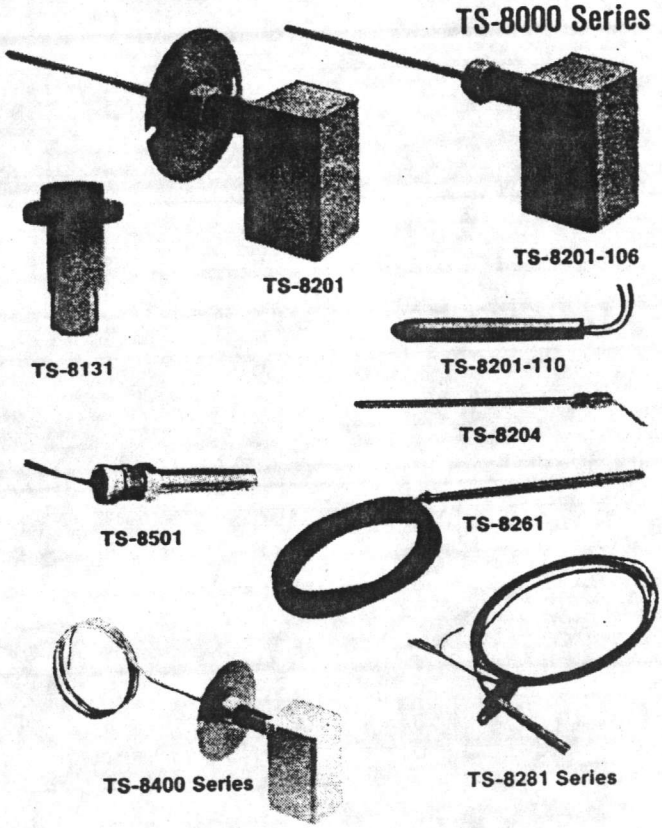


TABLE 1. AMBIENT TEMPERATURE LIMITS °F (°C)

Part Number	Shipping & Storage	Operating
TS-8131* TS-8261* TS-8281 Series*	-40 to 160 (-40 to 71)	40 to 140 4 to 60)
TS-8201 TS-8201-106 TS-8201-110	-40 to 250 (-40 to 121)	-40 to 250 (-40 to 121)
TS-8405 TS-8422 TS-8501	-40 to 220 (-40 to 104)	-40 to 220 (-40 to 104)
TS-8204	-40 to 400 (-40 to 204)	200 to 400 (93 to 204)

*Humidity, 5 to 95% RH, non-condensing.

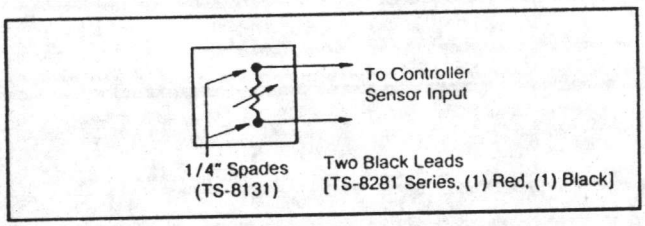


Figure 1. TS-8XXX Sensor Connections

TABLE 2. SPECIFICATIONS

Part Number	Description	Mounting Connection	Dimensions in. (mm)		Wiring Connections
			Element	Enclosure	
TS-8131	Unitary*	7/32" (13.5 mm) dia. Mounting Hole	3/4 dia. × 1-1/4 long (19 × 32)	None	1/4" Spade Connections
TS-8201	Duct/Immersion**	Plate, 1/4" NPT**	1/4 dia. × 6 long (6 × 152)	3-1/2 high × 2-1/4 wide × 2-1/4 deep (89 × 57 × 57) with 2-1/2 (64) extension to element; 1/2" knockouts (top & bottom)	12" (305 mm) Black Pigtail Leads
TS-8201-106	Immersion***	1/4" NPT Nut***	1/4 dia. × 4 long (6 × 102)		
TS-8201-110	Strap-on	Nylon Wire Tie†	1/4 dia. × 2-1/4 long (6 × 57)	None	12" (305 mm) Black Pigtail Leads
TS-8204	Duct/Immersion**	1/4" NPT Nut**; AT-208 included	1/4 dia. × 8 long (6 × 203)	None	16" (401 mm) Yellow Pigtail Leads
TS-8261	Comb. Light Fixtures & Ceiling Diffuser	None	1/4 dia. × 8-1/8 long (6 × 206)	None	6' (1.8 m) Black Pigtail Leads
TS-8281	Duct	Plate	5/16 dia. × 3-5/8 long (7.9 × 92)	None	6' (1.8 m) (1) Red, (1) Black Shielded & Jacketed
TS-8281-101					6' (1.8 m) (1) Red, (1) Black Shielded & Jacketed Plenum Rated Cable
TS-8405	Averaging (Duct)	Plate	5' (1.5 m) long	3-1/2 high × 2-1/4 wide × 2-1/4 deep (89 × 57 × 57) with 2-1/2 (64) extension to element; 1/2" knockouts (top & bottom)	12" (305 mm) Black Pigtail Leads
TS-8422	Averaging (Duct)	Plate	22' (6.7 m) long		
TS-8501	Outdoor	1/2" Conduit	1-1/8 dia. × 5 long (29 × 127)	None	3' (0.9 m) Black Pigtail Leads

*For mounting through fan coil of unit ventilator cabinet or similar application. **Immersion requires AT-215 bulb well. ***Immersion requires AT-225 bulb well.
†Factory supplied, 2-1/2" × 2" (64 mm × 51 mm) foam insulation tape and 30" (762 mm) nylon tie for 1-1/2" thru 8" (38 mm thru 203 mm) dia. pipes.

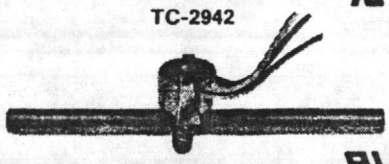
Strap-on Changeover Thermostat

TC-2931
TC-2942
TC-2974

APPLICATION

For summer-winter changeover in hydronic heating-cooling systems.

TC-2942

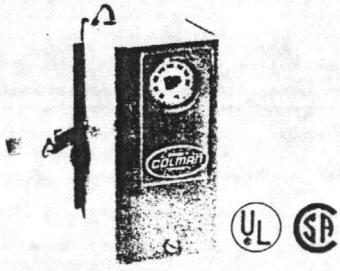


TC-2931

SPECIFICATIONS

Setpoint: 75°F (24°C) approx., fixed.
Sensing Element: Bimetal.
Differential: 15°F (8°C) fixed.
Ambient Temperature Limits:
Shipping, -40 to 220°F (-40 to 104°C).
Min. Hot Water Temperature: 90°F (32°C).
Max. Chilled Water Temperature: 60°F (16°C).
Electrical Switch: Snap-acting SPDT with silver contacts.
Ratings, See Table 1.
Connections: See Table 1.
Case: Hermetically sealed steel.
Mounting: On up to 1-1/2" pipe with mounting springs provided.
Dimensions: 2" diameter × 1-1/2" high (51 mm × 38 mm).

ACCESSORIES None



TC-2974

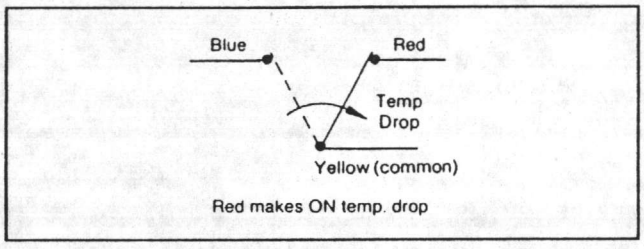


Figure 1. Switch Action and Lead Identification

TABLE 1. SPECIFICATIONS

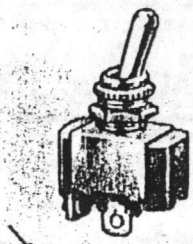
Part Number	Type	Connections	Switch Ratings (AC Only)				Non-Inductive (Amps)
			Voltage (Vac)	FLA (Amps)	LRA (Amps)	Pilot Duty (VA)	
TC-2931	Strap-on	Three (3) color-coded 16 gauge leads 3' (914 mm) long	120 240	5.8 2.9	34.8 17.4	125	N/A
TC-2942	Strap-on enclosed*	Three (3) color-coded 16 gage leads 3' (914 mm) long					
TC-2974	Strap-on	Three (3) color-coded 16 gage leads 3' (914 mm) long	120 240	9.8 8	58.8 48.8	360	22

*Has 1/2" conduit adaptor.

