INSTRUCTION MANUAL

FOR

AMMONIA SCREW COMPRESSOR UNITS

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HOWE CORPORATION

LIMITED WARRANTY

THIS WARRANTY IS EXCLUSIVE AND EXPRESSLY IN LIEU OF AND IS HEREBY IN DISCLAIMER OF ALL OTHER EXPRESS WARRANTIES, AND IS IN LIEU OF AND IN DISCLAIMER AND EXCLUSION OF ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AS WELL AS ALL OTHER IMPLIED WARRANTIES. IN LAW OR EQUITY, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF HOWE CORPORATION HEREINAFTER REFERRED TO AS "SELLER".

Seller warrants, to the original Buyer only, each new product made by Seller to be free from defects in material and workmanship, under normal use and service of the product, subject to the terms, conditions, and limitations hereinafter set forth. Seller's entire and exclusive obligation and liability under this Warranty, and Buyer's sole and exclusive remedy under this Warranty is limited to repairing, replacing, or exchanging, at Seller's option, free of charge, F.O.B., Seller's factory (Chicago, Illinois), and any part of the original product in the judgment of Seller proving defective or nonconforming for a period of twelve (12) months from the date of shipment and any replacement part in the judgment of Seller proving defective for a period of three (3) months from the date of shipment.

This Warranty applies only when the product has been properly installed, maintained and operated under normal use and service and/or Seller's recommendations. This Warranty does not cover defects caused by corrosion or normal deterioration.

To qualify for Warranty consideration, Buyer must notify Seller by registered mail or certified mail, return receipt requested, of a breach of warranty within thirty (30) days after discovery thereof, but not later than the Warranty period; otherwise, such claims shall be deemed waived. If the nonconforming or defective product must be returned to Seller, then the nonconforming and defective product must be returned, F.O.B. Seller's factory (Chicago, Illinois), all freight prepaid.

The obligations and liability of Seller under this Warranty shall not include any transportation costs, labor costs, costs of installation or other expenses, costs or charges associated with the repair, replacement or exchange of the defect or the failure of its product.

The obligation and liability of Seller under this Warranty shall not include liability for (a) any losses, (b) any direct or indirect incidental or consequential damages from the use or loss of use of the product, (c) any delays, caused by the failure of its product or any defect in this product, (d) refrigerant lost from the unit after shipment from the point of manufacture, (e) Buyer's expense for downtime or for making up downtime, damages for which the Buyer may be liable to other persons, damages to property, and injury to or death of any persons, or (f) any operation beyond rated capacity or the improper use or application of its product or the substitution upon it of parts not approved by Seller or repairs made by others without prior authorization by Seller shall void this Warranty.

This Warranty covers only the products of Howe Corporation. The products of other manufacturers which are furnished by Seller are covered only by such warranties as are given by said manufacturers to Seller.

This Warranty shall not apply to any of Seller's products, or parts thereof, which have been repaired, replaced or altered, without Seller's written consent, outside Seller's place of business or altered in any way so as, in the judgment of Seller, to affect adversely the stability or reliability of Seller's products, or has been subject to misuse, negligence, or accident, or has not been operated in accordance with Seller's printed instructions or has been operated under conditions more severe than, or otherwise exceeding, those set forth in the specifications.

This Warranty provision shall not be enforceable against Seller if Buyer is in default in making payment required by the Contract.

INSTALLATION:

Howe screw compressors may be installed on any foundation capable of supporting the unit. Generally a 4" to 6" high concrete pad is poured over a load bearing floor. There should be sufficient clearance around the unit for operation and maintenance purposes. Observe the clearance required to remove and replace the co-alescing elements in the oil separator. A clearance of 3'-6" is required for this purpose at the end of the oil separator that has the removable cover.

The unit must be properly leveled using shims at the base supporting points so that the compressor shaft is level. Use the face of the compressor coupling to check if the face is plumb. Other machined surfaces on the compressor body such as the suction flange or compressor feet may be used for checking lateral level. After assuring levels in both directions, the unit may be grouted.

Final motor alignment check should be made prior to start-up. A detailed procedure is described elsewhere in this bulletin.

INITIAL START-UP CHECK LIST

The following steps must be taken before initial start-up:

1) All refrigerant piping to the unit must be pressure tested tight. This means suction line, discharge line, also liquid line and hi-stage discharge line (in case of liquid injected boosters.)

2) Check water supply and return lines in case of water-cooled oil coolers.

3) Check alignment of compressor and motor before initial start-up. Hot alighment check should be made after unit is up to operating temperature (minimum of one hour.)

4) Check alignment of oil pump and motor.

5) Make sure wiring is complete according to wiring diagram.

6) Check functions of all electric controls.

7) Fill oil separator with approved oil to proper level. Standing oil should be visible in upper sight glass. Operating oil level should be visible in lower sight glass but no oil visible in upper sight glass. This applies to the primary chamber of the oil separator where the oil fill valve is located.

After the above initial checks are made, follow normal start-up procedure.

CONTROL SETTINGS & OPERATING LIMITS FOR HSC AMMONIA SCREW COMPRESSOR UNITS

		BOOSTER	HI-STAGE
DISCHARGE			
High Pressure cutout	PSIG	65	220
High temperature cutout:			
Liquid injected	°F	155°	155°
Water cooled or thermosyphon	°F	200°	200°
SUCTION			
Maximum suction pressure (for compressor safety)	PSIG	80	80
Minimum suction pressure (for compressor safety)	Ins. Hg VAC	27"	27"
Maximum super heat	°F	40°	40°
Low suction pressure cutout: Pressure corresponding to temperature below operating temperature	°F	10°	10°
OIL			
Maximum oil pressure above discharge	PSIG	55	55
Minimum oil pressure above discharge and cutout setting	PSIG	20	20
Normal operating oil pressure above discharge (adj. pressure diff. A4AL valve)	PSIG	45 to 55	35 to 45
High oil temperature cutout setting (same as discharge temperature gas after liquid injection)	°F	155°	155°
Minimum low oil temperature cutout setting	°F	85°	95°
Normal operating oil temperature: (to compressor)			
Liquid injection	°F	110° to 140°	115° to 130°
Water cooled	°F	115° to 125°	115° to 125°
Equalizing pressure for liquid injection TXV, set regulator	PSIG	60 to 70	60 to 70
Oil failure, time delay relay (1 TR)	Secs.	6 sec.	6 sec.
ELECTRICAL			
Operating start up delay setting (2 TR)	Secs.	30 sec.	30 sec.
Anti-recycle timer setting (4 TR)	Mins.	20 mins.	20 mins.
Maximum setting of current limiter		Motor FLA	Motor FLA

RECOMMENDED OILS

Required oil specification:

Viscosity at 100° F.	300 SUS
Pour point, maximum	-30° F.
Floc test, maximum	-45° F.
Flash point, minimum	350° F.
Neutralization number, maximum	.03

Recommended oils are
1) Texaco Capella WF68
2) Suniso 4GS

Acceptable oils are
3) Exxon Zerice 68
4) Mobile Artic 300

It is recommended that different brands of oil not be mixed in one system unless they are known to be compatible from prior experience.

LUBRICATION SYSTEM

Oil Pump

Howe HSC Screw compressor units are equipped with a positive displacement oil pump direct-driven by a 1200 RPM motor. The pump is located below the oil separator which insures positive suction head at all times. The oil pump not only provides continuous lubrication but also pre-lubrication before compressor start up.

Oil Pump Strainer

An oil strainer with a 100 mesh stainless steel screen is installed in the pump inlet line.

Oil Filter

An oversized filter housing with multiple replaceable cartridges is installed in the pump discharge line so that 100% filtered oil is delivered to the compressor. Filter cartridges should be replaced when pressure drop across the filters exceeds 10 psi. Isolating valves are provided so that filter cartridges can be replaced without purging the entire unit.

Oil Separator

The oil separator has two internal compartments. The first compartment not only acts as an oil reservoir but also receives the mixture of refrigerant gas and oil from the compressor discharge. The primary separation of oil from the discharge gas occurs here. This compartment is equipped with two level eyes. During normal operation oil will be visible in the lower level eye but none in the upper one. When the unit is off, oil level will be visible in the middle of the upper level eye. Do not overfill.

A thermostatically controlled electric heater maintains proper oil temperature in the reservoir during the "off" cycle. Electric heaters are de-energized when the compressor is running.

The second compartment of the separator contains replaceable co-alescing type oil separator elements. An access opening at the end of the separator is provided for service. The second stage of oil separation occurs here. This compartment is equipped with one level eye and under normal operation, oil should not be visible in this level eye.

Oil Pressure Regulator

An oil pressure regulator is located on the discharge side of the oil pump. It is designed to maintain proper oil pressure differential under varying operating conditions. Refer to page titled "Control settings & operating limits" for proper setting of this valve.

Oil Cooling Controls and Accessories

The HSC compressor unit may be equipped with one of the following methods of oil cooling:

1. Liquid injection oil cooling
2. Water-cooled oil cooler
3. Thermosyphon oil cooler

LIQUID INJECTION OIL COOLING

Compressor units with liquid injection oil cooling will have the following controls mounted on the unit: Liquid line shut off valve, solenoid valve with strainer, sight glass, thermostatic expansion valve with special charge, outlet pressure regulator for external equalizing of TXV.

The solenoid valve is wired so that it opens when compressor starts. The sensing bulb of the TXV is installed in the discharge line of the compressor. The external equalizing line of the TXV is connected to a constant pressure zone maintained between suction and discharge pressure by means of an outlet pressure regulator. A small amount of discharge gas is metered through the pressure regulator and returned to suction. A needle valve is provided downstream of the regulating valve to control rate of bleed to suction. Open this needle valve about 1/4 turn. Adjust pressure regulator so gauge reads approximately 65 psig. To increase oil temperature, increase pressure by turning adjustment on pressure regulator clockwise; to decrease oil temperature, decrease pressure by turning adjustment counter clockwise.

High stage compressor units will require an adequately sized liquid line to provide liquid refrigerant for oil cooling. It is essential that a constant uninterrupted supply of liquid refrigerant be available. To insure this it is recommended that liquid be obtained from a "dedicated" connection on the receiver which is several inches below liquid outlet to the plant or from an auxilliary liquid receiver which traps liquid in the drain line between condenser and receiver.

Booster compressor units require a liquid line connection as above and a 1/2" high pressure gas line from the discharge line of the high stage compressor in order to provide the 65 psig pressure zone for the TXV equalizing connection as discussed in an earlier paragraph.

Water-cooled Oil Cooler

A shell and tube heat exchanger is factory installed for this type of oil cooling system. Oil is circulated in the shell side and water in the tube side. The water side of the heat exchanger is fitted with removable heads and is cleanable.

A water regulating valve senses oil temperature and modulates the flow of water through the heat exchanger to maintain oil temperature within the operating limits.

Thermosyphon Oil Cooler

A shell and tube heat exchanger designed for oil in the shell side and high pressure liquid REFRIGNTin the tube side is factory installed on the unit. Provision must be made for an uninterrupted supply of liquid REFRIG NT through properly sized piping to establish thermosyphon flow. The evaporative condenser should be adequately sided to take this additional load into consideration.

CAPACITY CONTROL SYSTEM

The HSC series screw compressors are equipped with an internal slide valve for stepless capacity control down to 10% of full capacity. The slide valve is connected to a double acting hydraulic piston within the compressor housing. Oil pressure is applied through a 4-way solenoid valve to either the front or rear of the hydraulic piston to change position of the slide valve.

At full load the valve is closed as illustrated in figure E. At part load the valve is moved hydraulically, creating a gap (see fig. F) which allows suction gas to escape back to the suction inlet manifold, reducing compressor pumping rate. Since the gas release takes place before any compression begins no thermodynamic losses occur resulting in horsepower savings.

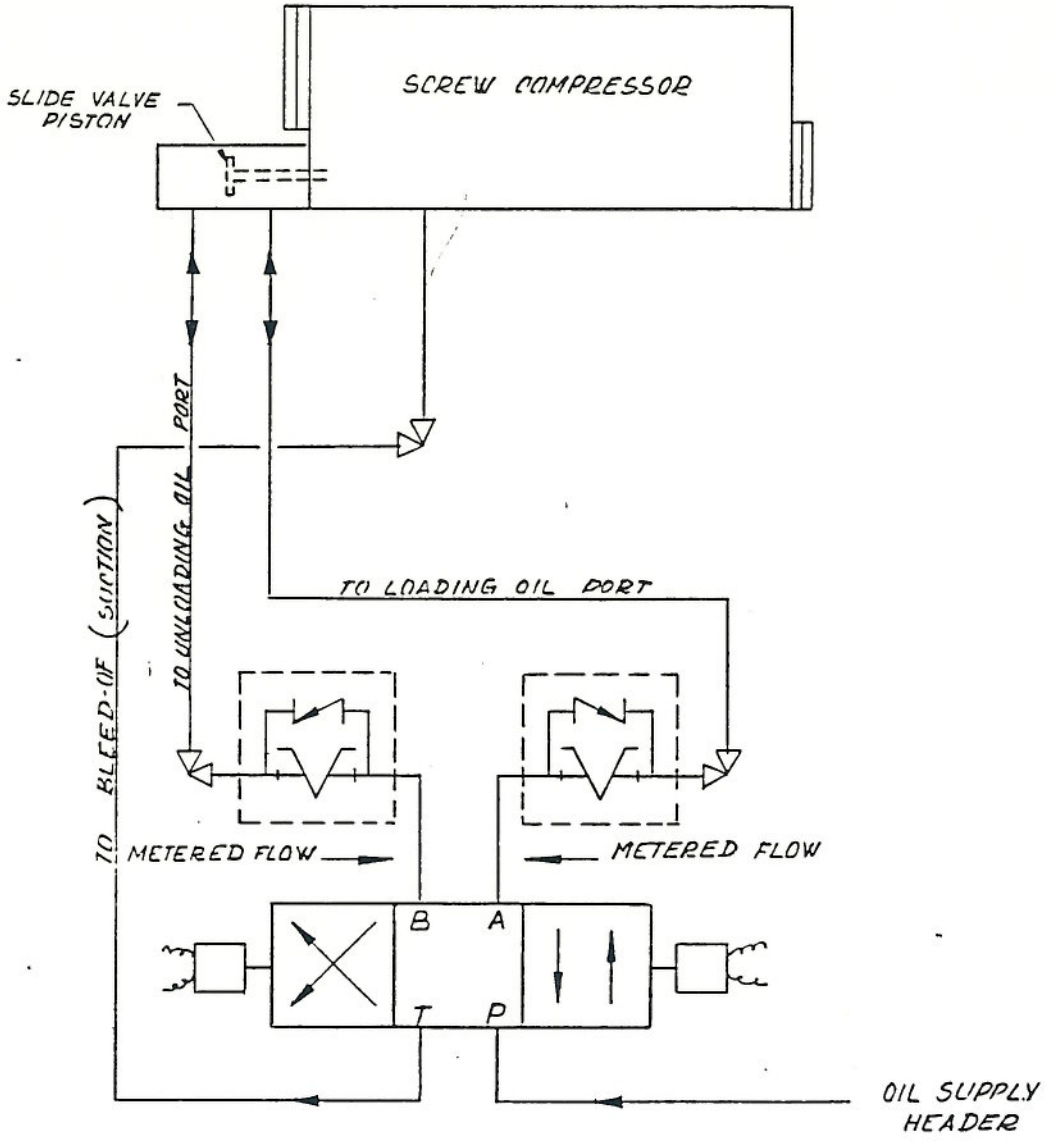
A rotary dial indicator located at the end of the compressor housing (opposite shaft end) indicates the position of the slide valve in percent of total travel. The indicator housing contains two cam operated microswitches. One microswitch is wired to the control panel indicating 0% position, a signal which permits the the compressor to start and is integrated into the starting sequence. The second microswitch can be field wired to signal other slide valve positions, for example, sequencing compressors.

The electric impulse signal to the 4-way solenoid valve to load or to unload comes from a Honeywell suction pressure controller installed in the electric control panel. A pressure transducer measures suction pressure and feeds the information electrically to the input of the Honeywell control. The Honeywell control is an electronic time proportioning device featuring an adjustable suction pressure set point and an adjustable dead band, both of which are face accessible. The time proportioning band and the cycle time are internally adjustable and are factory set. The red pointer in the front dial of the control indicates actual line suction pressure.

"Time proportioning" means that the larger the deviation is from the set point the longer the pulse will be to load or unload. "Dead band" means the pressure range on either side of the set point where the control neither loads nor unloads. For instance, with the control set at 10 psig, and dead band at minimum setting of 1.0 psi the compressor will neither load nor unload until the suction pressure drops below 9.5 psig or rises above 10.5 psig. Obviously a narrow dead band setting will cause the unit to maintain almost constant suction pressure but will cause the 4-way

valve and slide valve to cycle excessively. It is recommended that at start up, the dead band adjustment screw be set at mid point of its travel and then adjusted later to increase or decrease the dead band to suit the application.

