

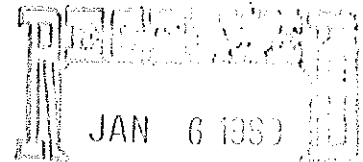
Barber-Colman Company
ENERGY MANAGEMENT GROUP



DATE July 1, 1987

OWNER MANUAL FOR
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TEMPERATURE CONTROLS:	BARBER-COLMAN COMPANY



PROCTOR-DAVIS-RAY

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DEVICE INFORMATION

Identification

Thermostats of this family may be easily identified by referring to the part number located on the carton and on the back and side of the device. Stamped on the back of the device is the date of manufacture (four digits, the first two representing the week of the year and the last two representing the year).

These thermostats are used for proportional control of pneumatically actuated valves, dampers and similar devices in heating, ventilating and air conditioning systems. See Performance table.

Pre-Installation

The thermostats are shipped with mounting screws and three 3/4-inch long copper tubes. Wall fittings must be ordered separately.

Before installation, make a visual inspection of the thermostat carton for obvious signs of damage.

Air Connections: Two plastic tubes reinforced with a coil spring are coded M & B. The M (Black) designates the supply main and the B (White) designates the controlled branch line.

Model TK-1601 has three plastic tubes. The additional tube A (White) designates the auxiliary (two-position) branch line.

INSTALLATION

Requirements

Locate the thermostat where it will be exposed to unrestricted circulation of air which represents the average temperature of the controlled space. Do not locate the thermostat near sources of heat or cold, such as lamps, motors, sunlight, or concealed ducts or pipes. Maximum safe ambient temperature is 150°F.

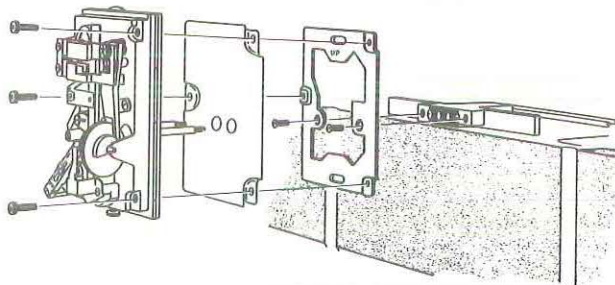
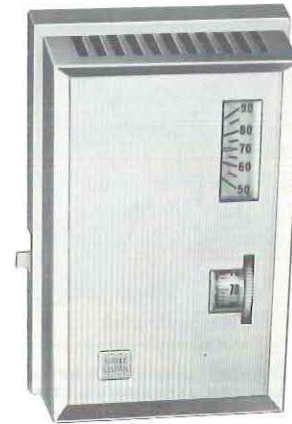


Figure 1. Mounting Thermostat to AT-507 Mortar Joint Fitting



The thermostat fitting is available for either flush or surface mounting. See Figures 1 and 3. The AT-506 and AT-508 (wall box fittings) are for surface mounting on all wall surfaces and flush mounting on plastered or stud walls. The AT-507 is for flush mounting in masonry walls. **Note:** No fitting is available for use for flush mounting in masonry walls when using the TK-1601, an electrical box is used for this application (Figure 2).

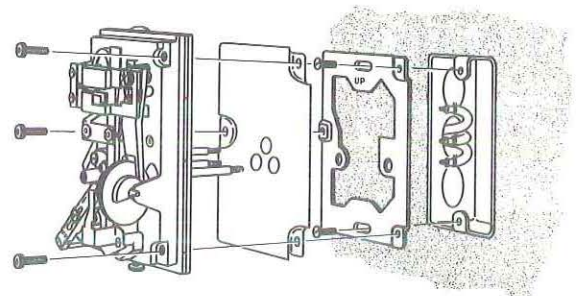


Figure 2. Mounting Thermostat to Electrical Box

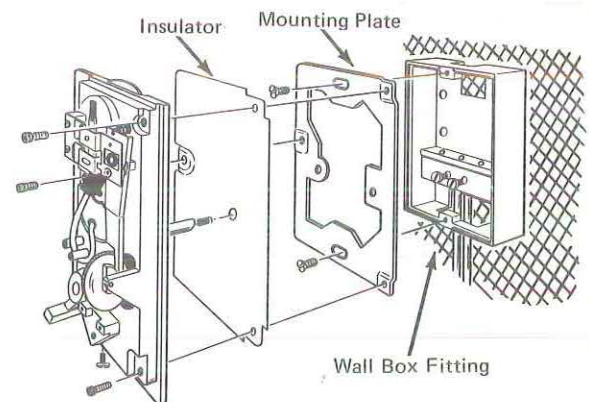


Figure 3. Mounting Thermostat to AT-506 or AT-508 Wall Box Fitting

PERFORMANCE

Part Number	Description and Action*	Dial Range (F)	Factory Setpoint Setting (F)	Throttling Range	Supply Air Pressure (psig)
TK-1001	Heating DA	55.85	75	Adjustable 2-10F°/10 psi Factory Set 4F°/10 psi	15 or 20
TK-1101	RA Cooling				
TK-1201	Heating-Cooling DA - 20 psig RA - 15 psig				15 - RA* 20 - DA*
TK-1301	Day-Night DA				15 - Day 20 - Night
TK-1601	Night - 20 psig Day - 15 psig				

*Direct acting: Increases output pressure on temperature rise
Reverse acting: Decreases output pressure on temperature rise

Air Consumption: .008 scim for sizing air compressor (exception: .024 for TK-1601).

Supply in Pressure: See Performance table.

Air Capacity: 16 scim for sizing air mains (exception: 32 for TK-1601).

Air Connection: 5/32 plastic tubing.

- If the thermostat tubing is too long for easy coiling in the wall box, it can be cut to length. Cut the tubing at a 45° angle, for ease in inserting the tubing into the "O" ring seal. Be sure that the coil spring is cut flush with the tubing.
- Remove and discard the short piece of tubing from the connector head of the wall box.
- Place the fiber board insulator over the tubes on the back of the thermostat.
- Insert the main (black) plastic tubing into the left hand hole in the connector head. Insert the branch line (white) tubing in the right hand hole in the connector. TK-1601 - Insert the auxiliary branch line (A White) in the center hole in the connector. Insert tubes at least 1/4-inch. Do not use any lubricant on the plastic tubing.
- Fasten the thermostat to the mounting plate with the three Allen mounting screws provided. Tighten the screws evenly.

To mount a thermostat on an electrical switch box. When installing a thermostat to an electrical switch box (Figure 2) in a masonry wall, proceed as follows:

- Attach the mounting plate to the switch box with the two flathead screws provided. Be sure the mounting plate is vertical.
- Place the fiber board insulator over the tubes on the back of the thermostat.
- Slightly rotate the tubes back and forth, and push firmly on to the fittings.
- Fasten the thermostat to the mounting plate with the Allen head screws provided and tighten evenly.

See Figure 5 for connection to field tubing.

Application of TK-1301 and TK-1601

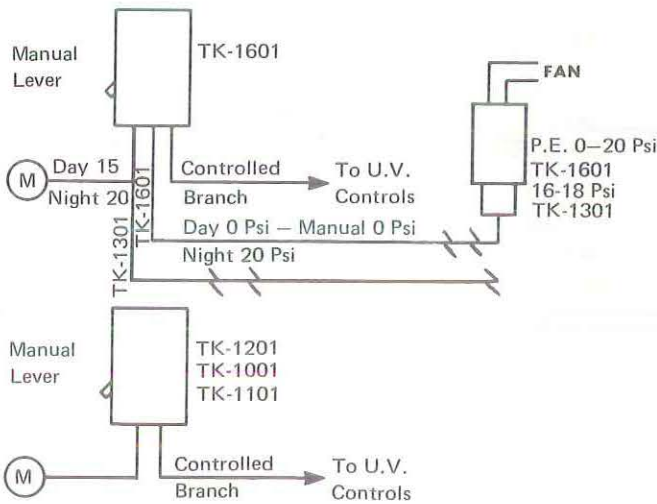


Figure 4

Procedure

To mount a thermostat on a AT-506 and AT-508 wall box fitting, refer to Figure 3:

- Remove and discard the cardboard cover plate on the wall box. (The cardboard cover protects the fitting while the wall is being plastered.)
- Fasten the mounting plate to the wall box with the two flat head screws provided. Make sure it is square with the wall before tightening the screws.

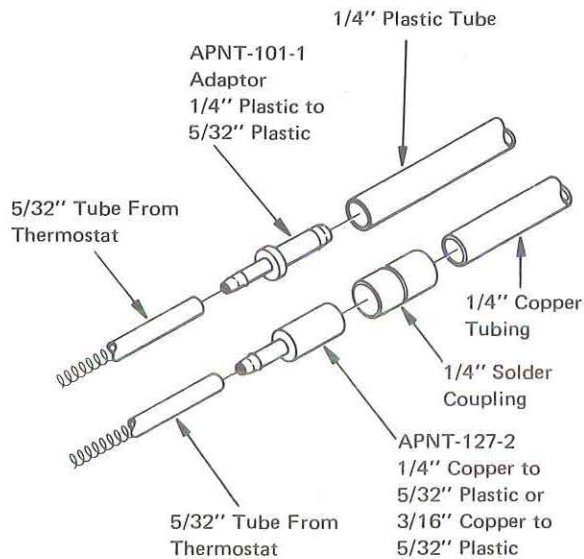


Figure 5

To mount a thermostat on a AT-507 mortar joint fitting (Figure 1) proceed as follows:

1. Remove the screws holding the protector block in place. Pry out and discard the protector block. Pull out and discard the short piece of plastic tubing inserted in the connector head.
2. Attach the thermostat mounting plate to the connector head with the two flathead screws provided. Be sure the mounting plate is vertical.
3. Measure 7/8-inch from the back of the thermostat and cut the tubing at a 45° angle to make the tubing slide into the connector head easily. Remove the coil spring from the tubing and discard.
4. Insert two 3/4-inch lengths of copper tubing, supplied with the thermostat into the plastic tubing to stiffen the plastic tubing so it can be installed easily.
5. Place the fiber board insulator over the tubes on the back of the thermostat.
6. Lubricate the outside of the two plastic tubes (this applies to the mortar joint fitting only) with water or glycerin. Be sure that none of the lubricant gets inside the tubing.
7. Insert the tubes into the connector head. Slightly rotate the tubes back and forth, and push firmly into the sockets at least 1/4-inch.
8. Fasten the thermostat to the mounting plate with Allen screws provided, and tighten evenly.

CHECKOUT

After installing the thermostat, verify proper operation as follows:

1. To check the nozzle and/or restriction, turn the setpoint dial to 85°F. If the thermostat is direct acting, the output pressure will drop. If the thermostat is

reverse acting, the output pressure will rise. Turn the setpoint dial to 55°. If the thermostat is direct acting, the output pressure should rise. If the thermostat is reverse acting, the output pressure will drop.

Note: The amount of rise or drop in the output pressure may vary depending on the ambient temperature in the test area. If output is always 0 psig, the restriction may be plugged. If output is always equal to supply or unable to decrease below 3 psig, the nozzle may be plugged.

2. To check for active thermal element, adjust the setpoint knob to obtain approximately 8 psig branch output. Slightly warm the element with your hand or breath. A direct acting thermostat will increase output pressure. A reverse acting thermostat will decrease output pressure. If the thermostat fails to function properly, refer to **REPAIR**.

RUN/ADJUST

Theory of Operation

These thermostats are piloted relay devices incorporating an internal pneumatic feedback principle which permits the use of low mass bimetal and minimum leak from the nozzle-restriction side of the circuit. This provides maximum sensitivity with minimum air consumption. Operation may be understood by referring to the schematic diagram in Figure 6.

The supply air pressure (1) is channeled from the main chamber through the restriction (2) into the nozzle (3).

The nozzle-restriction combination controls the pressure to the pilot diaphragm of the pneumatic relay. The bimetal positions the nozzle lever over the nozzle to regulate the pressure in the pilot chamber. The force exerted against the pilot diaphragm (4) actuates the relay part of the system.

The relay is operated by the pressure on the pilot diaphragm as follows:

An increase in pressure on the pilot chamber diaphragm (4) overcomes the preload force on the pilot diaphragm spring (5), the main valve plug spring (6) and the air pressure on the plug (7), to move the supply main valve plus off its seat. Supply air pressure then flows into the branch chamber (8). The resulting pressure change is transmitted to the feedback chamber (9), where it exerts a force on the feedback plunger (10), moving it up. The force is transmitted to the nozzle lever through the feedback levers (11 and 12) and spring (13) to balance the force exerted by the bimetal. This action provides a linear relationship between temperature at the bimetal and branch line pressure.

A reduction in pressure on the pilot diaphragm allows the diaphragm to move away from contact with the bleed valve seat (14). The bleed valve seat then moves off the main valve plug and allows air from the branch chamber to bleed through the bleed valve and out to atmosphere through exhaust port (15). This reduces the force in the feedback chamber until it is balanced by the reduced bimetal force.

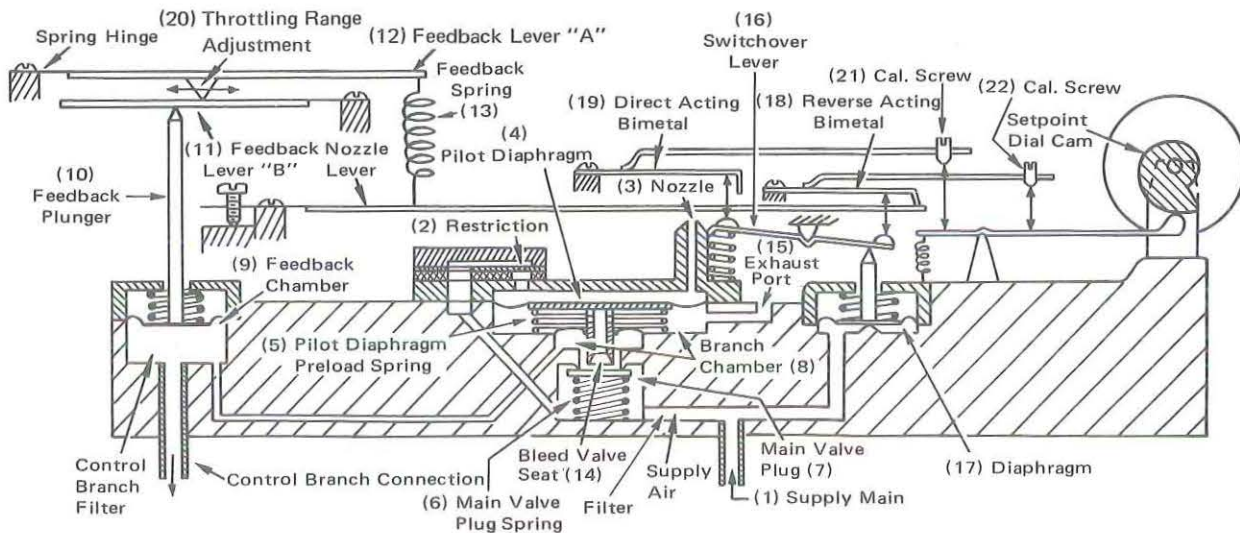


Figure 6

At that point the pilot chamber pressure is just adequate to cause the bleed valve to seat on the main valve plug and stop flow of air out of the branch.

Changeover: In the thermostat, two bimetals are mounted on the bimetal bracket. On TK-1201, one bimetal is direct acting and the other is reverse acting. On the TK-1301 and TK-1601, both are direct acting. The bimetal which is in control of the thermostat is determined by the position of the switchover lever (16). The position of the switchover lever is determined by a spring-loaded diaphragm (17), which is actuated by the supply main pressure. When the pressure is 15 psig, the piston is at the bottom of its stroke. At this position, the bimetal (18) rests on the nozzle lever and the bimetal (19) is raised off the nozzle lever by the change-over lever. When the main pressure is changed to 20 psig, the diaphragm overcomes the spring force and moves the piston to its upper limit, moving the over lever to allow the bimetal (19) to rest on the nozzle lever and lift the bimetal (18) off the nozzle lever.

Adjustments

Throttling Range: The throttling range is set at 4F° per 10 psi control pressure change. It should be set at the lowest value which will allow the thermostat to control the system without cycling under normal load conditions. The most satisfactory setting will vary with the type of system being controlled.

If the throttling range of the thermostat as shipped is not satisfactory, proceed as follows:

1. Measure temperature at sensing element. This should be a stable temperature.
2. Rotate setpoint dial to this temperature.
3. With 15 psig supplied to thermostat, adjust calibration screw until 3 psig is read on branch test gauge.

4. Rotate the setpoint dial in a direction which raises the output until 13 psig is read on the branch gauge.
5. The difference between the setpoint dial readings in Step 2 and 4 is the throttling range of the thermostat.
6. If the throttling range in Step 5 is not that desired, move the throttling range slider (Figure 7) in the appropriate direction and repeat Steps 2 through 5 until the desired throttling range is obtained.

The calibration of the thermostat should be checked after the throttling range has been changed.

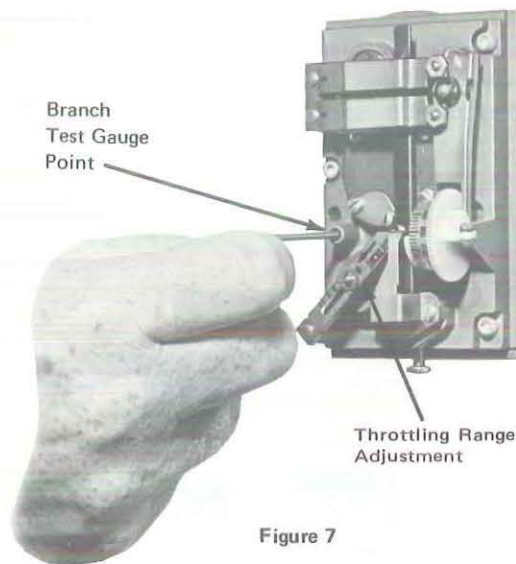


Figure 7

Calibration: As a nominal calibration, the branch line control pressure should be 8 psig when the setpoint is equal to the room temperature indicated by an accurate thermometer. On some applications, a value other than 8 psig will be required to get the desired control results. In this case, change the 8 psig designation used in the calibration procedure.

x
x CAUTION x

The thermal element of the room thermostat is very sensitive to temperature change. Do not affect its temperature by touching the bimetal or breathing on the thermostat. When calibrating the instrument, observe the room temperature frequently and reset the setpoint dial if required.

x x

1. Remove the thermostat cover by loosening the cover screw.
2. Using a 5/64-inch Allen wrench, unscrew (counterclockwise rotation) the test point screw one full turn (Figure 7).
3. Attach the test gauge rubber seal to the boss, as shown. Using a rotary motion, push the gauge on as far as it will go (1/4-inch minimum). See Figure 8. The tubing will support the test gauge in a position where it will be easily read. The supply pressure to the thermostat should be 15 psig.
4. Adjust the setpoint dial to the room temperature as indicated on the test thermometer.
5. With a .048-inch six spline wrench, turn the calibration screw (Figure 9) clockwise if the controlled pressure is above 8 psig and counterclockwise if it is below 8 psig. Adjust the screw until the controlled pressure is 8 ± 1 psi.

Note: The hex nuts on the calibration screws are tension devices only. They should not be loosened to make an adjustment.

The TK-1001, and TK-1101 thermostats are now calibrated. Proceed to Step 4 below. Bimetal (18) on TK-1201, 1301 and 1601 is also calibrated. To calibrate bimetal (19) proceed as follows using a special tool AL-80 or a small screwdriver.

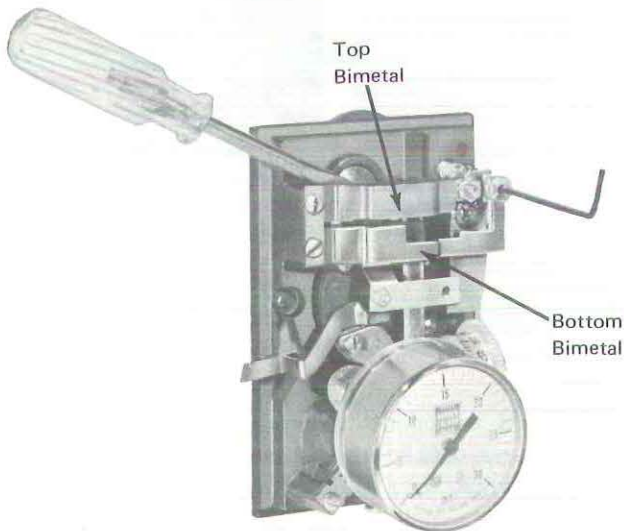


Figure 8

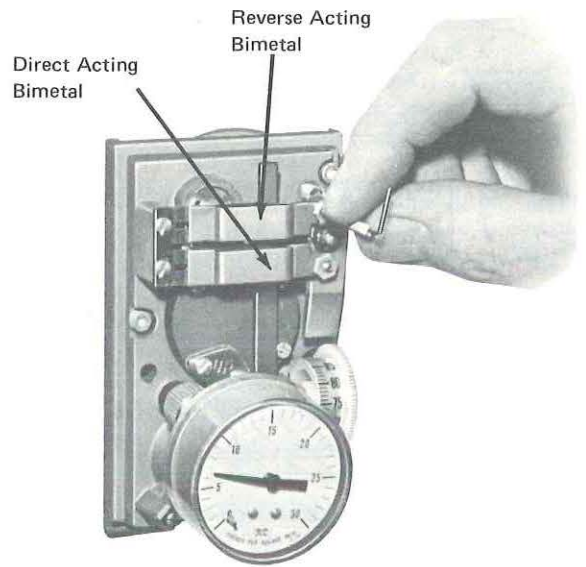


Figure 9

1. Insert the blade of the tool or screwdriver between the switchover plunger and the switchover lever shown in Figure 8. The top (18) bimetal should be approximately 1/32-inch off the lever and the bottom (19) bimetal should be in contact with the lever.
2. With a .048-inch six spline wrench, turn the calibration screw clockwise if the controlled pressure is above 8 psig and counterclockwise if the controlled pressure is below 8 psig. Adjust the screw until the pressure is ± 1 psi.
3. Manually switch the thermostat several times by removing and reinserting the AL-80 or screwdriver and observing the branch line pressure. If it varies beyond the limits, repeat the calibration.
4. Remove the test gauge.
5. Turn the test point screw clockwise to tighten.
6. Replace cover.

MAINTENANCE

The pneumatic thermostat requires no routine maintenance.

REPAIR

Field repair of pneumatic thermostats is not recommended. However, if the thermostat output pressure is 0 and it cannot be corrected by calibration, the restriction should be checked. Hold the restriction plate up to the light and check the .0075 hole. If the hole is blocked, the restriction plate must be replaced. The filter should be replaced at the same time. If the hole is not blocked, then the thermostat should be replaced.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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General Instructions

TK-2001, TK-2012, TK-2201,
TK-3001, TK-3201, TK-4001,
TK-4012, TK-4212, TK-4212-201,
Pneumatic Bulb Thermostats

For proportional temperature control of pneumatic valves and actuators to maintain discharge temperature of reheat systems and sampling chamber or return air temperature of terminal units and as a proportional low limit thermostat.

General Information

Proportional control type of pneumatic instrument, using balanced lever system actuated by a liquid-filled thermal copper element with a 3' (914 mm) capillary.

Maximum Safe Air Pressure: 30 psig (207 kPa).

Maximum Safe Case Temperature: 140°F (60°C).

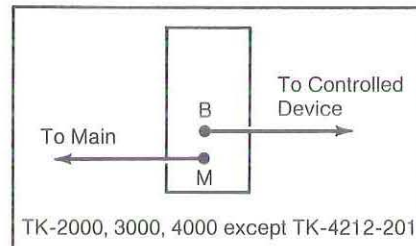
Mounting: Directly by means of top mounting holes or with a right angle mounting bracket included with thermostat.

Air Connections: Post with barb for 1/4" O.D. plastic tubing.

Air Consumption for Sizing Air Compressor: .016 SCFM (8 ml/s) @ 15 psig (103 kPa), .024 SCFM (11 ml/s) @ 20 psig (138 kPa).

Air Capacity for Sizing Air Mains: 36 SCIM (10 ml/s) @ 15 psig (103 kPa), 50 SCIM (14 ml/s) @ 20 psig (138 kPa).

Dimensions: 4-5/8" (117 mm) high x 2-1/8" (54 mm) wide x 1-5/8" (41 mm) deep.



Options: None.

Accessories:

AT-208 Duct mounting kit

Tool-95 Pneumatic calibration tool kit

Part Number	Description and Action* psi (kPa)	Max. Safe Bulb Temp. °F (°C)	Bulb Style Dimensions in Inches (mm)	Control Dial Range °F (°C)	Throttling Range	Supply Air Pressure psig (kPa)		
TK-2001	Heating DA**	140 (60)	Straight 7/32 x 14 (6 x 356)	Dial Marked Cooler- Warmer 60-90 (15-32)	Adjustable 2-10°F (1-6°C)/ 10 psi (69 kPa) Factory Set 4°F (2°C)/ 10 psi (69 kPa)	15 (103)		
TK-3001			Coiled 1 x 5 (25 x 127)					
TK-4001			Averaging 1/8 x 48 (3 x 1.2 m)					
TK-2201	Heating- Cooling 20 (138) DA 15 (103) RA		Straight 7/32 x 14 (6 x 356)			Dial Marked Cooler- Warmer 30-90 (-1 to 32)	Adjustable 5-25°F (3-14°C)/ 10 psi (69 kPa) Factory Set 10°F (6°C)/ 10 psi (69 kPa)	15 (103) RA* Cooling 20 (138) DA* Heating
TK-3201			Coiled 1 x 5 (25 x 127)					
TK-2012	Heating DA**		Straight 3/16 x 11-1/4 (5 x 286)					
TK-4012			Averaging 3/32 x 54 (2 x 1.4 m)					
TK-4212	Heating- Cooling 20 (138) DA 15 (103) RA	230 (110)	Averaging 3/32 x 54 (2 x 1.4 m)					
TK-4212-201			Averaging 3/32 x 54 (2 x 1.4 m)	15 (103) RA* Cooling 20 (138) DA* Heating				
	Heating- Cooling Low Limit† 20 (138) DA Full Output 15 (103)					15 (103) Full Output 20 (138) DA* Heating		

*Direct Acting (DA) — Increase output pressure on temp. rise.

Reverse Acting (RA) — Decrease output pressure on temp. rise.

**Field changeable to reverse acting.

†At 20 psi (138 kPa) unit can bleed down a branch line from a controlling thermostat.

At 15 psi (103 kPa) unit is inoperative, i.e., passes controlling thermostat signal.

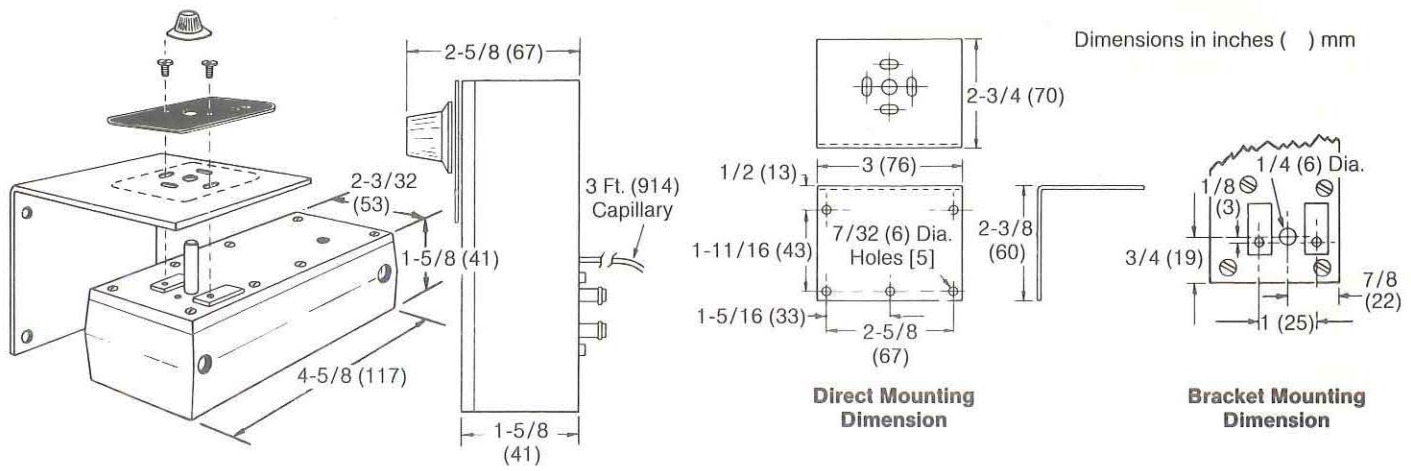


Figure 1. Mounting Dimensions

INSTALLATION

Locating

The thermostat can be mounted in any position. However, it is most common to mount the thermostat with the setpoint adjusting shaft on top. The adjusting mechanism is in the thermostat on the side opposite from the setpoint knob shaft. This area should be readily accessible so that the thermostat can be serviced easily. Locate the bulb in the return air intake in a position where it will sense representative air temperatures.