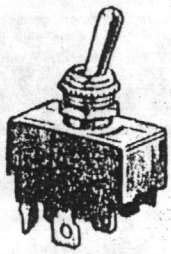
S-1; S-2: TP 1.4.1.g

General Purpose Switches For Electric Motors and Instruments

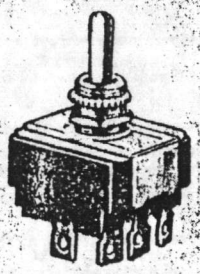
CARLINGSWITCH



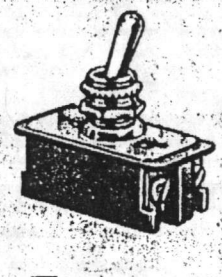
A No. 2X464



B No. 2X467

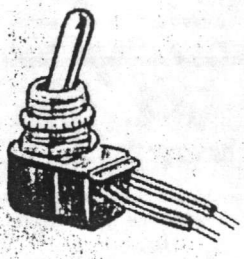


C No. 4X208



D No. 2X488

Toggle Switches with up to 15/10 Amp Ratings For 125/250 VAC
SPST, DPST, DPDT And 3PST Styles
Screw, Tab or Lead Terminal Endings
Standard Toggle Stem 15/32" Diameter, Threaded

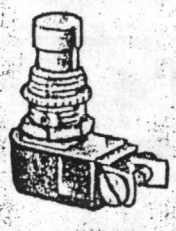


E No. 1X878

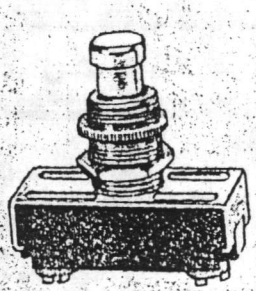
F No. 2X642

UL® E7560

CSA LR9280

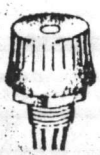


G No. 1X692



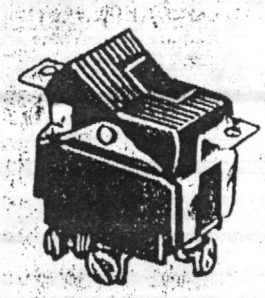
H No. 2X894

Miniature Toggle Stem 0.250", Threaded
Push-On, Push-Off Style Switches and Push-To-Activate, Release-To-Deactivate Styles
Rotary Switch Styles for Multi-Speed Or Multi-Circuit Applications
Tippette® And Curvette Rocker Switches For Attractive Panel Boards
Miniature Toggle Switches Can Be Used In Applications Where Space Is Limited



I No. 4X215

J No. 4X087



L No. 4X216

M No. 1A822

N No. 1A818

AT-101

APPLICATION

Lock cover screw kit modifies room thermostats so as to prevent unauthorized tampering of either the dial setting or the internal mechanism.

Electric	Electronic		Pneumatic
All except TA-121 TC-114	SLC-800X	TS-5191	All TK-1XXX and TK-5XXX except TK-17XX, TK-18XX
	TP-810X	TS-5711	
	TP-8232	TS-811X	

Note: Two kits are required for duplex type thermostats.

AT-104

APPLICATION

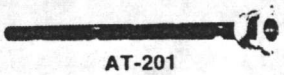
Package of 100 dial stop pins to insert in dial ends to limit the high or low setting of room thermostats.

Electric	Electronic		Pneumatic
All except TA-121 TC-114	TP-810X	TS-5711	All TK-1XXX and TK-5XXX except TK-17XX, TK-18XX
	TP-8232	TS-811X	
	TS-5191		

AT-201 AT-203 AT-206

APPLICATION

Immersion well for use with 3/8" (10 mm) temperature bulbs.



AT-201
AT-203

SPECIFICATIONS

Ambient Temperature Limits: -40 to 350°F (-40 to 177°C).

Part Number	Material	Dimensions				Application Limitations at 250°F (121°C) Fluid Temp.		Used With
		O.D. in. (mm)	Insertion Length in. (mm)	Overall Well Length in. (mm)	Fitting in.	Max. Recom. Velocity FPS (m/s)	Max. Recom. Static Pressure psig (kPa)	
AT-201*	Copper	1/2 (13)**	9-1/2 (241)	10-1/4 (260)	3/4 MNPT	11 (3.3)	250 (1728)	TC-28X, TC-4X1X, TC-4X2X, TC-4X5X, TK-6024, TK-6124, TKS-8000's
AT-203*	Stainless Steel	1/2 (13)**	9-1/2 (241)	10-1/2 (267)	3/4 MNPT	20 (6.1)	500 (3448)	Same as AT-201
AT-206	Copper	1/2 (13)**	4-1/2 (114)	5-13/16 (148)	1/2 MNPT	11 (3.3)	250 (1728)	TC-4X1X, TC-4X2X, TC-4X5X, TK-6024, TK-6124

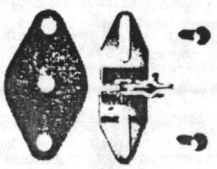
*Requires AT-209 for TC-4X1X, TC-4X2X, TC-4X5X, TK-6024, TK-6124.
**For 3/8" (10 mm) diameter bulbs.

AT-208 AT-209

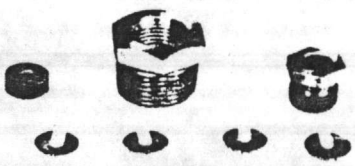
APPLICATION

Duct and liquid mounting kit for temperature bulbs.

Part Number	Description	Applications
AT-208	Duct Mounting Kit	Pneumatic & Electric Temperature Bulbs. TS-8201-105, TS-8204 Temperature Sensors.
AT-209	3/4" MNPT Liquid Line or Tank Mounting Kit	TC-4X1X, TC-4X2X, TC-4X5X TK-6024 or TK-6124 Series Bulb Thermostats. Bulb Well is Recommended.



AT-208

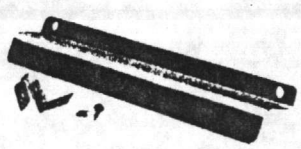


AT-209

AT-211

APPLICATION

Outdoor bulb shield for mounting bulb to outside wall to protect from damage and foreign matter and direct solar radiation.



SPECIFICATIONS

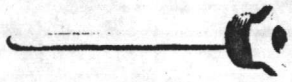
Construction: Aluminum.
Mounting: Two 17/64" (7 mm) mounting holes in shield. Kit is furnished with bulb holding clip.

Dimensions: 2" high × 11-3/4" wide × 1-1/8" deep (51 mm × 298 mm × 29 mm).

AT-215

APPLICATION

Bulb well for use with TS-5721, TS-5821, TS-8201, TS-8204 duct/immersion sensor and TSP-8465X temperature transmitters for insertion into a liquid line or tank to allow removal of sensing element without draining the system.



SPECIFICATIONS

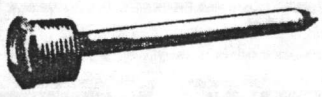
Construction: 316 stainless steel with 3/4" MNPT external thread and 1/4" MNPT internal thread.
Maximum Velocity: 20 FPS (6 m/s).

Maximum Static Pressure: 500 psig (3448 kPa).
Dimensions: 3/8" O.D × 7" long (9.5 mm × 178 mm). 6-1/4" (159 mm) insertion length.

AT-225

APPLICATION

Bulb well for use with TS-572X-101, TS-582X-101, TS-572X-901, TS-8201-106 sensors and TSP-8XXXX temperature transmitters for insertion into liquid line or tank to allow removal of sensing element without draining the system.



SPECIFICATIONS

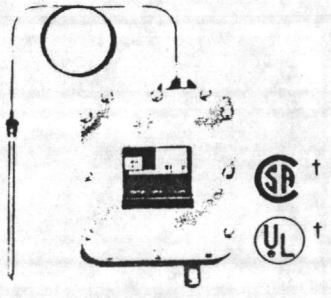
Construction: 316 stainless steel 1/2" MNPT external and 1/4" MNPT internal thread.
Maximum Velocity: 20 FPS (6 m/s).

Maximum Static Pressure: 500 psig (3448 kPa).
Dimensions: 3/8" O.D. × 4-13/16" long (9.5 mm × 122 mm). 4" (102 mm) insertion length.

AT-401

APPLICATION

Bulb control enclosures for use in hazardous locations. For use with TC-280 single bulb controls.



†Only factory enclosure/thermostat assemblies with thermostat types are Underwriters' Laboratories listed or CSA certified.

SPECIFICATIONS

N.E.C. Hazardous Locations: Class 1, Groups C and D, and Class 2, Groups E, F and G.
Adjustment: External control point adjustment with provisions for locking the dial setting.
Connections: One 1" pipe tapped opening for hazardous location joint with rigid metal conduit. 1" to 3/4" reducer installed for smaller conduit when applicable. All control wiring brought out to separate terminals for ease of installation.
Case: Cast aluminum with bolted cover.
Mounting: Three pads, each with a 21/64" (8.3 mm) hole for mounting lug.
Dimensions: 10" high × 8-1/2" wide × 4-3/8" deep (254 mm × 216 mm × 111 mm).