The loading and unloading rate, which means the speed with which the slide valve travels, is also adjustable by needle valves which are located immediately next to the 4-way valve at ports A and B. Adjust the needle valves so that it takes approximately 60 seconds for the slide valve to travel from 0% to 100% and 60 seconds from 100% to 0% while loading and unloading respectively. Closing the needle valve will slow the slide valve movement. Final adjustment should be made with oil at operating temperature. After the adjustment is made, both needle valves should be locked in position by tightening the Allen screws.



Honeywell

Reference
95-8260

Dialapak Single-Mode Time Proportioning Controllers

Instruction

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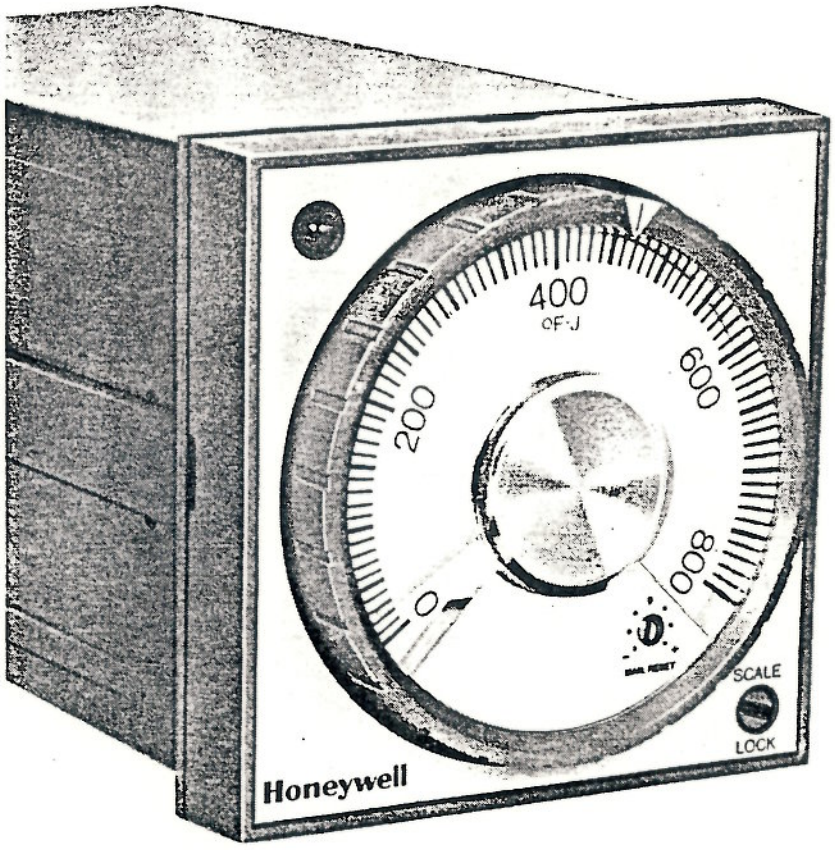

Figure 1 – Typical Single-mode Time Proportioning Controller.

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Description

Honeywell Dialapak Single-Mode Time Proportioning Controllers are miniaturized instruments featuring advanced solid state circuitry to provide an economical time proportioning control function. These controllers are available with deviation or process alarm and in a heat-cool version to meet many industrial process requirements. All models can be tailored to accept any one of the following types of input signals: thermocouple (T/C), resistance temperature detector (RTD, single or differential), mA dc, mV dc, or relative humidity (Honeywell gold grid humidity sensor). Primary output is through a spdt electromechanical relay or an optional solid-state relay. In addition to the basic time proportioned output, all models having auxiliary alarm outputs also have a 0–5 Vdc process variable auxiliary output. An optional local-remote switch is available to permit use with a remote as well as the local set point. The remote set signal can be either 0–2 Vdc or a 1000-ohm potentiometer. The 1000-ohm potentiometer may either be manually set or automatically programmed.

A molded case houses the compact plug-in chassis assembly. Field wiring is connected to the screw terminals on the rear of the case which has molded in terminal barriers and screw terminal identification. The case is designed for panel mounting and a U-shaped metal bracket is supplied for this purpose. A bracket for side mounting and a terminal wiring enclosure are available as optional features.

The compact plug-in chassis assembly consists of the printed wiring board(s) and the front assembly. The number and length of printed wiring boards supplied varies among models. The printed wiring boards snap-fit into the rear of the front assembly and are electrically connected through post and receptacle connections. Besides holding the printed wiring board(s) in place, the front assembly houses the meter (on indicating models), set point potentiometer, scale plate, indicating lights and front accessible adjustments. On indicating models, the 250 degree meter provides full scale indication of the process variable. The front assembly also provides a latching feature to hold the chassis assembly in the case.

Application

The Dialapak controllers come in models which are especially useful in applications for heating-cooling, floating controls, or control plus alarm – either deviation or process types. Typical applications include temperature control of environmental chambers, plastics processing machines, furnaces and ovens, packaging machinery, etc. These controllers can be used to control any other process parameter that can be converted to an electrical analog signal.

The thermocouple RH, mV, and resistance temperature detector input models have upscale burnout. The T/C and mV input models can be converted to downscale burnout, if required. The models with deviation or process alarm have an alarm light for visual indication of alarm condition.

Features

Compact	Economizes mounting space. (1/4 DIN dimension)
Versatile	Variety of models to choose from with wide choice of inputs and ranges.
Reliability	Solid-state – latest state of the art circuitry – LED's – can be mounted in any plane.
Setability	Large circular set point dial for easy setting.
Readability	Large scale with easy to read numerals.
All Modular Construction	Plug-in chassis and plug-in primary relay.
Operating Light	Indicates status of power to the load.
Easy Startup	Rear terminal wiring, combined with easily accessible adjustments, simplifies installation and startup.
Manual Reset	Allows adjustment of control point to desired set point.
Rugged	Designed for use in harsh industrial environments.
Potentiometric Null Balance Circuitry	Not limited by meter response. Control is independent of meter.
High Input Impedance	Calibration for Thermocouple lead length is not required.
Concentric Set Point and Indication Pointer	Provide instant visual indication of deviation from set point. Set point index does not hide indicating pointer when at set point.
Full Scale Indication	Process variable indication is always available no matter how far the process is away from set point.

Installation

Unpacking

Carefully unpack the Dialapak controller from shipping carton, and inspect it for shipping damages. Immediately report any damages to the carrier.

The controller is shipped as a complete unit and only needs to be mounted and wired for operation.

Mounting

Select mounting location and make sure ambient temperature does not exceed operating limits given in the specifications.

Figure 2 gives the panel cutout dimensions. Use the U-shaped metal bracket supplied to mount the controller in the panel. If you ordered the optional side mounting bracket, use it to mount the controller on the desired surface. The instrument can be mounted in any position or angle.

Wiring

NOTE: All wiring must comply with local codes, regulations, and ordinances.

Figure 3 illustrates typical wiring connections for the controller. Make connections to the appropriate screw terminals on the rear of the controller case, as noted in Figure 3.

IMPORTANT: Do not run sensor or low voltage leadwires in a conduit with the power line wiring.

Observe polarity when connecting thermocouple leadwires. On Honeywell supplied thermocouple leadwires, the negative (–) leadwire always has red insulation.

With 2-wire RTD input, minimize leadwire resistance since it adds directly to sensor resistance. With 3-wire RTD sensor, make resistance of all 3 leadwires equal for optimum compensation.

Refer to the specifications for the source resistance and input impedance limitations.

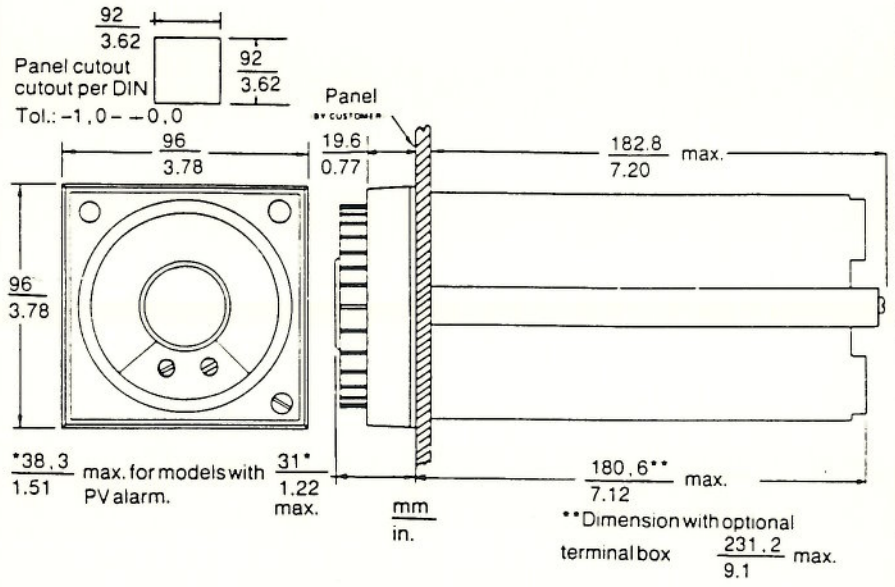


Figure 2 – Mounting and Panel Cutout Dimensions

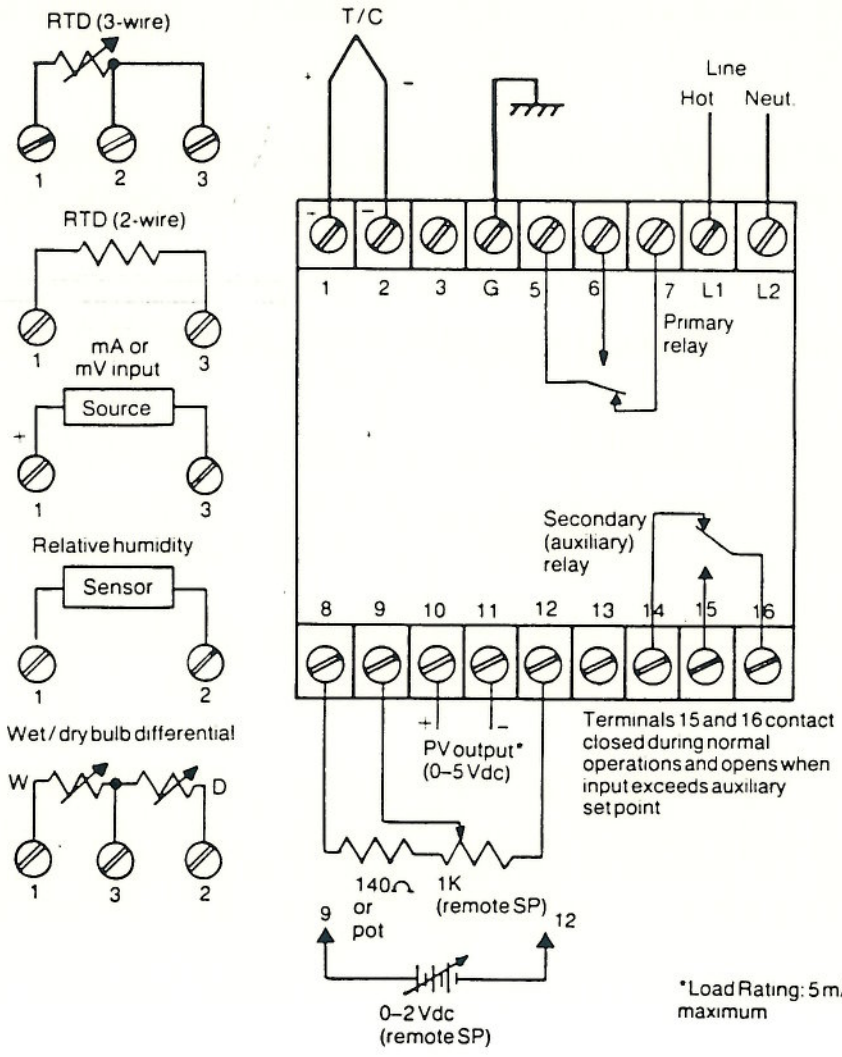


Figure 3 – Typical Wiring Connections

Locating Adjustments

Figure 4 shows the various front accessible adjustments that are supplied, depending on instrument model. Figures 5, 6, and 7 show the selectable adjustments which are accessible when the chassis is removed from the case, depending on model.

Startup Procedure

The Dialapak controller is factory calibrated to your specific range and actuation before shipment. You only need to set the control set point and deviation or process alarm set point, if applicable, upon initial turnon.

NOTE: Make provisions to bypass the alarm if process condition exceeds alarm set point at startup and the alarm contacts are wired to shut down power to the load.

Setting Control (Primary) Set Point

Turn the primary set point ring until its index point is aligned with the scale graduation that corresponds with the desired process control point.

Setting Deviation Alarm Set Point

The deviation alarm set point is adjustable between −10% to +10% of span from primary set point. The alarm circuit is wired so that the relay drops out (contact connected to terminals 15 and 16 opens and alarm light comes on) when the process variable input reaches or exceeds the alarm set point.

Setting Process Alarm Set Point

The process alarm set point is adjustable to any scale point independent of the primary set point. The alarm circuit is wired so that the relay drops out (contact connected to terminals 15 and 16 opens and alarm light comes on) when the process variable input reaches or exceeds the alarm set point.

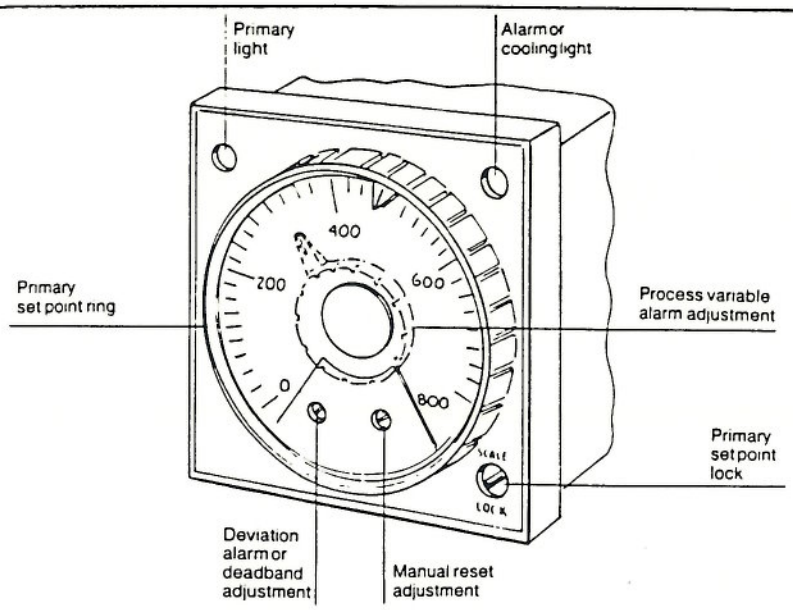


Figure 4 – Summary of Front Accessible Adjustments.