Mounting

If the thermostat is mounted directly to the unit air conditioner, drill three holes corresponding to the location of the mounting holes and setpoint shaft in the thermostat. To use bracket, drill three holes to match any three of the five bracket mounting holes selected (Figure 1).

Mount the thermostat using the two #10-32 screws, and the scale plate which indicates the temperature setting. Attach the knob, positioned so that the pointer indicates the cooler (CCW) position on the scale. Rotate setpoint to midscale.

Uncoil the capillary tubing and fasten the bulb in the air stream being controlled as shown in Figures 2 and 3 below. (See Figures 7 and 8 for duct mounting template and assembly.)

Attach 1/4" O.D. plastic tube to "M" (main) and "B" (branch) fittings by slightly rotating the tubes back and forth and pushing firmly onto the fitting (see Figure 4.)

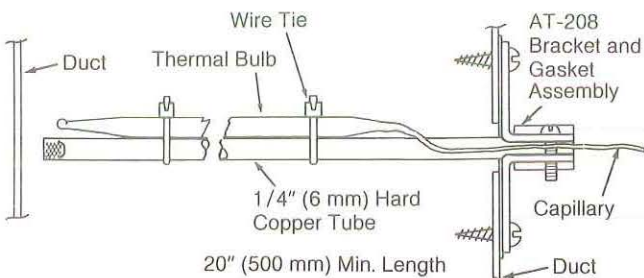


Figure 2. Mounting TK-2000 Series Bulb

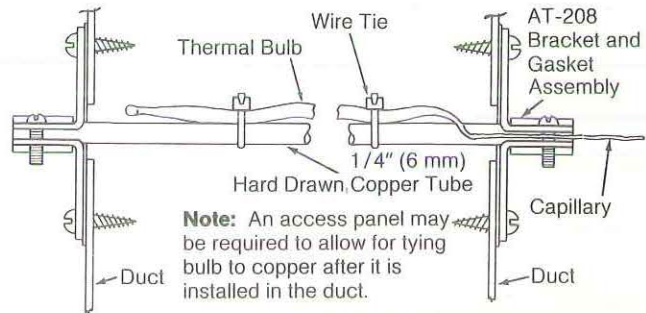


Figure 3. Mounting TK-4000 Series Bulb

CONVERSION OF DIRECT ACTING THERMOSTAT TO REVERSE ACTING

1. Remove direct acting calibration screw complete with tension nut (Figure 4).
2. Insert screw into threaded hole where reverse acting screw is shown in Figure 4.
3. Tighten tension nut carefully until it is snug.

CAUTION

DO NOT overtighten as this will ruin nut.

4. Calibrate per instructions shown below.

Reverse Acting Calibration Screw (Requires .048" Bristle Wrench or Tool-82)	Direct Acting Calibration Screw (Requires .048" Bristle Wrench or Tool-82)	Throttling Range Adjustment
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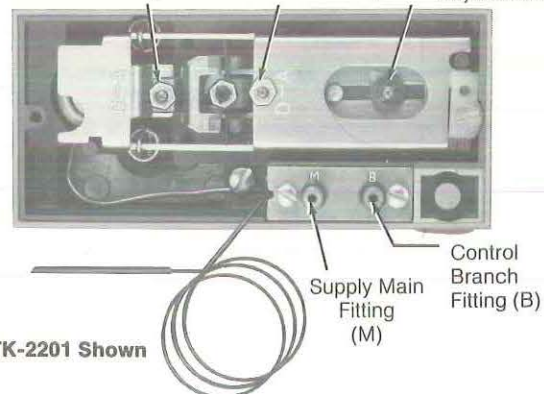


Figure 4.

THROTTLING RANGE ADJUSTMENT

The throttling range should be set at the lowest value which will allow the thermostat to control the system without cycling under normal load conditions. The most satisfactory setting will vary with the type of control system.

The throttling range is changed by sliding the throttling range adjustment pivot in the flapper to its proper position (see Figure 4). Calibration of the thermostat should be checked after the throttling range has been changed. When making the throttling range adjustment, care should be taken to prevent excessive side forces on the flapper lever (see Figure 6).

CAUTION

In no case should the pivot point be raised when the adjustment is made (see Figure 6).

CALIBRATION

After the throttling range adjustment is made, the thermostat should be checked for calibration. As a nominal calibration, the controlled branch pressure should be 8 psig (55 kPa) when the setpoint is equal to the bulb temperature, indicated by a thermometer located near the bulb. In some applications, a value other than 8 psig (55 kPa) will be required to get the desired control results. Change the 8 psig (55 kPa) designation as used in the calibration procedure, should this be the case.

Calibrate the thermostat as follows (See Figure 5):

Disconnect the branch line at the thermostat and attach a test gauge to the fitting (B). Push the tubing on as far as it will go, approximately 1/4" (6 mm). The tubing for this test gauge should be approximately 6" (150 mm) long to permit bringing the gauge out from the test point to a place where it can be easily read. The supply pressure to the thermostat should be 15 psig (103 kPa).

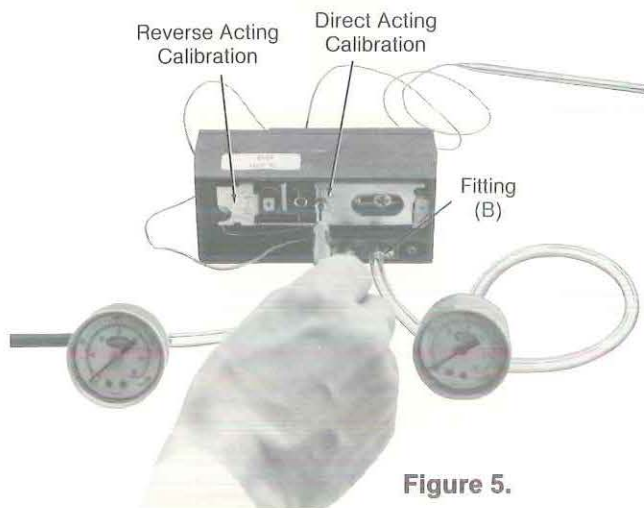


Figure 5.

One Temperature Thermostats

These thermostats are factory adjusted to operate at the mid-point of the dial span, when the adjusting dial is in its mid-position. Whenever the throttling range is changed, the thermostat calibration should be checked and adjusted if necessary as follows:

1. The scale on the thermostat represents 30°F (17°C) or 60°F (33°C) span (see page 1) with the desired control point in the center. Each division is equal to 5°F (3°C) for 30°F (17°C) span units and 10°F (6°C) for 60°F (33°C) span units.

2. Observe the temperature of the bulb using a test thermometer. Turn the knob of the thermostat to the point on the scale which would correspond to the bulb temperature. Read the branch line pressure. It should be 8 psig \pm 1 psig (55 kPa \pm 7 kPa).
3. If the pressure is not 8 psig (55 kPa) use a .048" Bristol wrench (Tool-82) in the calibrating screw and adjust the screw to obtain 8 psig (55 kPa). The proper screw holes for the reverse acting or direct acting calibration are labeled on the main lever (Figure 5).

CAUTION

Care should be taken when adjusting the reverse acting setpoint screw. Avoid unnecessary side motions and particularly avoid lifting the lever to which the screw is attached. Burrs on the Bristol wrench could cause it to stick in the screw. Note also, that the hex nuts on the adjusting screws are used to provide tension only and should not be loosened when making calibration adjustments.

4. When the calibration has been completed, turn the knob to the desired setpoint and remove the gauge, reconnect the branch line and replace the cover.

Heating-Cooling Thermostats

1. Adjust the supply line pressure for the system to 25 psig (172 kPa).
2. Connect a pressure regulator into the supply main between the main and the thermostat at the thermostat location.
3. Adjust the regulator to 20 psig (138 kPa); at this supply pressure the thermostat is direct acting.
4. Set the dial knob on the thermostat to the bulb temperature setting and observe the branch line control air pressure. This pressure should be 8 psig \pm 1 psi (55 kPa \pm 7 kPa).
5. If not, adjust the direct acting screw to obtain 8 psig (55 kPa) branch line control pressure using a .048" Bristol wrench (Tool-82).

CAUTION

Do not loosen the hex nut on the screw. This nut is for friction purposes only; it does not lock the screw.

6. Adjust the regulator in the main line to 15 psig (103 kPa). At this supply pressure the temperature is reverse acting.
7. Observe the branch line control air pressure. If this pressure is not 8 psig (55 kPa), use a .048" Bristol wrench (Tool-82) and adjust the reverse acting calibrating screw to obtain a 8 psig (55 kPa) branch line control pressure.

CAUTION

The lever to which this screw is attached contains a spring hinge and is pivoted on the switch point adjusting spring. Undue side motion or forces tending to lift the switch lever off the main lever can damage the hinge or unseat the lever.

8. Recheck calibration by switching the supply pressure between 15 and 20 psig (103 and 138 kPa) several times and observe the control pressure. If it varies from the desired pressure, repeat the calibration procedures.
9. Calibration is now complete. Turn the adjusting knob to the

desired setpoint. Remove the test gauge and regulator, reconnect the main and branch lines and replace the cover.

Heating-Cooling Low Limit TK-4212-201

A special Heating-Cooling Thermostat is available for unitary heating-cooling applications. This thermostat is very similar to the TK-4212 except:

1. The restriction plate has been removed making the unit a one pipe thermostat. The air signal to the main connection actuates only the switchover parts.
2. The R.A. calibration screw has been removed. Therefore, when the main pressure is reduced to 15 psig (103 kPa), there is no calibration screw to contact the main lever and the flapper closes the nozzle completely and the thermostat is inoperative.

To calibrate apply 20 psig (138 kPa) to the main and full branch pressure from the primary controller to the branch connection of the TK-4212-201. Then calibrate as a single temperature D.A. thermostat.

MAINTENANCE

This is a quality product. Regular maintenance of the total system is recommended to assure sustained optimum performance.

FIELD REPAIR

Repair is not recommended except for replacement of restrictor assembly. Use AT-529 restrictor kit (see Figure 6) if restrictor replacement is required. Otherwise, replace thermostats if system is not operating correctly and the cause is traced to the thermostat.

AT-529 Restrictor Kit

Item No.	Description	Quantity in Kit
1	Filter	2
2	Restrictor Gasket	1
3	Restrictor	1
4	Restrictor Gasket	1
5	Air Connector	1
6	Screws	2

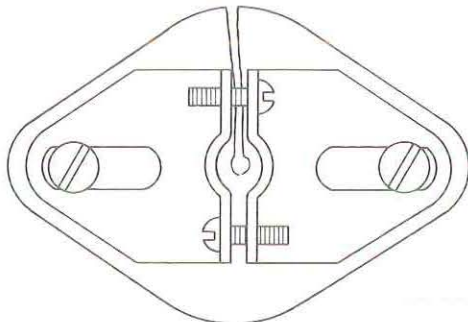
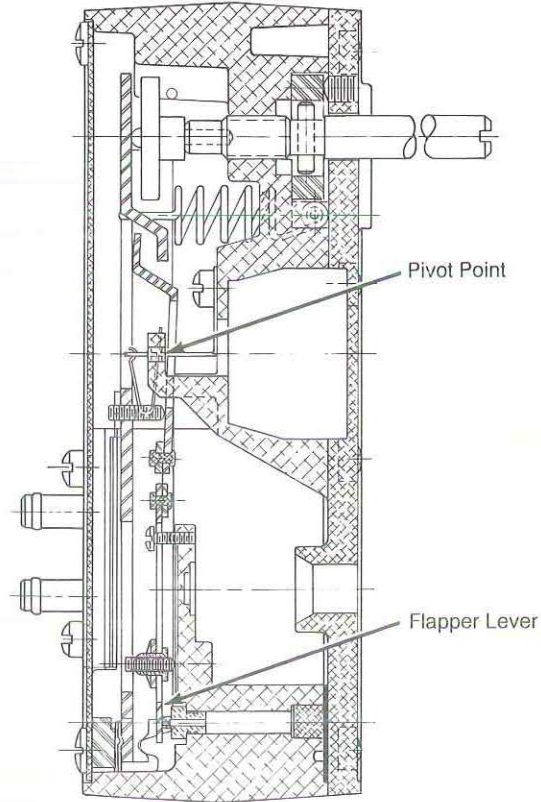
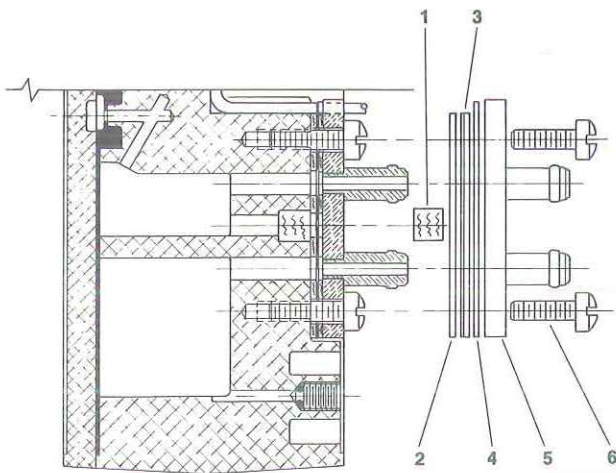


Figure 7. AT-208 Duct Mounting Kit

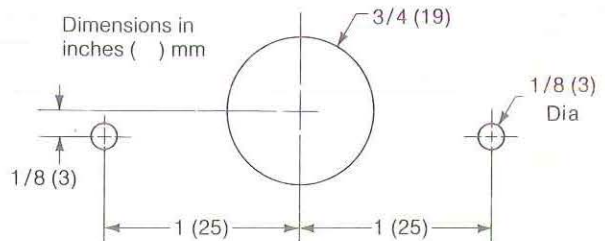


Figure 8. Bulb Mounting Hole Arrangement for Drilling Ductwork

Barber-Colman Company

ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940



General Instructions

TK-6024, 6124
TK-8024, 8124
Pneumatic
Bulb Thermostats

USES

For proportional control of Barber-Colman pneumatic valve and damper actuators to maintain air or liquid temperatures in duct, plenum chambers, liquid lines, tanks, etc. May also be used as a low limit thermostat.

CONSTRUCTION

A proportional control, relay type of pneumatic instrument which uses a liquid-filled remote sensing element bulb. The element actuates a piloted non-bleed relay through a stable balanced lever system. Internal feedback provides accurate proportional control at all levels of sensitivity.

The unit is available in direct or reverse-acting models. The unique design provides compensation to counteract the affects of variations in ambient temperature.

Supply Air Pressure 15 psig nominal, 30 psig maximum.

Maximum Safe Bulb Temperature 310°F.

Maximum Safe Case Temperature 150°F ambient.

Air Consumption For sizing air compressors, average air consumption is .008 standard cubic feet per minute (SCFM).

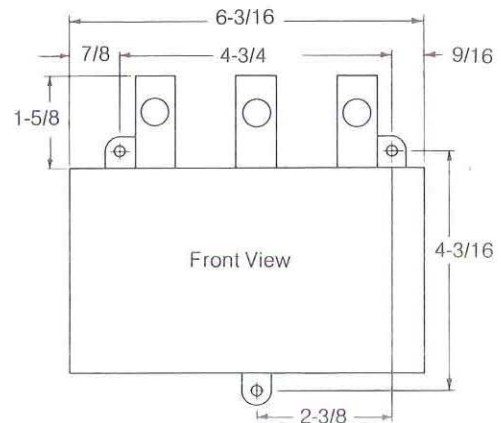
Air Capacity The maximum air requirement for sizing air mains is 16 standard cubic inches per minute.

Air Connections Manifold — 1/8" FNPT.

Bulb Length Straight 3/8" x 4-5/8"; Avg. 3/32" x 8'.



Figure 1.



Part No.	Action	Throttling Range	Bulb Style	† Scale °F	Factory Setpoint Setting °F
TK-6024	DA*	Adjustable 3-35°F Per 10 psi Change. Factory Set 5°F.	Straight	- 20 to + 240	50
TK-8024			Avg.		
TK-6124	RA*		Straight		
TK-8124			Avg.		

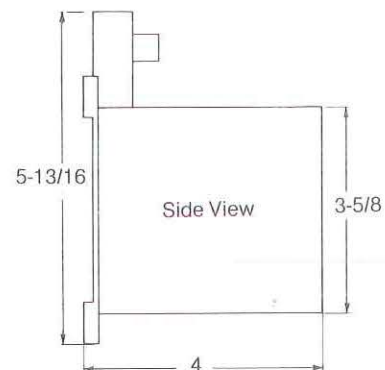
*Direct-Acting (DA): Increases output pressure on temperature rise.
Reverse-Acting (RA): Decreases output pressure on temperature rise.
†As shipped - 20 to 120°F, reverse side of dial 100 to 240°F.

OPTIONS

None

ACCESSORIES

- AL-362 Stem mounted back connected 0-30 psi gauge
- AT-201 3/8" x 9-1/2" with 3/4" MNPT copper well (requires AT-209)
- AT-203 3/8" x 9-1/2" with 3/4" MNPT stainless well (requires AT-209)
- AT-206 3/8" x 4-1/2" with 1/2" MNPT copper bulb well
- AT-208 Bulb duct mounting kit
- AT-209 Bulb mounting kit for use with AT-201 or AT-203
- AT-211 Outside bulb shield
- AT-539 Pilot pressure kit



INSTALLATION AND MOUNTING

Thermostat Mounting

Mount the thermostat in an upright position on a wall or vertical flat surface that does not vibrate. Avoid locations near steam or hot water coils or pipes, or wherever radiant heat will affect the bulb or capillary tube.

Bulb Mounting

LIQUID LINE AND TANK (TK-6X24)

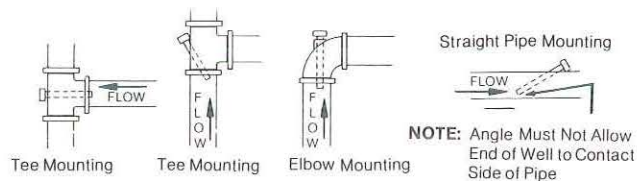
Installation Hardware

Part No.	Description	Mtg. Fitting	Insertion Size
AT-201*	Copper Bulb Well	3/4"	1/2" Dia. OD
AT-203*	Stainless Steel Bulb Well	MNPT	9-1/2" Long
AT-206	Copper Bulb Well	1/2" MNPT	1/2" Dia. OD 4-1/2" Long
AT-209†	Bulb Mounting Kit	3/4" MNPT	Length of Bulb

*Requires AT-209.

†Recommended installation is with a bulb well.

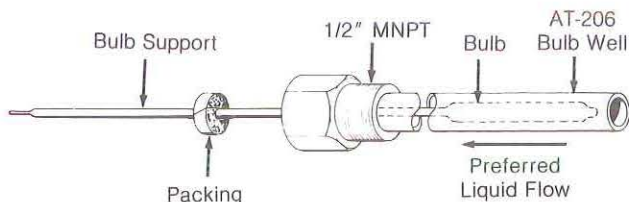
Bulb Well Installation Limitations



Part No.	Application Limitations at 250°F Fluid Temp. (Max. 350°F)	
	Max. Recommended Velocity (FPS)	Max. Recommended Static Pressure (psig)
AT-201	11	250
AT-203	20	500
AT-206	11	250
AT-209	4	150

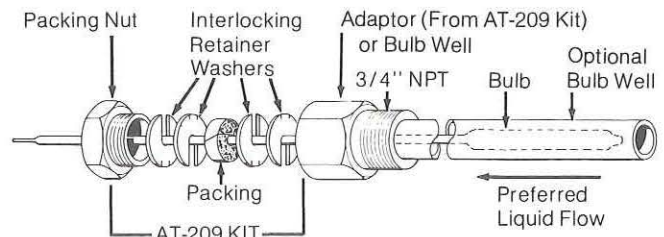
AT-206 INSTALLATION

Install AT-206 bulb well into 1/2" FNPT opening. Place packing (included with AT-206) over bulb support section and insert bulb into well. Push packing into nut on well using a screwdriver.



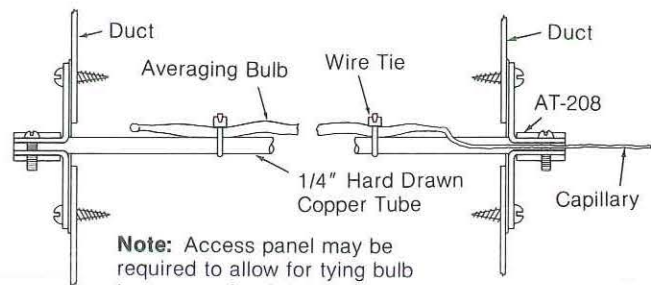
AT-201, AT-203 AND AT-209 INSTALLATION

Install bulb well or adaptor from AT-209 into 3/4" FNPT opening. Place packing nut, washers and packing from AT-209 over bulb support section and insert bulb into well or AT-209 adaptor. Push interlocking washers and packing into well or adaptor and tighten packing nut until firmly seated.



DUCT: TK-8X24

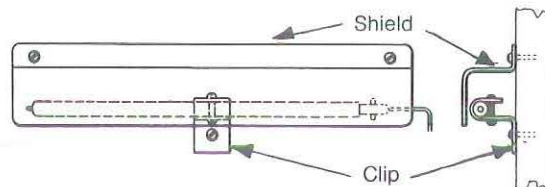
Install bulb mounting with two AT-208 kits as shown below.



OUTDOOR: TK-6X24

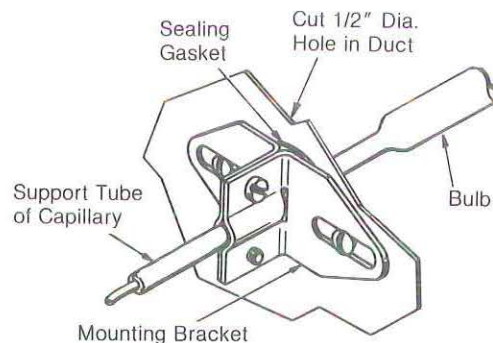
Install with AT-211 kit as shown below.

1. Mount bulb to outside wall or surface with bulb clip.
2. Place shield over bulb and fasten to mounting surface.



DUCT: TK-6X24

Install bulb with AT-208 kit as shown below.



ADJUSTMENTS

Thermostats are shipped from the factory calibrated to provide an 8 psig control line pressure when the control point is equal to the setpoint.

To make all adjustments remove the cover by first loosening the cover screw. Squeeze slightly on the top and bottom and pull forward and down, unhooking the top first.

Setpoint Dial

The thermostat has a total dial range of -20°F to $+240^{\circ}\text{F}$. One side of the dial is marked -20 to 120 and the other 100 to 240 . If a setpoint higher than 120° is required, proceed as follows:

1. Rotate setpoint dial to 110° .
2. Using a $3/16$ " open end wrench, hold hex shaft below setpoint dial.
3. Loosen screw that holds dial in place and remove.
4. Remove dial and turn over to the 100 to 240 side.
5. Start screw into dial post, before tightening line up dial at 110° , and tighten. Be sure to hold dial post with wrench when tightening screw tight.
6. Proceed with standard throttling range and calibration procedures.

Throttling Range

The throttling range should be set at the lowest value which will allow the thermostat to control the system without cycling under normal load conditions. The most satisfactory setting will vary with the type of control system. The throttling range is changed by sliding the throttling range adjustment slider to its proper position. See Figure 2. Calibration of the thermostat should be checked after the throttling range has been changed. When making the throttling range adjustment, care should be taken to prevent excessive side forces on the feedback lever. In no case should the pivot point be raised when the adjustment is made.

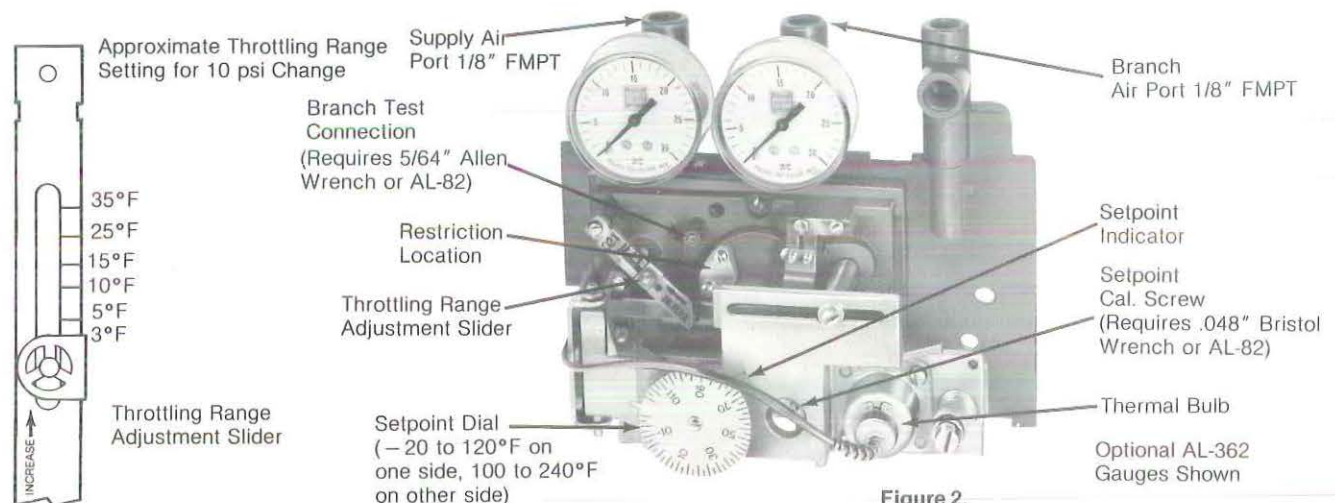


Figure 2.

Throttling Range Adjustment

If the throttling range of the thermostat as shipped is not satisfactory, proceed as follows:

1. Move slider to approximate position desired. (See Figure 2.)

2. With instrument measuring a stable temperature, rotate setpoint dial CCW to low end of scale, then CW to that temperature "setpoint".
3. Adjust setpoint calibration screw until 3 psig (RA) or 13 psig (DA) is read on branch gauge.
4. Rotate setpoint dial (CW) toward upper end of scale until 13 psig (RA) or 3 psig (DA) is read on branch gauge.
5. Difference between setpoint dial readings in Step 2 and 4 is the approximate mechanical throttling range of the thermostat. The thermal throttling range will be equal to or less than the mechanical throttling range.
6. If the throttling range in Step 5 does not provide the control desired, move throttling range slider in appropriate direction and repeat Steps 2 through 5 until desired control is obtained. If unable to obtain satisfactory control, check system for proper sizing of components being controlled and sensing element location.

Calibration

After the installation has been completed, the thermostat should be checked for calibration. As a nominal calibration, the controlled branch pressure should be 8 psig when the setpoint is equal to the bulb temperature, indicated by a thermometer located near the bulb. In some applications, a value other than 8 psig will be required to get the desired control results. Change the 8 psig designation as used in the calibration procedure, should this be the case.

1. Using the branch gauges, or a separate test gauge connected to the branch test port*, rotate the dial (direct-acting (DA) — lower, reverse-acting (RA) — raise) in the appropriate direction. The branch pressure should raise to be the same as the supply pressure ± 1 psi.

***Note:** As shown in Figure 2, each thermostat is furnished with a branch test connection. If a test gauge is to be used at this connection, use a $5/64$ " Allen wrench to unscrew (counterclockwise) the test point screw one full turn before attaching test gauge.

2. Measure the temperature at the bulb. This must be a stable temperature.
3. Rotate the dial to this temperature.
4. Turn the setpoint calibration screw (see Figure 6) until a branch pressure of 8 psig ± 1 psi is read on the branch gauge.

Note: The hex nut on the adjusting screw is used to provide tension only and should not be loosened when making adjustments.

5. Turn the dial to the desired setpoint.
6. If separate test gauge is used, remove gauge, tighten test point screw and replace cover.
7. Observe operation of system for satisfactory control. If necessary, recalibrate after system has come into control and stabilized.

USE AS A LOW LIMIT THERMOSTAT

These thermostats may be used as low limit thermostats. Normally in this application, they are used in series with the branch pressure of another proportional thermostat. When using two proportional thermostats in series, the second unit must have an external main air source for the pilot chamber of the thermostat. This is required to insure the operation of the second thermostat at low branch pressure from the first thermostat. An external pilot pressure kit is required for this. The part number of this kit is AT-539.

Attachment of AT-539

To attach the AT-539 external pilot pressure kit, use the following procedure:

1. Remove restriction cover plate, restriction and two gaskets (see Figure 2 for location).
2. Replace items in Step 1 with parts in AT-539 kit.
3. Route 5/32" plastic tubing through hole in base and connect to constant 15 or 20 psig main.