ENCLOSURE/BULB CONTROL ASSEMBLIES
Specify TC6.

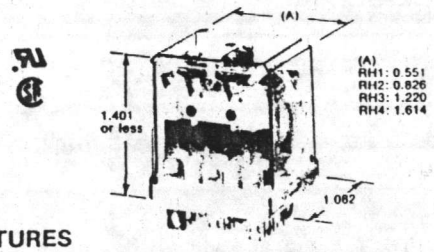
Only factory enclosure/bulb control assemblies using TC-280 series single bulb controls are Underwriters' Laboratories listed.

R-1; R-2 : TP 1.4.1.g

idec GENERAL PURPOSE RELAYS

RH SERIES

Compact Size, Large 10 Amp Capacity
2, 3 and 4 Pole

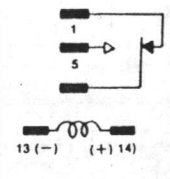
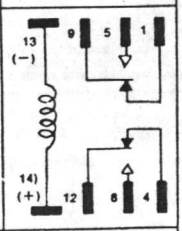
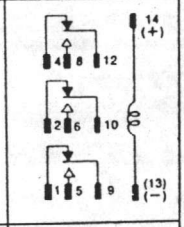
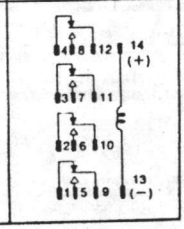


FEATURES

- Miniature size package allows compact system designing.
- 10 amp contact capacity.
- Dielectric strength — up to 2,000 volts.
- UL recognized and CSA certified.
- Indicator light or check button available on 2, 3 and 4-pole models.
- Complete accessories include IDEC's broad line of sockets, hold-down springs and mounting rails.

SPECIFICATIONS

Contact Material: Silver cadmium oxide (Ag-CdO)
Contact Resistance: 50 mΩ max. (initial value)
Operate Time: SPDT(RH1), DPDT(RH2) — 20 msec max., 3PDT(RH3), 4PDT(RH4) — 25 msec max.
Release Time: SPDT(RH1), DPDT(RH2) — 20 msec max., 3PDT(RH3), 4PDT(RH4) — 25 msec max.
Power Consumption (Approx.):
SPDT(RH1) — AC: 1.1 VA (50 Hz), 1 VA (60 Hz), DC: 0.8W
DPDT(RH2) — AC: 1.4 VA (50 Hz, 1.2 VA 60 Hz), DC: 0.9W
3PDT(RH3) — AC: 2 VA (50 Hz), 1.7 VA (60 Hz), DC: 1.5W
4PDT(RH4) — AC: 2.5 VA (50 Hz, 2 VA (60 Hz), DC: 1.5W
Insulation Resistance: 100 MΩ min. (at 500V DC megger)
Dielectric Strength:
SPDT(RH1)
Between live and non-live parts: 2000V AC, 1 minute
Between contact circuit and operating coil: 2000V AC, 1 minute
Between contacts of the same pole: 1000V AC, 1 minute
DPDT(RH2), 3PDT(RH3), 4PDT(RH4)
Between live and non-live parts: 2000V AC, 1 minute
Between contact circuit and operating coil: 2000V AC, 1 minute
Between contact circuit and operating coil: 2000V AC, 1 minute
Between contact circuits: 1500V AC, 1 minute
Between contacts of the same pole: 1000V AC, 1 minute
Frequency Response: 1800 operations/hour
Temperature Rise: Coil: 85 deg. max., Contact: 65 deg. max.
Vibration Resistance: 0 to 6g (55 Hz max.)
Shock Resistance: SPDT(RH1), DPDT(RH2) — 20g, 3PDT (RH3) 4PDT(RH4) — 10g
Operating Temperature: −22° to +158°F (−30°C to +70°C)
Weight (Approx:): RH1: 24g, RH2: 37g, RH3: 50g, RH4: 74g
Life Expectancy:
Electrical: 500,000 operations or more (120V AC, 10A)*
Mechanical: 50,000,000 operations or more
Note*: 200,000 operations or more (120V AC, 10A) in SPDT(RH1), 3PDT(RH3), 4PDT(RH4) Types.

Type	Coil Input	Coil Resist Ohms	Coil Nom. Power Approx.	Contact Arrangement	Contact Amps (Max.)	Circuit Diagram
RH1	6VAC	18.8	1VA	SPDT	10A	
	12VAC	76.8				
	24VAC	300				
	120VAC	7680				
	6VDC	47	0.8W			
	12VDC	188				
	24VDC	750				
	48VDC	2600				
	110VDC	13800				
RH2	6VAC	9.6	1.2VA	DPDT	10A	
	12VAC	40.5				
	24VAC	156.7				
	120VAC	4280				
	240VAC	15720				
	6VDC	40	0.9W			
	12VDC	160				
	24VDC	650				
	48VDC	2660				
	110VDC	12100				
RH3	6VAC	6.0	1.7VA	3PDT	10A	
	12VAC	25.3				
	24VAC	103				
	120VAC	2770				
	240VAC	12110				
	6VDC	25	1.5W			
	12VDC	100				
	24VDC	400				
	48VDC	1600				
	110VDC	8600				
RH4	6VAC	5.4	2VA	4PDT	10A	
	12VAC	21.2				
	24VAC	84.5				
	120VAC	2220				
	240VAC	9120				
	6VDC	24	1.5W			
	12VDC	96				
	24VDC	388				
	48VDC	1550				
	110VDC	7340				

Note: • Options : Light Emitting Diode (LED); Check Button and Neon; Check Button
• LED suited for 110VAC and less. Neon suited for greater than 110VAC

TYPE LIST

Terminal Style	Contact Config.	Basic Type	with Indicator Light	with Check Button	Top Bracket Mntg. Type
B (Blade)	SPDT	RH1B-U	—	—	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	—
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-UT
V2 (PCB)*	SPDT	RH1V2-U	—	—	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	—
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	—

Note*: 2mm (0.078) wide

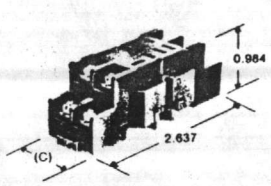
SOCKETS FOR RH SERIES

Relay	Socket No.	Hold-Down Spring
RH1B	SH1B-05 (DIN Mount)	SY2S-02F1, SFA-202
	SH1B-51 (Panel Mount)	SY4S-51F1
	SH1B-62 (PC Mount)	SY4S-51F1
RH2B RH2B	SH2B-05 (DIN Mount)	SY4S-02F1, SFA-202
	SH2B-51 (Panel Mount)	SY4S-51F1
	SH2B-62 (PC Mount)	SY4S-51F1
RH3B	SH3B-05 (DIN Mount)	SH3B-05F1, SFA-202
	SH3B-51 (Panel Mount)	SY4S-51F1
	SH3B-62 (PC Mount)	SY4S-51F1
RH4B	SH4B-05 (DIN Mount)	SH4B-02F1, SFA-202
	SH4B-51 (Panel Mount)	SY4S-51F1
	SH4B-62 (PC Mount)	SY4S-51F1

ACCESSORIES

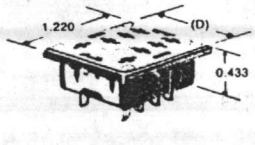
BND-1000	Aluminum DIN Rail
BNL-5	Metal End Clip

Dimensions indicated in inches



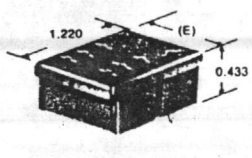
SH2B-05

(C)
SH1B-05: 0.787
SH2B-05: 1.181
SH3B-05: 1.575
SH4B-05: 1.968



SH2B-51

(D)
SH1B-51: 0.709
SH2B-51: 1.063
SH3B-51: 1.417
SH4B-51: 1.171



SH2B-62

(E)
SH1B-62: 0.708
SH2B-61: 0.835
SH3B-61: 1.447
SH4B-62: 1.772

CP-1 : TP 1.4.1.J

AIR PRODUCTS & CONTROLS, LTD.