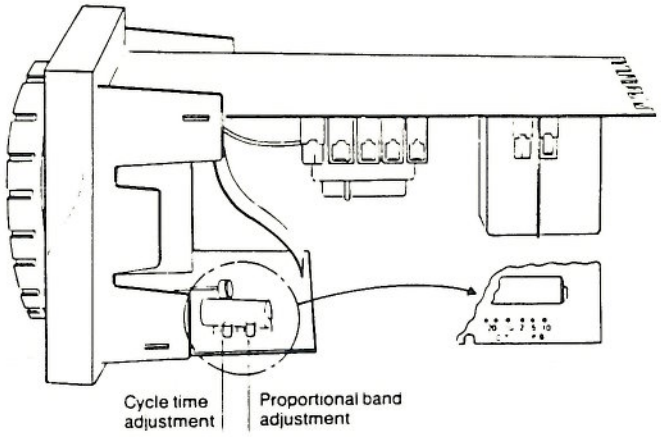


Figure 5 – Location of Selectable Adjustments on Typical 1-Mode Time Proportioning Controller Plug-in Chassis

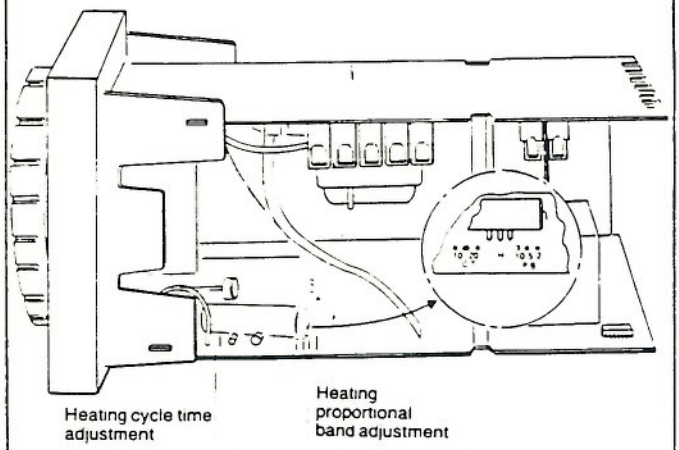


Figure 6 – Location of Selectable Adjustments for Heating Band on Heat-Cool Models

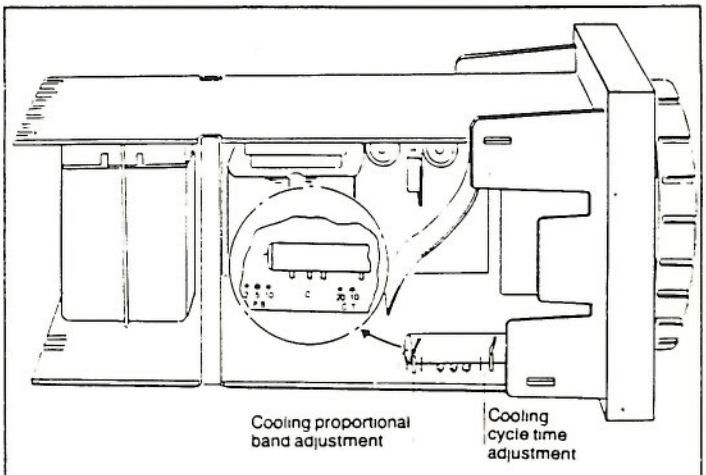
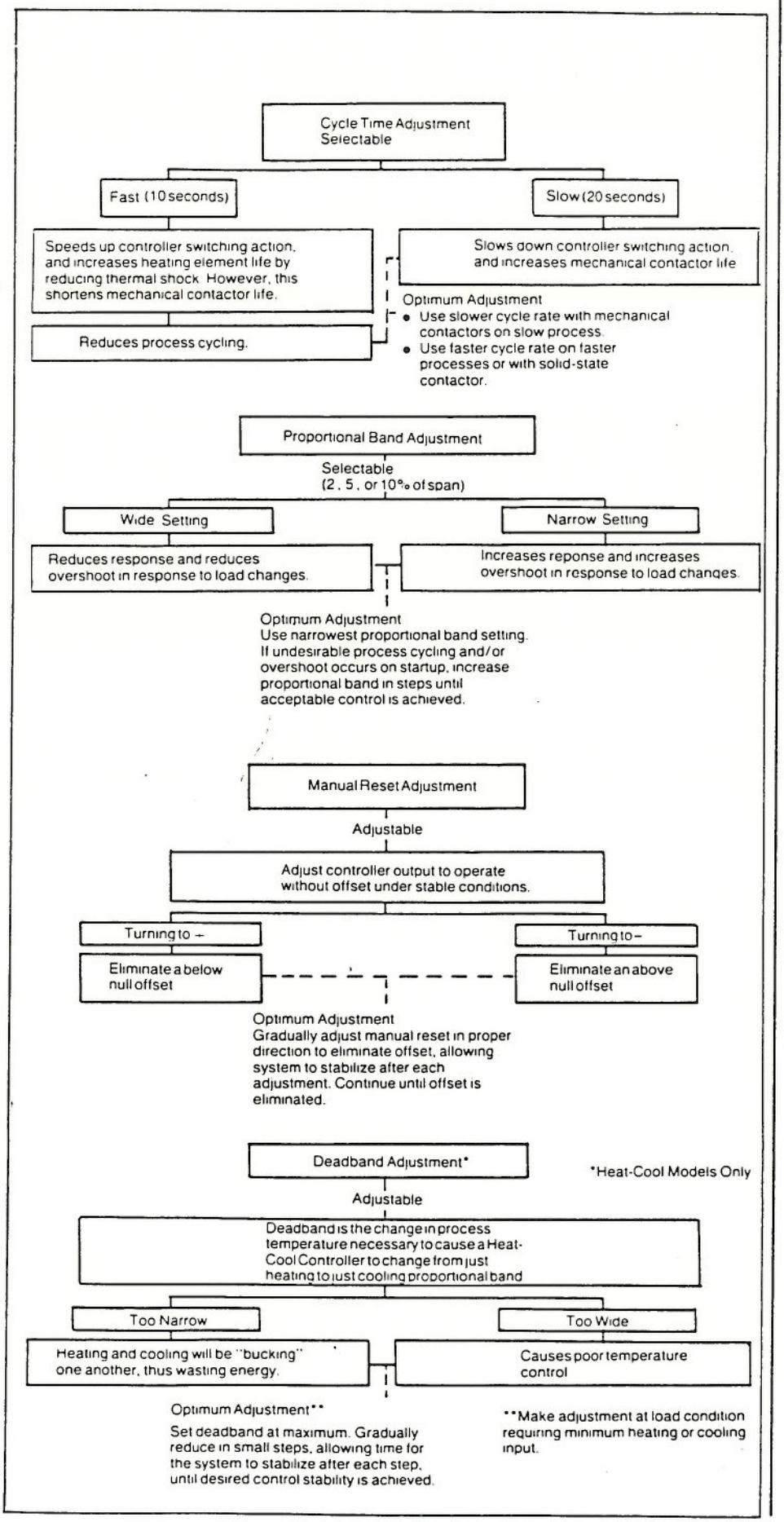


Figure 7 – Location of Selectable Adjustments for Cooling Band on Heat-Cool Models

Adjustments

For optimum control action use the following adjustments to tune the controller to your process for optimum control. Most of these adjustments are made through jumper and pin connections on the lower printed wiring board. You must remove the plug-in chassis from the case to make these adjustments. The potentiometer type adjustments are accessible from the front of the instrument. The function of each adjustment and the effect it has on the process are summarized in the following chart.



CONTROL PANEL

A 115V control panel with gauge board is factory mounted and wired to all electrical devices on the unit. If compressor motor starter is supplied by Howe it will contain:

1 - Compressor motor starter
1 - Oil pump starter
1 - Control transformer
230/460 primary, 115V secondary
1 - Current transformer

Field wiring diagram is provided showing wiring between Howe supplied starter panel and control panel. Disconnects should be used to meet local electrical codes, when not supplied within the starting panel.

Caution: The current transformer placed as a motor load monitor in the screw compressor starter should never be disconnected at either end without shorting the current transformer terminals in the starter. Failure to do this and to allow open terminals during motor operation will cause high voltages that may endanger personnel and equipment.

The thermal overload reset buttons in the motor starter panel should be manually reset to clear the trouble light "motor overload" that is located on the screw compressor control panel door.

DRAWING ASC25BN-DH-W1

This narrative uses the above drawing as reference for the start-up procedure, the control logic flow and the troubleshooting guide.

OIL HEATERS

Lubrication is critical to the operation of the screw compressor package. Ample flow, oil pressure, oil temperature, and viscosity are continuously monitored and the equipment is shut down if sensors report failure in these areas. The compressor will not be allowed to start if oil temperature is below factory settings and to insure proper temperatures the oil heaters are run continuously, independently fused as FU2 and FU3, whenever the compressor is not running. These circuits should not be shut down, except perhaps to replace a defective heater element, since ambient room temperatures may at times be below factory set points.

If low temperature conditions exist they will be signaled by the "High/Low Temperature" indicator light on the control panel door. The system will not start while this condition is present and an operating compressor will shut down if this condition occurs while running.

START UP PROCEDURE

With control power supplied to the system, and no trouble indicators lit, either manual or automatic operation may be selected by pushing the appropriate button. (Note: If the system has shut down on a failure the stop/reset button should be pushed before the manual or auto buttons.) Depending on the mode selected, the system will respond manually after the start-up delay or respond automatically only to instructions from the master control panel. The "Manual Start" or "Auto Start" lights will indicate the mode called for in startup.

The sequence will be the start of the oil pump motor, for the length of time determined by the setting of 102TR, the start-up delay timer, before the start of the screw compressor. This action is accompanied by the illumination of the "Start Up Time Delay" light. After the set delay, if oil pressure is established, the screw compressor will start at zero loading and run in conformity with the capacity control switch setting. Usually this switch will be left in the automatic position

COMPRESSOR SAFETY DEVICES

The screw compressor is protected by seven safety devices, the opening of any of which will shut down the machine. Four are automatically reset if the failure condition is corrected and three require manual resetting before the compressor can return to operation.

The cause for any failure should be investigated and noted; safety devices monitor the outer edges of design operation and are meant to shut down the machine before any damage may occur. For that reason the factory settings are critical and changes should never be made in those settings in an attempt to "just keep the compressor running".

Completely understanding the function and consequences of adjustments to these safety devices is very important; they are not "operating" controls" which are meant to be adjusted for various reasons; they protect the compressor from extreme conditions, lack of lubrication, etc. and can give prior warning to developing problems. Changing the safety settings to a point that keeps the unit operating also hides that chance for prewarning of a condition that may lead to expensive production downtime and/or repair. The factory is always available for consultation about problems with this system and should be thought of as another resource that is only a telephone call away to help get the problem solved.

LOW OIL PRESSURE This trouble light show that oil pressure is not being maintained at a high enough level to provide proper lubrication. Loss of oil, pump problems, oil thinning, etc. are some of the problems that can lead to this condition. When the system starts or is reset by the stop/ reset button, the oil pump is allowed approximately six seconds to bring the oil pressure to the factory setting. If the pressure is established, the oil pump continues running for approximately thirty seconds before the compressor is allowed to start to guarantee adequate lubrication for the compressor. The six second time delay is meant primarily to protect the oil pump from running with insufficient oil. Once the screw compressor is running, any oil failure will instantly shut down the system. (Auto reset)

TEMPERATURE FAILURE This indicator light shows that the machine has shut down because of either low oil temperature or high discharge temper- ature. Oil temperature is monitored to insure proper oil viscosity and also to drive any captured refrigerant out of the oil itself. If the refrigeration room is too cold, because doors were opened for ventilation, for example, the control panel will display this light and prevent start-up The oil heaters are not designed to compensate for this condition. (Auto reset)

After some period of running the compressor, the temperature failure light indicates a shutdown because of high discharge temperatures. This shutdown is designed to protect the compressor from overheated oil deterioration, metal stresses, etc.. (Auto reset)

LOW REFRIGERANT PRESSURE This safety is primarily designed to prevent operation with insufficient refrigerant. This may be caused by actual refrigerant loss, closed valves, etc. (Auto reset)

MOTOR OVERLOADS This indicator signals that either the oil pump motor overloads or the compressor motor overloads have tripped because of high motor currents. Since the oil pump is critical to the compressor operation, a failure of this subsystem will instantly shut down the compressor package. (Manual reset in motor control center as described earlier.)

HIGH DISCHARGE PRESSURE This indicator signals high refrigerant output pressure may exceed design specifications. (Manual reset)

As was described before, all settings of these safeties should never be changed indiscriminately or without full knowledge of the purpose of the devices and the possible consequences of any changes. If there are any questions, consult the factory.

Figure C

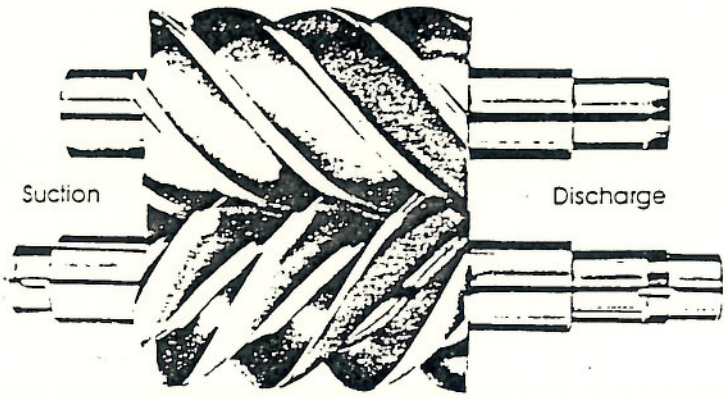


Figure D

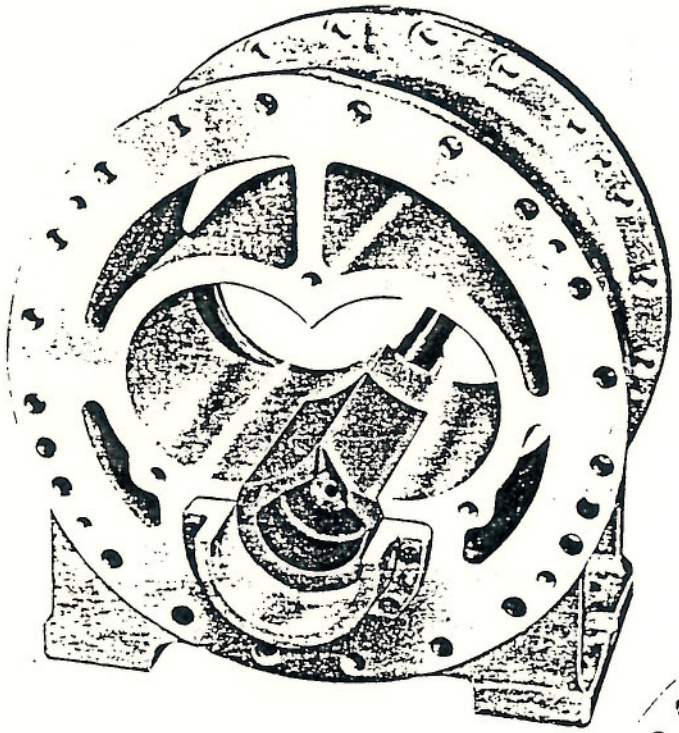


Figure E
Slide valve is in "closed" position at full load.

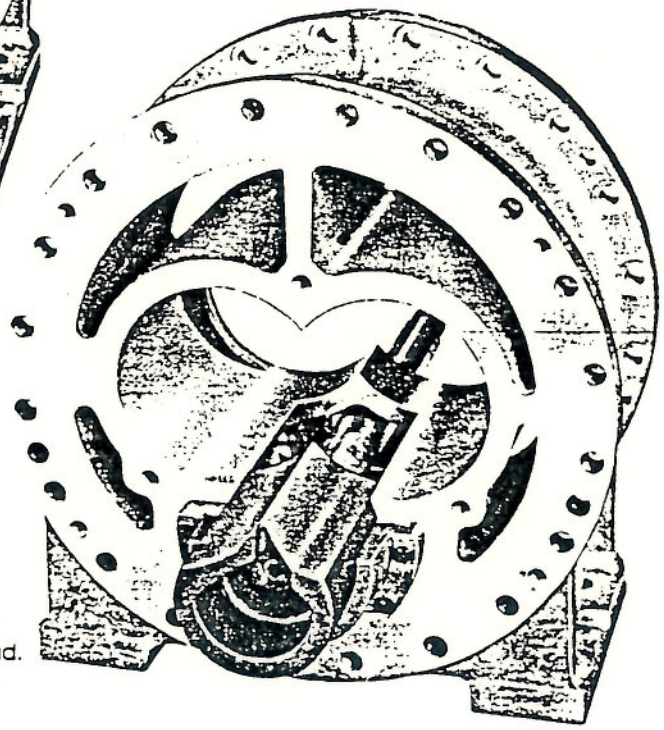


Figure F
Slide valve is in "open" position at reduced load.

OPERATING CONTROL DEVICES

CAPACITY CONTROL SWITCH

The capacity control switch determines the load setting or the output for the screw compressor. The load output can be adjusted manually, upward or downward, held at one position or level, or left to operate automatically in response to the setting of the Honeywell proportional controller mounted on the right side of the panel. This controller reacts to suction pressure changes and varies the slide valve (for compressor loading) as is required to maintainconstant suction pressure for varying load demands.

Manual Load Bypasses the suction pressure monitor and response system and drives the compressor into a "loaded" condition. The top load limit will then be determined by the setting of the motor ammeter relay which monitors motor load current. This setting cannot be exceeded in the manual position.

Hold Disconnects all circuits pertaining to the slide valve assembly thereby holding or locking the compressor loading at that point at which the capacity control was switched to "Hold". The motor ammeter relay, however, still preempts the "Hold" position to prevent overloading the compressor in case load demands vary greatly while the "Hold" position is set at some high level.

Manual Unload Bypasses the suction pressure monitor and response system and drives the compressor into an "unloaded" condition. The slide valve assembly can be driven down to the 0% position or completely unloaded. It will remain in that position for the time the capacity control switch remains in "Manual Unload".