Calibration When Used As Low Limit

1. Determine throttling range required. This normally is approximately 10°F.
2. Adjust branch pressure from first thermostat to maximum branch pressure.
3. Adjust throttling range as described in Throttling Range Adjustment above.
4. After throttling range is adjusted, proceed with calibration of control point as described in Calibration.

Barber-Colman Company

ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
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Rod and Tube and Remote Bulb Transmitters



DEVICE INFORMATION

These transmitters are used with Barber-Colman RKS receiver-controllers for control of air or water temperatures. They may be used in conjunction with AKS receiver gauges for temperature indication only.

Pre-Installation

For list of parts required, see **INSTALLATION Procedure** for mounting and piping.

Before installation, make a visual inspection of the carton and transmitter for signs of damage.

INSTALLATION

Requirements

Air Consumption: 48 scim for sizing air compressor.

Supply Air Pressure: (when used for indication only): 18 psig.

Air Capacity: 36 scim for sizing air mains.

Air Connection: 1/8-inch FNPT.

The transmitter may be mounted in any position; however, preferred mounting is with the air connection at the bottom with the unit in a vertical position.

PERFORMANCE

Device	Part No.	Action	Mounting	Max. Safe Temp. At Element	Range (Non-Adjustable)	Output Signal (psig)
Straight Bulb	TKS-2031	DA	Wall or Duct	93°C (200°F)	-40 to 71°C (-40 to 160°F)	3-15
Averaging Bulb	TKS-4014	DA	Duct	149°C (300°F)	-18 to 38°C (0 to 100°F)	3-15
Averaging Bulb	TKS-4017	DA	Duct	149°C (300°F)	10 to 66°C (50 to 150°F)	3-15
Rod & Tube	TKS-8014	DA	Immersion	149°C (300°F)	-18 to 38°C (0 to 100°F)	3-15
Rod & Tube	TKS-8033	DA	Immersion	149°C (300°F)	4 to 116°C (40 to 240°F)	3-15
Rod & Tube	TKS-9014	DA	Duct	149°C (300°F)	-18 to 38°C (0 to 100°F)	3-15
Rod & Tube	TKS-9017	DA	Duct	149°C (300°F)	10 to 66°C (50 to 150°F)	3-15

DA = Direct-Acting

Rod and Tube Transmitter

Procedure

MOUNTING OF ELEMENT (Figure 1): The 9-1/4-inch rod and tube transmitter is furnished with a mounting bracket threaded for use with standard AT-201 or AT-203 well. Attach the mounting bracket to the well, then insert transmitter element and attach transmitter to bracket with screws provided.

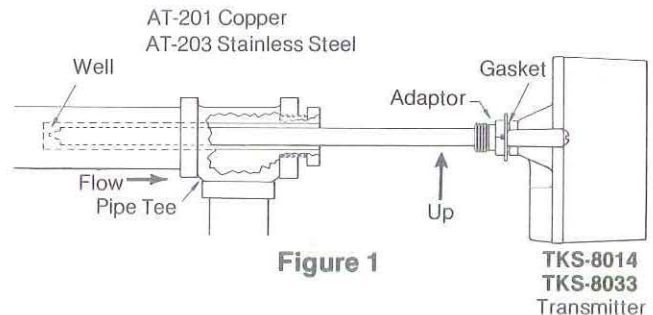


Figure 1

CAUTION

Well must be straight before inserting transmitter and be located in pipe tee as shown at least 15 feet from pump discharge or intake.

AIR DUCT MOUNTING (Figure 2): Drill three holes in the duct and fasten the transmitter to the duct with two screws provided. Use Figure 2 as a template.

Note: Locate transmitter as far from the fan as possible.

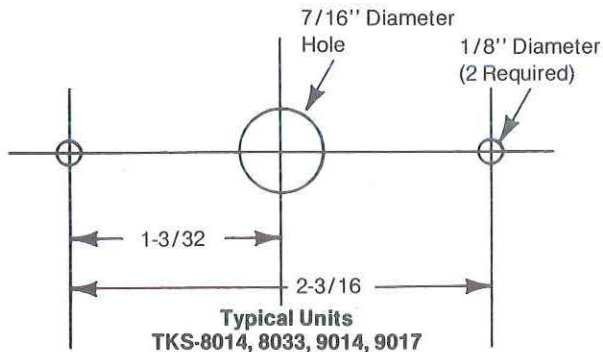


Figure 2. Full Scale Template for Drilling Rod/Tube Unit Holes

AIR DUCT MOUNTING — TKS-4014, TKS-4017 (Figure 3): Transmitters equipped with 5/64-inch x 24-foot averaging bulb include a mounting cork shown in Figure 3. Drill holes as shown in Figure 4. Mount transmitter with two screws provided. Thread element through 7/8-inch hole and apply cork to it. Secure element in duct, to duct supports, or use a length of hard drawn copper. Attach copper to duct, and attach element to copper with a wire tie. Insert cork into hole. An alternate method is shown in Figures 5 and 6.

CAUTION

Do not bend bulb in less than 3-inch diameter circle.

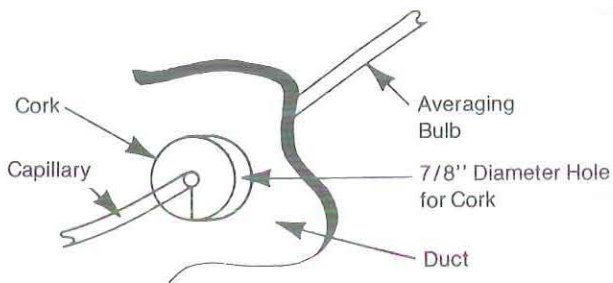


Figure 3. Installing Averaging Bulb Through Duct (See Figure 4)

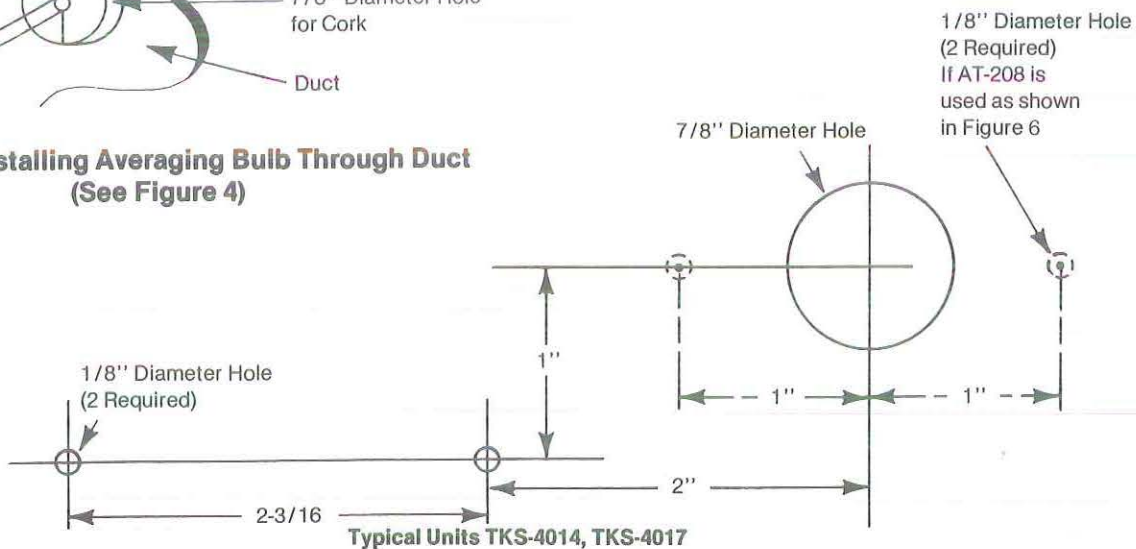


Figure 4. Full Scale Template for Drilling Averaging Unit Holes

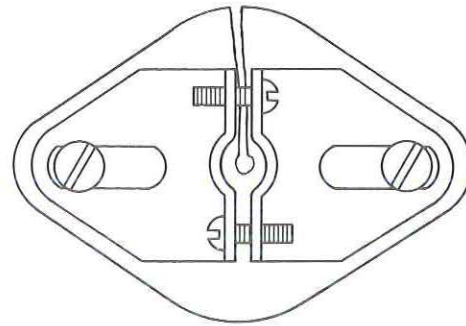
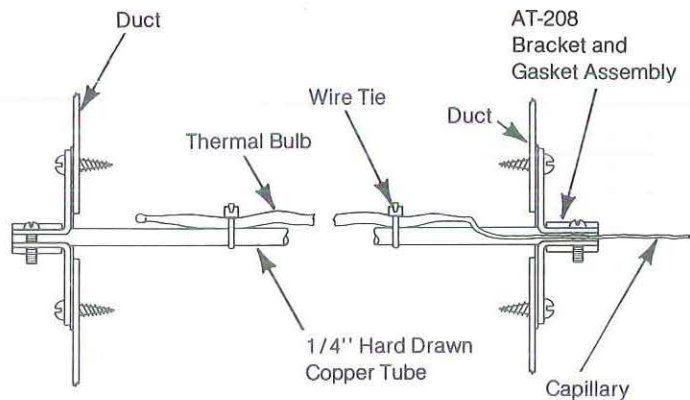


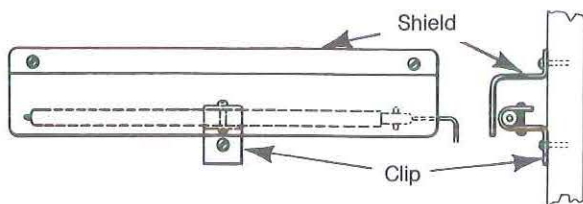
Figure 5. AT-208 Bracket and Gasket Assembly Used in Place of Cork Supplied with Unit



Note: An access panel is required to allow for tying bulb to copper after it is installed in the duct.

Figure 6. Mounting Averaging Bulb Through Duct

OUTDOOR MOUNTING (Figure 7): A bulb clip and shield (AT-211) are available for mounting the bulb to the outside wall or surface. After mounting the bulb with the clip, place the shield directly over the bulb and fasten the shield to the wall surface. Transmitter is located inside of building on wall or duct. Typical unit is TKS-2031, supplied with 3-foot capillary.



CAUTION
Do not crimp bulb with clamp.

Figure 7. Outdoor Wall Mounting of Element With AT-211 Bulb Shield

ADJUSTMENTS: All transmitters are factory set for the range indicated in the Performance table. No attempt should be made to readjust units in the field.

PIPING: When used in conjunction with a receiver-controller with less than 200 feet of 1/4-inch OD tubing between the receiver-controller and the transmitter, the air supply to the transmitter is through the receiver-controller as shown in Figure 8.

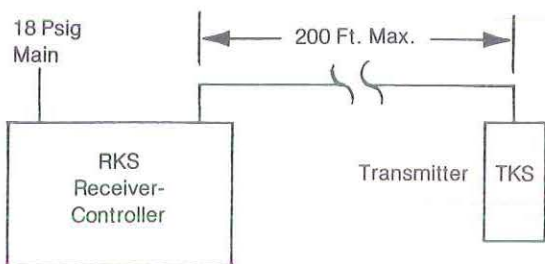
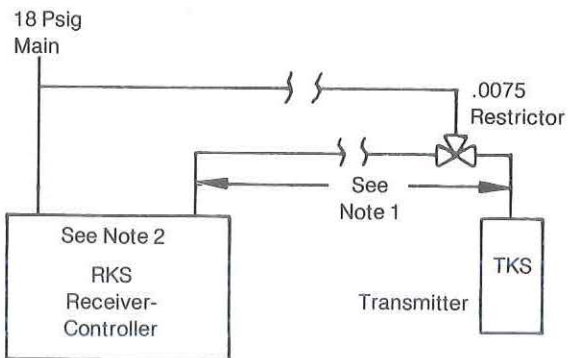


Figure 8

When the distance between the receiver-controller and the transmitter is over 200 feet but less than 1000 feet maximum recommended (Figure 9), it is necessary to provide a main air supply at the transmitter location and remove the built-in restrictor from the receiver-controller input.



Note: 1. More than 200 ft. up to a max. of 1000 ft.
2. Remove restriction from receiver-controller.

Figure 9

When the transmitter is used in conjunction with a receiver gauge for indication only, it is necessary to supply an air main to each transmitter through an .0075 restrictor (Figures 10 and 11).

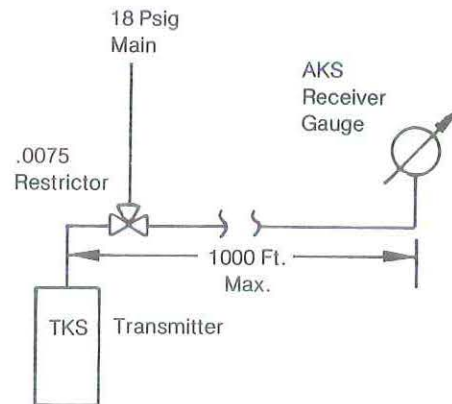


Figure 10

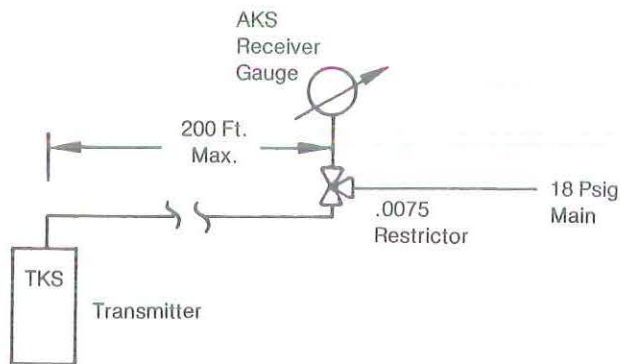


Figure 11

Note: It is recommended that field tubing termination to the transmitter be made with at least 6 inches of 1/4-inch O.D. plastic tube to avoid the possibility of forces from the tubing affecting the transmitter.

CHECKOUT

1. Connect the calibration box into No. 1 and 2 lines as shown in Figure 12 and 13.
2. Move toggle switches to the up (transmitter) position.
3. After making sure the transmitter is sensing a stable condition (temperature, humidity, pressure) measure the condition at the transmitter with an accurate measuring device such as thermometer, etc.
4. Note reading on calibration box gauges for specific ranges of transmitter used, compared to condition measured at the transmitter. Readings should be within $\pm 15^{\circ}\text{F}$. If readings are not within these limits, replace the transmitter.

RUN/ADJUST

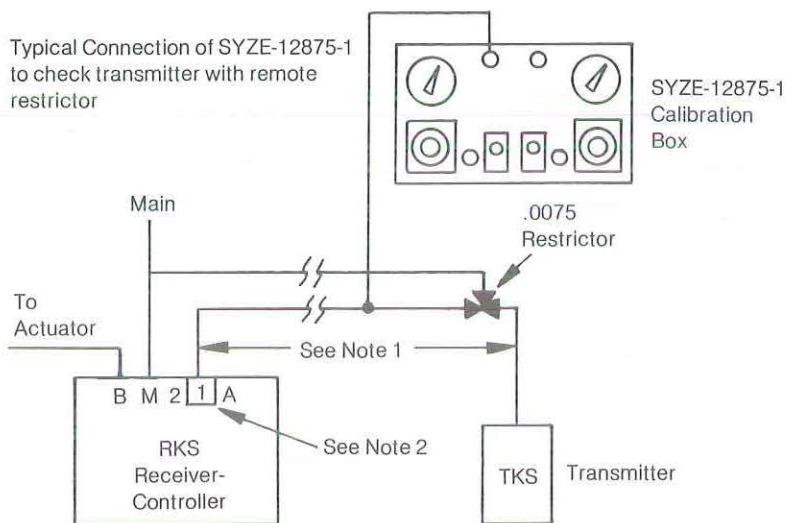
No adjustments are required on the transmitter.

MAINTENANCE

The unit requires no maintenance under normal conditions.

REPAIR

Field repair is not recommended. If the system is not operating correctly, and the reason is traced to the transmitter, it should be replaced.



- Note:** 1. More than 200 ft. up to a max. of 1000 ft.
2. Remove restriction from receiver-controller.

Figure 12

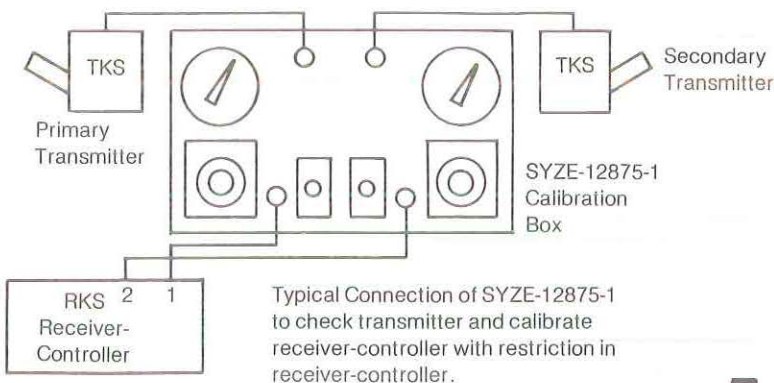


Figure 13

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

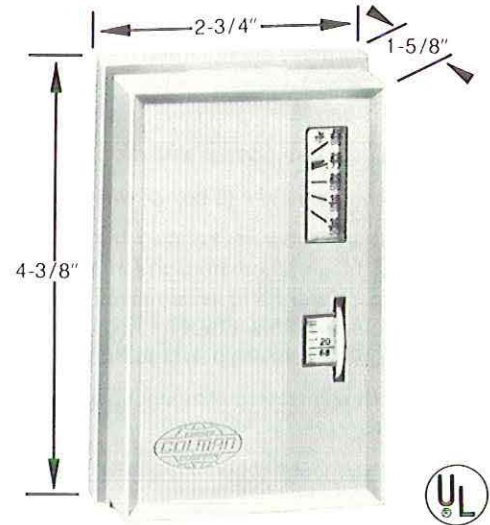
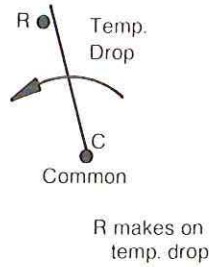
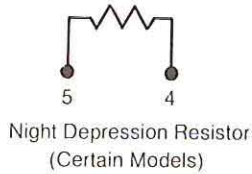
1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940



General Instructions

TA-1101, TA-1102 Two Position Electric Room Thermostat

For on-off control of unit heater motors, electrical heaters, high input motor starter coils.



Part No.	Control* Dial Range	Full Load Amps		Locked Rotor Amps		Non-Inductive Amps			Pilot Duty VA
		24/120 Vac	240 Vac	24/120 Vac	240 Vac	120 Vac	240 Vac	277 Vac	
TA-1101	55-85°F (13-29°C)	7.2	3.6	43.2	21.6	7.5	7.5	7.0	68 @ 24 Vac
TA-1102	45-75°F (7-23°C)								340 @ 120/240 Vac

*Units marked in both °F and °C, dial stop pins included to limit control range.

Bimetal operated snap action SPST switch with heavy duty contacts. Coded screw terminals. Differential 2°F maximum. Units have plastic covers as standard. Mounts on flush or surface switch box.

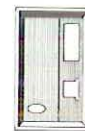
Dimensions: 4-3/8" high × 2-3/4" wide × 1-5/8" deep.

ACCESSORIES

- AT-101 Lock cover kit
- AT-104 Dial stop pins (NOTE: pins included with each unit)
- AT-136 Title plates (day, night, heat, cool)
- AT-504 Plaster hole cover kit (small)
- AT-505 Surface mounting base
- AT-546 Auxiliary mounting plate
- AT-602 Selector switch sub-base DP4T
- AT-603 Selector switch sub-base one DP4T, one DPDT
- AT-1103 Wire guard
- AT-1104 Cast aluminum guard
- AT-1105 Plastic guard
- AT-1155 Plastic guard
- AT-1165 Plastic guard
- Tool 11 Calibration wrench
- Tool 13 Contact burnishing tool

OPTIONS

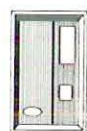
Add "dash-number" (-XXX) suffix to base part number for desired option.



Standard



-400



-401



-402



-403



-404

- 601 10°F night depression 120V Standard Cover†
- 602 10°F night depression 24V Standard Cover†
- 603 10°F night depression 240V Standard Cover†

†Normally, night depression is controlled by a centrally located time clock such as AE-174 or AE-178, or by selector switch sub-bases (AT-602 or AT-603).

INSTALLATION

Requirements

Locate thermostat where it will be exposed to unrestricted circulation of air which represents the average temperature of the controlled space. Do not locate the thermostat near sources of heat or cold, such as lamps, motors, sunlight or concealed ducts or pipes. The thermostat is designed for service in any normally encountered human environment.

Procedure

1. Pull all wires. (Use copper wire only.)
2. Fasten mounting plate to box or wall.
3. Make electrical connections to thermostat screw type terminals. Make all connections in accordance with the job wiring diagram and in compliance with national and local electrical codes. Class I wiring is required unless all circuits to contacts are powered from a Class II source.
4. Hook thermostat on top of mounting plate and swing down into place.
5. Tighten thermostat mounting screw.

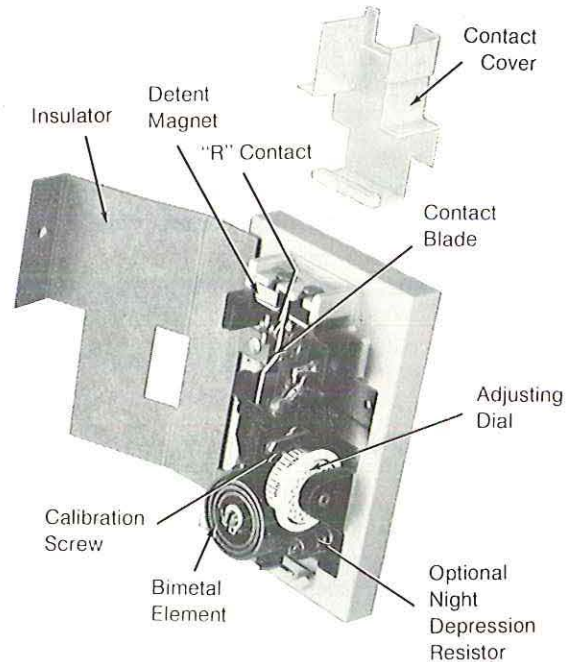
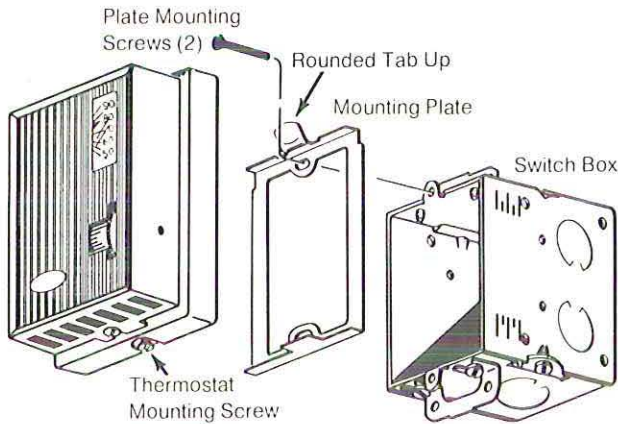


Figure 1



CHECKOUT

After installing a thermostat, make an initial check of the switching action. Verify the switch action by listening to and watching the switch contacts, using a voltmeter between the proper sides of the switch, or observing the controlled device.

1. Run the setpoint dial to a temperature above ambient. This should cause the thermostat to switch, calling for heat.
2. Turn the setpoint dial setting down gradually. The switch should break contact.

Calibration

All thermostats are calibrated at the factory and normally will not require any such attention. However, if recalibration is necessary for any reason, proceed as follows:

1. Disconnect power to thermostat.
2. Set the adjusting dial to correspond to actual room temperature.
3. Remove thermostat cover, remove screw that secures right-hand side of insulator, fold back insulator and remove contact cover. (See Figure 1.)

Do not breathe on the thermostat or handle excessively as this will affect the accuracy of the final calibration.

4. If contact blade is made to the left (R) contact, use a 3/16-inch open end wrench to turn calibration screw counterclockwise (looking at head of screw) until blade just breaks contact. Note: Each complete revolution of screw changes calibration approximately 8°F. Thermostat is now properly calibrated.
5. If contact is **not** made to the left, turn the calibration screw slowly clockwise until element makes to the R contact. Then turn screw very slowly counterclockwise until blade just breaks contact. Thermostat is now properly calibrated.
6. Replace contact cover insulator and thermostat cover.
7. Restore power to thermostat.
8. Recheck calibration about 30 minutes later to be sure heat from handling did not result in erroneous setting.

MAINTENANCE

Open areas at bottom and around base of thermostat should be kept clean and free from obstructions to allow proper flow of air. If switch contacts need cleaning, this may be done with a TOOL-13 contact burnishing tool.

REPAIR

Field repair of the thermostat is not recommended. If the system is not operating correctly and the reason is traced to the thermostat, it should be replaced.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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Loves Park, IL U.S.A. 61132-2940



DEVICE INFORMATION

TA-121, Electric Heat Room Thermostat, is designed for non-inductive loads only as shown in the table below and should not be applied to motors such as fans, unit heaters, etc.

Part No.	Switch Action	Control Dial Range*	Differential	Non-Inductive Amps		
				120 Vac	240 Vac	277 Vac
TA-121	DPST Snap Acting	10-30°C (50-86°F)	.5°C (1°F) Thermally 1.7°C (3°F) Mechanically	22	22	18

*Scale marked in both degrees F and degrees C. Positive off position on dial.

TC-114, Heavy Duty Room Thermostat, has SPDT switch that can be used to control unit heaters or motors per table below. The TC-114 cannot be used for non-inductive loads.

Part No.	Switch Action	Control Dial Range	Differential	Full Load Amps		Locked Rotor Amps	
				120 Vac	240 Vac	120 Vac	240 Vac
TC-114	SPDT Snap Acting	10-30°C (50-86°F)	1.1°C (2°F) Heating 1.7°C (3°F) Cooling	9.8	8	58.8	48

*Scale marked in both degrees F and degrees C.

INSTALLATION

Physically, these thermostats require upright mounting on a properly flat vertical surface. Locate the thermostat where it will be exposed to unrestricted circulation of air which represents the average temperature of the controlled space. Do not locate the thermostat near sources of heat or cold, such as lamps, motors, sunlight or concealed ducts or pipes. The thermostat is designed for service in any normally encountered human environment.

Procedure

The thermostat may be installed on either a flush switch box, or a surface switch box.

1. Pull the required wires.
2. Make the electrical connections to the thermostat as required by your application. Refer to the wiring figure 1 for TA-121 and figure 2 for TC-114.
3. Remove the cover by holding the metal base in the area of the switch and pull outward on the one piece plastic cover.
4. Mount the thermostat. Number 6 screws are provided for switch box mounting. Re-install the thermostat cover.

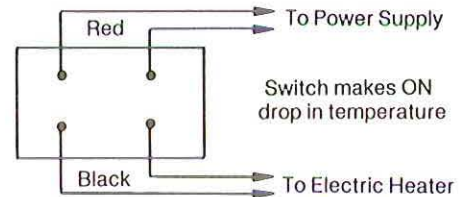
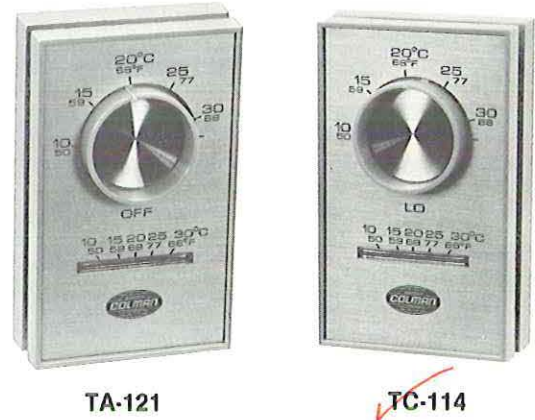


Figure 1. TA-121

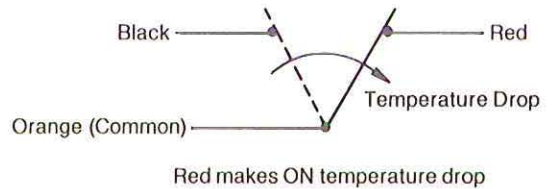


Figure 2. TC-114

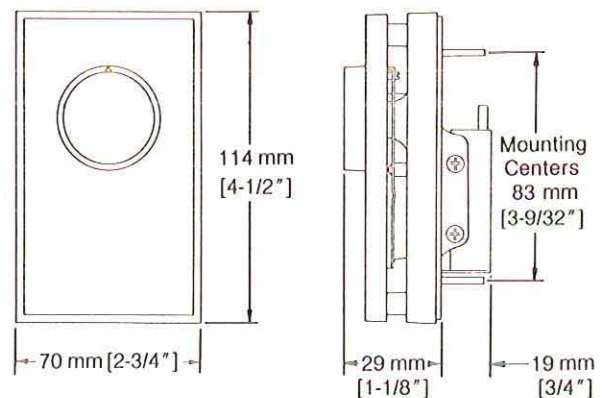


Figure 3. Mounting Dimensions

Checkout

After installing the thermostat, make an initial check of the switching action by observing the controlled device.