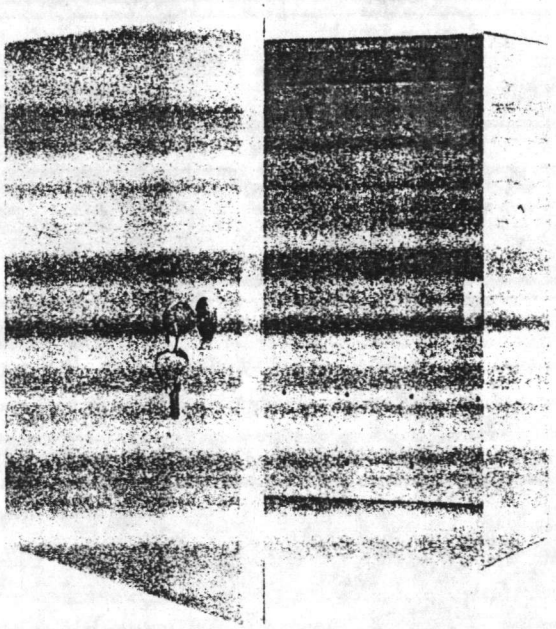
CPC SERIES CONTROL PANELS

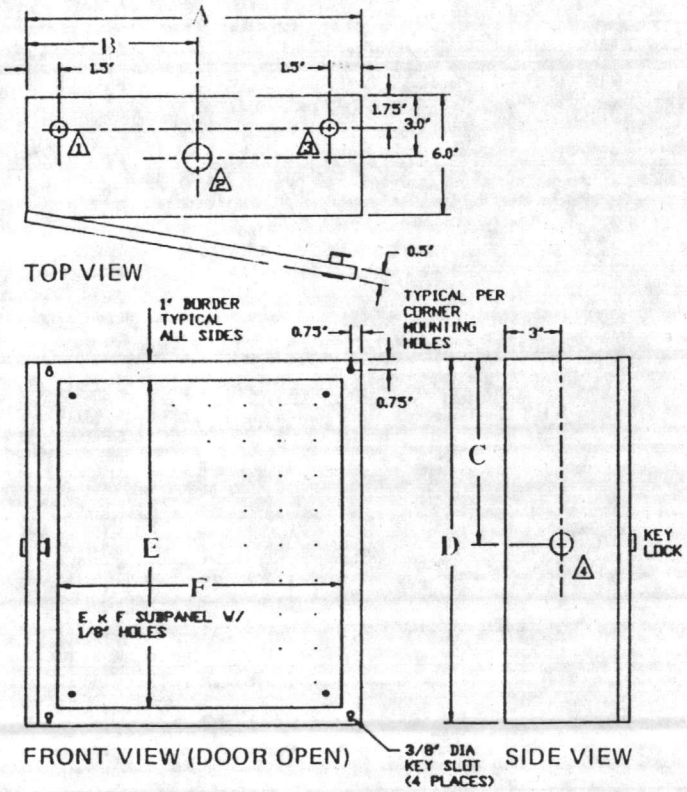
PRODUCT DESCRIPTION

The CPC control panel is designed to provide a convenient method of surface mounting and protecting either pneumatic or electrical control devices.

The ease of wallmounting, plus a subpanel on which the control devices are mounted, permits installation of the cabinet during construction and mounting of the finished subpanel at the required time.

The cabinet may be either a left or right handed door opening without additional hardware. Two or more cabinets may be mounted side by side or over and under to handle specific requirements. This eliminates the need for large, heavy-to-handle single panels. To join individual cabinets, remove the knockouts and fasten with appropriate fittings and lock nuts. This provides a neat flexible installation. Each side of the cabinet enclosure has convenient knockouts for rigid, soft or flexible tubing or electrical equipment connections.





Model No.: CPC 16: 16" wide x 18" high x 6" deep
CPC 20: 20" wide x 24" high x 6" deep
CPC 24: 24" wide x 36" high x 6" deep

Mounting: Keyhole surface mounting

Construction: Cabinet: Heavy duty steel
Subpanel: Steel perforated [1/8" holes 7/16" x 1/4" centers, staggered

Dimensions:	A	B	C	D	E x F
CPC-16:	16"	8"	9"	18"	16" x 14"
CPC-20:	20"	10"	12"	24"	22" x 18"
CPC-24:	24"	12"	18"	36"	34" x 22"

Knockouts: Provide on all four sides of the cabinet. See data for dimensions and specific location.

Door: Welded piano hinge
Key-operated latch
Tamper resistant

Finish: Textured

Color: Tan or Orange (specify)

Distributed By:

1. 3/4" KNOCKOUT ON TOP (1/2" ON BOTTOM)
2. 1" KNOCKOUT ON TOP AND BOTTOM
3. 1/2" KNOCKOUT ON TOP (3/4" ON BOTTOM)
4. 3/4" KNOCKOUT BOTH SIDES

PL-1; PL-2; PL-3

NON-RELAMPABLE

SERIES 1050QC ½" DIA.

FEATURES **Mounting:** Will snap-fit into .500/.505 (12.70/12.83) dia. hole in panels .020/.100 (.51/2.54) thick. Push-on speednut SN0461) (see pg. 170) also available.

Terminals: Tinned brass

Lens: Polycarbonate

Bezel: Chrome plated brass

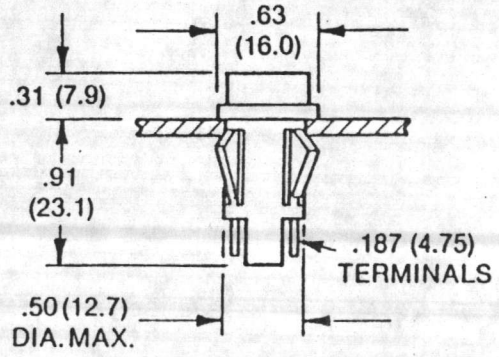
Housing: White nylon

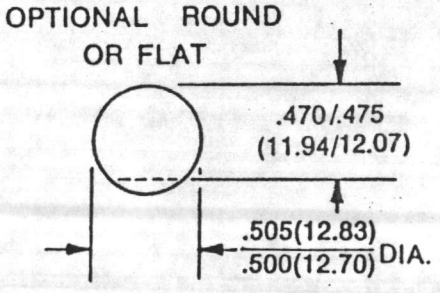
LENS COLOR	NEON	
	MODEL NO. 105-125VAC	MODEL NO. 208-250V
Red	1050QC1	1051QC1
Clear	1050QC2	—
Amber	1050QC3	1051QC3
White	1050QC4	1051QC4
Green	1052QC5*	1053QC5*
Lamp	C2A + Resistor	
Quick Connect Terminals		

* Incorporates G2B lamp and resistor

Underwriters Laboratories (UL) File No. E20325 —
Canadian Standards Association (CSA) File No. 13346

OUTLINE DIMENSIONS





MOUNTING HOLE REQUIRED

ALL DIMENSIONS ARE IN INCHES (MM).

TAB PLACEMENT HERE

DESCRIPTION:

7

☒ Tab page did not contain hand written information

☐ Tab page contained hand written information
*Scanned as next image

Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

Renovation of Building M231
Marine Corpos Base
Camp Lejeune, NC.
Conract: N62470-88-C-3764

Fan Coil Units
& Air Handlers

General Contractor:

CBC Enterprises, Inc.
1312 E. Little Creek Road
Norfolk, Virginia 23518

Mechanical Contractor:

G.R. Michaels & Co.
331 32nd Street
Newport News, Va.
Phone: (804) 622-3099

Wholesaler and Supplier:

AirTherm Manufacturing Co.
9339 Dielman Industrial Drive
Olivette, Missouri 63132
(314) 993-3400

Represenative:

Wright & Company
P.O. Box 6353
Norfolk, Virginia 23508
(804) 423-8997
Sonny Wright

AIRTHERM CENTRALAIRE II
CENTRAL STATION AIR CONDITIONING UNITS

INSTALLATION — START UP — MAINTENANCE INSTRUCTIONS

INTRODUCTION:

All Airtherm Centralaires are completely assembled at the Factory prior to shipment. The job motor and drive are factory mounted. While operating at job RPM, each unit is closely analyzed for vibration and balanced.

Following testing, Centralaires are mounted on skids and shipped fully assembled with motors and drives totally assembled. If units are too large for shipment completely assembled, they are shipped in the most complete increments shipping limitations will allow.

INSPECTION:

Check items received to insure equipment received is as ordered. Advise your Airtherm representative immediately of any discrepancy.

The complete unit and accessories should be inspected for transportation damage either visible or concealed. Check for bent fan wheel or shaft which may result in future vibration problems. If any damage is found, file a claim with the carrier within 15 days from time of delivery.

HANDLING:

Care should be taken when assembling units. Rough handling at the jobsite can result in damage to the shaft and bearings.

Units are furnished with conveniently located 5/8 NC tapped holes for use with field supplied 5/8" eye bolts for hoisting. Use spacer bars when hoisting to avoid damage to the unit.

STORAGE:

If storage is necessary, choose a location that is level and sturdy. When storing out of doors, cover entire unit with tarpaulins or plastic. Extend the cover under the unit if it is stored on the ground.

Bearings should be covered and sealed with tape to protect them from moisture, abrasives and corrosion. Inspect the units periodically to be sure no corrosion is occurring. Rotate the fan shafts slowly by hand monthly.

INSTALLATION:

The unit should be installed in a level position. Do not remove protective caps from the coil piping connections until ready to connect piping.

Leave Sufficient clearance for:

1. Condensate trap.
2. Removal of fan shaft and coil.
3. Service of filters (30" minimum), fan motor, bearings, damper linkage and damper motors.
4. Piping so belt guard can be removed.