To operate at some fixed level, "Manual Unload" (or "Manual Load") the compressor to the desired point and switch the system to "Hold".

Automatic Control In this position the setting of the Honeywell controller time-proportionally changes the slide valve position in response to the suction pressure tranducer that monitors suction pressure on the screw compressor. That setting is varied to produce the most efficient and economical operation inside the system design demands.

INDICATING AMMETER RELAY

The ammeter relay monitors the compressor motor amperage through the current transformer placed in the combination starter in the electrical closet. This instrument has two set-points: the high set-point which is the motor full load amperage times the service factor, and the low set-point which is 5% below the high set point.

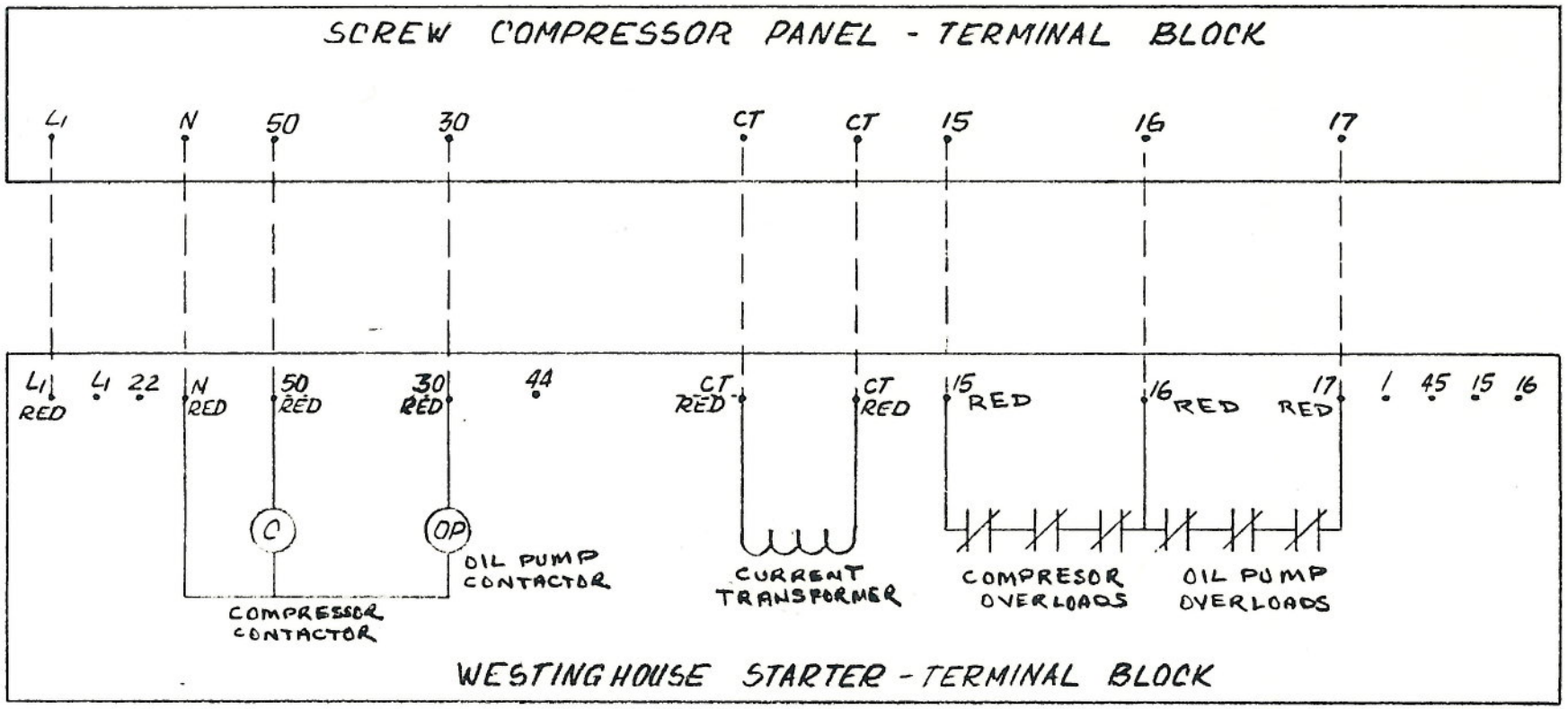
If the motor amperage rises above the first set point (FLA x SF - 5%) the load solenoid which drives the slide valve in the "load" direction is disabled. If for some reason the motor amperage should continue its rise the ammeter relay will automatically energize the unload solenoid which drives the slide valve in the "unload" direction thereby reducing the load on the compressor motor.

The ammeter relay can be thought of as primarily a safety control, guarding the compressor against overloading. The overload heaters in the compressor starter form the second level of defense against this condition; the relay is adjustable, the heaters are not (without physically exchanging the units).

SUCTION PRESSURE CONTROL

In the automatic setting of the capacity control switch, operation of the system is turned over to the Honeywell proportional relay which monitors suction pressure through the pressure transducer mounted in the suction side of the compressor. The Honeywell control translates the distance from the desired set-point to the actual suction pressure into a proportional time length for energizing the appropriate load or unload solenoid. This corrects the loading or unloading of the compressor in response to the actual operational demand. If the operational demand is stable, the compressor will match it and stay at that position of loading. If the demand changes, the compressor responds accordingly.

Use the settings given elsewhere in this booklet for the various production needs of your application.



NOTES:

1. DOTTED LINES SHOW FIELD WIRING - CONNECT AS SHOWN.
2. CONNECT 230/3/60 POWER FOR COMPRESSOR MOTOR & OIL PUMP MOTOR TO CIRCUIT BREAKER (NOT SHOWN.)
3. CONNECT COMPRESSOR MOTOR & OIL PUMP MOTOR LEADS TO STARTER T_1, T_2, T_3 (NOT SHOWN.)

FIELD WIRING

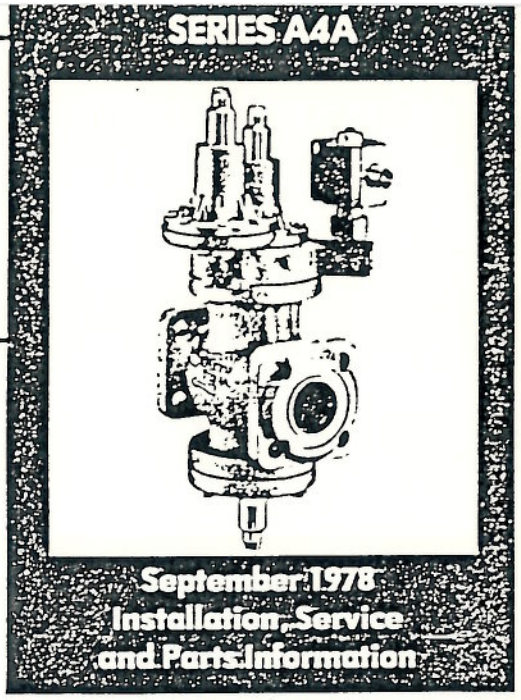
NO. WS-62

HOWE CORPORATION CHICAGO, ILLINOIS	DRAWN BY M. G	CHK'D BY	SCALE ———	DATE 1/87	FOR HSC SCREW COMPRESSORS

ADAPTOMODE® PRESSURE REGULATORS

FOR AMMONIA, R-12, R-22, R-502, OTHER REFRIGERANTS AND OIL

SERIES A4A
20mm (3/4")
to
100mm (4")



FEATURES

Unique Modular construction • Interchangeable parts • Many control variations are possible with the use of a few Modules and kits • All common variations have no external piping.

Pilot operated characterized V-Port for precise control • 21 kg/cm² (300 psig) design pressure (SWP) • Suitable for all common refrigerants and oil.

Flanges for threaded or welded iron pipe and copper tube • Easy to service • Close-coupled strainers.

INDEX

INSTALLATION

All regulators are packed for maximum protection. Unpack carefully. Check the carton to make sure all flanges and other items are unpacked. Save the enclosed instructions for the installer and eventual user.

Do not remove the protective coverings from the inlet and outlet of the regulator until the regulator is ready to be installed. Protect the inside of the regulator from moisture, dirt and chips before and during installation. When welded or brazed flange connections are used, all slag, scale and loose particles should be removed from the flange interior before the regulator is installed between the flanges. It is advisable to install a close-coupled companion strainer (RSF) at the inlet of the regulator to help protect it from any foreign material in the system.

The A4A series of regulators will give optimum performance if mounted in a horizontal line in a vertical position with the manual opening stem on bottom. Where other positions are desired, the factory should be consulted; please give application and piping details. The regulator must be installed with the arrow on the valve body pointing in the direction of the fluid flow for the regulator to function properly. Backward flow through the regulator is uncontrolled and will vary with the valve model and the reverse pressure drop encountered.

Tighten the flange bolts and nuts evenly to provide proper seating of the flange gasket and to avoid damage to gaskets or flanges. (See Flange Bolt Torque Table, p. 12). Avoid using the regulator flange bolts to stretch or align pipe. Even the heavy duty semi-steel body of an A4A can be distorted, causing the precision parts to bind.

The regulator should be installed in a location where it is easily accessible for adjustment and maintenance. The location should be such that the regulator can not be easily damaged by material handling equipment. When it is necessary to insulate the regulator (and companion strainer), the insulation should be installed to provide access to the regulator (and companion strainer) for adjustment and maintenance. Proper indicating gauges should be installed to be easily visible to the operating engineer for system checking and adjusting purposes.

Where a modular pilot solenoid or electric motor is used, it must be connected to a circuit of the same voltage and frequency (Hz) as printed on the nameplate of the solenoid or motor. All wiring and power sources (such as transformers) must be adequate to supply full voltage to the coil or motor at all times. A Flange Ring-tube Assembly is furnished with each Type A4AO (Outlet) and Type A4AL (Differential) Regulator for easy field connection of outlet pressure to the regulator.

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Refrigerating Specialties Division
2445 South 25th Avenue
Broadview, Illinois 60153

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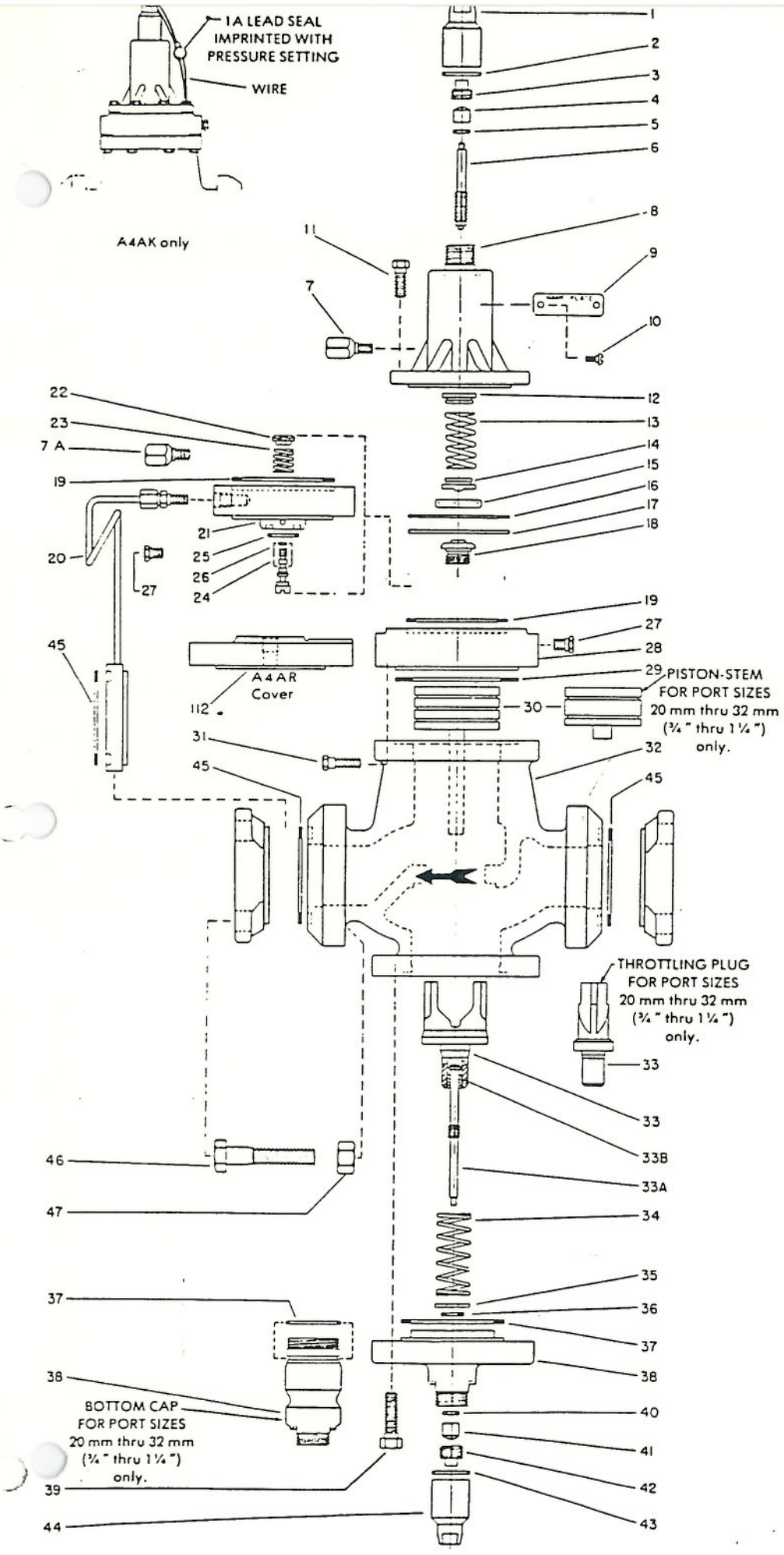


A4A, A4AK, A4AL, A4AE, A4AO
FIG. 1

DISASSEMBLY & ASSEMBLY

Refer to the exploded view (Fig. 1) for parts discussed in this section.

Before disassembling or assembling any A4A type regulator, read the information in this bulletin and Bulletin RSB, Safety Procedures for Refrigerating Specialties Company Refrigeration Control Valves.

Before a regulator is removed from the line or disassembled in the line, make sure that all refrigerant has been removed from the regulator, including the bonnet where applicable, and the close-coupled strainer. The regulator must be isolated from the rest of the system in a safe manner. When pumping down to remove the refrigerant the manual opening stem 33A must be turned all the way out (counter-clockwise) to make sure the valve is open.

ALL A4A REGULATORS

GENERAL PROCEDURE

The construction of the regulator and the method of disassembly are relatively simple, but some procedures must be followed to avoid damage. The following describes the procedure for the basic A4A; special instructions for other styles will be included in other appropriate sections.

Disassembly—Take care when removing Seal Caps 1 and 44 in case some refrigerant may be trapped inside. Back the Adjusting Stem 6 all the way out to remove any pressure from Range Spring 13 otherwise damage to Diaphragm 17 or Pilot Seat 18 may occur. Remove Bonnet 8 by carefully removing Cap Screws 11. Take care not to damage Diaphragm Follower 15. Remove Adapter 28 by removing Cap Screws 31. Turn the Manual Opening Stem 33A all the way in until the flats on the stem barely protrude from the stuffing box nut. Push Piston 30 down against the spring force. The piston should move freely down and be returned by the spring force. If the piston is jammed or sticky, remove Bottom Cap Assembly which includes Items 33 through 42 by removing Cap Screws 39 or unscrewing Bottom Cap, 20mm through 32mm (3/4" through 1-1/4"). Using a hard wood dowel rod inserted through the bottom of the valve, tap the piston upward and out. Thoroughly clean all parts. If jamming has taken place and the piston and bore are scored, remove all burrs by polishing the piston, bore and throttling plug with fine crocus cloth. Inspect the seating area of the Throttling Plug 33 for damage or erosion. If damaged it should be replaced. It would be advisable to replace the entire bottom cap assembly. Inspect all gaskets and "O" rings for damage and replace where necessary.