1. Move the setpoint dial to a temperature above ambient. This should cause the thermostat to switch, calling for heat.
2. Move the setpoint down gradually. The switch should break contact. On TC-114 only, it should make a contact call for cooling.

Run/Adjust

All thermostats are calibrated at the factory and normally will not require any attention other than setting the setpoint dial at the desired temperature.

Maintenance

Open areas on thermostat cover should be kept clean and free from obstruction to allow proper flow of air.

Repair

Field repair of the thermostat is not recommended. If the system is not operating correctly and the reason is traced to the thermostat, it should be replaced.

Barber-Colman Company
CONTROLS DIVISION

1300 Rock Street, Rockford, Illinois, U.S.A., 61101



General Instructions

TC-4100 Series TC-4200 Series Bulb Thermostats Return Air Thermostats

For on-off control of media temperature in ducts, tanks, liquid lines, etc.

TC-4100 Series **one stage** units control one electrical circuit. Available in single or dual bulb configurations. (See Performance Table.)

TC-4200 Series **two stage** units control two electrical circuits in sequence. Available in single or dual bulb configurations. (See Performance Table.)

Dual bulb units are used to vary the control point of the controlled media as a function of outside air temperature. The ratio specified is outdoor to indoor. A unit with a 1 to 1-1/2 ratio will increase the water temperature 1-1/2°F for a 1°F decrease in outdoor temperature.

Air bulb units feature a coiled, fast responding air bulb. Used in return air control applications.

Device: Liquid filled thermal element actuates one snap acting SPDT switch per stage. Large color coded terminals. Set-point adjustment dial plate is marked in °F on one side and °C on the other. The thermal differential is adjustable within the limits shown in the performance table. The mechanism is enclosed in a metal case and the cover, and has 1/2-inch to 3/4-inch conduit opening in the bottom of the case. Remote bulbs are suitable for immersion, duct, or outside air mounting.

Dimensions

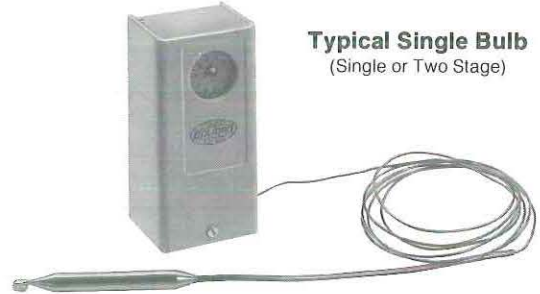
Bulb Units: 2-1/4" (57 mm) Wide x 4-5/8" (117 mm) High x 2" (51 mm) Deep.

Air Bulb Units: 2-1/4" (57 mm) Wide x 9" (229 mm) High x 2" (51 mm) Deep.

Electrical Rating: All Units Except TC-4115*

Switch Rating (50/60 Hz)	24V	120V	240V
Full Load Amps	9.8	9.8	8.0
Locked Rotor Amps	58.8	58.8	48.0
Pilot Duty VA	60	360	360
Non-Inductive Amps (Resistive)	—	—	—
Single Stage	22	22	22
Two Stage	16	16	8.0

*TC-4115 for System 8000 and dry circuit switching.
Electrical Rating: 1.0 amp at 24 Vac; .25 amp at 24 Vdc.



Typical Single Bulb
(Single or Two Stage)



Typical Dual Bulb
(Single or Two Stage)



Typical Air Bulb
(Single or Two Stage)



Performance and Selection Table

Type	Part Number	Setpoint Adjustment Range	Dual† Bulb Ratio	Dimensions		Differential		Maximum Safe Bulb Temperature	Case Ambient Temperature
				Capillary (Copper)	Bulb (Copper)	Factory Set	Adjustable		
Single Stage Single Bulb	TC-4111	-40 to 120°F		6'	3/8 × 4"	3°F	3 to 16°F	170°F	-40 to 150°F
	TC-4111-020			20'				310°F	
	TC-4112	100 to 260°F		6'				170°F	
	TC-4115*	-40 to 120°F		10' Armored				310°F	
	TC-4121							400°F	
	TC-4122	100 to 260°F							
	TC-4123	190 to 350°F							
Single Stage Dual Bulb	TC-4151	70 to 120°F	1:1-1/2**	30' Each Bulb	Indoor	3°F	1.5 to 10°F	Total of indoor and outdoor temperatures must not exceed 280°F	-40 to 150°F
	TC-4152		1:1		Outdoor				
One Stage Air Bulb	TC-4166	50 to 90°F		None	Coiled 2-1/2 × 2"	2°F Fixed		-40 to 145°F Safe Bulb Range	-40 to 150°F
Two Stage Single Bulb	TC-4211	-40 to 120°F		6'	3/8 × 4"	3°F	Per Stage Fixed	170°F	-40 to 150°F
	TC-4221			10' Armored				Between Stages	
	TC-4222	2 to 10°F						400°F	
	TC-4223	190 to 350°F							
Two Stage Dual Bulb	TC-4251	70 to 120°F	1:1-1/2**	30' Each Bulb	Indoor	3°F	Per Stage Fixed	Total of indoor and outdoor temperatures must not exceed 280°F	-40 to 150°F
	TC-4252		1:1		Outdoor				
Two Stage Air Bulb	TC-4266	50 to 90°F		None	Coiled 2-1/2 × 2"	3°F	Per Stage Fixed 2°F	-40 to 145°F Safe Bulb Range	-40 to 150°F

*TC-4115 for System 8000 and dry circuit switching. Electrical Rating: 1.0 amp at 24 Vac; 25 amp at 24 Vdc.

**TC-4151 and TC-4251 — For 1-1/2:1 ratio reverse bulbs and use extra dial supplied with unit.

†First number of reset ratio typically indicates outdoor air temperature change required to increase the setpoint by the second number.

Ratio Selection Table

Outdoor Temperature (°F)	Ratio	Change in Water Temperature for Different Ratios as Outdoor Temperature Drops from 70°F to Design Temperature					
		Dial Set at 70°F	Dial Set at 80°F	Dial Set at 90°F	Dial Set at 100°F	Dial Set at 110°F	Dial Set at 120°F
-30	1 to 1-1/2	70 to 220	80 to 230	90 to 240	100 to 250	110 to 260	120 to 270
	1 to 1	70 to 170	80 to 180	90 to 190	100 to 200	110 to 210	120 to 220
	1-1/2 to 1	70 to 137	80 to 147	90 to 157	100 to 167	—	—
-20	1 to 1-1/2	70 to 205	80 to 215	90 to 225	100 to 235	110 to 245	120 to 255
	1 to 1	70 to 160	80 to 170	90 to 180	100 to 190	110 to 200	120 to 210
	1-1/2 to 1	70 to 130	80 to 140	90 to 150	100 to 160	—	—
-10	1 to 1-1/2	70 to 190	80 to 200	90 to 210	100 to 220	110 to 230	120 to 240
	1 to 1	70 to 150	80 to 160	90 to 170	100 to 180	110 to 190	120 to 200
	1-1/2 to 1	70 to 123	80 to 133	90 to 143	100 to 153	—	—
0	1 to 1-1/2	70 to 175	80 to 185	90 to 195	100 to 205	110 to 215	120 to 225
	1 to 1	70 to 140	80 to 150	90 to 160	100 to 170	110 to 180	120 to 190
	1-1/2 to 1	70 to 117	80 to 127	90 to 137	100 to 147	—	—
+10	1 to 1-1/2	70 to 160	80 to 170	90 to 180	100 to 190	110 to 200	120 to 210
	1 to 1	70 to 130	80 to 140	90 to 150	100 to 160	110 to 170	120 to 180
	1-1/2 to 1	70 to 110	80 to 120	90 to 130	100 to 140	—	—
+20	1 to 1-1/2	70 to 145	80 to 155	90 to 165	100 to 175	110 to 185	120 to 195
	1 to 1	70 to 120	80 to 130	90 to 140	100 to 150	110 to 160	120 to 170
	1-1/2 to 1	70 to 103	80 to 113	90 to 123	100 to 133	—	—
+30	1 to 1-1/2	70 to 130	80 to 140	90 to 150	100 to 160	110 to 170	120 to 180
	1 to 1	70 to 110	80 to 120	90 to 130	100 to 140	110 to 150	120 to 160
	1-1/2 to 1	70 to 97	80 to 107	90 to 117	100 to 127	—	—

Dual Bulb Selection

On the dual bulb units, indoor and outdoor bulbs are determined by the ratio selected. See Performance and Selection Table. Ratio refers to the outdoor air temperature change compared to the water temperature change. The dial setpoint is the water temperature setpoint when the outdoor temperature is 70°F.

To select ratio, it is necessary to know only: (1) outdoor design temperature, (2) maximum water temperature at outdoor design temperature, and (3) desired water temperature at 70°F outdoors. Use the Ratio Selection Table to determine the required ratio based on this information and set the dial per item (3). NOTE: If a 1-1/2:1 ratio is selected, the extra dial supplied with the unit must be used.

Options

Single bulb units are available with optional capillary lengths of 20' or 45'.

Accessories: (Order Separately)

Part No.	Description	
AT-201*	Bulb Well	Copper, 3/4" MNPT 9-1/2"
AT-203*		Stainless, 3/4" MNPT 9-1/2"
AT-206		Copper, 1/2" MNPT 4-1/2"
AT-208	Duct Mounting Kit for Bulb	
AT-209	Liquid Line, or Tank, Bulb Mounting Kit. A Bulb Well is recommended. (Required with AT-201 or AT-203.)	
AT-210	Concealed Adjustment Kit. Includes plate to conceal setpoint adjustment and lock cover screw.	
AT-211	Outside Bulb Shield	

*Requires AT-209 Bulb Mounting Kit.

Example: Select ratio for an installation with a -10°F design temperature and estimated supply water temperatures of 75°F at 70°F outdoors and 125°F at -10°F outdoors. From Ratio Selection Table, -10°F for 1-1/2:1 ratio, note by interpolation (70°F to 123°F with dial at 70°F, 80°F to 133°F with dial at 80°F) that water temperature varies from 75°F to 128°F as outdoor temperature drops from 70°F to -10°F.

For this application, the 1-1/2:1 ratio should be selected. The extra dial supplied with the unit would be used, and the dial set at 75°F.



Immersion Well AT-20X



Bulb Duct Mounting Kit AT-208



Concealed Adjustment Kit AT-210



Liquid Line or Tank Bulb Mounting Kit AT-209
(Also Required with AT-201 or AT-203 Well)

Pre-Installation

Refer to the INSTALLATION and Performance Data applicable to the part number of the device being installed. Make a visual inspection of the device for obvious signs of damage. Avoid locations where excessive moisture, corrosive fumes, vibration or high ambient exists.

Installation

Location

Locate the device allowing proper distance to the bulb location. The case can be mounted in any position. Refer to Figure 1 for case dimensions.

Procedure

Remote Bulb Models

Air Bulb Models — Mounting in Return Air Duct

- Remove cover and provide 2 holes for #10 round head screws using the housing as the template or by using the dimensions shown in Figure 1.
- Partially insert the mounting screws in the screw holes. Fit the housing over the screws, slide housing down on the screws and tighten the screws.

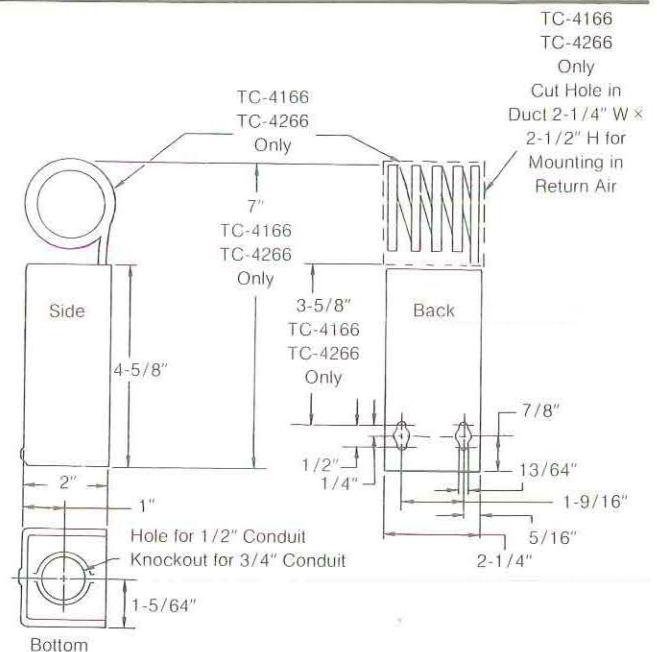


Figure 1. Case Dimensions

Air Bulb Models

Mounting Outside of Return Air Duct

1. Prepare duct for mounting by cutting hole and providing mounting screw holes per Figure 1.
2. Fabricate a cover as shown in Figure 2.
3. Carefully roll bulbs toward back of unit and insert through 2-1/4" x 2-1/2" hole.
4. Remove cover and attach unit to duct with #10 screws.
5. Attach cover over 2-1/4" x 2-1/2" hole.

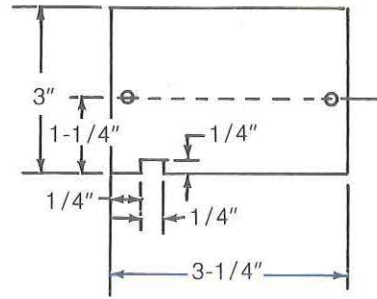


Figure 2. Field Supplied Duct Hole Cover Plate

Remote Bulb Mounting — Duct and Outdoor

Maximum insertion length (6 inches). Maximum safe bulb temperature above scale range. For dual bulbs, total of indoor and outdoor bulb temperatures must not exceed (280°F).

Duct: Install bulb with AT-208 kit as shown in Figure 3.

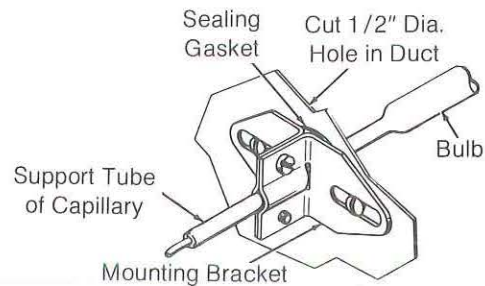


Figure 3. Duct Mounting with AT-208

Outdoor: Install with AT-211 kit as shown in Figure 4.

1. Mount bulb to outside wall or surface with bulb clip.
2. Place shield over bulb and fasten to mounting surface.

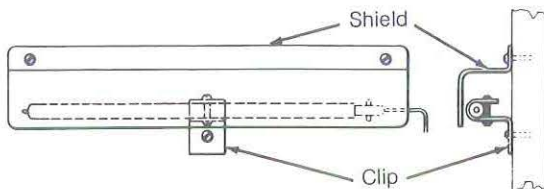
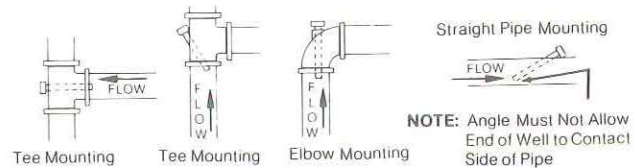


Figure 4. Outdoor Mounting with AT-211

Bulb Mounting — Liquid Line and Tank



Installation Hardware and Application Limitations

Part No.	Description	Mtg. Fitting	Insertion Size	Applications Limitations at 250°F Fluid Temp.*		Installation Per Figure
				Max. Recommended Velocity (FPS)	Max. Recommended Static Press. (PSIG)	
AT-201	Copper Bulb Well**	3/4" MNPT	1/2" Dia. O.D. 9-1/2" Long	11	250	5
AT-203	Stainless Steel Bulb Well**	3/4" MNPT	1/2" Dia. O.D. 9-1/2" Long	20	500	5
AT-206	Copper Bulb Well	1/2" MNPT	1/2" Dia. O.D. 4-1/2" Long	11	250	5A
AT-209†	Bulb Mounting Kit	3/4" MNPT	Length of Bulb	4	150	5

*Max. Recommended Fluid Temperature is 350°F.

**Requires AT-209.

†Recommended Installation is with a Bulb Well.

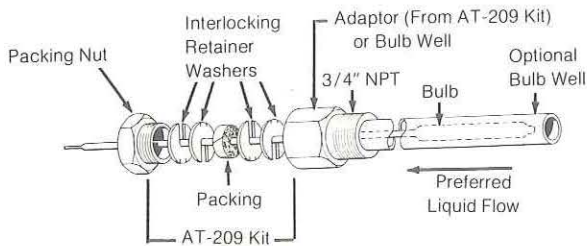


Figure 5. AT-201 or AT-203 Installation

Install bulb well or adaptor from AT-209 into 3/4" FNPT opening. Place packing nut, washers, and packing from AT-209 over bulb support section and insert bulb into well or AT-209 adaptor. Push interlocking washers and packing into well or adaptor and tighten packing nut until firmly seated.

Wiring

The thermostat has one 1/2-inch to 3/4-inch conduit opening in bottom of housing. Make all electrical connections in accordance with the job wiring diagram and in compliance with national and local electrical codes. Terminal coding and switch action is shown in Figure 6, and Figure 7 shows two stage switching sequence.

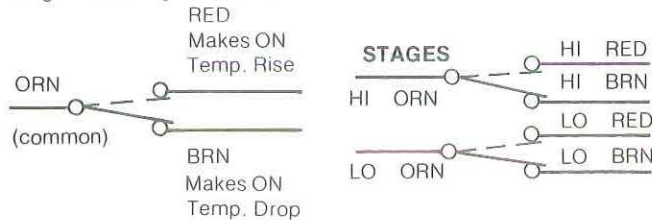


Figure 6. Terminal Coding and Switch Action

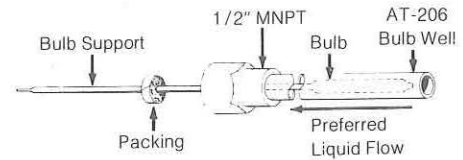


Figure 5A. AT-206 Installation

Install AT-206 bulb well into 1/2" FNPT opening. Place packing (included with AT-206) over bulb support section and insert bulb into well. Push packing into nut on well using a screwdriver.

Concealed Setpoint and Lock Cover Screw

Order AT-210 Concealed Adjustment Kit separately.

1. Peel off adhesive film from the concealed adjustment plate and place into the recess of cover.
2. Remove screw from cover.
3. Install lock cover screw provided with AT-210.

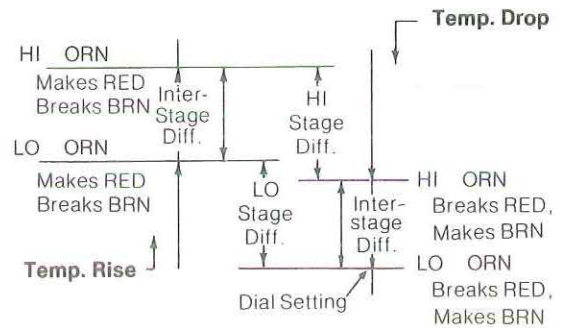


Figure 7. Two Stage Switch Sequence

Typical Applications

Figure 8 shows a typical heating or cooling application for single stage units. Figure 9 shows typical heating and cooling applications for two stage units.

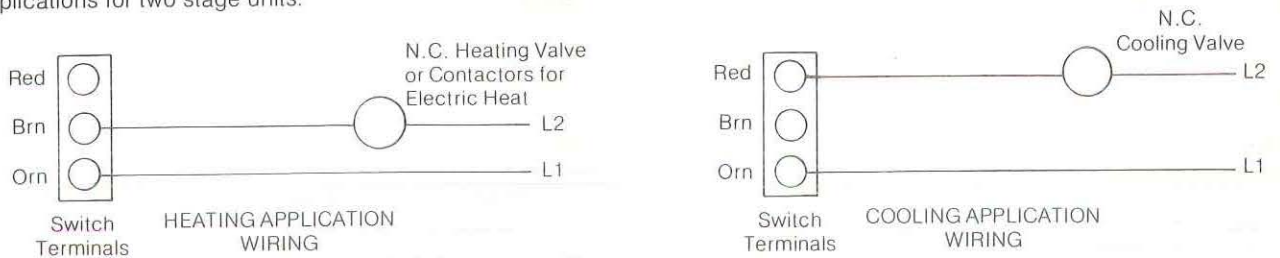


Figure 8. Typical Heating or Cooling Application for Single-Stage Units

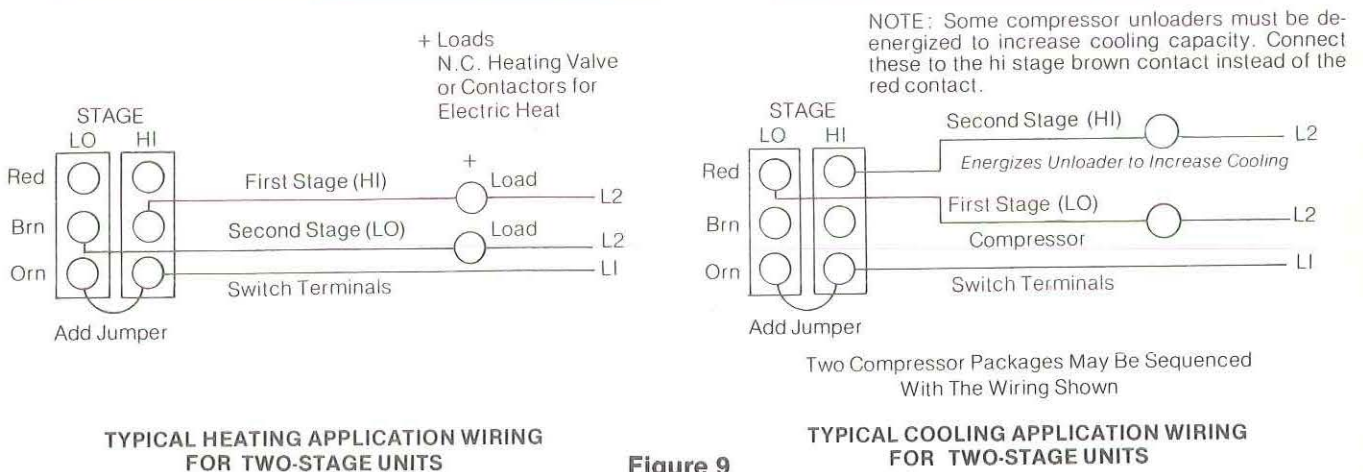


Figure 9

Two Compressor Packages May Be Sequenced With The Wiring Shown

Checkout

After installing a thermostat, make an initial check of the switching action. Verify the switch action by listening to the switch contacts.

1. Turn the setpoint dial to a temperature above ambient. This should cause the thermostat to switch, making orange to brown.
2. Turn the setpoint dial setting down gradually. Orange to brown must break, making orange to red.
3. Compare the differential of the device to the differential shown on the performance charts by turning the dial. The differential of the devices is the difference in dial reading between the make of orange to brown and the make of orange to red on single switch units.

Run/Adjust

Setpoint

Screwdriver adjustment. Scales dual marked °F on front and °C on back. To change scale, remove spring retaining ring, select scale and replace retaining ring.

Differential Adjustment

The differential is adjustable by turning the adjustor located on side of device (see Figure 10).

Single stage: Each line represents approximately 3°F change.

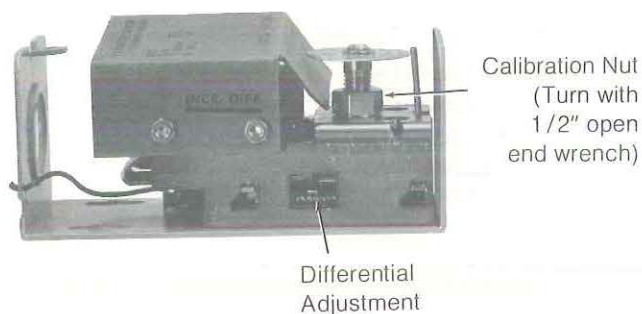


Figure 10

Two stage: Each notch represents approximately 2°F change between stages. (Differential per switch is fixed.)

To adjust differential:

1. Disconnect power to unit.
2. Remove cover.
3. Turn adjustor to approximately desired position.
4. Check out by turning dial and noting dial readings where switch contacts make.
5. After changing differential, recalibrate. See Service and Repair.

Service and Repair

Calibration

1. With all power disconnected, soak bulb(s) for 10 minutes at known temperature (must be 70°F for dual bulb).
2. Turn dial and note where switch contacts make.
3. Turn dial midway between click points.
4. Turn the calibration nut (located under dial) until the temperature of the bulb is indicated on the dial. (See Figure 10.)

NOTE

On two-stage units follow above procedure. "LO" switch is first stage on cooling applications. "HI" switch is first stage on heating applications.

Repair

Field repair is not recommended. Replace defective device.

Barber-Colman Company
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APPLICATION

For low or line voltage low temperature control in ducts.

SPECIFICATIONS

- Setpoint Dial Range:** 34 to 60°F (1 to 16°C).
- Sensing Element:** Vapor pressure type, copper construction.
- Response:** To lowest temperature sensed by any one foot section of its element.
- Differential:** 5°F (3°C) fixed.
- Environment:**
 - Ambient Temperature Limits,**
 - Shipping** -40 to 150°F (-40 to 66°C).
 - Operating** Must be 5°F (3°C) above setpoint to a maximum of 150°F (66°C) at case.
 - Thermal Sensing Element** 300°F (149°C).
 - Humidity,**
 - Enclosure** 5 to 95% RH, non-condensing.
 - Thermal Sensing Element** 0 to 100% RH.
 - Atmosphere,** NEMA Type 1 locations only.
- Electrical Switch:** Snap action SPDT.
- Ratings,** See Table 1.

Connections:

- TC-51X1,** Coded screw terminals.
- TC-51X1-201,** 4-1/2' (1.4 m) 208/240 Vac power cord.

Cover: Beige painted steel case with 1/2" conduit opening.
Mounting, In any position on any surface not subject to excessive vibration.

Dimensions:

- Case,** 2-1/2" high x 3-1/8" wide x 2-3/16" deep (63 mm x 79 mm x 55 mm).
- Element,** 1/8" OD x 20' length (3 mm x 6.1 m).

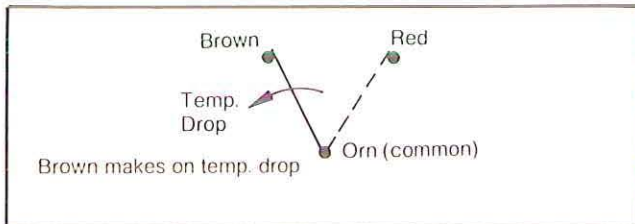
ACCESSORIES None



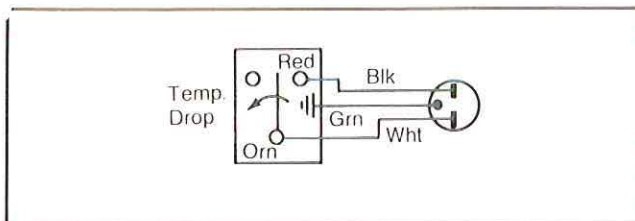
TABLE 1. SPECIFICATIONS

Part Number	Device Type	Voltage Vac	Full Load Amps	Locked Rotor Amps	Pilot Duty (VA)	Non-Inductive Amps
TC-5131 TC-5131-201	Low temp auto reset	24	—	—	100	16
		120	13.8	82.8	650	16
		208	9.6	57.6	750	9.6
TC-5141 TC-5141-201	Low temp manual reset**	240	8.3	49.8	750	8.3
		277*	—	—	—	7.2

*277 Vac not CSA approved.
 **Reset cannot be accomplished until the sensed temperature is at least 5°F above setpoint.



**Figure 1. TC-5131 or TC-5141
Switch Action and Terminal Identification**



**Figure 2. TC-5131-201 or TC-5141-201
Switch Action and Terminal Identification**

PRE-INSTALLATION

Inspection

Visually inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious defects. Return damaged or defective products. Check the part number on the unit to be sure the correct device is being installed.

Required Installation Items

- Wiring diagrams
- Tools (not provided):
 - Volt-ohm meter
 - Appropriate screwdriver for mounting screws and terminal connections
 - Appropriate drill and drill bit for mounting screws
- Mounting screws, two (2) #10 maximum (not provided)
- Capillary mounting hardware (not provided)

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Disconnect power supply before installation to prevent electrical shock and equipment damage.
3. Make all connections in accordance with the wiring diagram, and in accordance with national and local electrical codes.
4. Do not exceed ratings of the device.
5. Avoid locations where excessive moisture, corrosive fumes or vibration are present. Suitable only for NEMA Type 1 indoor locations. Thermostat enclosure is intended to provide a degree of protection against contact with other equipment.