When the coil section and fan section are shipped separately or when filter or mixing sections, etc. are to be field mounted to the unit, sufficient screws, nuts and bolts to accomplish field assembly are included.

When the unit is located on a roof, it must be mounted on support beams that span load bearing walls. If this is not done, excessive vibration may occur due to roof resiliency.

Whenever, on an outdoor unit installation, component sections are shipped separately and must be assembled in the field, a weatherproof seal must be effected between the sections. Cartridges of sealer for field caulking between sections are provided for this purpose.

Vibration isolators are ordered as accessory equipment. All isolators will be properly marked and identified as to where (on what section) they should be installed.

INITIAL START UP CHECK LIST:

1. Remove all construction debris from interior of the unit.
2. Check motor mounting to make sure all nuts are tight.
3. Check motor sheave and fan pulley for proper alignment, and set screws for tightness. The motor shaft must be parallel to the fan shaft.
4. Check belt tension. (See V-Belt Drive section.)
5. Check bearing locking collar set screws for tightness.
6. Rotate blower shaft by hand to be sure it is free.
7. Be sure that fan and motor bearings are properly lubricated. (See section on Motors and Fan Shaft Bearings.)
8. Apply power momentarily to fans; check for correct direction of rotation. If rotation is incorrect, it can be corrected as follows: on three phase motors exchange two of the three leads at the motor starter. The rotation of single phase motors can be reversed by exchanging leads inside the motor junction box. (See Motor Wiring Diagram.)
9. Check damper operation for full movement. Damper shaft bearings are bronze type which can be lubricated with a few drops of oil if required to provide freer movement.
10. Start fan motor. Check motor voltage and amperage to be sure they conform closely to nameplate data. Observe noise level and secure if unusual vibration or noise is observed. Be sure fans do not rub on scrolls. If excessive vibration is observed, check the following:
    - A. Fan wheel(s) out of balance due to shipping damage or due to foreign material on wheel(s).
    - B. Motor out of balance.
    - C. Sheaves eccentric or out of balance.
    - D. Sheaves loose on shaft.
    - E. Fan wheel(s) loose on shaft.
    - F. Loose anchor bolts.
    - G. Loose bearing mounting bolts.
    - H. Drive alignment.
    - I. Vibration isolators improperly adjusted.
11. Check fan RPM and adjust as necessary. See section on V-Belt Drive.
12. Water coils that are used for cooling only and will be exposed to below 35°F must be drained or an anti-freeze solution put into the coil to prevent it from freezing. All water coils are provided with vent and drain connections which extend through the unit casing.

MAINTENANCE:

Motors:

Instructions are included on the motor name plate for greasing ball bearing motors or oiling sleeve bearing type motors. Use only an S.A.E. No. 30 non-detergent electric motor oil with sleeve bearing motors.

Fan Shaft Bearings:

Check bearings for wear and for excessive end play. Clean fans if necessary; accumulated dirt will cause unbalance which results in vibration and noise. Check fan set screws for tightness and that fans are properly positioned.

Centralaire fan shaft bearings are self aligning ball bearings that have been factory pre-lubricated by the manufacturer. They are designed for use with grease, not oil.

(OVER)

AIRTHERM MANUFACTURING COMPANY
9339 DIELMAN INDUSTRIAL DRIVE, P.O. BOX 7039, ST. LOUIS, MO 63177
PHONE: (314) 993-3400 FAX: 314-993-1118

Recommended Bearing Lubrication Schedule

SHAFT SIZE INCHES	OPERATING SPEED (RPM)					
	500	1000	1500	2000	2500	3000
	LUBRICATION CYCLE (MONTHS)					
1-7/16	6	6	6	6	6	6
1-1/2 - 1-3/4	6	6	6	4	4	2
1-7/8 - 2-3/16	6	6	4	4	2	2
2-1/4 - 2-7/16	6	4	4	2	2	1
2-1/2 - 3	6	4	4	2	1	1
3-7/16	6	4	2	1	1	1

Lubricate with the following greases or their equivalent:

Shell – Alvania EP Grease No. 2

Texaco – Molytex Grease No. 2

Mobil – Mobilux EP2

Gulf – Gulfcrown Grease No. 2

American Amolith Grease No. 2.

If bearings are subjected to temperatures Below 32° or above 200°F, consult factory for proper lubrication.

Apply sufficient grease when relubricating to cause some purging of grease at seals. When bearings are filled to capacity, there will be a rise of approximately 30°F in operating temperature.

Increase the frequency of relubrication in conditions of abnormal moisture or dirt.

Lubricate for extended shutdown or storage and rotate shaft monthly for corrosion protection.

V-Belt Drive:

Motors are factory adjusted for proper belt tension. After operating for a while the belt will stretch and it will be necessary to take up the slack by adjusting the motor. If a belt is replaced, it will be necessary to readjust the motor.

Replace belts if there are any breaks or shreds. Multiple belts should always be replaced in matched sets.

On units equipped with adjustable drive, adjust the driver sheave to change the fan speed. When this is done, adjustment of belt tension will be necessary. If fan speed is being increased, check current demand of motor to insure it is not overloaded.

Filters:

Dirty filters reduce air flow, and in turn, capacity of the unit. When dirty, replace or clean, depending on the type.

Coil:

Periodically check heating and/or cooling coils. Make certain that their surfaces are free of dirt and other airborne deposits. Dirt may be removed by brushing or vacuum cleaning the face of the coil on the entering air side. High pressure air may be blown through the coil in a direction opposite the air flow to dislodge dirt. In some cases it may be necessary to clean the coils with water hose and detergent.

Replacement Parts:

When replacement parts are required, furnish the factory with a description of the part and the unit size and serial number which are on the nameplate located on the drive end of the blower section.

LIMITED WARRANTY

Products manufactured by AIRTHERM Manufacturing Company are warranted against defects in material or workmanship for a period of one year from the date of shipment.

Requests for repair or replacement of products under this warranty must be referred to AIRTHERM Manufacturing Company for issuance of a return authorization. Transportation charges must be prepaid on shipments of products returned to the factory.

Products determined to be defective will be repaired or replaced and returned to the purchaser F.O.B. factory.

This warranty does not apply to any equipment which shall have been altered or repaired outside AIRTHERM's factory, or which has been subject to misuse, negligence or operating conditions in excess of those stated in AIRTHERM's catalog. Products of other manufacture, assembled with or accessory to these products, are subject to the warranty of their manufacturer.

Under no conditions shall the company be held liable for consequential damages or repair costs.

The company reserves the right to make changes in design or dimensions, or to add or eliminate products without prior notice.

UNITAIRE III
INSTALLATION—OPERATION—MAINTENANCE INSTRUCTIONS

INSTALLATION

INSPECTION - Entire shipment should be inspected for damage, either readily visible or concealed. Remove the shipping carton as soon as received and inspect for in-transit damage. Any damage should be noted on the freight bill by the carriers agent and a claim filed as soon as possible. To prevent damage after inspection, each fan coil unit should be kept in its carton until ready for installation.

MOUNTING - Walls should be plumb and continuous behind the fan coil unit. Position the unit, and fasten to the wall or ceiling by means of toggle bolts, anchor or expansion bolts using the four 7/16" diameter holes provided in the cabinet. When installing on panel walls, consult the wall manufacturer or architect for recommended method of fastening.

The units must be installed level and rest evenly on the floor. If the floor is not level, insert shims between the bottom of the cabinet and floor until the cabinet is level.

The installation instructions for surface mounted floor, or wall and ceiling models also apply to recessed models.

On model C-A with rear inlet, maintain 6" minimum clearance from the rear inlet to the wall or other obstruction for proper operation.

When fan coil units are furnished with electric heating elements, ducted units must be installed in accordance with instructions located on the front cover of the control compartment. External static pressure (except when high static PSC motors are supplied) can not exceed .125" of water.

PIPING - A clean system is required to insure against blockage of the coil and to assure proper operation of the control valves. A complete purging of the system is recommended before unit piping connections are made. The basic unit coil connections are 5/8" O.D.

The supply connection is at the top, and the return connection is at the bottom on vertical model fan coil units.

Horizontal model fan coil units have the supply connection located at the bottom and the return connection located at the top.

Field insulation is required on all chilled water piping and components that are not located over the auxiliary drain pan.

Care should be exercised in piping connections to the unit to prevent excess soldering material from entering the system.

Each basic unit is equipped with a manually operated air vent valve. This valve permits air to be vented from the coils and keeps it operating at full capacity.

STOP VALVES - should be provided so that each water coil may be readily removed without draining excessive quantities of water from the system.

Use soft solder to make field connection to hand valves. Avoid excessive heat to prevent destruction of internal functional parts. Most valves may be soldered while in "Open" position. Ball type valves must be in "Closed" position. Disassembly when possible is recommended to avoid chance of overheating. Operate by hand only. Do not force to open or close.