Assembly—When reassembling the valve, all internal parts should be clean, dry and lightly oiled with refrigerant oil, except "O" rings. Apply silicone grease to the "O" rings. Care must be taken especially when the parts are cold since moisture can condense on parts and cause rapid rusting. When replacing gaskets, they should be oiled very lightly with refrigerant oil before assembly. Install bottom cap assembly first and tighten in place. Carefully replace the piston; never try to force it in place. Align the Adapter Gasket 29 carefully with the proper holes in the adapter and valve body and fasten adapter in place. Before assembling the bonnet be sure the Adjusting Stem 6 is turned all the way out and that the Bonnet 8 and Diaphragm Follower 15 are properly aligned, otherwise damage to the

1	Seal Cap	20-4005-00	1	8, 16	Bonnet	20-4044-11K	1	11	Screw Bonnet A4AO, A4A3P	90-1000-61	8	15	Diaphragm Follower	20-1092-00	1
	Seal Cap A4AK only	20-4005-01	1		Bonnet A4AP, A4AL, A4A3P	20-4044-12K	1	12	Spring Rest, Upper Range A & V	40-1025-00	1	16	Bonnet Gasket	81-1001-35	1
1A	Wire & Seal A4AK only	93-1001-21	1	9	Nameplate	20-4100-01	1		Range D	20-4018-00	1		Bonnet Gasket A4AP & A4AL	81-1001-47	1
2	Gasket, Seal Cap	81-1000-12	1		Nameplate for field conversion	20-4100-00	1	13	Spring, Range A & V	80-1001-15	1	17	Diaphragm, Range A & V	20-1087-04	1
3	Nut, Stuffing Box	20-1080-00	1	10	Screw, Name Plate	90-1000-23	2		Spring, Range D	80-1001-16	1		Diaphragm, Range D	20-1087-04	2
4	Packing Ring	20-1077-00	1	11	Screw Bonnet	90-1000-57	8	14	Spring Rest, Lower Range A & V	40-1026-00	1	16,17, 19	Diaphragm Kit		
5	Packing Washer	20-1084-00	1		Screw, Bonnet A4AK	90-1000-57	7		Range D	20-4017-00	1		Range A & V	21-0103-00K	1
6	Adjusting Stem	20-4007-00	1		Screw, Bonnet A4AK	20-4101-00	1						Range D	21-0103-01K	1
7	Fitting, Bonnet A4AL only	20-4110-00	1												
7A	A4AOE only	30-1017-00	1												

PARTS LIST #2—BASIC REGULATORS—(Figure 1)

Item	Description	20 mm (3/4")	Q t y	25 mm (1")	Q t y	32 mm (1-1/4")	Q t y	40 mm (1-5/8")	Q t y	50 mm (2")	Q t y	65 mm (2-1/2")	Q t y	75 mm (3")	Q t y	100 mm (4")	Q t y
1-6, 8-17	Bonnet Assy. See Parts List #1																
18, 16, 19, ①⑤	Pilot Seat Range A & D	20-0415-01K	1	20-0415-01K	1	20-0415-01K	1	20-0415-01K	1	20-0415-01K	1	20-0415-02K	1	20-0415-02K	1	20-0415-02K	1
	Range V (Vacuum Cartridge VC)	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1	20-0415-00K	1
19	Gasket, Adapter	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1	81-1000-19	1
20	Flg. Ring-tube Asmbly. A4AOT	20-0419-06	1	20-0419-06	1	20-0419-07	1	20-0419-08	1	20-0419-08	1	20-0419-09	1	20-0419-10	1	20-0419-11	1
20, 45	" " A4AO, A4AL	20-0419-00K	1	20-0419-00K	1	20-0419-01K	1	20-0419-02K	1	20-0419-02K	1	20-0419-03K	1	20-0419-04K	1	20-0419-05K	1
21-27, 19	A4AO Pilot Assembly	20-0989-00K	1	20-0989-00K	1	20-0989-00K	1	20-0989-00K	1	20-0989-00K	1	20-0989-01K	1	20-0989-01K	1	20-0989-01K	1
21	Adapter, A4AO	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1	20-4046-11	1
22	Spring Nut	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1	20-4088-00	1
23	Spring, Pilot Plug	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1	80-1001-28	1
24-26	Valve Plug Repair Kit	21-0104-02K	1	21-0104-02K	1	21-0104-02K	1	21-0104-02K	1	21-0104-02K	1	21-0104-03K	1	21-0104-03K	1	21-0104-03K	1
24	Pilot Plug	—		—		—		—		—		—		—		—	
25	"O" Ring, Seal	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1	93-1001-15	1
26	"O" Ring, Pilot Plug	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1	93-1000-51	1
27	Gauge Port Pipe Plug	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1	92-1000-13	1
28, 19, 29	Adapter, Body	20-1091-21K	1	20-1091-21K	1	20-1090-21K	1	20-1123-21K	1	20-1123-21K	1	20-1018-11K	1	20-1105-21K	1	20-1106-21K	1
29	Gasket, Adapter	81-1000-76	1	81-1000-76	1	81-1000-41	1	81-1000-22	1	81-1000-22	1	81-1001-02	1	81-1000-54	1	81-1000-34	1
	Gasket, Adapter, A4AE Only	81-1000-75	1	81-1000-75	1	81-1000-40	1	81-1000-21	1	81-1000-21	1	81-1001-01	1	81-1000-53	1	81-1000-33	1
30, 29	Piston—Stem	20-4040-00K	1	20-4040-00K	1	20-4056-00K	1	20-4011-01K	1	20-0411-01K	1	20-0411-02K	1	20-0411-03K	1	20-0102-15K	1
31	Screw, Adapter	90-1000-60	8	90-1000-60	8	90-1000-58	8	90-1000-58	8	90-1000-58	8	90-1000-58	8	90-1001-18	6	90-1001-18	6
	Screw, Cover, A4AR	90-1000-60	8	90-1000-60	8	90-1000-58	8	90-1000-65	8	90-1000-65	8	90-1000-65	8	90-1001-17	6	90-1001-18	6
32, 45	Valve Body	20-4086-11K	1	20-4086-11K	1	20-1100-14K	1	20-1149-01K	1	20-1149-01K	1	20-1015-11K	1	20-1023-11K	1	20-1041-12K	1
33-33B	Throttling Plug Ass'y. A4AK	20-0410-00K	1	20-0410-01K	1	20-0410-02K	1	20-0410-03K	1	20-0410-04K	1	20-0410-05K	1	20-0410-06K	1	20-0410-13K	1
		20-0412-00K	1	20-0412-01K	1	20-0412-02K	1	20-0410-03K	1	20-0410-04K	1	20-0410-05K	1	20-0410-06K	1	20-0410-13K	1
33	Throttling Plug	—		—		—		—		—		—		—		—	
33A	Manual Opening Stem	—		—		—		—		—		—		—		—	
33B	Stem Nut	—		—		—		—		—		—		—		—	
34	Spring, Closing	80-1001-32③	1	80-1001-32③	1	80-1001-33④	1	80-1001-35	1	80-1001-35	1	80-1001-36	1	80-1001-37	1	80-1000-35	1
35	Dirt Wiper Retainer	20-4067-00	1	20-4067-00	1	20-4067-00	1	20-4080-00	1	20-4080-00	1	20-4080-00	1	20-4085-00	1	20-4109-00	1
36	Dirt Wiper	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4042-00	1	20-4084-00	1	20-4084-00	1
37	Seal, Bottom Cap	93-1000-79	1	93-1000-79	1	93-1000-79	1	81-1000-15	1	81-1000-15	1	81-1000-15	1	81-1000-08	1	81-1000-17	1
38, 37	Bottom Cap	20-4043-00K	1	20-4043-00K	1	20-4050-11K	1	20-4050-11K	1	20-4050-11K	1	20-4050-11K	1	20-4048-11K	1	20-1113-00K	1
39	Screw, Bottom Cap	—		—		—		90-1000-81	6	90-1000-81	6	90-1000-81	6	90-1001-17	6	90-1001-17	6
40	Packing Washer	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1084-00	1	20-1114-00	1	20-1114-00	1
41	Packing Ring	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1077-00	1	20-1116-00	1	20-1116-00	1
42	Stuffing Box Nut	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1080-00	1	20-1129-00	1	20-1129-00	1
43	Gasket, Seal Cap	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-12	1	81-1000-20	1	81-1000-20	1
44	Seal Cap	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-4005-00	1	20-1130-00	1	20-1130-00	1
45	Gasket, Flange②	81-1000-03	2	81-1000-03	2	81-1000-04	2	81-1000-05	2	81-1000-05	2	81-1000-06	2	81-1000-07	2	81-1000-09	2
46	Bolt, Flange	90-1001-14	4	90-1001-14	4	90-1001-11	8	90-1001-20	8	90-1001-20	8	90-1001-35	8	90-1001-35	8	90-1001-32	8
	Bolt, Flange (inlet) A4AO, A4AL, A4AOT Only	90-1001-14	2	90-1001-14	2	90-1001-11	4	90-1001-20	4	90-1001-20	4	90-1001-35	4	90-1001-35	4	90-1001-32	4
	Bolt, Flange (outlet) A4AO, A4AL, A4AOT Only	90-1001-20	2	90-1001-20	2	90-1001-14	4	90-1001-20	4	90-1001-20	4	90-1001-35	4	90-1001-35	4	90-1001-32	4
47	Nut, Flange	90-1000-02	4	90-1000-02	4	90-1000-02	8	90-1000-02	8	90-1000-02	8	90-1000-05	8	90-1000-05	8	90-1000-06	8
112, 29	Cover, A4AR	20-1010-12K	1	20-1010-12K	1	20-1001-01K	1	20-1003-01K	1	20-1003-01K	1	20-1019-12K	1	20-1005-13K	1	20-1006-12K	1

For Flanges available see Flange Table on Page 12. Part Numbers with "-K" suffix are Kits which include item numbers shown.

① Chrome Plated Pilot Seat Standard. ② A4AO, A4AL, A4AOT only, quantity is 3. ③ A4AK is 80-1001-48. ④ A4AK is 80-1001-49. ⑤ Not used with any A4AO or variations.

DISASSEMBLY & ASSEMBLY (cont.)

diaphragm and pilot seat may occur. Place Gasket 19 in the slot in the adapter and align Gasket 16 and Diaphragm 17 to the center of bonnet. The raised center of the diaphragm must be towards the bonnet. For range "D" use two diaphragms. Tighten Cap Screws 11 evenly. The ideal tightening torque is 1.5 kg-m (11 ft.-lbs.). Valve is now ready to be adjusted for normal operation.

If close-coupled strainer is used, it may be cleaned before putting the valve back in operation. The regulator must be tested for leaks with refrigerant gas or other appropriate gas before the system is put into operation.

A4A

After the General Procedure for disassembly, inspect the Pilot Seat 18 top seating surface for dirt, wear or damage. Remove seat from valve body and clean, lap on a flat plate or replace as necessary. Examine the diaphragm region which contacts the seat surface, look for dirt, heavy scratches or corrosion. If the diaphragm cannot be easily wiped clean, it should be replaced. Reassemble the regulator following the General Procedure.

A4AP, A4A3P and A4AL

Remove the sensing tube connection which is part of the Flange Ring-tube Assembly 20 attached to the bonnet (A4AL) or the external pneumatic connection to the bonnet (A4AP or A4A3P). Disassemble following the General Procedure. Check the seat and diaphragm as for A4A. Check the parts inside the bonnet for dirt, moisture or corrosion, especially on the outside diameter of the diaphragm follower. If the source of dirt, moisture or corrosion cannot be eliminated, it may be advisable to install and maintain a filter-drier in the sensing line to the bonnet. Reassemble the regulator as described in the General Procedure and connect the sensing tube.

A4AK

For disassembly and assembly follow the General Procedure and the procedure for A4A. This regulator has a sealed wire connection to keep the seal cap from being removed. This wire must be removed before the regulator can be disassembled. Please Note: Removal of the seal voids any Refrigerating Specialties Company factory responsibility for the regulator pressure set-point.

A4AO and A4AOE

Remove the sensing tube connection which is part of the Flange Ring-tube Assembly 20 (A4AO) or the external sensing connection to the adapter 7A (A4AOE). Disassemble following the General Procedure. Remove the A4AO adapter. Disassemble the Pilot Plug 24 and Spring 23 by inserting a screwdriver in the slot in the bottom of the pilot plug and turning the Spring Nut 22 with a wrench. Inspect the pilot plug and the matching surface on the Adapter 21 for dirt and damage. Clean, lap in place or replace as needed. Assemble new "O" Ring 26 to the pilot plug and carefully insert the assembly into the adapter. Reassemble the pilot plug, spring and spring nut. Replace "O" Ring 25. Reassemble regulator following the General Procedure.

A4A INLET PRESSURE REGULATOR

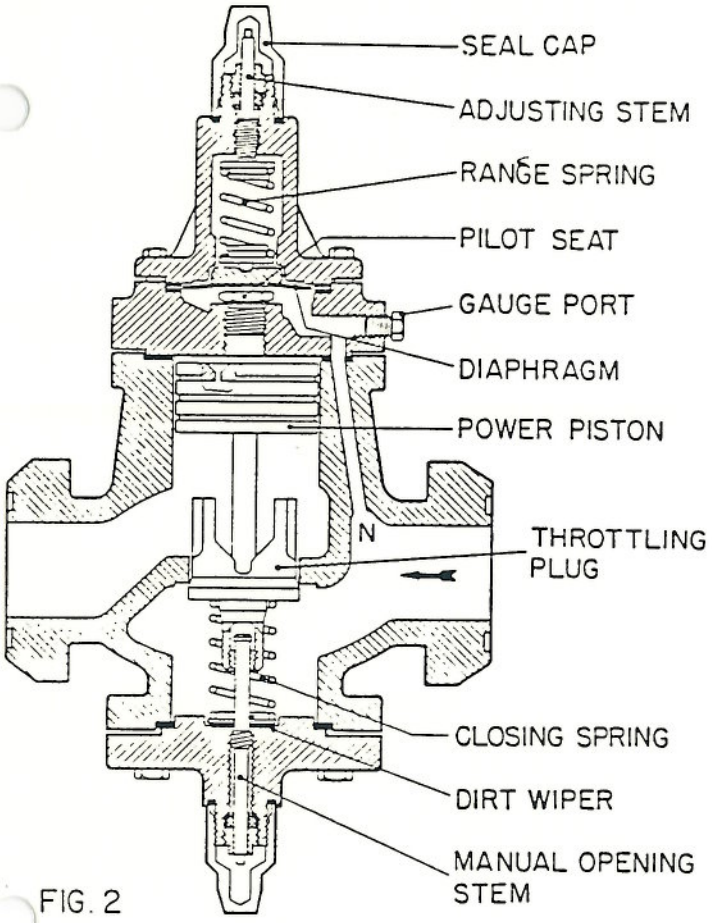
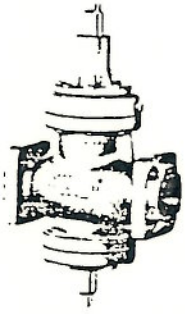


FIG. 2

OPERATION



The inlet pressure enters the space under the diaphragm through passage N. When the force created by the pressure exceeds the force of the range spring, the diaphragm is lifted off the pilot seat allowing pressure to enter on top of the power piston. This causes the power piston to move downward forcing the throttling plug to open and modulate to maintain constant inlet pressure. Increase in inlet pressure lifts the diaphragm further, allowing more pressure on top of the power piston and opening the valve wider. Decrease in inlet pressure causes the diaphragm to move closer to the pilot seat reducing the pressure on top of the piston and causing the closing spring to reduce the valve opening. The pressure on top of the power piston is controlled by the flow through the pilot seat and the bleed off through a bleed hole in the power piston and through the clearance between the piston and the cylinder. A maximum of 0.14 kg/cm² (2 psi) pressure drop across the valve is required to open it fully.

The A4A Inlet Pressure regulator therefore opens on a rise in the inlet pressure above its set point and closes on a drop in inlet pressure below its set point. The inlet pressure set point is not appreciably affected by variations in the outlet pressure.

ANUAL OPENING STEM

Type A4A Regulators are provided with a manual opening stem. To open the regulator manually, back the stem out (turn counter-clockwise) until it stops. To put the regulator into automatic operation, turn the stem in (clockwise) until only the flats on the stem protrude from the stuffing box nut.

ADJUSTMENT

Install an accurate pressure gauge in the gauge port. Back the adjusting stem all the way out to stop. This will reduce the set point to its lowest level and cause the valve to open wide. Start the system, and when suction pressure is about the desired pressure, turn the adjusting stem in until the pressure gauge shows a slight rise in the inlet pressure. At this point the adjusting stem may be turned in (clockwise) to raise the pressure further, or backed out (counter-clockwise) to lower it; but the final adjustment should be made after the system has been operating for a period of time.

INLET PRESSURE SETTING RANGES

Set Point Ranges	Approx. Pressure Change per Turn of Adjusting Screw
A: 0 to 11 kg/cm² (0 to 150 psig)	1.8 kg/cm² (25 psi)
V: 500 mm hg to 8 kg/cm² (20 in hg to 120 psig)	1.8 kg/cm² (25 psi)
D: 5 to 20 kg/cm² (75 to 280 psig)	3.7 kg/cm² (53 psi)

A4AE INLET PRESSURE REGULATOR, REMOTE SENSING CONNECTION

This regulator allows control of upstream pressure at a point remote from the regulator inlet. The Adapter 28 is rotated one bolt hole to block the flow through passage N to under the diaphragm. The sensing pressure from the desired control point, upstream of the regulator, is connected to the gauge port leading to under the diaphragm. Thus the regulator will control the pressure at this point. The regulator operation and adjustment is the same as for A4A.