Mounting

Install all but a few inches of the thermal element securely in the controlled media for maximum sensing capability and minimum vibration damage. Usual location of the thermal element is on the downstream side of the coil. The element should be serpentine in a horizontal pattern so that it will be exposed to all areas where low temperatures are possible (see Figure 3).

CAUTION

Do not kink capillary or thermostat will be damaged.

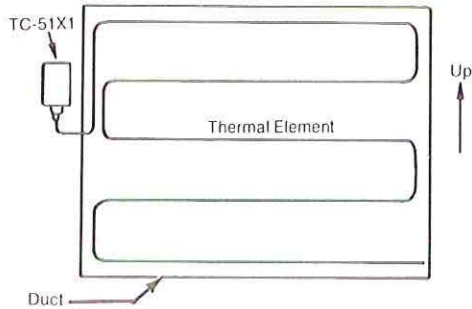


Figure 3. Thermal Element Location

1. Remove the cover.
2. Mount case with two screws (#10 max) in screw slots in back of case (see Figure 4).

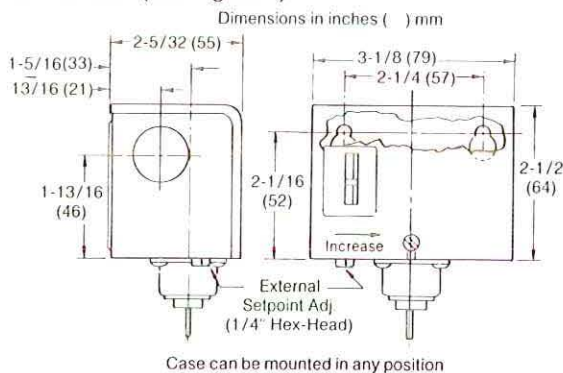


Figure 4. Mounting Dimensions

Wiring

See Figures 1 and 2 for switch action and terminal identification.

TC-51X1's case has an opening for a 1/2" conduit. The units include a green ground attached to the case. Make connections to coded screw terminals and ground.

TC-51X1-201 has grounded power cord.

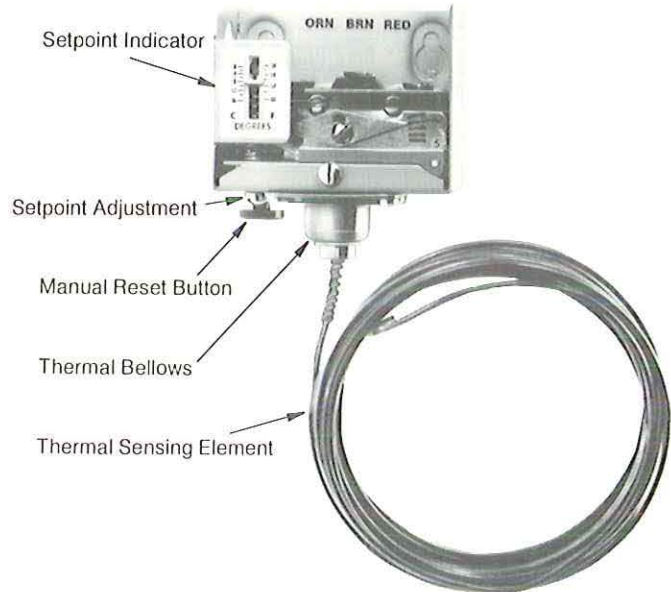


Figure 5. TC-5141 with Cover Removed

TYPICAL APPLICATION

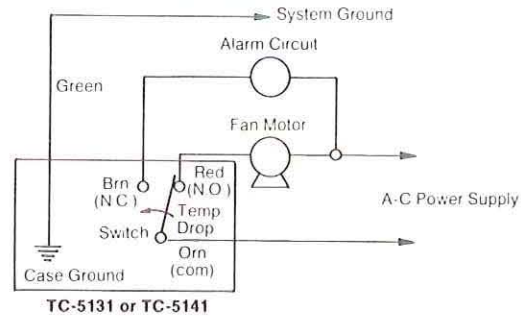


Figure 6. Typical Application

CHECKOUT

Turn setpoint adjustment screw (1/4" hex-head) located in bottom of case until indicating pointer is at desired temperature.

CAUTION

Unit includes mechanical stop to prevent adjustment below 34°F (1°C). Do not attempt to set below 34°F (1°C) as this may damage the device.

CALIBRATION

All thermostats are precision calibrated at the factory and normally will not require any further attention.

REPAIR

Thermostat is not field repairable. If the system is not operating correctly and the reason is traced to the thermostat, it should be replaced.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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GENERAL INFORMATION

Proportional pneumatic actuator with 11 sq. in. (71 cm²) effective area used to control damper and air valves in heating, ventilating and air conditioning systems.

OPERATION

The type of positioning, proportional or two-position, is determined by the controller, such as a thermostat or relay. Actuators are positioned by air pressure acting upon a diaphragm and piston. Opposing the force on the top of the piston is a spring. The piston force overcomes the spring force, as the air pressure increases, extending the actuator shaft. If the pressure lessens, the spring force retracts the shaft.

CONSTRUCTION

Units are constructed of a sturdy die cast aluminum housing enclosing an easily replaceable beaded molded neoprene diaphragm, steel piston, piston shaft, sintered bronze shaft-guide bushing and steel spring.

The molded neoprene diaphragm has a circular bead which mates with a groove in the pressure housing insuring positive locating and sealing of the diaphragm with the housing.

STROKE LENGTH

Adjustable 1/2 to 3" (13 to 76 mm). Factory set at 2" (51 mm).

MAXIMUM SAFE AIR PRESSURE

30 psig (207 kPa).

AMBIENT TEMPERATURE LIMITS

-20 to 160°F (-29 to 71°C).

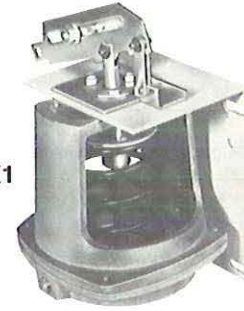
MOUNTING

In any position. Mounting bracket, linkage and connector for 5/16" (8 mm) diameter push rod included.

AIR CONNECTIONS

1/8" FNPT.

MK-44X1



DIMENSIONS

7-7/16" (189 mm) high × 5-3/4" (146 mm) wide × 4-7/8" (124 mm) deep.

OPTIONS

None.

ACCESSORIES

- AM-111 Crank arm for 5/16" diameter damper shaft
- AM-112 Crank arm for 3/8" diameter damper shaft
- AM-113 Crank arm for 1/2" diameter damper shaft
- AM-115 Crank arm for 7/16" diameter damper shaft
- AM-122 Linkage connector straight type
- AM-123 Damper clip
- AM-125 5/16" × 20" damper rod
- AM-125-048 5/16" × 48" damper rod
- AM-132 Ball joint connector
- AM-161-3 Damper linkage kit
- Tool-95 Pneumatic calibration tool kit

Damper Type	Nominal Damper Area for Proportional* Control**	Nominal Damper Area for Two-Position Control MK-4421 (8-13 Spring, 20 psi Supply)**
Parallel Blade	4.4 sq. ft.	13.2 sq. ft.
Opposed Blade	5.6 sq. ft.	16.8 sq. ft.

*MK-4421 requires 15 psi be available to actuator, MK-4461 requires 20 psi be available to actuator.

**Damper ratings are nominal and based on standard (not low leakage) damper at 1" W.C. static pressure and 2000 fpm (10 m/s) velocity.

Part Number	Nominal Operating Range	Starting Pressure Adjustable	Maximum Force††				Nominal Torque** Proportional Control†††		
			Return Stroke	Power Stroke			15 psi Supply Dual Press. System	15 psi Supply Single Press. System†	20 psi Supply Single or Dual Press. System†
			Based on 1.5 psi Pressure to Actuator	15 psi Supply Dual Press. System	15 psi Supply Single Press. System†	20 psi Supply Single or Dual Press. System†			
psi	psi	lb.	lb.	lb.	lb.	lb-in.	lb-in.	lb-in.	
MK-4401	3-8	3 ± 1	8.25	30.25	38.5	66	7.9	7.9	7.9
MK-4411	5-10	5 ± 1	19.25	19.25	27.5	55	7.9	7.9	7.9
MK-4421	8-13	8 ± 1	35.75	2.75	11	38.5	2.6	7.9	7.9
MK-4451	3-6,9-12	3 to 6	8.25	8.25	16.5	44	7.9	7.9	7.9
MK-4461	3-6,11-17	3 to 6	8.25	0	0	16.5	0	0	7.9

**Nominal torque for actuators is based on 1.5 psi pressure change at the actuator.

††Force and torques based on factory set stroke and starting pressure.

†Adjust pressure reducing valve so that listed pressures are available at the actuator.

Relationship between Stroke and Control Air Pressure for Two-Stage Actuators

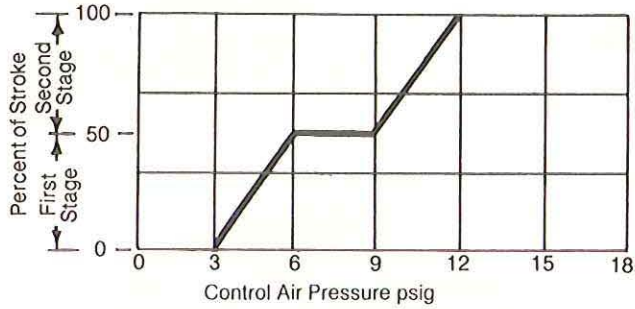


Figure 1. MK-4451

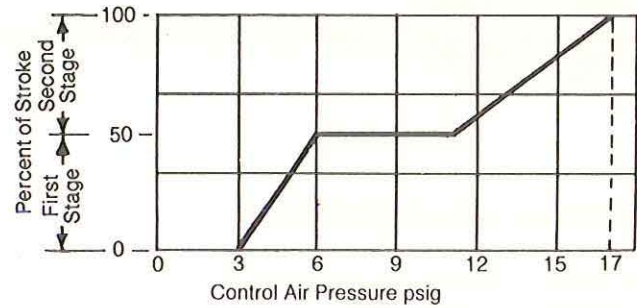


Figure 2. MK-4461

INSTALLATION

Make all connections in accordance with job piping diagram. Use 1/4" OD copper or plastic tubing to connect the actuator to the controller. Units have 1/8" NPT female inlet for connection to the supply air. Actuators are mounted by means of four screws (not included) through the mounting bracket. See Figure 3 for mounting dimensions.

Insert the push rod in the actuator and damper connectors and tighten the set screws. (See Figure 4 for damper linkage for 90° rotation.) Apply air pressure and run the actuator through the entire stroke. Readjust linkage if binding occurs during damper shaft rotation. Readjustment may also be necessary if damper shaft does not achieve acceptable rotation.

ADJUSTABLE STARTING PRESSURE

The start point is the air pressure value that causes the actuator shaft to just begin to extend. If adjustment of starting pressure is required, turn adjusting nut supporting the spring clockwise to decrease and counterclockwise to increase the starting pressure, when viewing the actuator from the shaft end (Figure 3). Each rotation of the adjusting nut changes the starting pressure 0.04 psi (.28 kPa).

NOTE

The stroke during the first stage of operation (MK-4451 & MK-4461) is adjustable from 0 to 50% of total stroke.

DIAPHRAGM REPLACEMENT

If the actuator diaphragm should leak, it may easily be replaced:

1. Disconnect air line to the actuator.
2. Remove the screws on the top power housing, the top cover and the old diaphragm.
3. Insert new diaphragm over piston.

IMPORTANT

Put the top power housing back in place making sure the bead on the diaphragm is in the housing groove and the screw holes are lined up.

4. Tighten the top power housing screws.

MAINTENANCE

This is a quality product. Regular maintenance of the total system is recommended to assure sustained optimum performance.

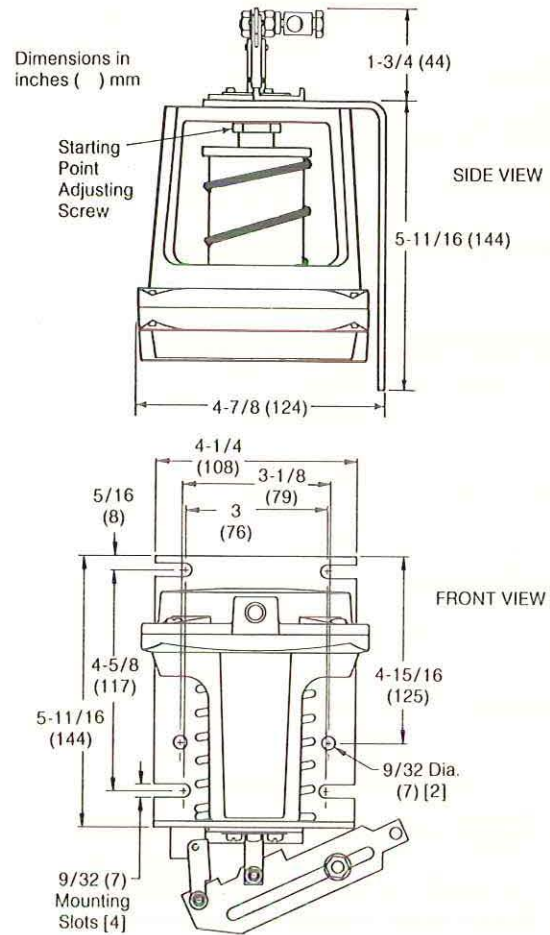


Figure 3.

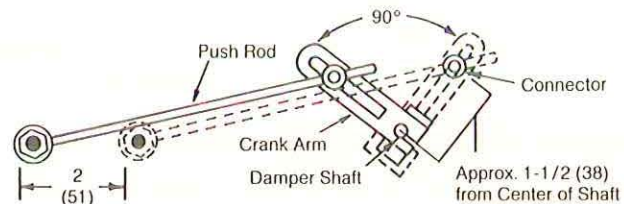


Figure 4.

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General Instructions

MK-2400
MK-2410
MK-2420

Pneumatic Damper Actuators

Proportional pneumatic actuator with 6 sq. in. (39 cm²) effective area used to control small dampers and mixing box valves. Spring return retracts actuator shaft on a loss of air pressure.

CONTROLLER REQUIREMENTS

Any Barber-Colman proportional pneumatic controller.

CONSTRUCTION

Housing is a sturdy die cast aluminum incorporating easily replaceable beaded molded neoprene diaphragm.

STROKE

Linkage: Adjustable 3/8" (10 mm) to 1-1/2" (38 mm) and 2" (51 mm) at hole in end of crank arm; factory set for 1" (25 mm).

Shaft: 1/2" (13 mm).

MAXIMUM SAFE AIR PRESSURE

30 psig (207 kPa).

AMBIENT TEMPERATURE LIMITS

-20 to 160°F (-29 to 71°C).

AIR CONNECTIONS

Barbed elbow for 1/4" O.D. plastic tube, installed into 1/8" FNPT connection.

DIMENSIONS

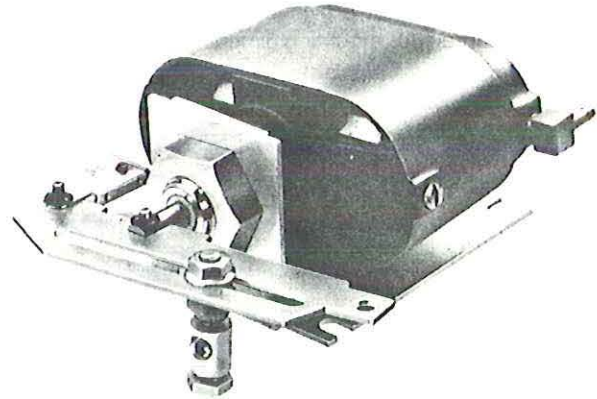
6-3/4" (172 mm) high × 4-3/4" (121 mm) wide × 3" (76 mm) deep.

OPTIONS

None.

Damper Type	Nominal Damper Area for Proportional Control*	Nominal Damper Area for Two-Position Control MK-2420 at 20 psi*
Parallel Blade	1.25 sq. ft.	3.75 sq. ft.
Opposed Blade	1.6 sq. ft.	4.8 sq. ft.

* Damper ratings are nominal and based on standard (not low leakage) dampers at 1" (25.4 mm) static pressure and 2000 fpm (10 m/s) velocity.



ACCESSORIES

- AM-111 Crank arm for 5/16" diameter damper shaft
- AM-112 Crank arm for 3/8" diameter damper shaft
- AM-113 Crank arm for 1/2" diameter damper shaft
- AM-115 Crank arm for 7/16" diameter damper shaft
- AM-122 Linkage connector straight type
- AM-123 Damper clip
- AM-125 5/16" × 20" damper rod
- AM-125-048 5/16" × 48" damper rod
- AM-132 Ball joint connector
- AM-161-3 Damper linkage kit
- Tool-95 Pneumatic calibration tool kit

METRIC CONVERSION

- 1" = 25.4 mm
- 1 psig = 6.895 kPa
- 1 sq. ft. = .09 sq. m.
- 1 lb-in. = 0.113 N-m

Part Number	Nominal Operating Range	Starting Pressure Non-Adjustable	Maximum Force††				Nominal Torque** Proportional Control††		
			Return Stroke	Power Stroke			15 psi Supply Dual Press. System	15 psi Supply Single Press. System†	20 psi Supply Single or Dual Press. System†
				Based on 1.5 psi Pressure to Actuator	15 psi Supply Dual Press. System	15 psi Supply Single Press. System†			
psi	psi	lb.	lb.	lb.	lb.	lb-in.	lb-in.	lb-in.	
MK-2400	3-7	3	4.5	19.5	24	39	2.25	2.25	2.25
MK-2410	5-10	5	10.5	10.5	15	30	2.25	2.25	2.25
MK-2420	8-13	8	19.5	1.5	6	21	.75	2.25	2.25

**Nominal torque for actuators is based on 1.5 psi (10 kPa) pressure change at the actuator.

††Force and torques based on factory set stroke, starting pressure and 90° rotation of driven damper shaft.

†Adjust pressure reducing valve so that listed pressures are available at the actuator.

INSTALLATION

Actuator may be mounted in any position. Mounting bracket and connector for 5/16" (8 mm) diameter push rod comes assembled to the actuator. Use 1/4" O.D. plastic tubing to connect actuator to the controller. 1/4" O.D. copper tubing may be used by replacing barbed elbow with 1/4" x 1/8" MPT compression fitting. Actuators are mounted by means of three 1/4" (6 mm) screws (not provided) through the mounting bracket. See Figure 1 for mounting dimensions.

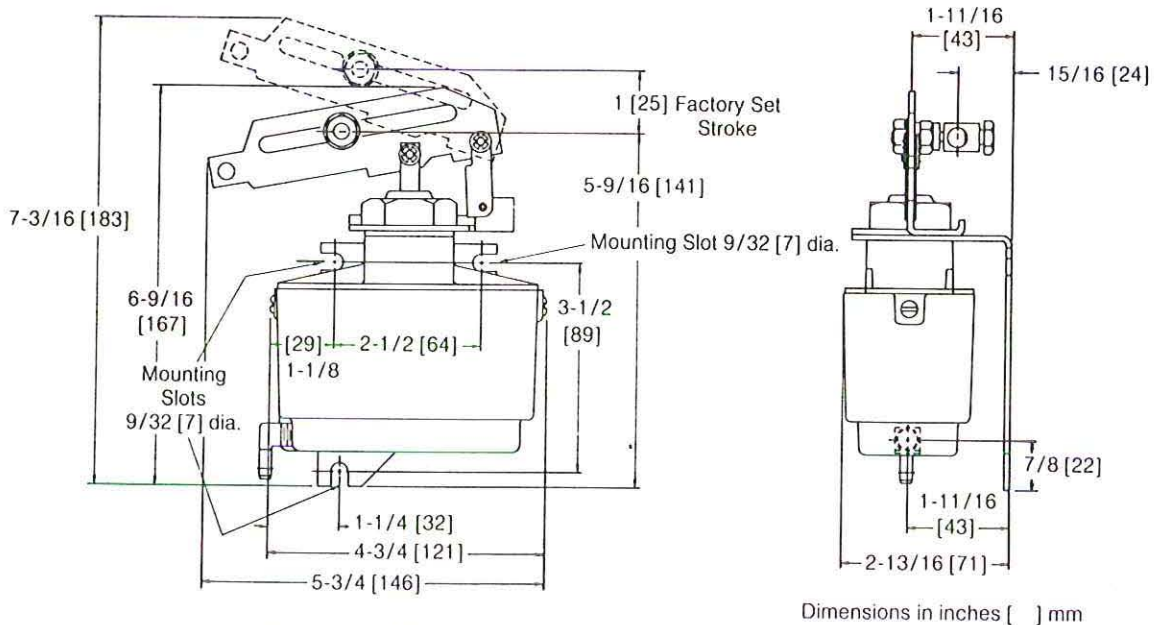


Figure 1. MK-2400 Series Mounting Dimensions

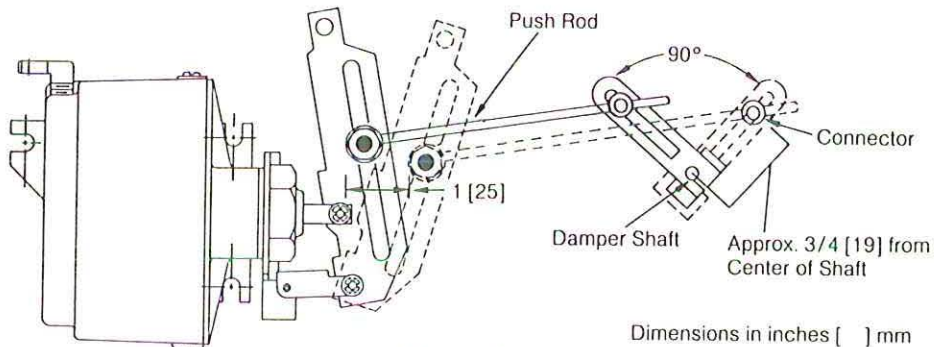


Figure 2.

Assemble linkage by attaching connector to the lever arm on damper shaft. Insert push rod from the actuator connector into the damper lever arm connector and tighten set screw. Apply air to the actuator and run through entire stroke. Readjust linkage if binding occurs during damper shaft rotation. Readjustment may also be necessary if damper shaft does not achieve acceptable rotation. Figure 2 illustrates linkage for 90° damper rotation.

MAINTENANCE

This is a quality product. Regular maintenance of the total system is recommended to assure sustained optimum performance.

Barber-Colman Company
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General Instructions

MK-3000 Series MK2-3000 Series MK4-3000 Series Pneumatic Damper Actuators

APPLICATION

Proportional pneumatic actuator with 8 in.² (52 cm²) effective area used to control dampers, mixing boxes, air valves, etc., in heating, ventilating and air conditioning systems. MK2-31X1 used for high temperatures.

SPECIFICATIONS

Construction:

Housing, Die cast aluminum.

Diaphragm, Beaded molded neoprene.

MK2-31X1 only — Beaded molded silicone.

Stroke: See Table 2.

Start Point: Adjustable on most models ± 1 psi, see Table 2.

Spring: Retracts actuator shaft on loss of air pressure.

Maximum Air Pressure: 30 psig (207 kPa).

Ambient Temperature Limits:

Shipping, -40 to 160°F (-40 to 71°C).

Operating, -20 to 160°F (-29 to 71°C).

MK2-31X1 only —

Shipping, -40 to 250°F (-40 to 121°C).

Operating, -20 to 250°F (-29 to 121°C), for 30 minute exposure 450°F (232°C).

Air Connections: 1/8" FNPT.

Mounting: In any position. Mounting bracket and swivel connector for 5/16" (8 mm) diameter push rod included with actuator.

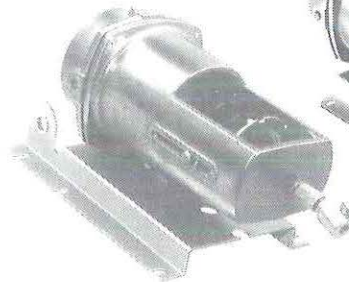
Dimensions: 12" high \times 5-7/8" wide \times 5-1/2" deep (305 mm \times 143 mm \times 140 mm)

OPTIONS None

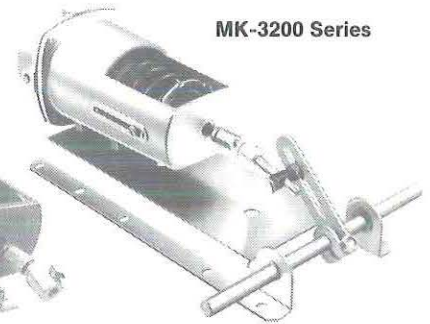
ACCESSORIES

AK-52309-500	Positive positioner and linkage, do not use with MK2-3100 series
AM-111	Crank arm for 5/16" diameter damper shaft
AM-112	Crank arm for 3/8" diameter damper shaft
AM-113	Crank arm for 1/2" diameter damper shaft
AM-115	Crank arm for 7/16" diameter damper shaft
AM-122	Linkage connector straight type
AM-123	Damper clip
AM-125	5/16" \times 20" damper rod
AM-125-048	5/16" \times 48" damper rod
AM-132	Ball joint connector
AM-161-3	Damper linkage kit
AM-301	90° mounting bracket for pivot mounting
AM-530	Crank arm for 1/2" diameter damper shaft holes for 3-1/2" stroke
AM-531	Weld-on frame lug and damper blade clip kit
AM-532	Bolt-on frame lug and damper blade clip kit
AM-533	Actuator shaft extension
AM-534	Pivot stud for pivot mounting
AM-535	Clevis for pivot mounting
AM-536	Mounting plates for pivot mounting on ducts or damper frame
TOOL-95	Pneumatic calibration tool kit

MK-3100 Series
MK2-3100 Series



MK-3200 Series



MK-3300 Series
(MK-3311-109 Shown)

MK-3800 Series

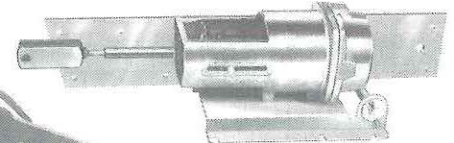


TABLE 1. NOMINAL DAMPER AREA FOR PROPORTIONAL CONTROL†

Actuator Part Number	Parallel Blades		Opposed Blades	
	ft ²	m ²	ft ²	m ²
MK-3101	11.6	1.07	15	1.39
MK2-3101				
MK4-3101				
MK-3111				
MK2-3111				
MK-3121				
MK2-3121				
MK-3141				
MK4-3141				
MK-3151				
MK-3161*				
MK-3201				
MK-3211				
MK-3221				
MK-3801	23.2	2.15	30	2.79
MK4-3801				
MK-3811				
MK-3821				
MK-3841				
MK4-3841				
MK4-3111**				
MK4-3811**				
MK4-3121*	34.8	3.23	45	4.18
MK-32XX***				
MK4-3821*				

*Requires 20 psi be available to the actuator.

**Requires minimum 15 psi be available to the actuator.

***Proportional control with positioner (8-13 spring, 20 psi supply).

†For two-position control use proportional spring of the same actuator with positive positioner. Damper ratings are nominal and based on standard (not low leakage) dampers at 1" (25.4 mm) W.C. static pressure and 2000 fpm (10 m/s) velocity.