FILTERS - are shipped installed in units. It is the responsibility of the installer to provide access to filters in model CP-A and CP-B fan coil units.

AUTOMATIC CONTROL VALVES - Certain automatic water control valves are shipped unmounted to prevent transit damage to valve piping components. These valves will be mounted at the factory with union or flare connections. Prior to shipment the valve will be disconnected from the piping cluster, packed in a separate carton and shipped separately or in the end pocket of the unit. Field assembly by the installer is required.

It is recommended these valves be mounted on units before final unit installation.

All water mains must be adequately supported to carry the necessary weight involved. Due to the fact that hot or cold water may be circulated through the water mains, a sizable movement due to expansion or contraction may be expected. If the piping is supported rigidly with no provision for movement, it is possible that breakage of tubing or fitings may result causing water damage.

Consult Airtherm certified drawings for additional piping details.

UNITS FOR HYDRONIC
COOLING AND HEATING

All codes and local requirements governing the installation of this type of equipment must be followed. Conformance with the National Electric Code is a minimum requirement.

Unit internal wiring is terminated in a junction box located on either the left hand or right hand side of the unit. Each fan coil unit is provided with a data plate stating voltage and ampacity. Field wiring to the electric junction box shall have a temperature rating of no less than 75 degrees C.

UNITS WITH HYDRONIC
COOLING COILS AND ELECTRIC HEATING ELEMENTS

WIRING - All electric connections are to be made in the control compartment located on either the left end or right end of the fan coil unit.

Remove the compartment cover and refer to the unit wiring diagram on the reverse side. All codes and local requirements governing the installation of electrical heating equipment must be followed. Conformance to the National Electric Code should be considered the minimum requirement.

The chassis must be electrically grounded, and a grounding lug(s) has been provided for this purpose.

Each fan coil unit is provided with a data plate showing voltage and ampacity. Field wiring to the control compartment shall have a temperature rating of no less than 75 degrees C. (Refer to data located on the outside of the control compartment cover for minimum wire size.)

ELECTRIC HEAT CONTROL PACKAGE
ENCLOSURE CLEARANCE

Control Package*	Sides	Top	Bottom	Rear**
All models except 24V. Control Pkg.	0"	0"	0"	0"
All concealed models with 24V. Control Pkg.	2"	2"	2"	0"

*Packages having 24V. control voltage end in suffix "24.3".
**"Rear" is the unit mounting side.

(CONTINUED, NEXT SIDE)

AIRTHERM MANUFACTURING COMPANY
9339 DIELMAN INDUSTRIAL DRIVE, P.O. BOX 7039, ST. LOUIS, MO 63177
PHONE: (314) 993-3400 TELEX: 44-7216

LINE POWER CIRCUIT WIRING - Connections are to be made at the contactor terminals marked L1 and L2 or at power terminal block (when provided) marked L1 and L2. Consult unit wiring diagram located on the reverse side of the control compartment cover.

CONTROL CIRCUIT WIRING - When a separate control power supply is required, wiring connections are to be made to control terminal blocks marked C1, and C2.

REMOTE MOUNTED COMPONENTS - Units requiring remote mounted thermostats should be installed in accordance with the manufacturer's instructions shipped with the thermostat, and should be connected as shown on the wiring diagram included with the unit.

24V REMOTE THERMOSTAT WIRING MUST BE IN ACCORDANCE WITH N.E.C. CLASS I

Some control packages also require a remote mounted fan speed switch. This switch should be mounted adjacent to the thermostat for ease of operation and installation. The electric connections from the remote components through the control box should be installed in conduit or other protective covering. All wiring should conform to the NEC or local codes.

OPERATION

THE FOLLOWING OPERATIONAL CHECKS SHOULD BE MADE AFTER EACH FAN COIL UNIT HAS BEEN INSTALLED

ACCESS - The front panel must be removed for access to interior components. Sufficient space for front panel removal must be provided.

FANS - Check the fan wheels for free rotation by spinning manually. Any slight misalignment can be corrected by repositioning the motor base, or reposition fan wheel on motor shaft. When making an adjustment, be certain the fan wheel is centered on the housing inlet.

DATA PLATE - Before energizing fan coil units, check the data plate rating for required power and control voltages. Verify the correct voltages have been wired to the unit.

START-UP - With the front panel in place, allow the fan coil unit to run for several minutes. Rotate the fan speed control selector switch, and observe motor speed changes.

THERMOSTATS - On units with built-in thermostats, check thermostat operation by rotating the temperature adjustment knob, or manually adjust the remote wall thermostat.

CONTACTORS - Check contactors for proper operation. Chattering Indicates low control circuit voltage, and can cause permanent damage to contactor contacts.

CAUTION: DISCONNECT THE LINE AND CONTROL POWER FROM THE FAN COIL UNIT BEFORE MAKING ANY ADJUSTMENTS.

OPERATION - If the fan is shut off for any extended period, when chilled water is being circulated, condensation may occur on the unit when it is installed in a high humidity area. To prevent condensation, it is recommended that a valve at the unit be used to stop the flow of chilled water when the fan is off.

FILTER - Check that the filter is in place and clean.

MAINTENANCE

Airtherm Unitaire III fan coil units will provide many years of trouble-free service if a regular schedule of inspection and maintenance is followed. Usually inspection every 4 months under normal operating conditions is adequate. However, this period may be varied to suit a particular installation. The following routine maintenance is recommended to insure peak performance.

NOTE: DISCONNECT POWER TO THE UNIT BEFORE PERFORMING MAINTENANCE.

CLEANING: Gain entry to unit interior by removing appropriate panels. Remove all accumulated dust and dirt with a suction vacuum cleaner and visually check for loose screws, fasteners, etc.

COILS: Clean the coil once a year, or more often if necessary, so cooling and heating capacity will not be impaired. Dirt may be removed by brushing or vacuuming the base of the coil. High pressure air may be blown through the coil in a direction opposite to air flow to dislodge dirt. In extreme cases it may be necessary to remove the coil from unit and spray with a mild alkaline cleaning solution followed by a rinse.

CONTROL COMPARTMENT: It is not necessary to remove the control compartment of fan coil units for use with electric heating elements for routine maintenance. No adjustments are required, unless malfunction due to control wiring or component failures is suspected.

FILTERS: Disposable filters should be changed a minimum of twice per cooling season and heating season to assure that excessive dust and lint have not accumulated to interrupt free-flow of air. If, due to extreme circumstances and unit location, excessive accumulation is noted, filters should be changed more often. Cleanable filters should be cleaned twice during both cooling and heating seasons with periodic checks for excessive dust and lint accumulation as noted above. Cleanable filters may be cleaned by immersing in water and shaking dry. They can also be cleaned with suction attachment on a vacuum cleaner.

A duplicate set of throw-away filters should be kept on hand for replacement purposes.

MOTORS Are permanently lubricated with provisions for re-oiling to extend their life. Under normal operating conditions, lubricate the motor every 2 years or 8000 hours which ever occurs first. When re-oiling, use #20 non-detergent automotive oil. Inspect the fan and the motor assembly a minimum of once a year for accumulation of dust and dirt. If necessary, remove and clean. Motors and fans are mounted on a removable motor board assembly. When fan wheels are replaced, be sure the blades curve forward in the direction of rotation.

SELECTOR SWITCHES AND THERMOSTATS: Check for satisfactory operation following the same procedure described under the heading above - "Start-Up".

LIMITED WARRANTY

Products manufactured by AIRTHERM Manufacturing Company are warranted against defects in material or workmanship for a period of one year from the date of shipment.

Requests for repair or replacement of products under this warranty must be referred to AIRTHERM Manufacturing Company for issuance of a return authorization. Transportation charges must be prepaid on shipments of products returned to the factory.

Products determined to be defective will be repaired or replaced and returned to the purchaser F.O.B. factory.

This warranty does not apply to any equipment which shall have been altered or repaired outside AIRTHERM's factory, or which has been subject to misuse, negligence or operating conditions in excess of those stated in AIRTHERM's catalog. Products of other manufacturers, assembled with or accessory to these products, are subject to the warranty of their manufacturer.

Under no conditions shall the company be held liable for consequential damages or repair costs.

The company reserves the right to make changes in design or dimensions, to add or eliminate products without prior notice.