A4AK RESEATING RELIEF REGULATOR

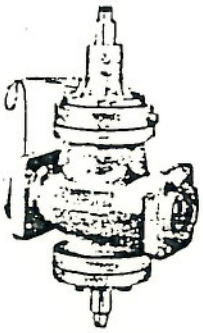
This regulator is adjusted at the factory for a given inlet pressure relief setting. The seal cap is wired to a bonnet cap screw and the wires are sealed with a lead seal. The relief pressure setting is stamped on the seal. **Breaking or removal of the seal voids the factory responsibility for the relief pressure setting of the regulator.**

The operation and other construction features are similar to A4A, except that sizes 20mm (3/4") through 32mm (1¼") use a teflon seat in the throttling plug.

Because of slight leakage tolerance, this regulator is not intended for use as a system relief regulator to the atmosphere, but rather to a lower pressure section of that system. Because of large diaphragm to seat area ratio, setting is affected only slightly by outlet pressure.

This regulator is often used as a defrost pressure relief regulator.

A4AL DIFFERENTIAL PRESSURE REGULATOR



When it is desired to control the differential pressure between the regulator inlet and outlet, this regulator is necessary. The outlet pressure is introduced through a sensing tube, which is part of the Flange Ring-tube Assembly 20, from the outlet of the regulator into the bonnet and to the top of the diaphragm, thus allowing the regulator to maintain a differential pressure between the inlet and outlet equivalent to the spring setting.

For adjustment, pressure gauges should be connected to the gauge port at the regulator inlet and also downstream of the regulator. With the system operating, back the adjusting stem all the way out to stop (counter-clockwise) to give minimum differential, which is about 0.14 kg/cm² (2 psi). Gradually turn the adjusting stem in (clockwise) until the desired differential pressure is reached, assuming the system is capable of achieving such a differential. Check the differential setting after the system has been in operation for a while and make any minor corrections necessary.

INTRODUCTION

The illustrations used in this article are for identification purposes only and *should not be used for ordering parts*. Secure a parts list from the factory or a Viking representative. Always give complete name of part, part number and material with the model and serial number of the pump when ordering repair parts. The unmounted pump or unit model and serial number can be found on a nameplate attached to the pump or base.

In the Viking model number system, the basic size letters are combined with the series number (195) indicating both the unmounted or mounted pump units.

UNMOUNTED PUMP AND UNIT MODEL NUMBERS

UNMOUNTED PUMP MECH. SEAL	UNIT
GG195 HJ195 HL195 AS195 AK195 AL195	Units are designated by the unmounted pump model numbers followed by a letter indicating drive style. D—Direct Drive

Maintenance

Model 195 pumps are designed for long, trouble free life under a wide variety of application conditions with a minimum of maintenance, however the following should be considered:

1. END CLEARANCE ADJUSTMENT—After long term operation it is sometimes possible to improve the performance of the pump, without major repair, thru adjustment of end clearance of the pump. Refer to instructions under Re-assembly of the pump for information regarding this procedure.
2. CLEANING THE PUMP—It is good practice to keep the pump as clean as possible. This will facilitate inspection, adjustment and repair work and help prevent omission of lubrication to fittings covered or hidden with dirt.
3. STORAGE—If the pump is to be stored or not used for any appreciable length of time it should be drained and a light coat of lubricating and preservative oil should be applied to the internal parts. Lubricate all fittings.

Disassembly

1. Remove the head capscrews.
2. Remove the head and O-Ring gasket.

CAUTION: AVOID TILTING THE HEAD DOWN, AS THE IDLER MAY SLIDE OFF.

3. Remove the idler from the idler pin. If the idler pin is worn, the head, idler pin and the idler bushing should be replaced.
   If the idler bushing is worn, it is strongly recommended that the idler and bushing be replaced. This bushing can be replaced in the field, but is very difficult. It is a brittle material, and extreme care should be taken to prevent breaking when it is being installed in the idler. If it is cracked in the idler, this bushing will quickly disintegrate. A hydraulic press should be used to install carbon graphite bushings. Be sure the bushing is started straight. DO NOT STOP the pressing operation until the bushing is in the proper position.

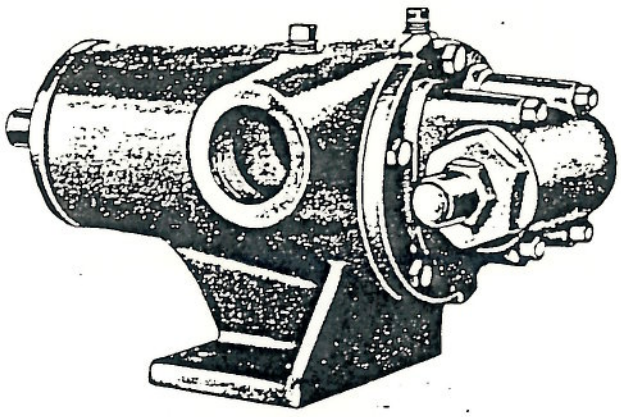


FIGURE 1
GG, HJ AND HL195 UNMOUNTED PUMP

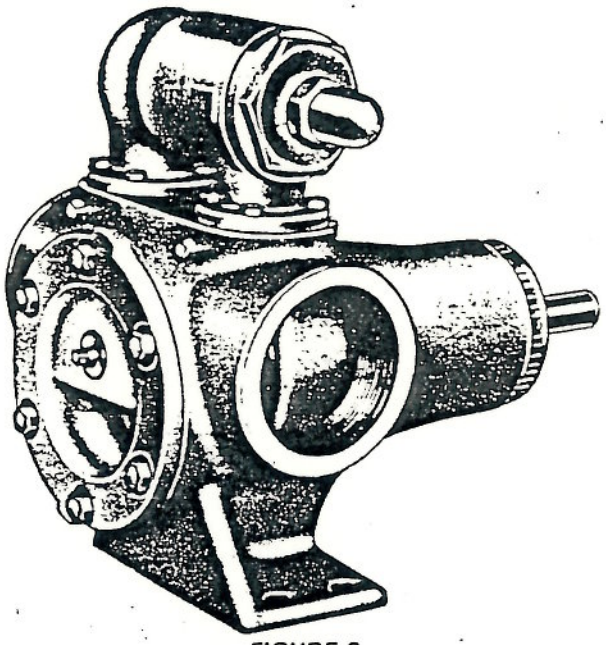


FIGURE 2
AS, AK AND AL195 UNMOUNTED PUMP

4. Remove the locknut from the shaft. A piece of brass rod or hardwood inserted in the port opening will hold the shaft from turning.
5. The rotor and shaft can now be removed from the casing. The spring and rotary member of the mechanical seal will come out with the shaft.

NOTE: On the HJ and HL size pumps the bearing housing and double row ball bearing must be removed before the snap ring in the shaft can be removed. The rotor and shaft cannot be removed until the snap ring is removed from the shaft.

6. Loosen the two (2) setscrews in the end of the bearing housing, turn the bearing housing coun-

terclockwise and remove from the casing. Remove the snap ring from the bearing housing on GG, HJ and HL size pumps and the double row ball bearing can be removed. On the AS, AK, and AL size pumps you must loosen the setscrews in the outer ring of the bearing housing and remove bearing housing end cap, closure and bearing collar. Use a spanner wrench to remove the end cap.

Wash the bearing thoroughly and examine. If there is any evidence of wear or damage, a new bearing should be used.

7. Remove the snap ring and casing ball bearing in the GG, HJ and HL size pumps. Remove the bearing spacer in the AS, AK and AL size pumps. The bearing retainer washer, located between the casing bearing and seal seat, can now be removed if it did not stay on the rotor shaft when the shaft was removed.
8. The seal seat or stationary part of the seal can now be removed from the casing.
9. The casing should be examined for wear, particularly at the seal area between the port openings.

All parts should be checked for wear before the pump is put together. When making major repairs, such as replacing a rotor and shaft, it is usually advisable to also install a new head and idler.

Reassembly

1. Installing New Seal: See Figure 3. The seal is simple to install and good performance will result if care is taken in its installation.

NOTE: Never touch the sealing faces with anything except the fingers or a clean cloth. Clean the rotor hub, shaft and seal seat housing in the casing, making sure they are clean and free from dirt and grit.

Coat the outside diameter of the seal seat and the inside diameter of the seal housing bore with light oil. With thumb and forefinger, push the seal seat into place in the casing.

Place the tapered sleeve (furnished with replacement seals) on the shaft as far as it will go. Thin end must be toward end of shaft. See Figure 3. Coat the inside of the rotary member and the outside of the tapered sleeve with light oil. Be sure the shaft is free of nicks and burrs. Place the spring and rotary member on the shaft, spring first, over the sleeve and against the hub of the rotor. *Remove the tapered sleeve.*

2. Flush the sealing faces of both the rotary member and seal seat with light oil and install rotor and shaft. Push the rotor and shaft into the casing slowly until the ends of the rotor teeth are just beyond the face of the casing.
3. Place the idler on the idler pin and the O-ring head gasket on the head. Place the head assembly on the pump and tighten the capscrews evenly and securely. The seal is now automatically compressed to its proper working length.
4. Pack the single row ball bearing with grease and install in the casing. Install the snap ring in GG, HJ and HL pumps.

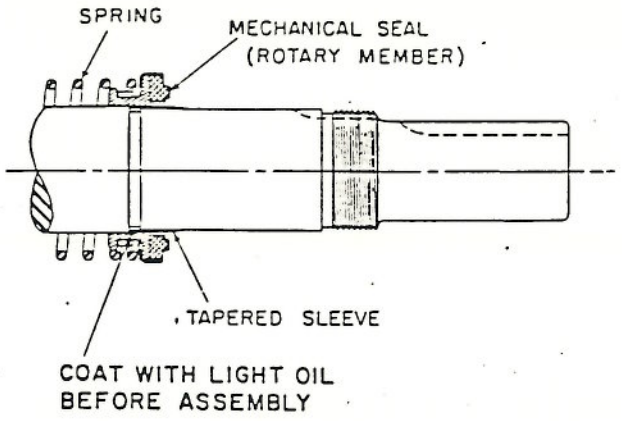


FIGURE 3

NOTE: The AS, AK and AL pumps do not have a snap ring, but the bearing retainer washer must be assembled over the end of the shaft before the bearing is assembled.

5. Place the bearing spacer over the shaft and against the single row ball bearing in the casing. (AS, AK, & AL size pumps).
6. Install the snap ring in the groove in the shaft on the HJ or HL size pumps.
7. Pack the lubrication chamber between the casing ball bearing and the double row ball bearing in the bearing housing approximately half full with *lithium base ball bearing grease.*
8. Pack the double row ball bearing with *lithium base ball bearing grease* and press into the bearing housing. Install the snap ring to hold the bearing in place.

NOTE: On AS, AK and AL pumps, install the closure in the bearing housing end cap. Put the bearing spacer sleeve in the closure and install this in the bearing housing and tighten securely.

9. Start the bearing housing into the casing. Turn by hand until tight. This forces the rotor against the head. Replace and tighten the locknut on the shaft. Insert a piece of brass or hardwood through the port opening between the rotor teeth to keep the shaft from turning.
10. Adjust the pump end clearance as follows:

Thrust Bearing Adjustment

Loosen the two setscrews in the bearing housing and turn counterclockwise ½" measured on the outside of the bearing housing of GG, HJ and HL size pumps. This represents approximately .003" end clearance. On the AS, AK and AL size pumps, turn the thrust bearing assembly counterclockwise two notches which represents approximately .003" end clearance.

NOTE: Be sure the shaft can be rotated freely. If not, turn the bearing housing counterclockwise until the shaft can be turned. Be sure set screws are tightened securely after adjustment is made. High viscosity liquids require additional end clearance. The amount of end clearance depends on the viscosity of the liquid being pumped.

VIKING HEAVY-DUTY PUMPS
195 SERIES

MAINTENANCE AND REPAIR INSTRUCTIONS

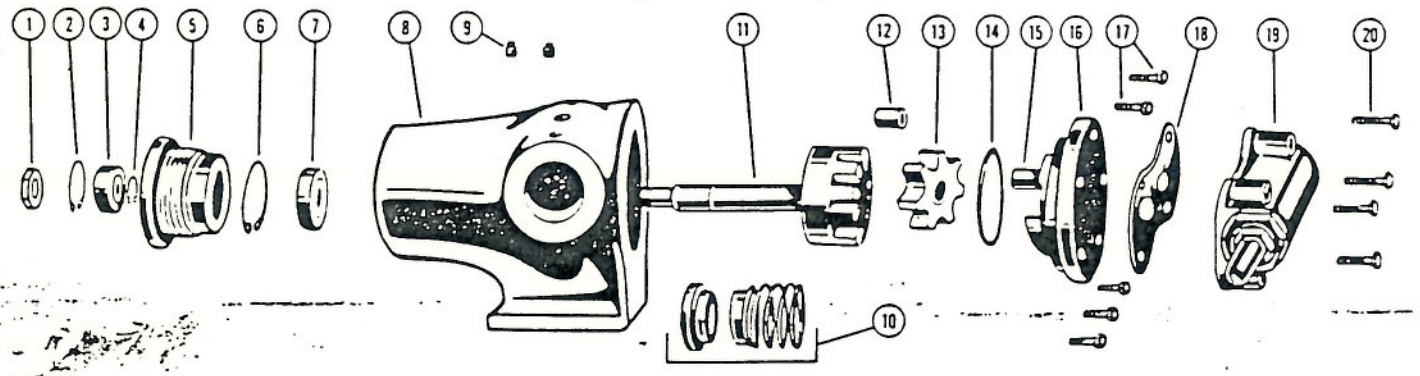


FIGURE 6 EXPLODED VIEW GG, HJ, HL195 PUMPS

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	6	Snap Ring	11	Rotor and Shaft	16	Head
2	Snap Ring	7	Ball Bearing	12	Idler Bushing	17	Capscrew for Head
3	Ball Bearing	8	Casing	13	Idler	18	Gasket for Relief Valve
4	Snap Ring	9	Pipe Plug	14	O-Ring Gasket	19	Relief Valve
5	Bearing Housing	10	Mechanical Seal	15	Idler Pin	20	Capscrew