TABLE 2. SPECIFICATIONS

Part Number	Nominal Operating Range		Starting Pressure		Nominal Stroke †††	Maximum Force††								Nominal Torque** Proportional Control†††					
						Return Stroke		Power Stroke						15 psi (103 kPa) Supply Dual Press. System		15 psi (103 kPa) Supply Single Press. System†		20 psi (138 kPa) Supply Single or Dual Press. System†	
						Based on 1.5 psi (10 kPa) Pressure to Actuator		15 psi (103 kPa) Supply Dual Press. System		15 psi (103 kPa) Supply Single Press. System†		20 psi (138 kPa) Supply Single or Dual Press. System†		15 psi (103 kPa) Supply Dual Press. System		15 psi (103 kPa) Supply Single Press. System†		20 psi (138 kPa) Supply Single or Dual Press. System†	
						lb.	N	lb.	N	lb.	N	lb.	N	lb-in.	N-m	lb-in.	N-m	lb-in.	N-m
psig	kPa	psig	kPa	in. (mm)															
MK-3101 MK2-3101	3-8	21-55	3 ±1	21 ±7	3½ (89), Adjustable 2 to 4 (51 to 102)	12	53	44	196	56	249	96	427	21	2.37	21	2.37	21	2.37
MK4-3101*	3-8	21-55	3 ±1	21 ±7		12	53	44	196	56	249	96	427	21	2.37	21	2.37	21	2.37
MK-3111 MK2-3111	5-10	34-69	5 ±1	34 ±7		28	125	28	125	40	178	80	356	21	2.37	21	2.37	21	2.37
MK4-3111*	5-10	34-69	5 ±1	34 ±7		28	125	28	125	40	178	80	356	49	5.54	49	5.54	49	5.54
MK-3121 MK2-3121	8-13	55-90	8 ±1	55 ±7		52	231	4	18	16	71	56	249	7	.79	21	2.37	21	2.37
MK4-3121*	8-13	55-90	8 ±1	55 ±7		52	231	4	18	16	71	56	249	7	.79	28	3.16	91	10.28
MK-3141 MK4-3141*	3-13	21-90	3 non-adj.	21 non-adj.		12	53	4	18	16	71	56	249	7	.79	21	2.37	21	2.37
MK-3151	3-6, 9-12	21-41, 62-83	3-6	21 to 41	2¾ (70), Adjustable 2 to 2¾ (51 to 70)	12	53	12	53	24	107	64	285	21	2.37	21	2.37	21	2.37
MK-3161	3-6, 11-17	21-41, 76-117	3-6	21 to 41	12	53	0	0	0	0	24	107	0	0	0	0	21	2.37	
MK-3201	3-8	21-55	3 ±1	21 ±7	90° Rotation Typical, Adjustable 1.2 to 4.4 (30 to 111)	12	53	44	196	56	249	96	427	21	2.37	21	2.37	21	2.37
MK-3211	5-10	34-69	5 ±1	34 ±7		28	125	28	125	40	178	80	356	21	2.37	21	2.37	21	2.37
MK-3221	8-13	55-90	8 ±1	55 ±7		52	231	4	18	16	71	56	249	7	.79	21	2.37	21	2.37
MK-3301-101	3-8	21-55	3 ±1	21 ±7	3½ (89), Adjustable 2 to 4 (51 to 102)	12	53	44	196	56	249	96	427	21	2.37	21	2.37	21	2.37
MK-3311-109	5-10	34-69	5 ±1	34 ±7		28	125	28	125	40	178	80	356	21	2.37	21	2.37	21	2.37
MK-3321-101 MK-3321-102	8-13	55-90	8 ±1	55 ±7		52	231	4	18	16	71	56	249	7	.79	21	2.37	21	2.37
MK-3321-110	8-13½	55-93	8 ±1	55 ±7	4 (102), Adjustable 2 to 4 (51 to 102)	52	231	0	0	12	53	52	231	7	.79	21	2.37	21	2.37
MK-3801 MK4-3801*	3-8	21-55	3 ±1	21 ±7	3½ (89), Adjustable 2 to 4 (51 to 102)	12	53	44	196	56	249	96	427	21	2.37	21	2.37	21	2.37
MK-3811	5-10	34-69	5 ±1	34 ±1		28	125	28	125	40	178	80	356	21	2.37	21	2.37	21	2.37
MK4-3811*	5-10	34-69	5 ±1	34 ±1		28	125	28	125	40	178	80	356	49	5.54	49	5.54	49	5.54
MK-3821	8-3	55-90	8 ±1	55 ±1		52	231	4	18	16	71	56	249	7	.79	21	2.37	21	2.37
MK4-3821*	8-13	55-90	8 ±1	55 ±1		52	231	4	18	16	71	56	249	7	.79	28	3.16	91	10.28
MK-3841 MK4-3841*	3-13	21-90	3 non-adj.	21 non-adj.		12	53	4	18	16	71	56	249	7	.79	21	2.37	21	2.37

*Factory installed positive positioner (AK-52309-500) start point adjustable 2 to 10 psi with range adjustable 2 to 10 psi.

**Nominal torque for actuators without positive positioner is based on 1.5 psi pressure change at the actuator.

†Adjust pressure reducing valve so that listed pressures are available at the actuator.

††Force and torques based on factory set stroke and starting pressure.

†††Factory setting required for published operating range.

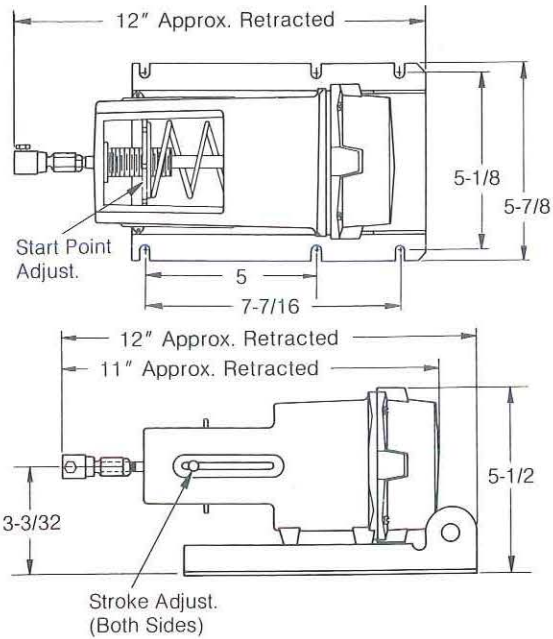


Figure 1. MK-3100 Series Dimensions

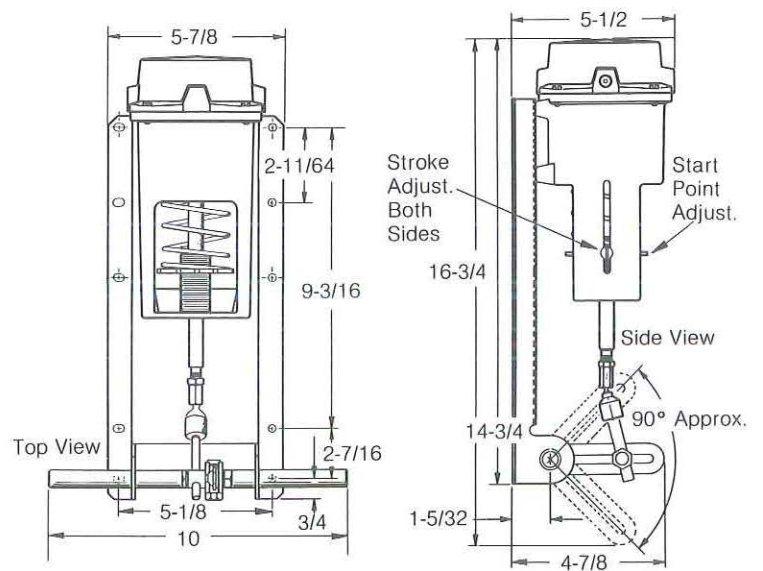
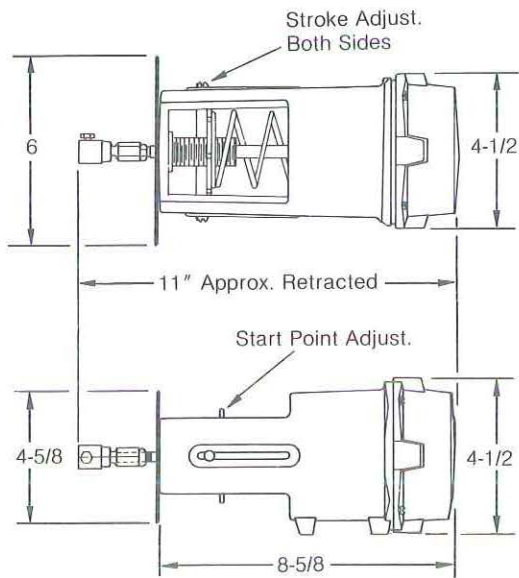


Figure 2. MK-3200 Series Dimensions



Mounting Plate for MK-3300-101, -102, -110 Series Actuator

Figure 3. MK-3300 Series Dimensions*

All Dimensions shown in this Instruction Sheet are in Inches

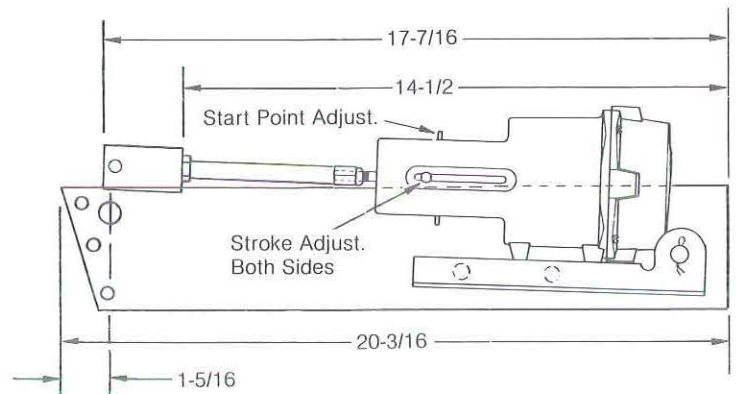


Figure 4. MK-3800 Series Dimensions

* Typical Model shown. Mounting, Linkage, and air connection details may vary from Model to Model.

MK-3100 Series Typical Mounting

Accessories Required for Mounting per Figure 5

- 1 — AM-113 crank arm.
- 1 — AM-122-0-0-2 or AM-132-0-0-2 ball joint.
- 1 — AM-125 link rod 5/16-inch x 20 inches.

To mount proceed as follows. Refer to Figure 5.

1. Measure a minimum of 8 inches from damper shaft in the direction of actuator location.
2. Hold actuator up to duct with actuator shaft approximately 1-1/2 inches above (N.C.) or below (N.O.) damper shaft and mark mounting holes.
3. With drill or punch, pierce holes marked in Step 2.
4. Mount actuator to duct.
5. Attach ball joint to crank arm at approximately 2-1/2 inches from center of shaft hole.
6. Attach crank arm to damper shaft at approximately 45° angle, from vertical, toward actuator with damper in the normal actuator retracted position.
7. Connect actuator ball joint to crank arm ball joint with 5/16-inch diameter rod. Cut off excess rod.
8. Refer to Checkout.

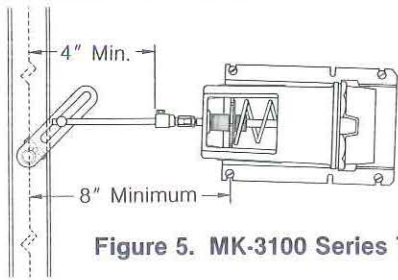


Figure 5. MK-3100 Series Typical Mounting

MK-3300 Series Typical Mounting

NOTE

MK-3300 Series Models are designed for Mixing Box applications. Mounting, Linkage, and air connection details vary among Models. See Actuator Selection Sheet F-13795 for more information.

Accessories Required for Mounting per Figure 8

- 1 — AM-125 link rod 5/16-inch x 20 inches.
- 1 — Connector as required for connection to driven device.

To mount proceed as follows. Refer to Figures 6 and 8.

1. Drill holes in mounting surface as shown in Figure 6.
2. Mount actuator.
3. Connect actuator.
4. Refer to Checkout.

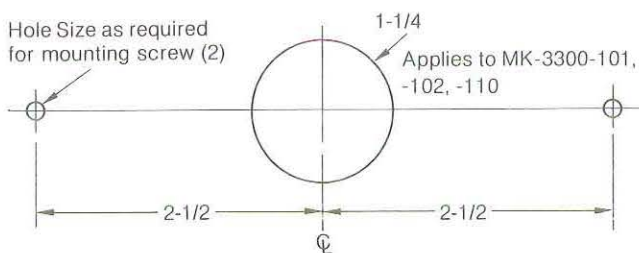


Figure 6.

MK-3200 Series Typical Mounting

Accessories Required for Mounting per Figure 7

- 2 — AM-113 crank arm.
- 2 — AM-122-0-0-2 or AM-132-0-0-2 ball joint.
- 1 — AM-125 link rod 5/16-inch x 20 inches.

To mount proceed as follows. Refer to Figure 7.

1. Locate actuator on a surface perpendicular to the damper shaft, with the actuator rotary shaft approximately in line with the damper shaft.
2. Hold actuator up to duct and mark mounting holes.
3. With drill or punch, pierce holes marked in Step 2.
4. Mount actuator to duct.
5. Attach crank arm to actuator shaft at approximately 45° angle.
6. Attach ball joint to crank arm at approximately 2-1/2 inches from center of shaft hole.
7. Attach crank arm to damper shaft at approximately 45° angle, from vertical, toward actuator with damper in the normal actuator retracted position.
8. Attach ball joint to crank arm at approximately 2-1/2 inches from center of shaft.
9. Connect actuator ball joint to crank arm ball joint with 5-1/6-inch diameter rod. Cut off excess rod.
10. Refer to Checkout.

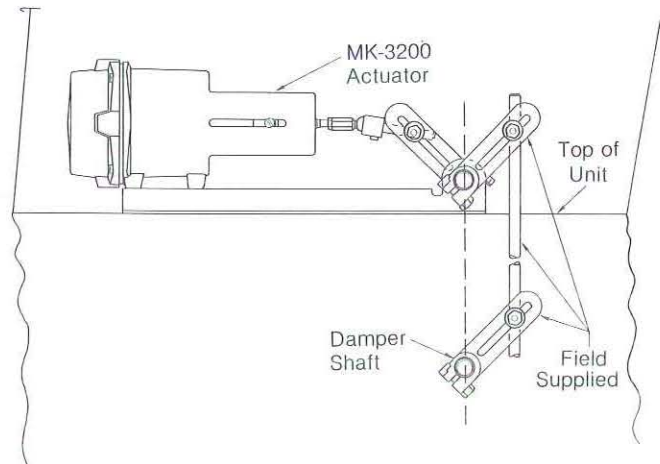
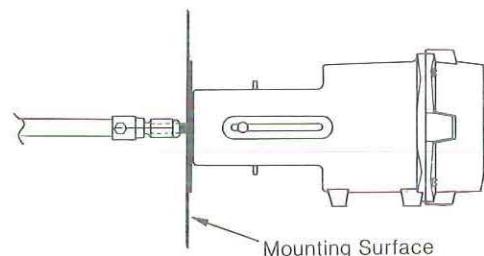


Figure 7. MK-3200 Series Typical Mounting



MK-3300-101 shown

Figure 8. MK-3300 Typical Mounting

Accessories Required for Mounting of Actuator per Figure 14

1 — AM-530 crank arm.

To install proceed as follows.

1. Attach mounting plate to duct or wall with damper shaft protruding through locator hole in mounting plate. If this is not possible, additional shaft extensions may be used to allow locating the actuator farther from the damper shaft. Each extension provides 4 inches of extension to the actuator shaft and may be used in multiples.
2. Install the pivot stud to the mounting plate.
3. Install actuator on pivot stud.
4. Install crank arm on damper shaft at approximately 45° angle from vertical toward actuator.

NOTE

Figure 14 shows position for normally closed.

5. Manually position damper to full retracted actuator position and tighten crank arm in position described in Step 4.
6. Connect clevis to crank arm in hole closest to damper shaft. If necessary adjust clevis and/or extensions.
7. Refer to check out.

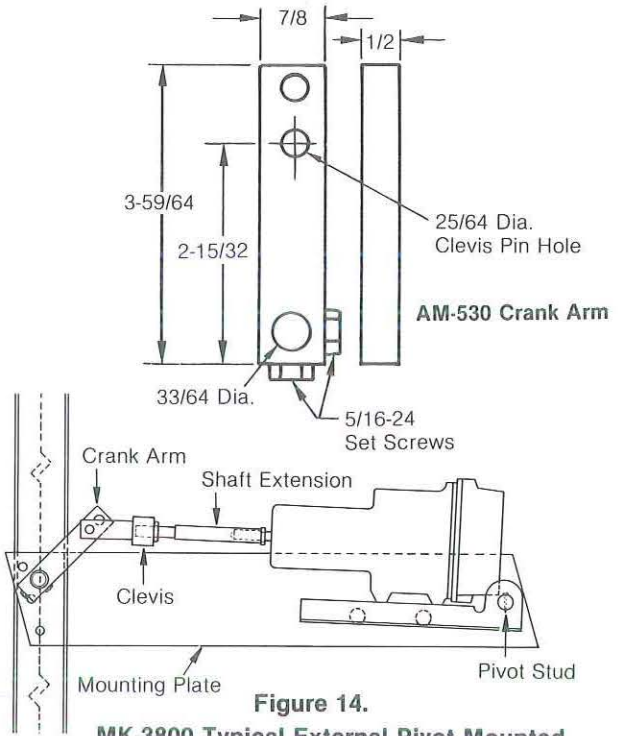


Figure 14.
MK-3800 Typical External Pivot Mounted

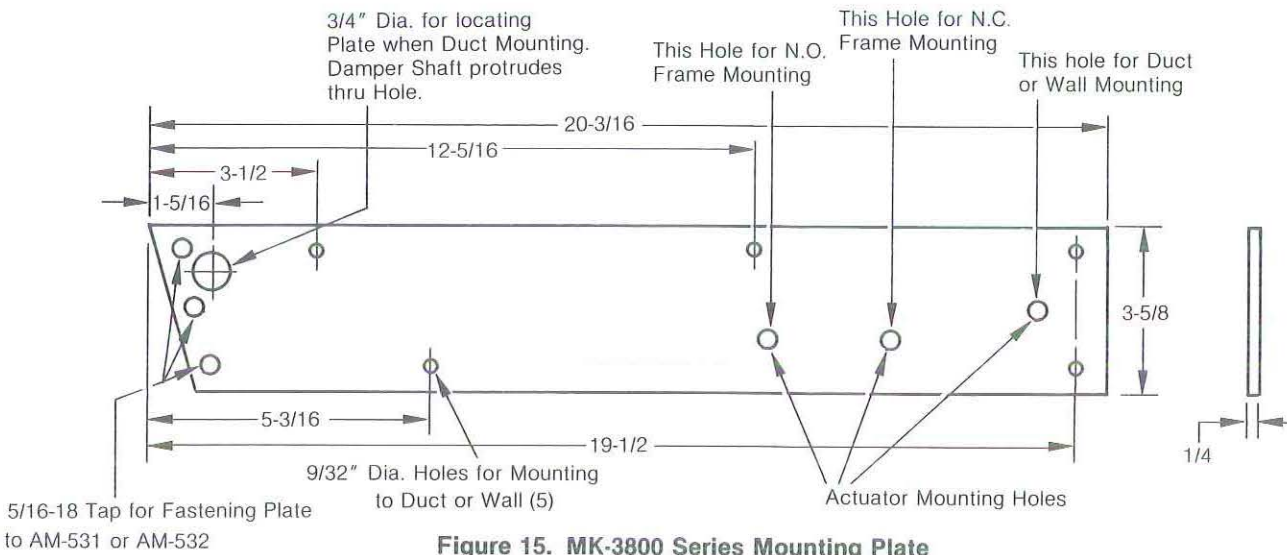


Figure 15. MK-3800 Series Mounting Plate

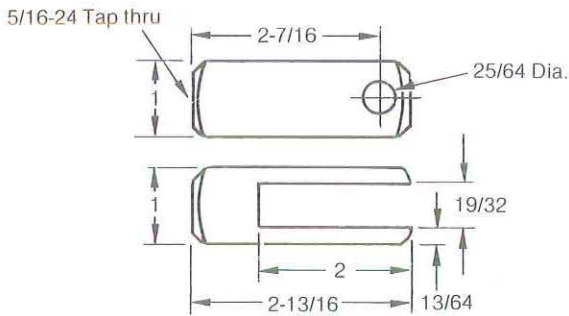


Figure 16. MK-3800 Series Clevis

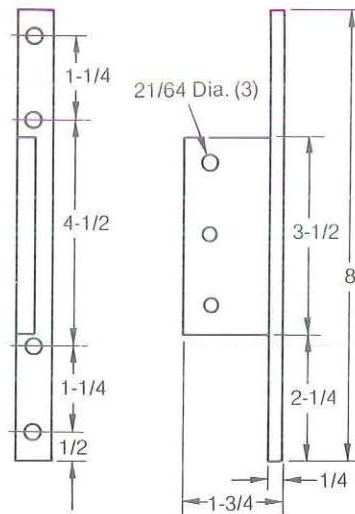


Figure 17. AM-532 Bolt-on Frame Bracket

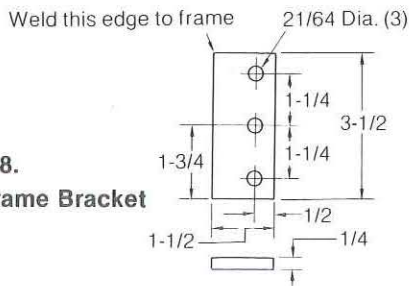


Figure 18.
AM-531 Weld-on Frame Bracket

CHECKOUT

After installation, the actuator should be checked to insure proper damper operation. To check the actuator and linkage, proceed as follows:

1. Check the linkage with the actuator in the retracted position for proper return force. The actuator should be linked so that on a normally closed application, the damper is closed with no more than 1/16-inch compression of the spring. (The actuator shaft would return an additional 1/16-inch if the linkage were disconnected.) For a normally open application, the actuator should be linked with the actuator fully retracted.
2. Apply air pressure to the actuator or pilot port of a positioner and check the linkage as follows. On a normally closed application, the damper should be just full open when the actuator piston reaches the stops in the actuator. On a normally open application, the damper should reach the closed position with no more than 1/16-inch stroke remaining to reach the actuator stops.
3. The above can be obtained through adjustment of the ball joint in the crank arms or by adjustment of the actuator stops. The amount of thread engagement of the actuator ball joint or extension shaft may also be used to assist in proper linking.

Connection of Air Line: On pivot mounting arrangements, Figures 9, 10 and 14, control air lines MUST be terminated at the actuator with at least 6 inches of flexible tubing to allow for pivoting of the actuator. On mounting arrangements, Figures 5, 7 and 8, control air lines may be connected directly with either copper or plastic tubing, as required by application.

CAUTION

On MK2-31X1 Series, metal connectors and tubing must be used.

Adjustable Starting Pressure: Actuators are available with adjustable starting pressure. To adjust the starting pressure, turn adjusting nut supporting the spring clockwise to increase, and counterclockwise to decrease the starting pressure. Each rotation of the adjusting nut changes the starting pressure .04 psi (.28 kPa).

Adjustable Stroke Length: Stroke length is determined by the two stops located on either side of the actuator. Stops are set for 3-1/2-inch stroke. Mark this point and measure toward the diaphragm end of the actuator to reduce the stroke or away from the diaphragm end to increase the stroke. Maximum stroke length is 4 inches. By increasing the stroke length, the force available to resist an opposing force is decreased while decreasing the stroke length increases this force.

Diaphragm Replacement: If the actuator diaphragm should leak, it may easily be replaced by removing the four screws holding the top power housing. Make sure the shaft swivel joint is in place on the end of the shaft. Remove the screws and old diaphragm. Roll the new diaphragm inside out and

install over the piston making sure the circular bead is facing up. Put the top power housing back in place making sure the bead on the diaphragm is in the housing groove and the screw holes are lined up. Tighten housing screws.

UNITS WITH FACTORY MOUNTED POSITIVE POSITIONERS

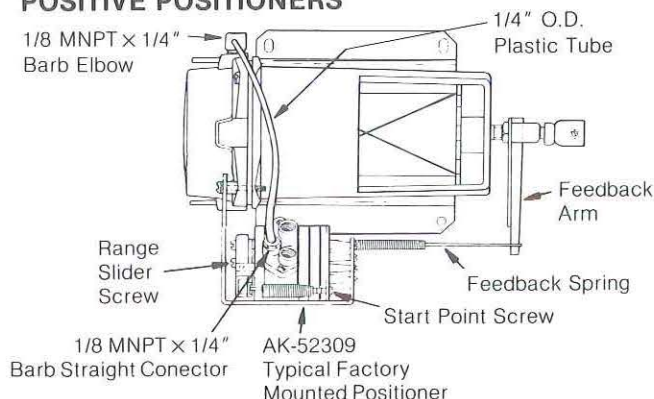


Figure 19. Typical Factory Mounted Positioner

For Actuators with Positioners:

NOTE

If actuator is frame pivot mounted, the actuator must be mounted to the left hand frame. If actuator is mounted external, Figure 14 must be on right hand side of duct.

Install fittings required in Ports 2 and 3.

ADJUSTMENTS Refer to Figure 19.

Range Adjustment: Adjustable 2 to 10 psig (14 to 69 kPa). Factory set at 5 psig (34 kPa). Range is the pressure change required to produce full actuator stroke.

If adjustment is required (see Figure 19), with a small screwdriver loosen screw on range slider approximately 1/2 turn.

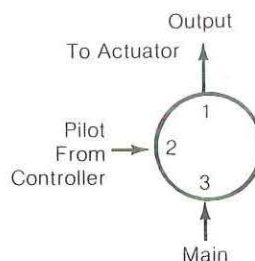
Move the graduated range slider until desired pressure mark lines up with center of screw and tighten screw.

Start Point

Adjustable 2 to 10 psig (14 to 69 kPa). Start point is the pressure at which the actuator just begins to extend. See Figure 19.

Connect main air supply to Port 3 and a variable air supply to Port 2.

1. Adjust variable air supply on Port 2 to desired start point pressure.
2. Adjust the start point screw with small screwdriver until actuator just starts to extend.
3. Gradually raise pressure on Port 2 until actuator is fully extended, and readjust range slider to obtain desired range if further adjustment is necessary.
4. Remove variable air supply from Port 2 and connect to controller output.



NOTE: If slave damper actuators are to be controlled, tee into the tubing from Port 1 to the actuators. All dampers must be mechanically interconnected.

Figure 20.
Typical Piping Diagram
with Factory Mounted
Positive Positioner

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940



General Instructions

MA-305, MA-318 Series MA-405 thru MA-419 Series Two-Position Oil Submerged Actuators

APPLICATION

For two-position operation of damper, valves and other equipment which require the return to normal position upon power interruption.

SPECIFICATIONS

Control Circuit: Two wire.

Shaft Rotation: CW 180° when power is applied.

Spring Return: CCW to original position when actuator is de-energized.

Auxiliary Switch (-500 Models): SPDT makes (or breaks) circuit at powered end of stroke.

Ambient Temperature Limits:

Shipping, -40 to 136°F (-40 to 58°C).

Operating, -40 to 136°F (-40 to 58°C).

Connections: Coded screw terminals.

Case: Die cast aluminum with two 1/2" conduit openings.

Mounting: Allow 6" (152 mm) clearance above the actuator wiring compartment. See Table 1 for additional data.

Dimensions: 5-3/4" high x 5-3/8" wide x 6-9/16" deep (146 mm x 136 mm x 167 mm).

50 Hz: 120, 208, 240 Vac specify MA5-4XX.

Hazardous Locations: Specify MA6-3XX, MA6-4XX (60 Hz); MA7-3XX, MA7-4XX (50 Hz). Models for hazardous locations are only available as factory enclosure/actuator assemblies.



MA6-XXX/MA7-XXX Series



MA-3XX/MA-4XX Series



ACCESSORIES

Damper Linkage:

- AM-111 Crank arm for 5/16" diameter damper shaft
- AM-112 Crank arm for 3/8" diameter damper shaft
- AM-113 Crank arm for actuator or 1/2" diameter damper shaft
- AM-115 Crank arm for 7/16" diameter damper shaft
- AM-116 Splined crank arm for actuator
- AM-122 Linkage connector straight type
- AM-123 Damper clip
- AM-125 5/16" diameter x 20" damper rod
- AM-125-048 5/16" diameter x 48" damper rod
- AM-132 Ball joint connector
- AM-161 Damper linkage kit
- AM-161-1 Damper linkage kit
- AM-301 90 degree mounting bracket

Valve Linkage:

- AV-329 2-1/2" & 3" VB-9323
- AV-391 1/2" to 1-1/4" VB-92X3 or VB-93X3
- AV-392 1-1/2" & 2" VB-92X3 or VB-93X3
- AV-395 2-1/2" to 4" VB-92X3 or VB-9313

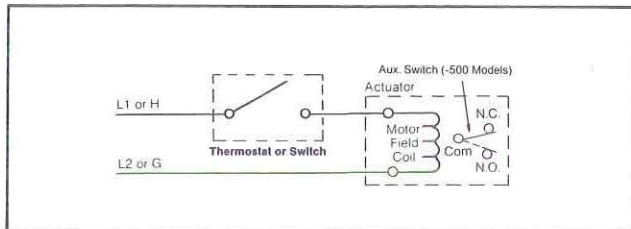


Figure 1. Wiring for MA-305, 405, 406 and 407 Series

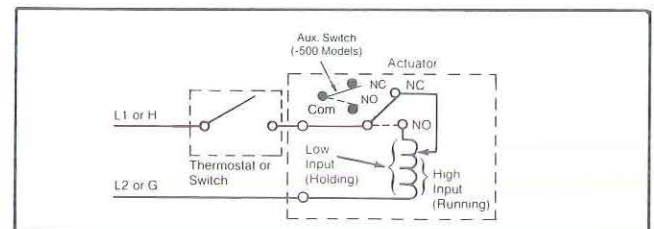


Figure 2. Wiring for MA-318, 416, 418 and 419 Series

TABLE 1. SPECIFICATIONS

Actuator Part Number	Power Supply (Vac) 60 Hz	Aux.* Switch	Input (Watts)	VA		Rated Torque Lb.-In. (N-m)	No Load Timing† at 75°F (24°C) Secs/180°	Nominal** Damper Area Sq. Ft. (m²)		Mounting	Application
				Run- ing	Hold- ing			Parallel	Opposed		
MA-305	24	No	25	56	56	16 (1.8)	20	9 (.8)	11 (1)	Any Position	Damper
MA-305-500	24	Yes									
MA-405	120	No									
MA-405-500	120	Yes									
MA-406	208	No									
MA-406-500	208	Yes									
MA-407	240	No									
MA-407-500	240	Yes									
MA-318	24	No	70 Running	92	32	60 (6.8)	20	33 (3.1)	43 (4)	Output Shaft Horizontal	Valve or Damper
MA-318-500	24	Yes									
MA-418	120	No	25 Holding	108	42						
MA-418-500	120	Yes									
MA-416	208	No									
MA-416-500	208	Yes									
MA-419	240	No									
MA-419-500	240	Yes									

*2 FLA, 12 LRA @ 24/120 Vac; 1 FLA, 6 LRA @ 240 Vac.