UNITAIRE III PARTS LIST

UNIT SIZE	PART NO.	DESCRIPTION
		COILS
021		3 ROW COOLING/HEATING COILS — VERTICAL & HORIZONTAL MODELS
	C5751 0101 C5753 0101	STANDARD COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT* HIGH CAPACITY COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT*
		1 ROW AUXILIARY HEATING COIL — VERTICAL & HORIZONTAL MODELS
	C4636 3101	AUXILIARY COIL - HOT WATER OR STEAM - PIPING CONN SAME OR OPPOSITE COOLING - 5/8 OD SWEAT CONN.
031		3 ROW COOLING/HEATING COILS — VERTICAL & HORIZONTAL MODELS
	C5751 0102 C5753 0102	STANDARD COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT* HIGH CAPACITY COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT*
		1 ROW AUXILIARY HEATING COIL - VERTICAL & HORIZONTAL MODELS
	C4636 3102	AUXILIARY COIL - HOT WATER OR STEAM - PIPING CONN SAME OR OPPOSITE COOLING - 5/8 OD SWEAT CONN.
041		3 ROW COOLING/HEATING COILS — VERTICAL & HORIZONTAL MODELS
	C5751 0103 C5753 0103	STANDARD COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT* HIGH CAPACITY COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT*
		1 ROW AUXILIARY HEATING COIL — VERTICAL & HORIZONTAL MODELS
	C4636 3103	AUXILIARY COIL - HOT WATER OR STEAM - PIPING CONN SAME OR OPPOSITE COOLING - 5/8 OD SWEAT CONN.
061		3 ROW COOLING/HEATING COILS — VERTICAL & HORIZONTAL MODELS
	C5752 0101 C5751 0104	STANDARD COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT* HIGH CAPACITY COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT*
		1 ROW AUXILIARY HEATING COIL - VERTICAL & HORIZONTAL MODELS
	C5461 0101	AUXILIARY COIL - HOT WATER OR STEAM - PIPING CONN SAME OR OPPOSITE COOLING - 5/8 OD SWEAT CONN.
081		3 ROW COOLING/HEATING COILS — VERTICAL & HORIZONTAL MODELS
	C5752 0102 C5751 0105	STANDARD COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT* HIGH CAPACITY COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT*
		1 ROW AUXILIARY HEATING COIL - VERTICAL & HORIZONTAL MODELS
	C5461 0102	AUXILIARY COIL - HOT WATER OR STEAM - PIPING CONN SAME OR OPPOSITE COOLING - 5/8 OD SWEAT CONN.
101/121		3 ROW COOLING/HEATING COILS — VERTICAL & HORIZONTAL MODELS
	C5752 0103 C5752 0104	STANDARD COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT* HIGH CAPACITY COIL - SPECIFY FOR VERTICAL OR HORIZONTAL MODEL AND PIPING HAND, LEFT OR RIGHT*
		1 ROW AUXILIARY HEATING COIL — VERTICAL & HORIZONTAL MODELS
	C5461 0103	AUXILIARY COIL - HOT WATER OR STEAM - PIPING CONN SAME OR OPPOSITE COOLING - 5/8 OD SWEAT CONN.

*PIPING HAND IS DETERMINED WHILE FACING AIR DISCHARGE.

UNIT SIZE	PART NO.	DESCRIPTION	VENDOR I.D. (STAMPED ON PART)
		ACCESS DOORS — VERTICAL MODELS (EXCEPT CF AND AF)	
ALL	C4059 1001	ACCESS DOOR LID. 4" x 6"	
	C4059 1002	ACCESS DOOR HINGE PIN, 3/32" DIAWIRE	
		AUTOMATIC CHANGEOVER SWITCH (AQUASTAT)	
	4420 0011	AUTO CHANGEOVER SWITCH 115/60/1	20425D69-95660
		AUXILIARY DRAIN PAN (PLASTIC) — VERTICAL MODELS	
ALL	2121 3001	PLASTIC AUXILIARY DRAIN PAN	
		BLOWER WHEELS	
ALL	5251 1002	PLASTIC BLOWER WHEEL 5.75" DIA, 7.875" WIDTH (NOTE 1)	524-800
021-101	5251 2002	ALUMINUM BLOWER WHEEL 5.75" DIA, 7.875" WIDTH (NOTE 2)	Q575-400D
		CONTACTORS	
	4413 0001	CONTACTOR, SPST, 120V HOLDING COIL (ELECTRIC HEAT CONTROL CODE R1*)	R4242A 1015
	4413 0002	CONTACTOR, DPST, 120V HOLDING COIL (ELECTRIC HEAT CONTROL CODE R2*)	R4242B 1005
	4413 0003	CONTACTOR, DPST, 208/240V HOLDING COIL (ELECTRIC HEAT CONTROL CODE R3*)	R4242B 1013
	4413 0004	CONTACTOR, SPST, 24V HOLDING COIL (ELECTRIC HEAT CONTROL CODE R4*)	R8242A 1008
	4413 0005	CONTACTOR, DPST, 24V HOLDING COIL (ELECTRIC HEAT CONTROL CODE R5*)	R8242B 1006

NOTES: 1. FURNISHED WITH ALL UL CONSTRUCTED HYDRONIC COOLING AND HEATING MODELS, AND VERTICAL MODELS WITH ELECTRIC HEAT.
2. FURNISHED ON HORIZONTAL MODELS WITH ELECTRIC HEAT.

*REFER TO UNIT WIRING DIAGRAM.

(CONTINUED ON PAGE 2)

AIRTHERM MANUFACTURING COMPANY
9339 DIELMAN INDUSTRIAL DRIVE, P.O. BOX 7039, ST. LOUIS, MO 63177
PHONE: (314) 993-3400 FAX: 314-993-1118

UNIT SIZE	PART NO.	DESCRIPTION	VENDOR I.D. (STAMPED ON PART)
DAMPER MOTORS — VERTICAL MODELS			
ALL	4520 0001	LH DAMPER MOTOR 120/60/1	0453G0077QB00
	4520 0002	RH DAMPER MOTOR 120/60/1	0453G0182QB00
ELECTRIC HEATING ELEMENTS — 120V			
	4620 0015	1.0KW	
	4620 0014	1.5KW	
	4620 0003	1.25KW	
	4620 0002	1.75KW	
	4620 0026	2.0KW	
	4620 0001	2.5KW	
ELECTRIC HEATING ELEMENTS 208/240V			
	4620 0004	2.5/3.4KW	
	4620 0005	1.88/2.5KW	
	4620 0006	1.31/1.75KW	
	4620 0007	.94/1.25KW	
	4620 0016	1.5/2.0KW	
	4620 0017	2.25/3.0KW	
	4620 0018	3.0/4.0KW	
	4620 0021	.75/1.0KW	
ELECTRIC HEATING ELEMENTS 277V			
	4620 0027	.75KW	
	4620 0025	1.3KW	
	4620 0024	.5KW	
	4620 0023	1.5KW	
	4620 0022	1.0KW	
	4620 0020	4.0KW	
	4620 0019	3.0KW	
	4620 0013	2.0KW	
	4620 0012	1.25KW	
	4620 0011	1.75KW	
	4620 0010	2.5KW	
	4620 0009	3.2KW	
	4620 0008	3.4KW	
ELECTRIC VALVES 5/8" O.D. — 60 HZ, 1 PHASE			
	5620 1002	2-WAY VALVE 120V 30" ELECTRICAL LEADS SWEAT	VA1403-213-4-4
	5620 1011	2-WAY VALVE 120V 30" ELECTRICAL LEADS SWEAT	V4043-E-1003
	5620 1016	2-WAY VALVE 120V 30" ELECTRICAL LEADS FLARE	V4043-A1002
	5620 1017	2-WAY VALVE 208V 30" ELECTRICAL LEADS FLARE	V4043-A1028
	5620 1018	2-WAY VALVE 240V 30" ELECTRICAL LEADS FLARE	V4043-A1044
	5620 1019	2-WAY VALVE 24V 30" ELECTRICAL LEADS FLARE	V8043-A1003
	5620 1003	3-WAY VALVE 120V 30" ELECTRICAL LEADS SWEAT	VA3403-215-6-4
	5620 1013	3-WAY VALVE 120V 30" ELECTRICAL LEADS FLARE	V4044-A1001
	5620 1014	3-WAY VALVE 208V 30" ELECTRICAL LEADS SWEAT	V4044-A1035
	5620 1015	3-WAY VALVE 240V 30" ELECTRICAL LEADS FLARE	V4044-A1043
	5620-1012	3-WAY VALVE 24V 30" ELECTRICAL LEADS FLARE	V8044-A1002
FAN SPEED CONTROL SWITCHES 115/240/277/60/1			
	4240 1002	3-SPEED SWITCH WITH AUXILIARY CIRCUIT (CONTROL CODE S1*)	3D107
	4240 1008	3-SPEED SWITCH - NO AUXILIARY CIRCUIT	3A168
	4240 1005	3-SPEED SWITCH (CONTROL CODE S2*)	3TA217
	4240 1004	2-POS. KEY SWITCH (CONTROL CODE S3*)	639-855039-1
	4240 1006	3-SPEED SWITCH W/O WALL PLATE WITH AUXILIARY CIRCUIT	3D274
	4240 1003	2-SPEED SWITCH (UNIT SIZE 121)	2TA207

(CONTINUED ON PAGE 3)

WHEN ORDERING REPLACEMENT PARTS, SPECIFY PART NUMBER, PART DESCRIPTION AND UNIT SERIAL NUMBER.
EXAMPLE: 5251 2002 BLOWER WHEEL, UNIT SERIAL NO. 8-84.