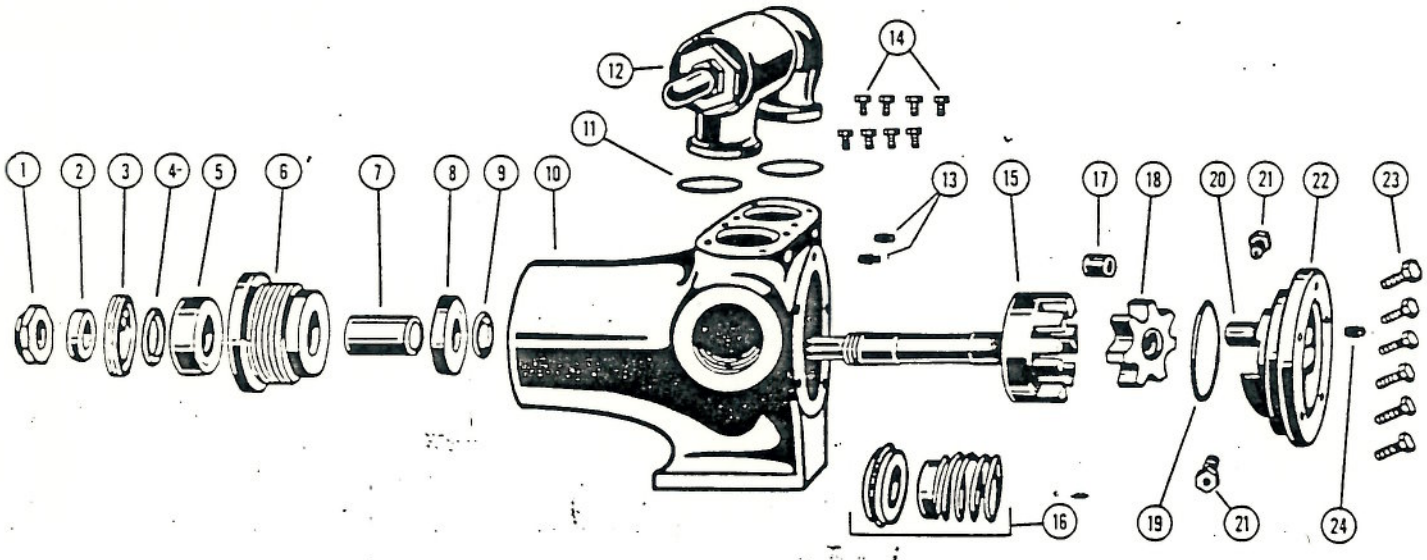


FIGURE 7 EXPLODED VIEW AS, AK, AL195 PUMPS

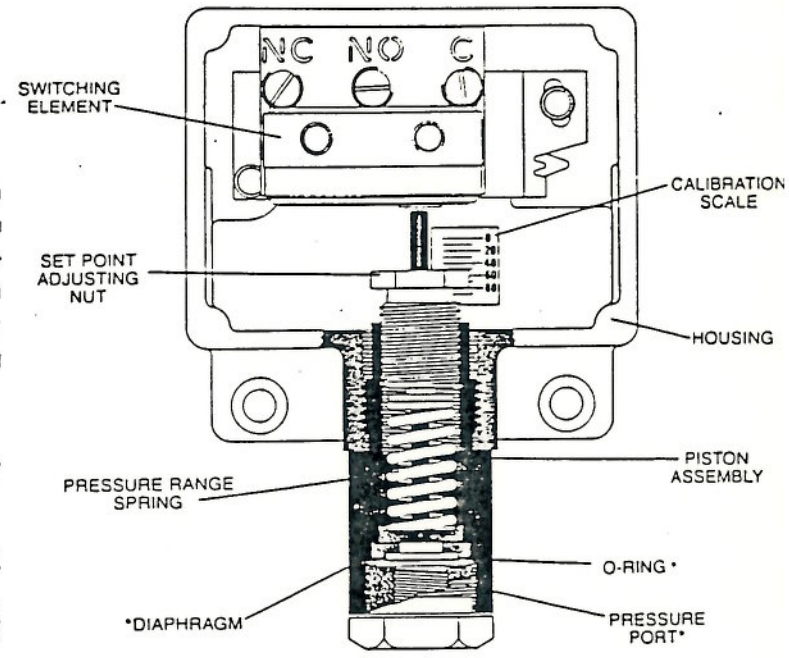
ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	7	Bearing Spacer	13	Pipe Plug	19	O-Ring Gasket
2	Bearing Spacer Collar	8	Ball Bearing (1-Row)	14	Capscrew for Valve	20	Idler Pin
3	End Cap for Bearing Housing	9	Bearing Retainer Washer	15	Rotor and Shaft	21	Check Valve
4	Closure for Bearing Housing	10	Casing	16	Mechanical Seal	22	Head
5	Ball Bearing (2-Row)	11	O-Ring Gasket	17	Idler Bushing	23	Capscrew for Head
6	Bearing Housing	12	Relief Valve	18	Idler	24	Pipe Plug

PRESSURE SWITCH COMPANY
11705 BLACKBOB ROAD, P.O. BOX 591, OLATHE, KANSAS 66061
Telex: 42-6130 PHONE: 913/764-2630

GENERAL INSTRUCTIONS

Static "O" Ring Pressure Switch

INCLUDING WIRING DIAGRAM



CAUTION: The switching element in this switch has been positioned with a dial indicator to a tolerance of ± .002". DO NOT MOVE this switching element! Its position has nothing to do with any set point adjustment. Any movement can either render the switch inoperative or cause the switching element to be damaged with overpressure.

TO ADJUST PRESSURE AT WHICH SWITCH WILL OPERATE, PROCEED AS FOLLOWS:

1. STANDARD UNIT (FIXED DIFFERENTIAL)
   Tighten the hex headed adjusting nut to increase pressure – loosen to reduce pressure. The adjusting nut is the hex headed, threaded bushing through which the shaft that operates the switching element extends.

2. ADJUSTABLE DIFFERENTIAL TYPE (Utilizes "T" –Micro 10BS210– Switch Element)
   Use above procedure to set actuation point on Decreasing Pressure.

   High actuation is adjustable by turning the white plastic knob on the micro-switch. Setting at "A" gives the narrowest differential and at "F" gives the widest differential. Differential settings above "E" are not recommended for maximum repeatability.

Approximate actuation pressure can be determined on most switches by sighting across the top of the hex head to the chart on the bottom of the housing.

WIRING SUGGESTIONS:

1. Most of the switches are Single Pole, Double Throw and may be connected to either make or break on increasing or decreasing pressure. Terminals or leads are marked NC for Normally Closed, NO for Normally Open, and C for Common or ground.
2. Most switches are Micro Switches with screw type terminals. This is the most convenient wiring arrangement but CARE MUST BE EXERCISED to AVOID DAMAGING the SWITCHING ELEMENT!
3. Some switches are provided with leads rather than the screw terminals. All such leads are marked NC, NO and C for your convenience. Leads to specification, as to length and hook up, are available on request.

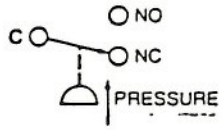
RECOMMENDED SPARE PARTS:

Since the Static "O" Ring Pressure Switch is an instrument constructed of close tolerance components and assembled with dial indicators to assure proper location and movement, it is not considered practical to attempt field repairs. Our experience indicates a very low percentage of repair or parts replacement required. We do not recommend changing parts in the field. If spares are essential we recommend spare pressure switches. The defective instruments should be returned to our factory for a complete over-haul. We have, therefore, no recommended spare parts list.

SCHEMATIC WIRING DIAGRAMS
FOR
Pressure, Vacuum, and Differential Pressure Switches

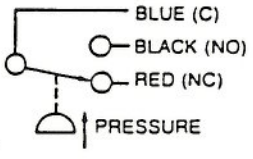
NOTE: The following wiring diagrams are schematic only and are not intended to be physical wiring diagrams. For physical orientation of terminals or wire leads, see the particular Switching Element.

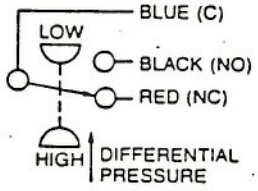
SWITCHING ELEMENTS WITH SCREW TERMINALS

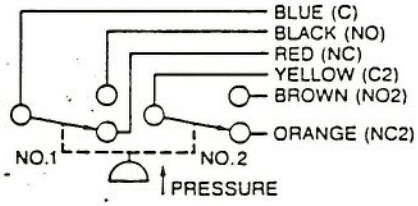


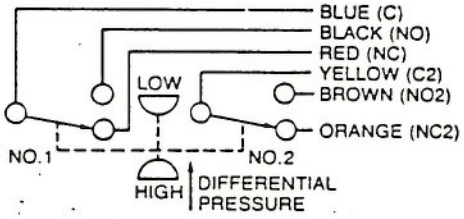
C = Common
NO = Normally Open
NC = Normally Closed

SWITCHING ELEMENTS WITH WIRE LEADS









NOTE: A splice should be made EXTERNAL to the Switch Housing in junction box, wireway, etc., on Pressure or Differential Pressure Switches that have wire leads. DO NOT make splice in Pressure Switch Housing and DO NOT store excess wire in Pressure Switch Housing as this may prevent proper operation of the Pressure Switch.

DO NOT move the wire leads from the electrical hub as installed at the factory on Pressure Switches with multiple electrical hubs and Double Switching Elements. This will affect the overtravel adjustment of the Switching Element and prevent proper operation of the Pressure Switch.

VACUUM SWITCHES

WIRING SCHEMATICS FOR SPDT SWITCHING ELEMENT IN COMPOUND VACUUM-PRESSURE SWITCHES

I. When operating in vacuum range, i.e. when set point is calibrated to vacuum, use wiring schematic Fig 1.

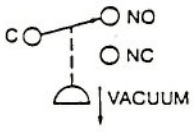
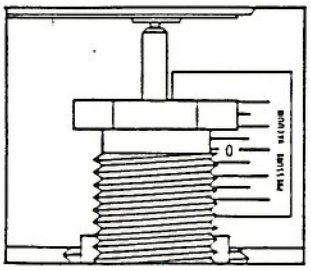


Fig. 1



II. When operating in positive pressure range, i.e. when set point is calibrated to positive gauge pressure, use wiring schematic Fig 2.

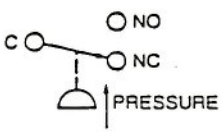
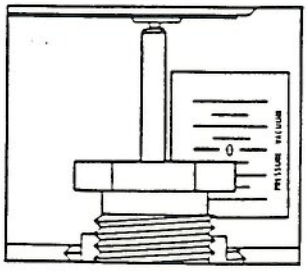


Fig. 2

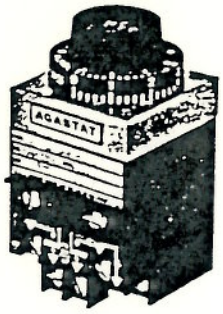


SDR INC
CONTROL DEVICES
P.O. Box 591
11705 Blackbob Road
Olathe, Kansas 66061
913/764-2630 The Greater Kansas City Area

Represented by:

AGASTAT®

7000 Series timing relay
Models 7012, 7022, 7032
INSTALLATION AND OPERATION



Every AGASTAT timing relay is a precise timing instrument which balances pneumatic, electrical and mechanical forces in a unique design using a minimum of moving parts. Its accuracy and performance to specifications have been carefully tested before shipment. Properly applied, it offers exceptional life expectancy. A few minutes spent in familiarizing yourself with these instructions will help you get the best possible service from this unit in your application.

Because of the skilled calibration and adjustment required on certain components prior to final assembly, we recommend that field servicing be limited to the replacement of the switchblock and coil assemblies, listed below. These have been designed to insure factory-built performance after field servicing without elaborate calibration. In cases where damage or abuse make it impossible to restore satisfactory performance by replacing these assemblies, the unit should be returned to the factory for repair or replacement.

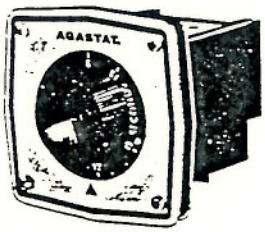
MOUNTING INSTRUCTIONS

A. VERTICAL

Normal mounting for the basic 7000 Series unit is in a vertical position, from the back of the panel. Four 8-32 tapped holes are provided in the back plate, making it interchangeable with earlier models. Mounting screws should not project more than 5/32" into the back of the unit, to prevent internal damage.

A bracket for mounting the unit from the front, and the screws required to attach it to the relay are also supplied with each unit. The bracket extends approximately 3/8" from each side of the unit.

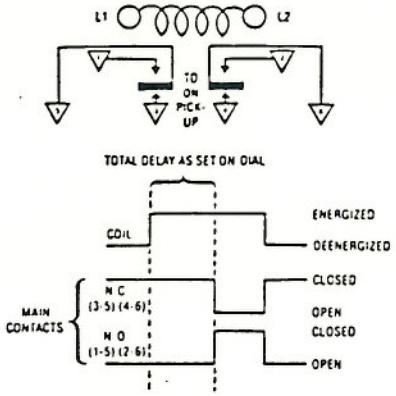
B. HORIZONTAL/PANELMOUNT



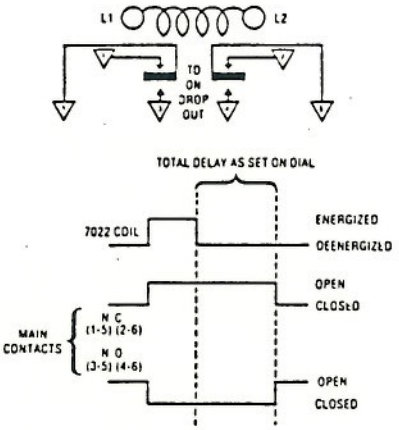
All basic 7000 Series units may be mounted horizontally. However, a dial calibration error (as much as 32% in some units) will result unless the timer is factory equipped with horizontal operation option X or Y1. A unit factory equipped with ...al-horizontal operation option Y2 will require ...emoval of the Position Compensation Spring in order to maintain accurate calibration. This spring may be removed after the removal of the plastic dust cover, which is fastened to the bottom of the timer with two screws. The dust cover must be replaced after removing the spring.

If the Panel Mounting Kit (option X) is added in the field to units not factory equipped with options Y1 or Y2, an error in dial calibration will result.

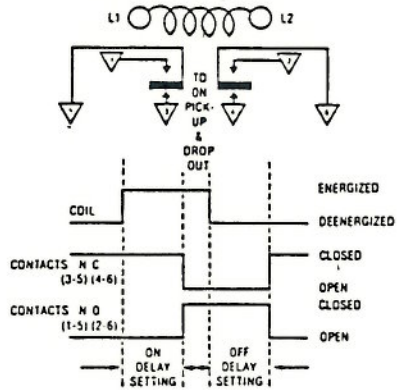
On-Delay Models, 7012
(Delay on pick-up)



Off-Delay Models, 7022
(Delay on drop-out)



On-Delay, Off-Delay Models, 7032
(Double Head)



LINEAR TIMING RANGES

Time Range Code	Models 7012, 7022	*Model 7032
A	.1 to .1 Sec.	.2 to 2 Sec.
B	.5 to 5 Sec.	.7 to 7 Sec.
C	1.5 to 15 Sec.	2 to 20 Sec.
D	5 to 50 Sec.	10 to 100 Sec.
E	20 to 200 Sec.	30 to 300 Sec.
F	1 to 10 Min.	1.5 to 15 Min.
H	3 to 30 Min.	3 to 30 Min.
I	6 to 60 Min.	Not avail.
J	3 to 120 Cyc.	Not avail.
K	1 to 300 Sec.	Not avail.

Basic models are furnished with dials calibrated in linear increments covering the range selected. In addition, time-calibrated ranges B through K provide non-linear adjustment from .2 second to the beginning of the linear zone. For easiest adjustment and lowest cost, the shortest time range suitable for the application should be selected.

*Model 7032 is available with letter calibrated dials only. The upper end of the time ranges in this model may be twice the values shown.

AC

Coil Part Number	Code Letter	Rated Voltage @ 60 Hz	Operating Voltage Range @ 60 Hz	Rated Voltage @ 50 Hz	Operating Voltage Range @ 50 Hz
7000—	A	120	102-132	110	93.5-121
	B	240	204-264	220	187-242
	C	480	408-528		
	D	550	468-605		
	E	24	20.5-26.5		
	F			127	108-140
	G			240	204-264
	H	12	10.2-13.2		
	I	6	5.1-6.6		
	J	208	178-229		
	K	DUAL VOLTAGE COIL (COMBINES A & B)			

AC SPECIALS L1, L2, etc.

A C Coils (Part No. = 7000 followed by dash and code letter above.)

DC

Coil Part Number	Code Letter	Rated Voltage	Operating Voltage Range DC
7010—	M	28	22.5-33.5
	N	48	38.5-57.5
	O	24	19.2-28.8
	P	125	100-150
	Q	12	9.6-14.4
	R	60	48-74
	S	250	200-300
	T	550	440-660
	U	16	12.8-19.2
	V	32	25.6-38.4
	W	96	76.8-115
	Y	6	4.8-7.2
	Z	220	176-264

DC SPECIALS X1, X2, etc.

D C Coils (Part No. = 7010 followed by dash and code letter above.)

All units draw approximately 8 watts power at rated voltage.

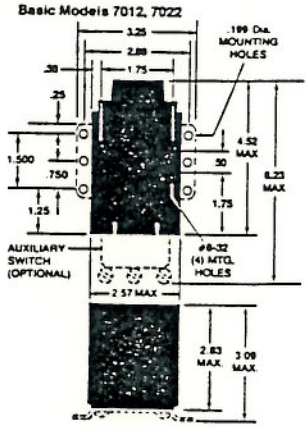
Minimum operating voltages are based on vertically mounted 7012 (on-delay) units. 7012 horizontally mounted or 7022 (off-delay) vertically or horizontally mounted units will operate satisfactorily at minimum voltages approximately 5% lower than those listed.

A C units drop out at approximately 50% of rated voltage. D C units drop out at approximately 10% of rated voltage.

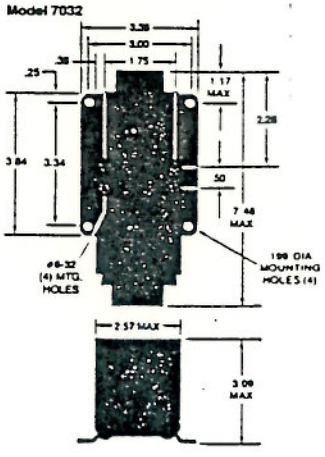
All units may be operated on intermittent duty cycle at voltages 10% above the listed maximums. (Intermittent duty — maximum 50% duty cycle and 30 minutes "on" time.)