**Damper ratings are nominal and based on standard (not low leakage) dampers at 1" (25.4 mm) W.C. pressure and 2000 FPM (10 m/s).

†Spring return timing with full load opposing spring approximately 60 sec.

THEORY OF OPERATION

The output shaft rotates 180° clockwise (CW) when energized and spring returns counterclockwise (CCW) to 0° when de-energized.

MA-305, 405, 406 and 407 series actuator motors are assembled to a gear train and stall at the end of the power stroke.

MA-318, 416, 418 and 419 series actuators have an end of travel switch which reduces the running input from 70 watts to 25 watts at the end of the CW rotation.

PRE-INSTALLATION

Inspection

Visually inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious defects. Return damaged or defective products.

Required Installation Items

- Wiring diagram
- Tools (not provided):
 - Volt-ohm meter
 - Appropriate screwdriver for mounting screws
 - Appropriate drill and drill bit for mounting screws
- Appropriate accessories
- Mounting screws (not provided)

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Disconnect power supply before installation to prevent electrical shock and equipment damage.
3. Make all connections in accordance with the wiring diagram, and in accordance with national and local electrical codes.
4. Do not exceed ratings of the device.

Mounting Location

Allow 6" (152 mm) clearance above the actuator wiring compartment. Locate actuator in a weather protected area. Three 7/16" (11.1 mm) mounting holes are provided in the base of the actuator. (See Figure 3 for mounting dimensions.)

MA-305, 405, 406 and 407 series actuators can be mounted in any position. The MA-318, 416, 418 and 419 series actuators output shaft must be mounted in a horizontal position.

Wiring

Two 1/2" conduit knockouts are provided on the actuator case.

See Figures 4 thru 6 and Table 2 for wiring information.

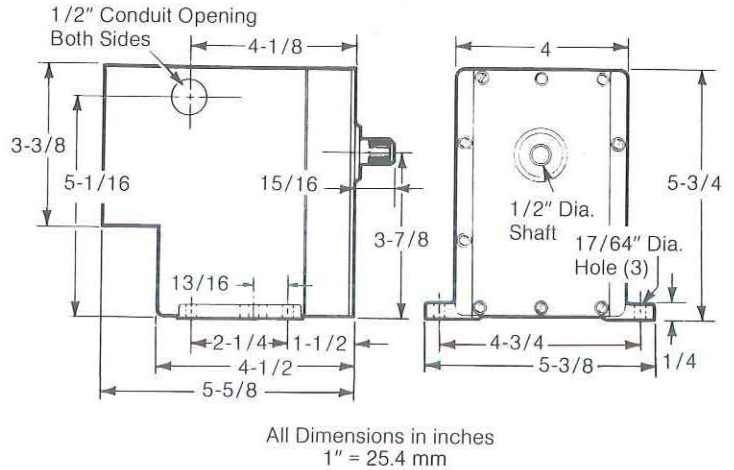


Figure 3. Mounting Dimensions

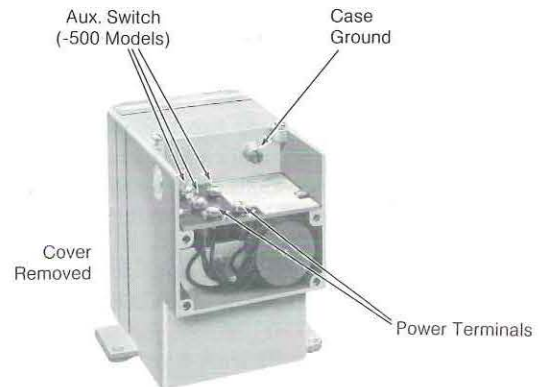
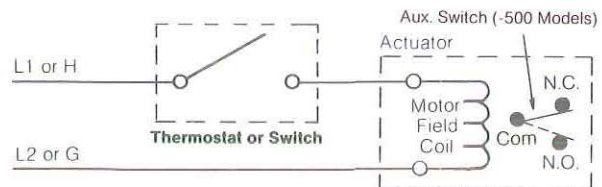
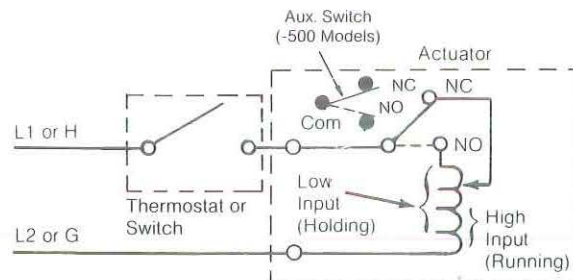


Figure 4. Terminal Locations



Actuator rotates 180° CW when thermostat or switch contacts are closed. Actuator spring returns when thermostat or switch contacts are open.

Figure 5. Typical Wiring for MA-305, 405, 406 and 407 Series



Actuator rotates 180° CW when thermostat or switch contacts are closed. Actuator spring returns when thermostat or switch contacts are open.

Figure 6. Typical Wiring for MA-318, 416, 418 and 419 Series

TABLE 2. POWER WIRE SELECTION

Actuator Series	Wire Size (AWG)	Maximum Run — Ft. (m) (1 run has 2 wires)
MA-305	14	122 (37)
	12	191 (58)
	10	305 (93)
MA-405 MA-406 MA-407	14	2800 (853)
MA-318	14	44 (13)
	12	68 (21)
	10	110 (34)
MA-416 MA-418 MA-419	14	950 (290)
	12	1580 (482)

Opposite each model number and wire size is the maximum 2 wire run in feet for one actuator. To determine the maximum run when multiple actuators are used, divide the number of actuators into the corresponding maximum run.

Damper Linkage

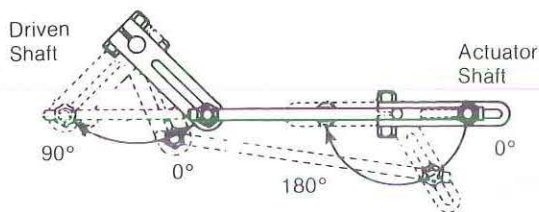


Figure 7. 180° Rotation Actuator Driving Damper 90°

To fasten linkage for 180° actuator shaft rotation operating an arm through 90° arc (see Figure 7):

1. Fasten linkage connector at end of driven crank shaft arm.
2. Fasten linkage connector at punch mark on actuator crank arm (about .707 of the radius).
3. Attach damper rod to connectors on crank arms.

Normally Closed

1. Loosen crank arm from actuator shaft and swing linkage and damper shaft through entire rotation to insure the proper damper action.
2. Return damper to closed position.
3. Tighten crank arm on actuator shaft.
4. Loosen the actuator crank arm connector.
5. Pull damper rod through the crank arm connector until the damper is tightly closed.
6. Tighten clamp connecting link on actuator crank arm.

Normally Open

1. Move damper to approximately 85° of full open position and clamp connecting links to damper rod.
2. Check adjustment for proper operation by running actuator and driven shaft between limits of travel.

CAUTION

Actuator must be linked to the load (i.e., damper) to allow the actuator on power stroke, full end of travel movement. If crank arm does not provide proper travel, reset connecting linkage connector. NEVER ATTEMPT TO TURN THE ACTUATOR SHAFT WITH A WRENCH OR A CRANK. This will cause internal damage to the actuator.

Valve Installation

Install all globe type valves maintaining proper flow direction as indicated by arrows on the valve body:

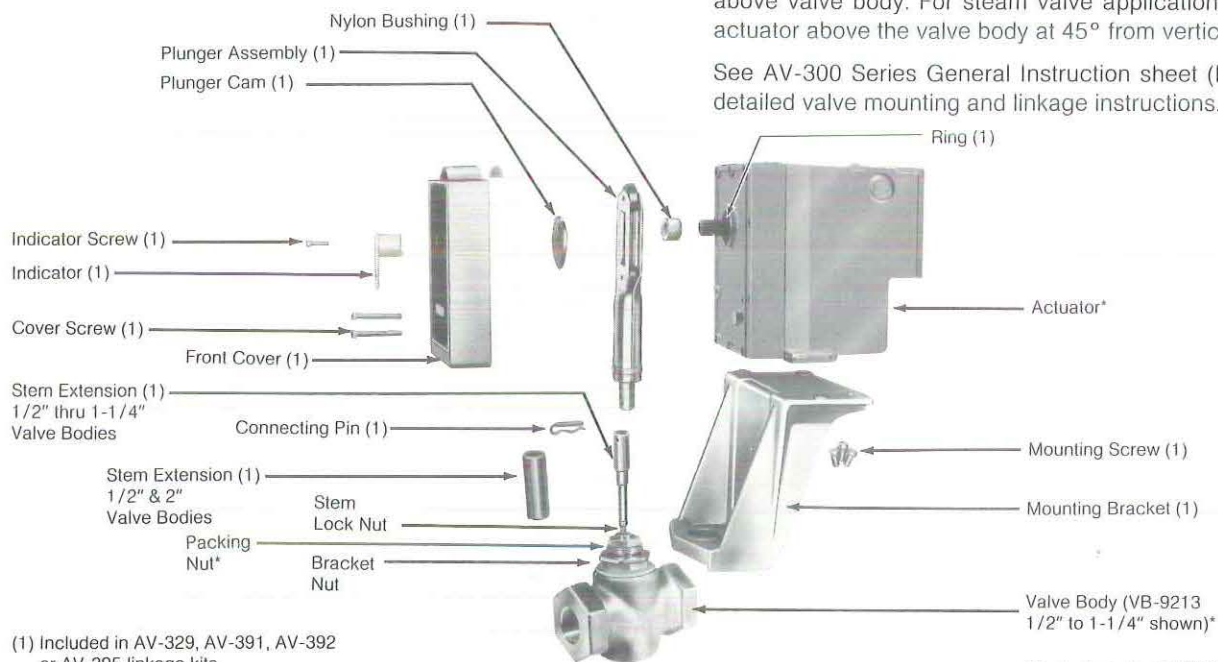
Always install single-seat valves with pressure under the seat.

Always install three-way mixing valves with two inlets and one outlet.

Always install three-way diverting valves with one inlet and two outlets.

For hot or chilled water valve applications mount the actuator above valve body. For steam valve applications mount the actuator above the valve body at 45° from vertical.

See AV-300 Series General Instruction sheet (F-19068) for detailed valve mounting and linkage instructions.



(1) Included in AV-329, AV-391, AV-392 or AV-395 linkage kits.

*Not included in "AV" kits.

Figure 8. Typical Components for Valve Installation

CHECKOUT

After the entire system has been installed, the following check for proper operation can be made:

1. Make certain that the system wiring is connected and powered.
2. Be sure the controller (manual or automatic) is operating properly per system requirements.
3. When the controller (manual or automatic) energizes the actuator, the output shaft will run to the end of the stroke (180° CW).
4. When the controller (manual or automatic) de-energizes the actuator, the spring will return the output shaft to its original position.

5. The action of the auxiliary switch (-500 models):

C made to NC when actuator is de-energized.

C made to NO when actuator is energized and the output shaft reaches the end of the stroke.

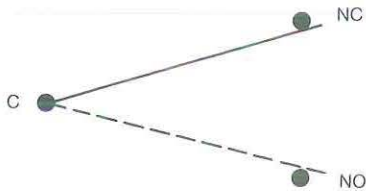


Figure 9. Auxiliary Switch (-500 Models)

MAINTENANCE

Regular maintenance of the total system is recommended to assure sustained optimum performance.

FIELD REPAIR

None. Replace with a functional actuator. Actuators may be returned to the factory for reconditioning.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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General Instructions

Pneumatic Receiver-Controller
RKS-1001, 2001, 3002, 4002



General Information: These receiver-controllers are used in conjunction with Barber-Colman transmitters for proportional control of valves and actuators. Depending on the transmitter, they may be used to control temperature, humidity and duct pressures. May be used as single controller, master-submaster or either of above with remote reset of set point.

Construction: A proportional control relay type pneumatic instrument which accepts a 3 to 15 psig signal, and controls using a small portion of the input signal. The unit, depending on model, will accept from 1 to 3 input signals. The stable balanced lever system produces a linear output signal to the actuator based on the value of the input signals.

The units are all capable of being changed in the field from direct to reverse-acting. This action is referenced to the number 1 input signal. The direction of reset effect on the dual input units is reverse only and not field changeable.

The set point of the unit is of a vernier type. The adjustment knob is located under the cover. On units with a remote set point input, the set point may be either adjusted at the instrument or remotely. The remote set point adjuster is ordered separately and not part of the receiver controller.

Supply Air Pressure: 18 psig nominal, 30 psig maximum.

Proportional Band: Adjustable from 2-1/2% to 40% of Input No. 1 transmitter span; i.e., 200F° transmitter span, 5F° = 2-1/2%, 80F° = 40%. At 2-1/2% proportioning band, 5F° will produce a 10 psig change in output pressure (nominally 3-13 psig).

Ambient Temperatures: 150F maximum, 40F minimum.

Authority: On dual input units adjustable from 10 to 200%, 100% authority means that both transmitters have the same authority if they have the same span. 1 psi change at Input No. 1 is balanced by 1 psi change at Input No. 2.

Air Consumption: For sizing air compressors, average air consumption is 0.008 scfm (standard cubic feet per minute). Add 0.024 scfm for each transmitter connected to the receiver-controller. A dual input unit with remote set point would be (.008 + .024 + .024 + .024) = .08 scfm.

Air Capacity: For sizing air mains, receiver-controller air requirement is 16 scim (standard cubic inches per minute). Add 36 scim for each transmitter connected to the receiver-controller (such as a dual input and remote set point adjuster). A receiver-controller with two transmitters and one remote set point adjuster connected would have a total of 124 scim (16 + 36 + 36 + 36).

Air Connections: 1/8" FNPT. Spacing designed to accept 1-1/2" dia. back connected gauges for direct mounting.

Table 1
AVAILABLE RECEIVER CONTROLLER MODELS

Model		Remote SPA	Action*	Authority‡	Proportional Band†
Single Input	RKS 1001	None	DA	None	2-1/2% to 40% of Primary Transmitter Span.
	RKS 2001	±10% of Primary Transmitter Span	DA		
Dual Input	RKS 3002	None	DA	10% to 200% of Primary Transmitter Span. Adjustable.	
	RKS 4002	±10% of Primary Transmitter Span	DA		

*DA (direct-acting): Increases output pressure on rise in Input No. 1 pressure. Field changeable to RA. RA (reverse-acting): Decreases output pressure on rise in Input No. 1 pressure.

‡Primary transmitter connects to Input No. 1.

INSTALLATION AND MOUNTING

Mount unit in upright position on wall, panel, etc. using the three holes provided. Do not mount on a surface subject to vibration.

Front 1/8" FNPT connections (4) on manifold are spaced to allow installation of 1-1/2" gauges. Connections on top are provided for connection to system piping.

Refer to Figure 1 for location of port connections and table for features of individual units.

Port B - Branch, connected to controlled device.

M - Main, supply air pressure of 18 psig.

2 - Input No. 2, Input from secondary transmitter.

1 - Input No. 1, primary transmitter input.

A - Remote set point adjuster input.

ADJUSTMENTS

Changing From Direct to Reverse-Action (referenced to Input No. 1).

The action (direct or reverse) of the unit must be correct for the application before calibration is attempted. Standard factory assembly is for direct-acting (DA).

When the units are received on the job-site, they may be field converted for reverse-action (RA) as follows:

1. Cut the pilot tube with end cutter on 45° angle as close to the DA pilot tube connection as possible. See Figure 2, for tube location.
2. Remove plug from RA pilot tube connection and tape it to inside of cover. Insert pilot tube into RA tube connection.
3. With 3/16" wrench, turn RA screw in (CW) until contact is made with lever "B". See Figure 2A. With a 3/16" wrench, back DA screw out (CCW) approximately 4 turns. See Figure 3.

If it should be necessary to return the receiver-controller to the direct-acting mode, proceed as follows:

1. Remove the pilot tube from the RA pilot tube connection.
2. Insert plug in to vacated hole.
3. Assemble eyelet EYRF-292 to pilot tube. Remove any tube and eyelet that may be on DA pilot tube connections. Force tube over the DA pilot tube connection.
4. Using pliers, push EYRF-292 eyelet in place to secure pilot tube to DA pilot tube connection.
5. With 3/16" wrench, turn DA screw in (CW) until contact is made with lever "B". With 3/16" wrench, turn RA screw out (CCW) approximately 4 turns.

Attachment of AT 539: To attach the AT 539 external pilot pressure kit, use the following procedure:

1. Remove Receiver Controller restriction cover plate, restriction, and two gaskets (see Figure 2 for location).
2. Replace items in Step 1 with parts in AT 539 kit.
3. Route 5/32" plastic tubing between main and No. 2 input bosses and connect to constant 18 psig main.
4. With pliers break off protrusion on cover that normally fits between the main and No. 2 input bosses.
5. NOTE: When using the AT-539 the restrictions for the transmitters must be removed and the PNC-42 blocking gasket installed. The transmitters then require a remote restrictor.
6. Place cover on receiver-controller.

Percent Proportional Band Adjustment

See Figure 4 for location of adjustment of percent proportional band.

Percent proportional band is a value which is a percentage of the primary transmitter span (Input No. 1) which will produce a 3-13 psig (10 psi change) output in branch line pressure. This setting must be calculated and set prior to calibration of the receiver-controller set point. If changes in proportional band setting are required for stable control, recalibration of the receiver-controller is required.

The formula for converting throttling range to proportional band setting is:

$$\text{Proportional Band Setting} = \frac{\text{Throttling Range}}{\text{Transmitter Span}} \times 100$$

Typical Conversions are:

Transmitter Span		THROTTLING RANGE			
		50F °F	200F °F	80% RH % RH	2" H ₂ O "H ₂ O
P R O P.	2.5	1.25	5	2	.05
	5	2.5	10	4	.1
	10	5	20	8	.2
B A N D	15	7.5	30	12	.3
	20	10	40	16	.4
S E T T I N G	25	12.5	50	20	.5
	30	15	60	24	.6
	35	17.5	70	28	.7
	40	20	80	32	.8

See F-14246 for conversions for other throttling ranges.

THROTTLING RANGE VS. PROP. BAND SETTING

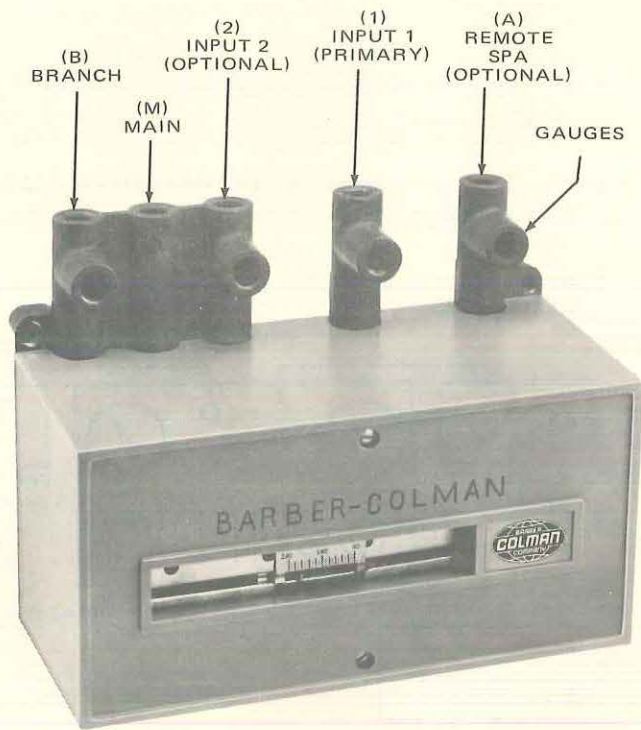


Figure 1 – RECEIVER-CONTROLLER PORT IDENTIFICATION

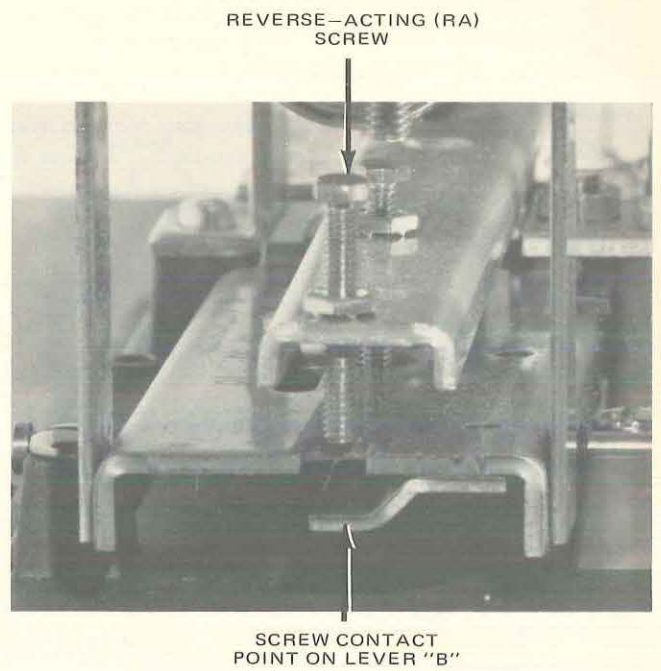


Figure 2a – REVERSE ACTING SCREW ADJUSTMENT

REVERSE-ACTING (RA)
PILOT TUBE
CONNECTION
(SHOWN WITH PLUG IN HOLE)

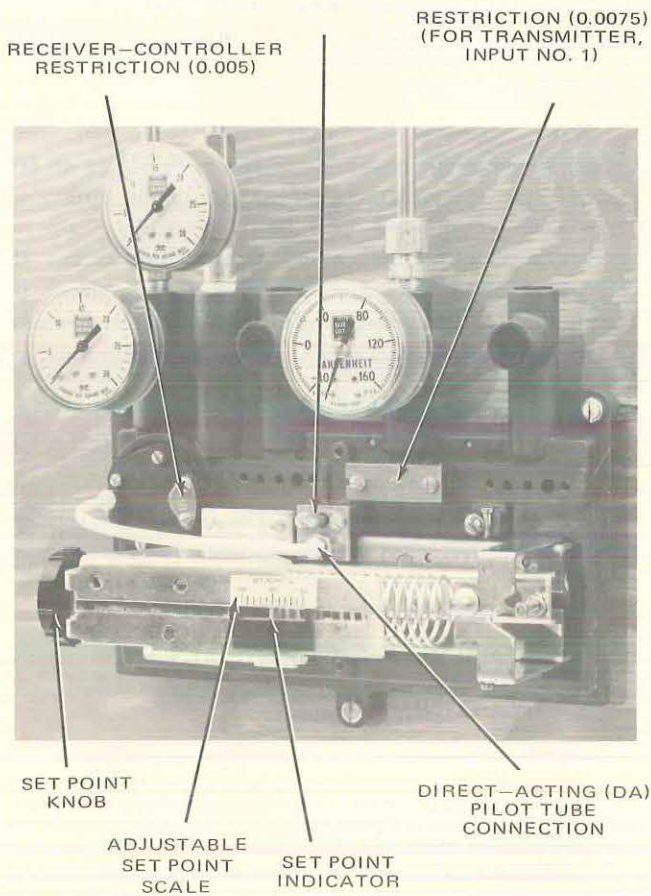


Figure 2

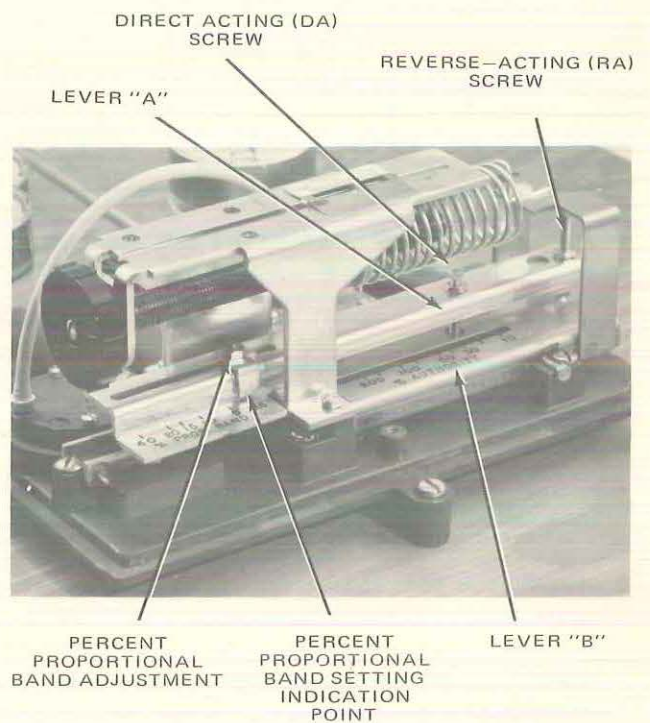


Figure 3

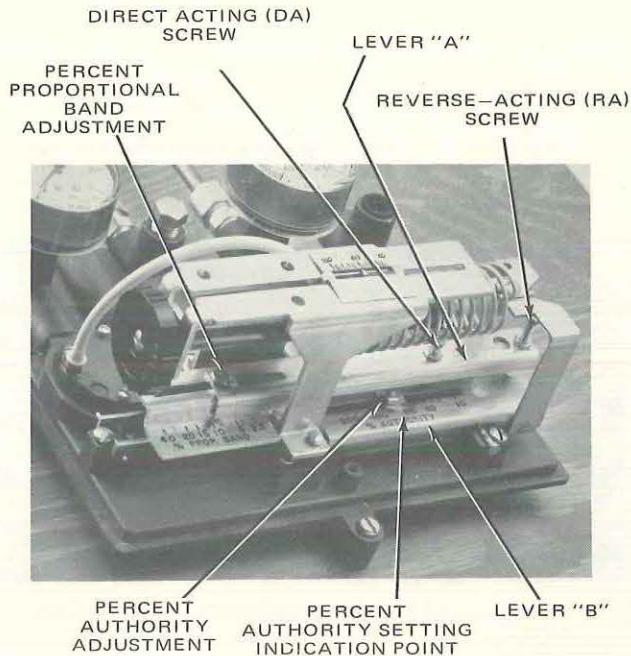


Figure 4

Percent Authority Adjustment

See Figure 4 for location of adjustment of percent authority.

Percent authority is the value that is the ratio of the effect of the secondary transmitter on output pressure compared with the effect of the primary transmitter. Example: 200°F span transmitters at both inputs 1 and 2.

10% authority means input 2 must change 10° in order to have the same affect as 1° change at input 1 in relation to the output pressure.

See Page 7 for method of calculating.

In cases where the transmitter is more than 200 feet from the receiver-controller or where the input signal is the output pressure of another controller or thermostat except TK-5000 series, the restriction for that input must be removed and the passages must be blocked. To block these passages, proceed as follows. Refer to Figure 2.

1. Remove restrictor cover plate screws.
2. Remove restrictor cover plate.
3. Remove restrictor plate and gaskets.
4. Install blocking gasket packaged with the receiver-controller.
5. Install cover plate and secure blocking gasket and cover plate with two screws.

If additional gaskets are required, order under Part Number PNC-42. These gaskets have a Red edge which will be visible above the top of the cover plate to indicate the restriction has been removed.

CALIBRATION

1. Set percent proportional band and percent authority adjustment and determining percent authority setting.

2. Select and apply proper set point decal provided with the receiver-controller.

NOTE: The scale must match the range of the primary (input) transmitter.