UNIT SIZE	PART NO.	DESCRIPTION	VENDOR I.D. (STAMPED ON PART)
FILTERS			
021	5310 1010	1" THROW AWAY FILTER 9"x20-7/8"	
	5310 2004	1" FOAM MEDIA CLEANABLE FILTER 9"x20-7/8"	
031	5310 1011	1" THROW AWAY FILTER 9"x26-7/8"	
	5310 2005	1" FOAM MEDIA CLEANABLE FILTER 9"x26-7/8"	
041	5310 1012	1" THROW AWAY FILTER 9"x30-7/8"	
	5310 2006	1" FOAM MEDIA CLEANABLE FILTER 9"x30-7/8"	
061	5310 1013	1" THROW AWAY FILTER 9"x44-7/8"	
	5310 2007	1" FOAM MEDIA CLEANABLE FILTER 9"x44-7/8"	
081	5310 1015	1" THROW AWAY FILTER 9"x56-7/8"	
	5310 2008	1" FOAM MEDIA CLEANABLE FILTER 9"x56-7/8"	
101/121	5310 1014	1" THROW AWAY FILTER 9"x46"	
	5310 1012	1" THROW AWAY FILTER 9"x30-7/8"	
	5310 2009	1" FOAM MEDIA CLEANABLE FILTER 9"x76-7/8"	
LINEAR LIMIT CONTROLS			
021-031	4420 0100	LINEAR LIMIT CONTROL, 24" CAPILLARY (CONTROL CODE L1*)	210909
041	4420 0101	LINEAR LIMIT CONTROL, 30" CAPILLARY (CONTROL CODE L1*)	210927
061	4420 0102	LINEAR LIMIT CONTROL, 42" CAPILLARY (CONTROL CODE L1*)	210962
081/101	4420 0103	LINEAR LIMIT CONTROL, 72" CAPILLARY (CONTROL CODE L1*)	220831
MOTORS — 60 HZ, 1 PHASE			
021	4310 0101	120V STANDARD PSC MOTOR SINGLE SHAFT	CE3D003N
	4310 0301	120V HIGH STATIC PSC MOTOR (M-24) SINGLE SHAFT	DE2D076N
	4310 0206-2	208V PSC MOTOR (M-25) SINGLE SHAFT	DE3D293N
	4310 0206-2	230V PSC MOTOR (M-26) SINGLE SHAFT	DE3D293N
	4310 0204-2	277V PSC MOTOR (M-27) SINGLE SHAFT	DE3D290N
031 081	4310 0102	120V STANDARD PSC MOTOR SINGLE SHAFT	CE3E003N
	4310 0302	120V HIGH STATIC PSC MOTOR (M-24) SINGLE SHAFT	DE2E042N
	4310 0206-3	208V PSC MOTOR (M-25) SINGLE SHAFT	DE3D293N
	4310 0206-3	230V PSC MOTOR (M-26) SINGLE SHAFT	DE3D293N
	4310 0204-3	277V PSC MOTOR (M-27) SINGLE SHAFT	DE3D290N
041	4310 0103A	120V PSC MOTOR DOUBLE SHAFT	7176 2939
	4310 0103	120V STANDARD PSC MOTOR DOUBLE SHAFT	DE3E188N
	4310 0303	120V HIGH STATIC PSC MOTOR (M-24) DOUBLE SHAFT	DE2J023N
	4310 0207-3	208V PSC MOTOR (M-25) DOUBLE SHAFT	DE3E086N
	4310 0207-2	230V PSC MOTOR (M-26) DOUBLE SHAFT	DE3E086N
	4310 0205-2	277V PSC MOTOR (M-27) DOUBLE SHAFT	DE3E085N
061 081 101	4310 0104A	120V PSC MOTOR DOUBLE SHAFT	7176 1452
	4310 0104	120V STANDARD PSC MOTOR DOUBLE SHAFT	HE3E101N
	4310 0304	120V HIGH STATIC PSC MOTOR (M-24) DOUBLE SHAFT	DE2J024N
	4310 0207-5	208V PSC MOTOR (M-25) DOUBLE SHAFT	DE3E086N
	4310 0207-4	230V PSC MOTOR (M-26) DOUBLE SHAFT	DE3E086N
	4310 0205-3	277V PSC MOTOR (M-27) DOUBLE SHAFT	DE3E085N
121	4310 0111	120V PSC MOTOR DOUBLE SHAFT	DE2F064N
	4310 0304	120V HIGH STATIC PSC MOTOR (M-24) DOUBLE SHAFT	DE2J024N
	4310 0304	208V PSC MOTOR (M-25) DOUBLE SHAFT SPECIFY VENDOR ID WHEN ORDERING	DE2J024N
	OR	230V PSC MOTOR (M-26) DOUBLE SHAFT SPECIFY VENDOR ID WHEN ORDERING	OR
	4310 0111	277V PSC MOTOR (M-27) DOUBLE SHAFT SPECIFY VENDOR ID WHEN ORDERING	DE2F064N
SAFETY THERMAL CUTOFFS (FUSIBLE LINKS)			
	4240 2125	SAFETY THERMAL CUTOFF (FUSIBLE LINK)	4D4194A
	4240 2128	SAFETY THERMAL CUTOFF (FUSIBLE)	4D9194

*REFER TO UNIT WIRING DIAGRAM

(CONTINUED ON PAGE 4)

WHEN ORDERING REPLACEMENT PARTS, SPECIFY PART NUMBER, PART DESCRIPTION AND UNIT SERIAL NUMBER.
EXAMPLE: 5620 1002 ELECTRIC VALVE, UNIT SERIAL NO. 8-84.

UNIT SIZE	PART NO.	DESCRIPTION	VENDOR I.D. (STAMPED ON PART)
		THERMOSTATS 60 HZ. 1 PHASE	
	4420 0003	UNIT MOUNTED THERMOSTAT, LINE VOLTAGE HYDRONIC CONTROL PKG. TP-4, TP-4A, TP-4B TP-4C, STP-4C (ELECTRIC HEAT CONTROL CODE T2*)	TF-103-007
	4420 0007	UNIT MOUNTED THERMOSTAT, LINE VOLTAGE HYDRONIC CONTROL PKG. TP-4C4P, STP-4A (ELECTRIC HEAT CONTROL CODE T2*)	C17-100-36
	4240 1004	KEY OPERATED SWITCH TP-4, TP-4A	639-855039-1
	4420 0001	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. TP-3, TP-3A	TB-136-001
	4420 0002	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. TP-3B, TP-3C, STP-3C	TC-126-001
	4420 0008A	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. TP-9	TC-154-037
	4420 0009A	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. TP-9A	TC-154-038
	4420 0039A	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL STP-9A	TC-154-035
	4420 0006	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. TP-3C4P	TH-126-001
	4420 0062	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. STP-3A	T651A2010
	4420 0060	THERMOSTAT SUBBASE , HYDRONIC CONTROL PKG. STP-3A	Q473A2006
	4420 0010	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. TP-9B, TP-9C, STP-9C	TD-136-001
	4420 0013	WALL THERMOSTAT, LINE VOLTAGE, HYDRONIC CONTROL PKG. TP-9C4P	TC-136-001
	4420 0019	WALL THERMOSTAT, LINE VOLTAGE, ELECTRIC HEAT CONTROL CODE T3*	T694F1009
	4420 0012	WALL THERMOSTAT, LINE VOLTAGE, ELECTRIC HEAT CONTROL CODE T4*	T4039M-1004
	4420 0020	WALL THERMOSTAT, 24V , ELECTRIC HEAT CONTROL CODE T6*	T87F1800
	4420 0021	THERMOSTAT SUBBASE , ELECTRIC HEAT CONTROL CODE T6*	Q539B1005
	4420 0050	LOCKING THERMOSTAT COVER	
		TRANSFORMERS 60 HZ, 1 PHASE	
	4240 0803	AUTOFORMER SPEED CONTROL, 120V (SIZE 121 WITH DE2J024N MOTOR)	6907
	4240 0804	AUTOFORMER SPEED CONTROL, 277V (ELECTRIC HEAT CONTROL CODE A1**)	6177
	4240 0820	TRANSFORMER, 45VA 277/27V (ELECTRIC HEAT CONTROL CODE A2**)	AT87A-1189

*REFER TO UNIT WIRING DIAGRAM

WHEN ORDERING REPLACEMENT PARTS, SPECIFY PART NUMBER, PART DESCRIPTION AND UNIT SERIAL NUMBER.
EXAMPLE: 4420 0007 THERMOSTAT, UNIT SERIAL NO. 8-84.