Dimensions

Basic Models 7012, 7022

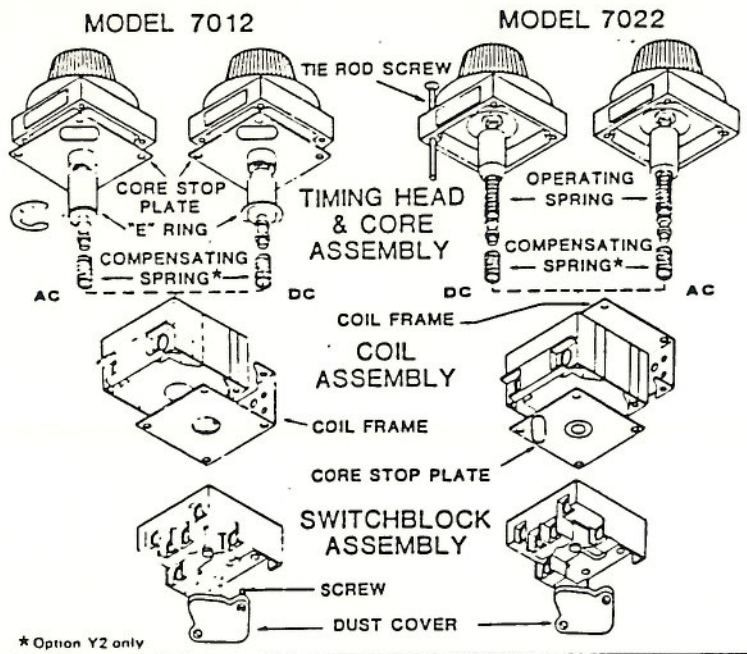


Model 7032



REPLACING SWITCHBLOCK AND COIL ASSEMBLIES — MODEL 7012 AND 7022

Switchblock assemblies are universally interchangeable between all standard 7000 Series units. The same assembly is used for A C and D C models for delay on pull-in or delay on dropout service. Neither timing head/core assembly nor coil assembly is interchangeable between A C and D C models.



AUXILIARY SWITCH ADJUSTMENT

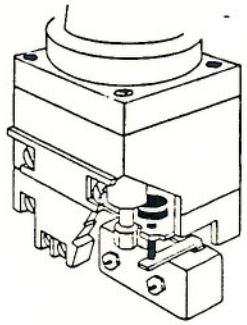
MODEL 7012

(INSTANT TRANSFER AUX. SWITCH)
(CODE L OR CODE LL)

Aux. switch should transfer immediately when relay coil is energized, and should reset shortly before solenoid core returns to its normal position, following deenergization. If it fails to reset before end of core's downward stroke, loosen screw in slotted hole of mounting bracket and move switch closer to terminal block.

TWO STEP AUX. SWITCH (CODE T)

Aux. switch contacts should transfer following first delay period after coil energization, and should reset shortly before core returns to its normal position, following coil deenergization. To increase first delay period, increase the distance between actuator screw head and arm by turning it clockwise, using 1/4" open end wrench.*



CODE L & LL

MODEL 7022

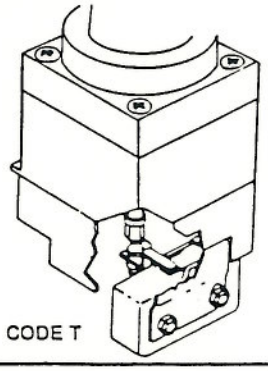
INSTANT TRANSFER AUX. SWITCH
(CODE T)

Aux. switch should transfer immediately when relay coil is energized, and should reset shortly before spindle returns to its normal position, following deenergization. To increase aux. switch delay period, increase the distance between actuator screw head and arm by turning it clockwise, using 1/4" open end wrench.

TWO STEP AUX. SWITCH (CODE T)

Check operation as for Instant Transfer, above. Increase first delay period by turning actuator screw clockwise until the desired delay before aux. switch transfer is reached.

*First delay is independently adjustable, but must be no more than 30% of overall delay. (Recommended max. 100 sec.)



CODE T

CONTACT RATINGS

Contact Capacity in Amperes (Resistive Loads)

Contact Voltage	Min. 100,000 Operations	Min. 1,000,000 Operations
30 vdc	15.0	7.0
110 vdc	1.0	0.5
120 v 60 Hz	20.0	15.0
240 v 60 Hz	20.0	15.0
480 v 60 Hz	12.0	10.0

Contact Ratings are listed under the UL Component Recognition Program for 100,000 operations:

10 Amps Resistive, 240 VAC
¼ Horsepower, 120 VAC/240 VAC
15 Amps, 30 VDC
5 Amps., General Purpose, 600 VAC
} Per Pole

REPLACEMENT ASSEMBLIES

	Part No.
AC Coil Assembly	7000-*
DC Coil Assembly	7010-*
Switchblock Assembly	700030
Auxiliary Switch Kit (Code L)	700047
Auxiliary Switch Kit (Code T)	700121
Auxiliary Switch Kit (Code LL)	700048

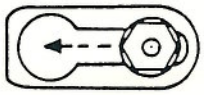
*Specify voltage with code letter.

REMOVING SWITCHBLOCK

(Before disassembling unit: Slice decal on right side of unit with razor blade between switchblock and coil assembly.)

1. Remove four tie rod screws.
2. Hold timing head and coil assembly in one hand, switchblock in the other.
3. Slide switchblock 1/2" forward of coil assembly to center spindle in large end of keyhole slot in switch blade. (See diagram A).
4. Slowly lift timing head and coil assembly off switchblock, being careful to keep spindle collar away from switchblade while withdrawing it.

REVERSE THIS PROCEDURE TO INSTALL NEW SWITCHBLOCK



A

REMOVING COIL

Follow steps 1 to 4 above, then:

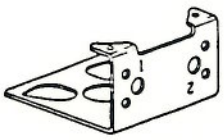
5. Remove timing head and core assembly. (On Model 7022 units the core stop plate and operating spring are loose pieces, located below the core rather than attached to the timing head and core assembly, as on the Model 7012 units. These two pieces should be removed before removing the coil frame, to prevent loss of the loose spring.)

   7012 models require removal of "E" ring from core to permit removing core from coil.

6. Slide off coil frame.

When installing new coil, be sure to replace coil frame with proper side up. Number "1" on back of frame should be up on 7012 (Delay on Pull-in) Models, Number "2" should be up on 7022 (Delay on Drop-out) Models. See Diagram B.

On 7012 models, replace "E" ring in core slot after assembling coil frame to coil.



B

WARRANTY

The AGASTAT timing relay is warranted against mechanical and electrical defects for a period of one year from date of shipment from factory if it has been installed and used in accordance with factory recommendations. New parts will be furnished free of charge in exchange for parts which have proven defective. The furnishing of these parts shall constitute fulfillment of the Company's obligations and liabilities.

FOR REPAIR SERVICE

Return defective units to:
CONTROL PRODUCTS DIVISION
AMERACE CORPORATION
1000 Hickory Street
Grafton, Wisconsin 53024

ATTENTION: Product Service Department

CONTROL PRODUCTS DIVISION
Amerace Corporation
Control Products Division
2330 Vauxhall Road
Union, New Jersey 07083

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Catalog Section A
Series A19
Bulletin No. 3530-F
Supersedes 3530-E, 3830-B

JOHNSON CONTROLS

Johnson Controls, Inc.
Control Products Division

1250 East Diehl Road
Naperville, IL 60540

Types A19ANC, A19ANF General Purpose Industrial Thermostats With Rainproof Enclosure

Applications

The A19ANC and A19ANF thermostats are designed for a variety of applications where rainproof enclosures are necessary or desirable. A typical use is to control the temperature of fluid conveyed through pipes (commonly termed pipe tracing). An alarm or signal circuit can be operated by the auxiliary contacts. (See Fig. 2.)

All Series A19 thermostats are designed for use only as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) that protect against, or systems (alarm, supervisory systems) that warn of control failure.

Features

—Rainproof gasketed enclosure has gray U.L. listed outdoor finish.

—Liquid-filled element is unaffected by barometric pressure and cross ambient temperatures.

—Dependable field proved snap-acting contacts have heavy duty rating for inductive or resistance loads. The A19ANC has a pilot rating to 600 VAC.

—Wide choice of range options.

—Simple strain-free mounting on three rubber cushioned mounting feet.

—High temperature dial stop.

—Copper bulb well available.

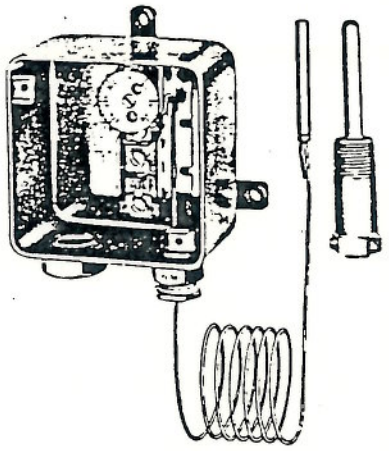

Fig. 1—Interior of an A19ANC thermostat.

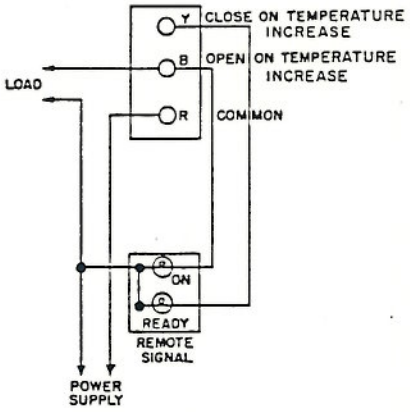

Fig. 2—Wiring diagram showing remote signal.

Specifications

Type Number	A19ANC	SPDT Contact Action, Standard Differential
	A19ANF	SPDT Contact Action, Close Differential
Range and Maximum Temperature		See Selection Chart
Differential*	A19ANC	6 F° (3.3 C°)
	A19ANF	2 F° (1.1 C°)
Capillary		.062" O.D., Standard Length is 10' (3 m)
Enclosure		Rainproof with Gasketed Cover (NEMA 3R)
Finish		U.L. Listed Outdoor Gray Enamel
Material		.062" (1.6 mm) Cold Drawn Steel
Contact Unit		Snap-Acting Contacts in Dust Protected Enclosure
Conduit Opening		Welded 3/4" Female Connector
Wiring Connections		Screw Type Terminals
Mounting		Three Rubber Cushioned Mounting Feet
Shipping Weight		2.3 Lb (1.0 kg)

*Differential is based on direct bulb immersion in liquid at 1 F° per minute rate of change. In a bulb well, the differential will widen. When the bulb is clamped to a surface such as a pipe, the differential may be wider or narrower depending on several variables.

General Description

The thermostats have an enclosed SPDT contact unit. The red terminal is common. When the red and blue terminals are wired, the circuit opens on a temperature increase (See Fig. 3) and when the red and yellow terminals are wired, the circuit closes on a temperature increase.

The thermostats have an adjustable high temperature stop.

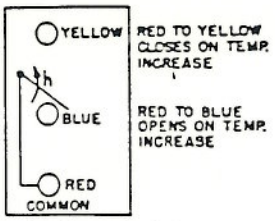

Fig. 3—Terminal Arrangement.

A special wrench (Part 836-61) required to adjust the keyed stop is provided with each thermostat.

Optional Constructions

Sensing Elements

Standard capillary length is 10 feet (3 m). Other lengths are available at extra cost, consult Customer Service.

Bulb Well

Copper bulb wells with a 1/2" NPT brass connector can be supplied when required, at extra cost. See "Specifications Table" for Part Numbers. For special applications requiring a connector made with a different metallic material, contact Customer Service for the availability of these bulb wells.

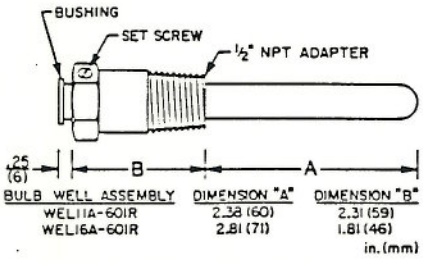

Fig. 4—Bulb wells and dimensions.

Ordering Information

To order specify Product Number. If Product Number is not known, specify the following:

1. Type Number.
2. Range required.
3. Capillary length if other than 10 feet (consult Customer Service).
4. Bulb well, if required.

Product Selection Chart

Product Number	Range °F (°C)	Maximum Allowable Temp. °F (°C)	Bulb Size	Bulb Well (If Required)
A19ANC-1	0 to 150 (-18 to 66)	190 (88)	0.290 × 2½"	WEL11A-601R
A19ANC-2	100 to 250 (38 to 121)	290 (143)	0.290 × 2½"	WEL11A-601R
A19ANC-3	200 to 350 (93 to 177)	390 (199)	0.366 × 2¼"	WEL16A-601R
A19ANC-4	325 to 475 (163 to 246)	515 (268)	0.366 × 2¼"	WEL16A-601R
A19ANF-3	20 to 90 (-6.7 to 32)	130 (54)	0.366 × 2⅞"	WEL16A-601R

Installation

CAUTION: To prevent possible electrical shock or damage to the equipment, disconnect the power supply before wiring and mounting connections are made.

CAUTION: Do not dent or deform the sensitive bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting.

Note: Use terminal screws furnished (8-32 × 1/4" binder head). Substitution of other screws may cause problems in making proper connections. Make all wiring connections using copper conductors only, and in accordance with the National Electrical Code and local regulations.

Indoors, the thermostat may be mounted in any position by means of three mounting feet (rubber bushed). When the thermostat will be exposed directly to the outdoor weather, the electrical connection and capillary should be mounted with the fittings facing downward as illustrated in Fig. 1.

Where the capillary is exposed and subject to possible mechanical damage some means of protection should be provided. The capillary outlet is designed to permit the capillary to be run through 1/2" thin wall conduit or through metal hose such as 3/8" Anaconda "Sealtite" or equivalent. Remove the capillary outlet seal nut. (See Fig. 5.) Push the bulb and capillary through a conduit coupling or suitable hose fitting and on through the conduit or hose. By tightening the coupling to the 1/2" female capillary outlet fitting, the seal around the capillary will be maintained and the conduit or hose will be rigidly attached to the enclosure. The end of the conduit or hose away from the

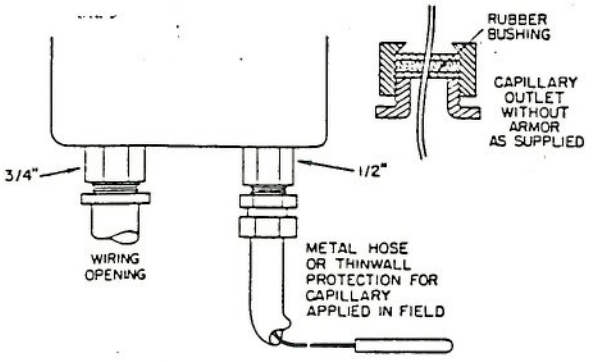

Fig. 5—Typical installation where capillary protection is required.

control should be clamped and bushed and the capillary should be taped to prevent cutting or wear from any sharp edges and any strain on the capillary.

Pilot Lamp Circuits

Remote lights or other types of signal circuits may be connected as shown in Fig. 2. Self contained pilot lamps are not available.

Adjustments

The temperature set point may be changed to meet the requirement of the installation. Remove the cover to change the setting. Using a screwdriver, rotate the dial to the desired set point.

High Temperature Stop

To change the stop setting, loosen the two screws in the dial plate (see Fig. 1) with the wrench packed with the control. Turn the dial so the pointer indicates the stop setting. Move the stop (located behind the dial plate) against the stop bracket. Tighten screws to lock the stop in position.

High cutout stop can be set between 55 F° (31 C)° above the bottom of the range and the top of the range. Example: The high temperature stop can be set between 255° to 350° F (124° to 177° C) on a control with a range of 200° to 350° F (93° to 177° C).

Checkout Procedure

Before leaving the installation, observe at least three complete operating cycles to be sure that all components are functioning correctly.

Repairs and Replacement

Field repairs must not be made except for replacement of the bulb well and cover. For a replacement thermostat, bulb well, or cover, contact the nearest Johnson Controls wholesaler.

Electrical Ratings

A19ANC

Voltage, AC Only		120	208	240
Full Load Amps.		16.0	9.2	8.0
Locked Rotor Amps.		96.0	55.2	48.0
Non-Ind. Amps.	When connected – SPST	22.0	22.0	22.0
	When connected – SPDT	16.0	9.2	8.0
Pilot Duty — 125 VA, 24/600 VAC				

A19ANF

Voltage, AC Only	120	208	240	277
Full Load Amps.	6.0	3.4	3.0	—
Locked Rotor Amps.	36.0	20.4	18.0	—
Non-Inductive Amps.	10.0	10.0	10.0	10.0
Pilot Duty — 125 VA., 24/277 VAC				