3. Connect into transmitter No. 1 and 2 lines calibration box as shown below:

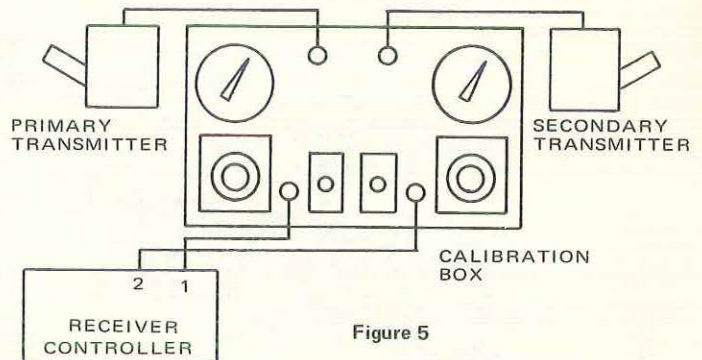


Figure 5

4. Position toggle switches to up (trans) position.
5. After making sure the transmitters are sensing a stable condition (temperature, humidity, pressure) measure the condition at the transmitter with an accurate measuring device such as thermometer, etc.
6. Note reading on calibration box gauges for specific range of transmitter used, compared to condition measured at the transmitter.
7. If readings are within $\pm 15^\circ\text{F}$ on 200° span transmitter, $\pm 4^\circ\text{F}$ on a 50° span transmitter, $\pm 6\%$ RH on an 80% RH span transmitter or $.15^\circ\text{H}_2\text{O}$ on the differential transmitter proceed as follows. If readings are not within these limits on all transmitters except the differential pressure transmitter, replace the transmitter. When installing the new transmitter refer to the transmitter general instructions and make sure it is installed properly.
8. Adjust all permanent receiver gauges to match the condition as measured with the accurate measuring device such as thermometer, etc. (Not calibration box gauge.)

9. Position toggle switches to down (calib) position.

TO CHECK PERCENT PROPORTIONAL BAND:

10. Single Input Units & Dual Input
 - A. Adjust the signal to Input No. 1 until 3 psig is read on the branch gauge. Note reading on the No. 1 test gauge.
 - B. Adjust the signal to Input No. 1 until the branch gauge indicates 13 psig. Note reading on the No. 1 test gauge.
 - C. Determine difference between step A & B.
 - D. If this difference is not correct for desired throttling range, adjust the percent proportional band adjustor in the proper direction and return to step A in calibration above.

FOR SINGLE INPUT UNITS ONLY –

11. Adjust the signal to input No. 1 until the permanent gauge indicates the desired temperature. In units with remote set point the pressure to input "A" must be 9 psig.
12. Rotate set point knob until 8 psig ± 1 psig is obtained on the branch gauge.
13. Slide the set point scale until the desired temperature is read at the set point indicator.

The single input unit is now calibrated; remove calibration box and reconnect transmitter.

FOR DUAL INPUT UNITS the Percent Authority must also be checked. To explain this we will use the following for an example:

Given OA	O	70	Secondary Transmitter (2)
HW	180	100	Primary Transmitter (1)

11. Determine percent authority setting, and adjust authority adjustment.

DETERMINING PERCENT AUTHORITY SETTING

The percent authority adjustment on the RKS 3002 and RKS 4002 receiver-controllers is similar to the reset of a submaster thermostat as used in a master-submaster system. However, the authority setting cannot be determined in the same manner due to the difference in spans of the transmitters. The calculation must be made using the formula on page six.

Example: Hot Water Reset from Outdoor Air

Refer to Figure 8, example of transmitter relationship chart, F-14245. Plot the limits as follows:

Given: Outdoor Air	Hot Water
-10F	180F
60F	100F

Transmitters Range
 O.A., -40 to +160F (200F^o Span)
 H. W., 40 to 240F (200F^o Span)
 Desired TR, 10F^o

- A. Reading on T-1 scale of Figure 8, plot point at upper limit of H.W. (180F) (Point 1) and lower limits of O.A. on T-2. (-10F). Point 1 becomes 180F (T-1) at -10F (T-2).

Next, plot Point 2 at lower limit of H.W. (100F), and upper limit of O.A. on T-1 (60F). Point 2 becomes 100F (T-1) at 60F (T-2).
- B. Draw vertical lines from Points 1 and 2 down to horizontal T-2 scale. Designate difference between two vertical lines as "B" (70F^o).
- C. Draw horizontal lines from Points 1 and 2 across to vertical T-1 scale. Designate difference between two horizontal lines as "A" (80F^o).

D. Formula -

$$\% \text{ Authority Setting} = \frac{A}{B} \times K$$

A and B are as plotted on Chart F-14245

$$K = \frac{\text{Span of (O.A. Transmitter) T-2}}{\text{Span of (H.W. Transmitter) T-1}} \times 100$$

For above example

$$\% \text{ Authority Setting} = \frac{80^{\circ}\text{F}}{70^{\circ}\text{F}} \times 100$$

$$\% \text{ Authority Setting} = 1.14 \times 100$$

$$\% \text{ Authority Setting} = 114\%$$

Example: Room and Discharge Control

The calculations and plottings are the same for this system as for H.W. reset.

In this case the room transmitter is the primary transmitter and is connected to Input No. 1.

Input 1 Transmitter Span	Input 2 Transmitter Span	K Factor
50 F	50 F	100
50 F	200 F	400
50 F	80% RH	160
50 F	2" Water	4
200 F	50 F	25
200 F	200 F	100
200 F	80% RH	40
200 F	2" Water	1
80% RH	50 F	62.5
80% RH	200 F	250
80% RH	80% RH	100
80% RH	2" Water	2.5
2" Water	50 F	2,500
2" Water	200 F	10,000
2" Water	80% RH	4,000
2" Water	2" Water	100

12. CHECK PERCENT AUTHORITY

TO CHECK PERCENT AUTHORITY:

- A. Adjust signal to Input 2 to equal Max. Temp. (in example 70^o)
- B. Adjust signal to Input 1 to equal Min. Temp. desired (in example 100^o)
- C. Adjust set point knob until a branch pressure of between 5 and 10 psig is read on the branch line gauge.
- D. Note branch pressure reading.
- E. Lower the signal to input No. 2 until the test gauge indicates the lowest desired temperature (in example 0^oF).
- F. Raise the signal to Input No. 1 until the branch gauge again reads the same as it did in Step D.
- G. Note the reading on the No. 1 test gauge. If it is not correct, (in example 180^o) readjust the percent authority slider in the appropriate direction (Increase setting if reading is too much, decrease setting if reading is too little) and return to step A.

13. Adjust the signal to Input No. 1 until the permanent gauge indicates the min. desired temperature at input No. 1 in example 100°.
14. Adjust the signal to input No. 2 until the permanent gauge indicates the maximum desired temperature at input No. 2 in example 70°.
15. On units with remote set point adjustment, make certain that the signal from the set point adjustor is 9 psig.
16. Rotate set point knob until 8 psi ± 1 psi is obtained on branch pressure gauge.
17. Slide the set point scale until the minimum desired temperature (in example 100°F) is read at the set point indicator.

The unit is now calibrated: remove calibration box and reconnect transmitters.

NOTE: If system requires changing Percent Proportional Band unit, setpoint must be calibrated.

Band unit set point must be calibrated.

DIRECTION OF SET POINT KNOB ROTATION TO OBTAIN 8 PSIG BRANCH LINE PRESSURE.

Action	Initial Branch Pressure Below 8 PSI	Initial Branch Pressure Above 8 PSI
DA	CCW	CW
RA	CW	CCW

DIAL KNOB HAS 10 EQUAL DIVISIONS.

Transmitter Span Input 1	Each Division Represents
50°F	.25°F
200°F	1°F
80% RH	.4% RH
2" H ₂ O	.01" H ₂ O

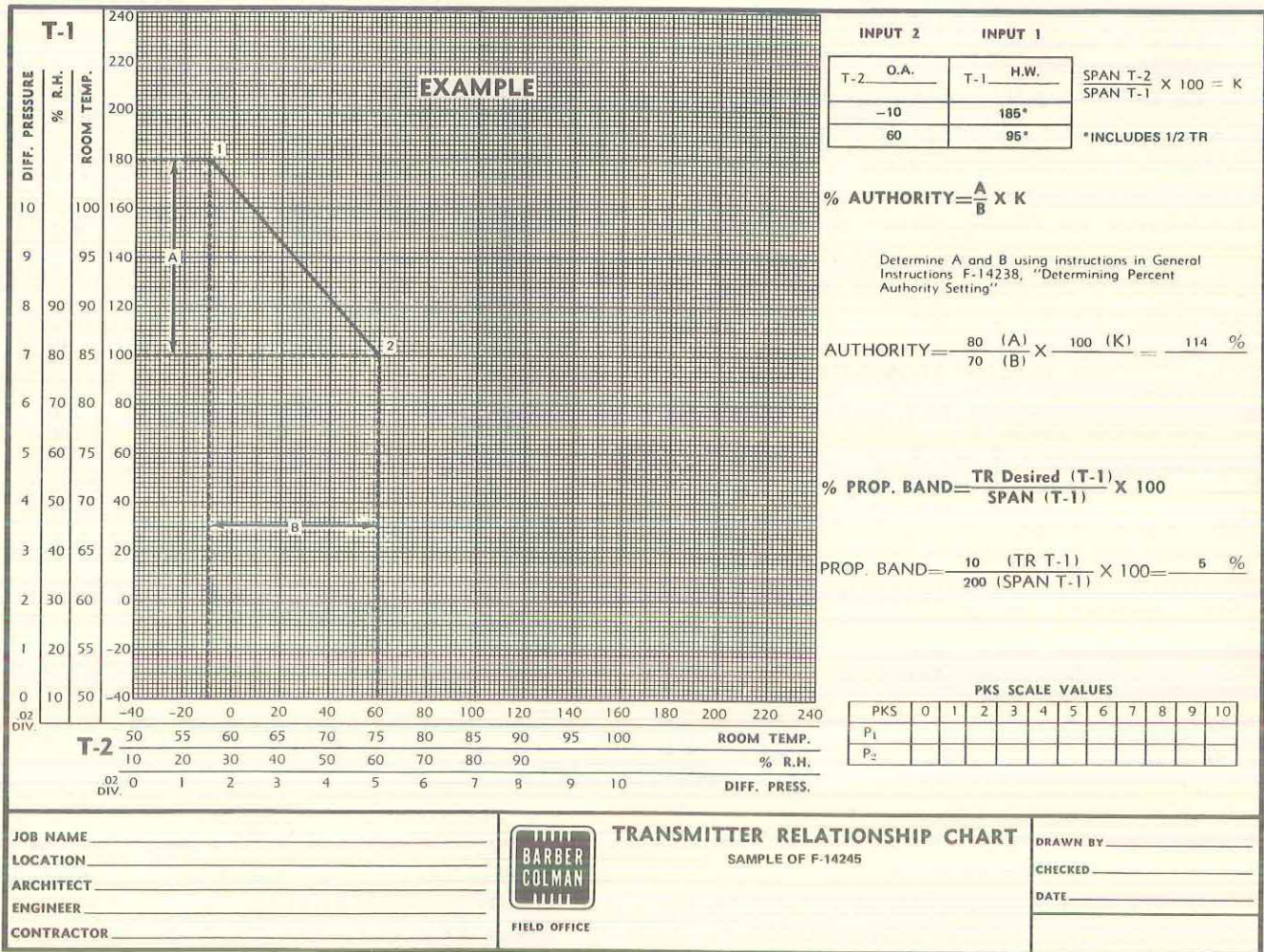
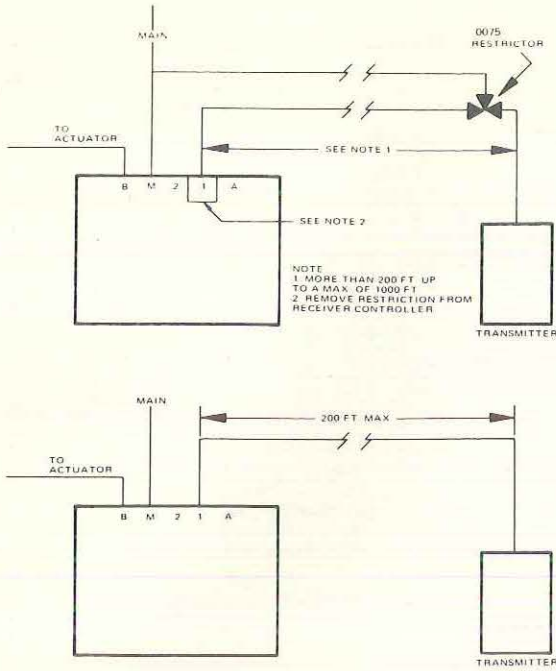
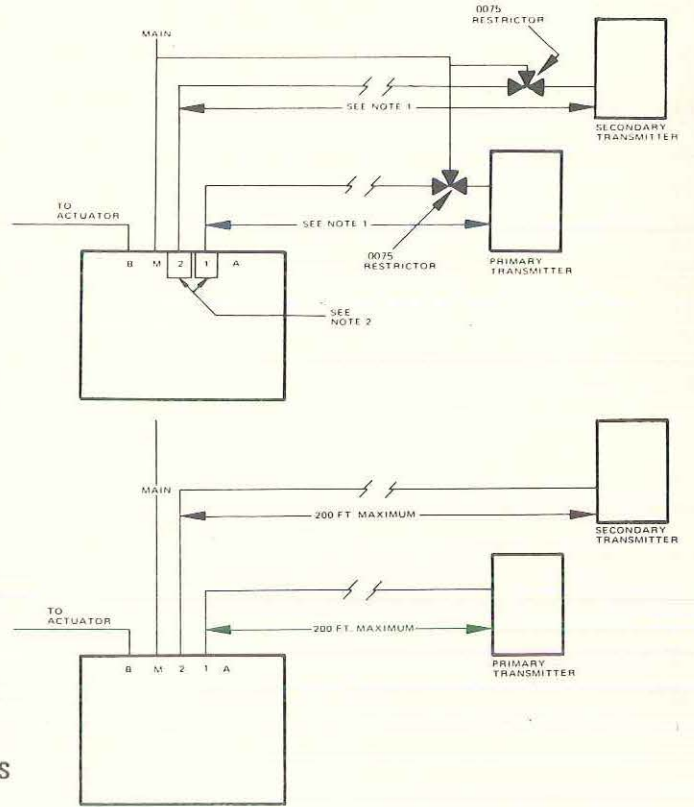


Figure 8

TYPICAL PIPING SINGLE INPUT RECEIVER CONTROLLER



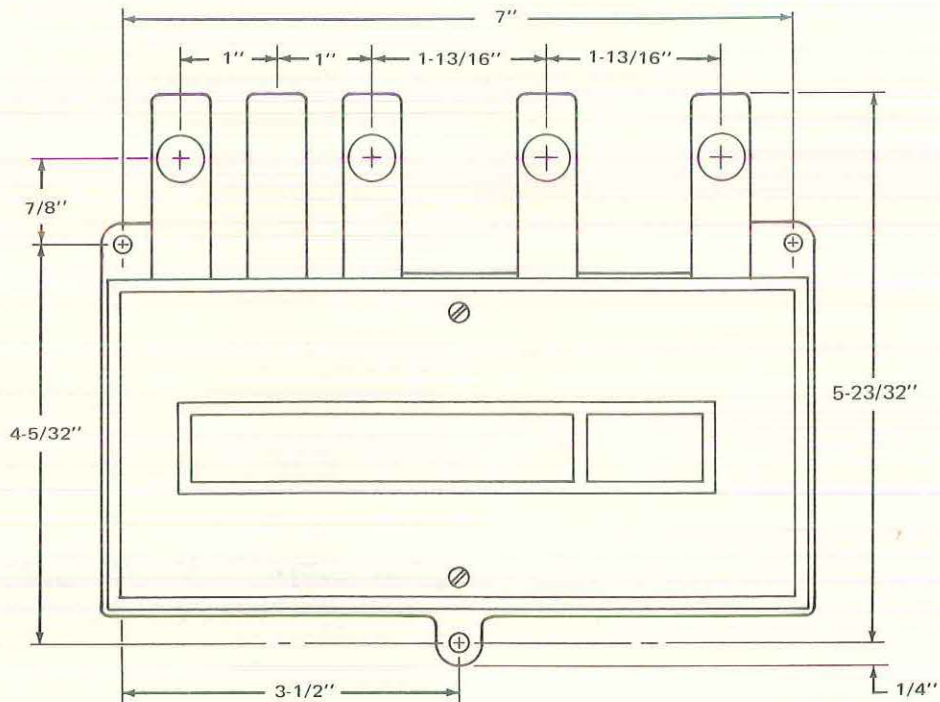
TYPICAL PIPING DUAL INPUT RECEIVER CONTROLLER

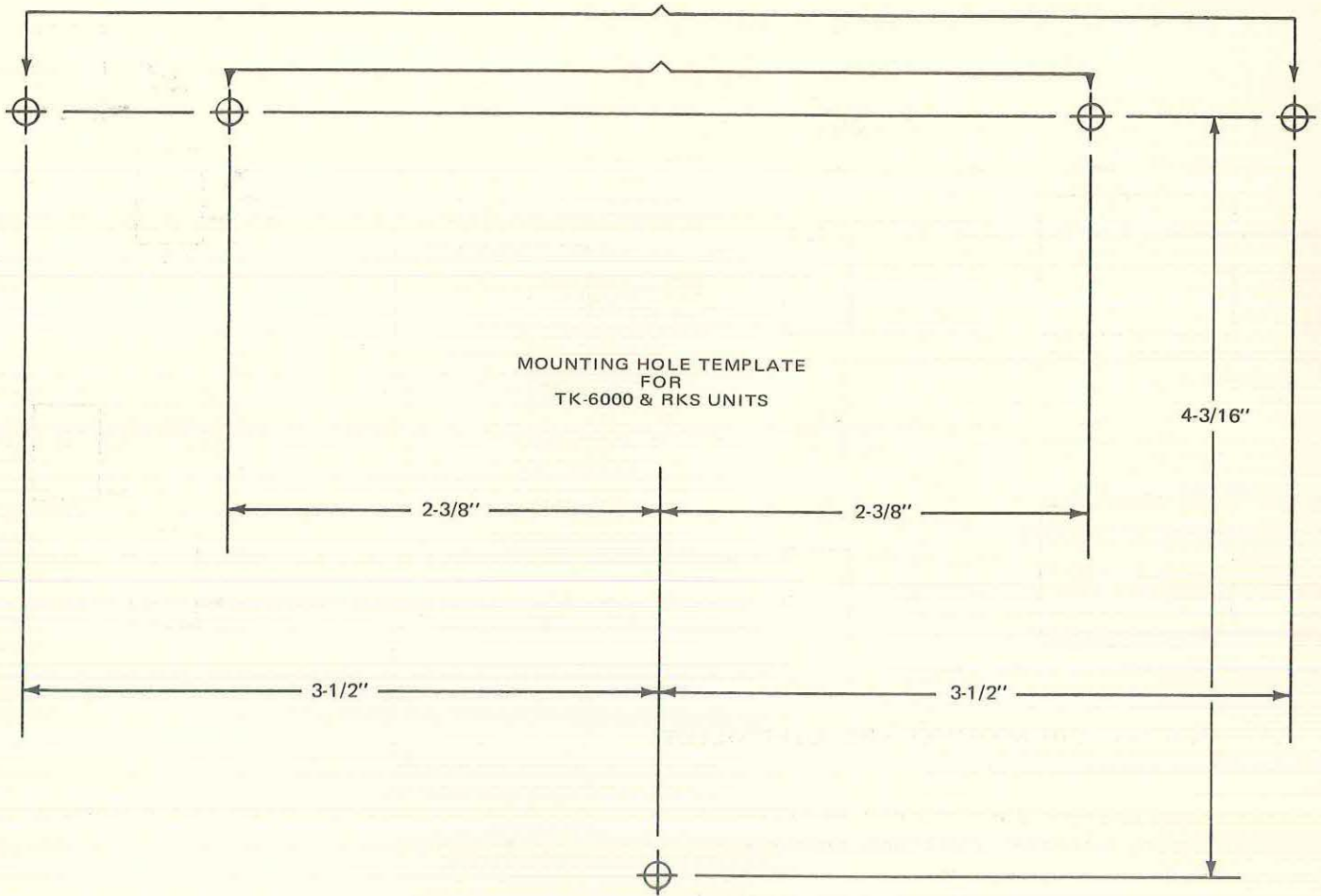


USE OF CONTROLLERS WITH RECEIVER-CONTROLLERS

There are occasions when it is desirable to use a controller such as a room thermostat, remote bulb thermostat, or receiver controller to provide the signal to the input chamber of a dual input receiver controller. A typical example of this is room and discharge control. These types of applications are acceptable as long as indication is not

required and proper calculations are made for the authority adjustment setting.





Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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DEVICE INFORMATION

Identification

The RKS-5001 may be easily identified by referring to the part number shown on the carton and also on the front of the base plate. Stamped on the back is the date of manufacture (four digits, the first two representing the week of the year and the last two representing the year).

The RKS-5001 is used in conjunction with Barber-Colman pneumatic transmitters for control of terminal systems such as mixing boxes, reheat coils, multizone zone dampers, etc. It can also be used in conjunction with amplifying relays for control of central fan system devices.

The device is field changeable from direct-acting, as shipped from the factory, to reverse-acting or 1:1 ratio reverse-acting.

Pre-Installation

The RKS-5001 is shipped with a PNC-114 blocking gasket, two mounting screws and setpoint decals. The setpoint scale decal must be field installed. The setpoint must match the transmitter used with the receiver-controller.

The receiver-controller is designed for either panel or wall mounting. See Figure 1 for mounting dimensions. The mounting plate is an integral part of the unit. It can also be mounted

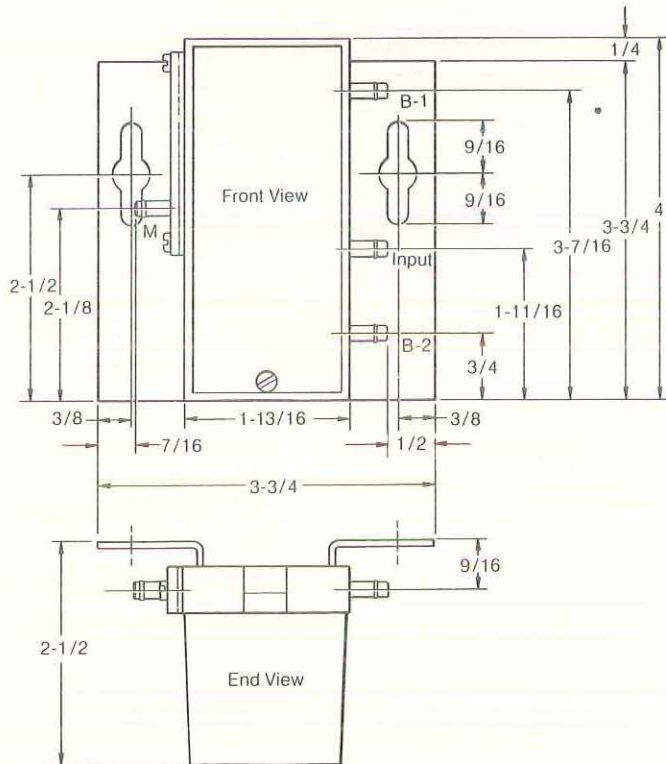
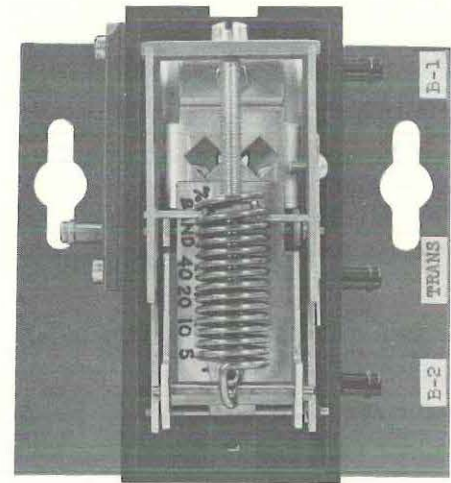


Figure 1.



RKS-5001 Without Cover

using an SYZE-567 mounting track (Figure 2) by snapping the integral mounting plate into the track.



Figure 2.

Proportional Band: Adjustable 4 to 40% of input transmitter span.

Air Connection: Barbed connections for 1/4-inch O.D. .030 wall polyethylene tubing. No clamps are required under normal use.

INSTALLATION

Requirements

Supply Air: 18 psig nominal, 30 psig maximum.

Air Consumption: For sizing compressors .028 scfm, plus transmitter requirement.

Ambient Temperature: 40°F minimum, 150°F maximum.

Air Capacity: 36 scfm for sizing mains, plus transmitter requirements.

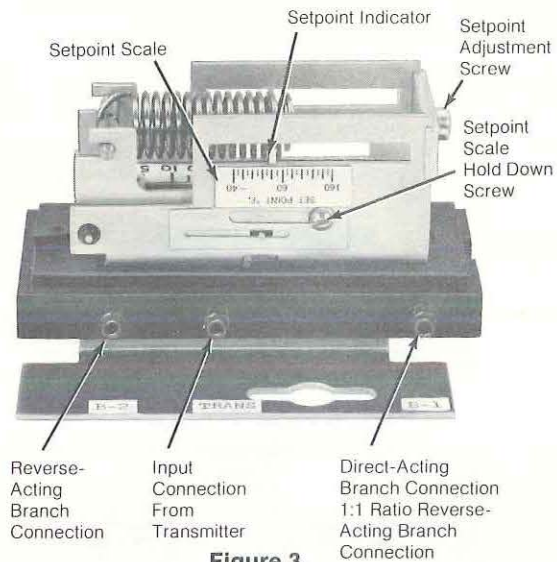


Figure 3.

Procedure

Tubing Connections: Connection B-1 is used as the branch output from the receiver-controller when the unit is used as direct-acting or 1:1 ratio reverse-acting. Connection B-2 is used as the branch output from the receiver-controller when the unit is used as reverse-acting. Connection "Trans" is the input connection to the receiver-controller from the transmitter. See Figures 3 and 4.

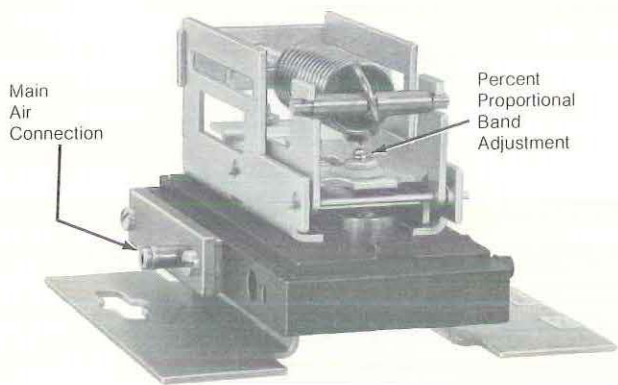


Figure 4.

RUN/ADJUST

Setpoint Adjustment: The setpoint of the unit is adjustable with separate field applied scale decals for the various transmitter ranges. Change in setpoint for one full rotation of setpoint screw is equal to 1/20 of transmitter span.

Clockwise rotation of the setpoint screw increases the setpoint.

Percent Proportional Band Adjustment: Slide the percent proportional band (Figure 4) adjustor by using an ADDA-618 wrench. Place the right angle end (1/4-inch) around the nut on the adjustor and push or pull as required.

Applications Requiring 1:1 Ratio Reverse-Acting: EN-101 shows applications such as humidity reset or summer compensation where a 1:1 ratio reverse-acting receiver-controller is used with its branch line connected to input 2 of a RKS-3002. With the RKS-5001 converted to 1:1 ratio reverse-acting the full span of its transmitter is usable for resetting an RKS-3002.

As a straight reverse-acting controller only 40% of the transmitter span times 1.2 is usable. *Example:* A humidity being reset by outdoor air temperature. The humidity transmitter is piped to input 1 of an RKS-3002 and the output of the RKS-5001 is piped to input 2 of an RKS-3002. If the RKS-5001 is simply reverse-acting only, 96° change of the O.A. transmitter is usable for resetting the humidity. By using the RKS-5001 as 1:1 ratio reverse-acting, the full 200° span of the O.A. transmitter is usable.

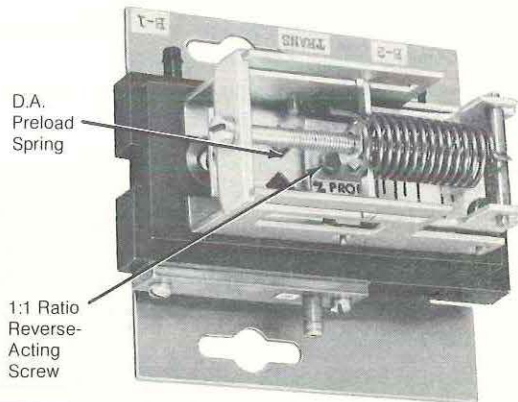


Figure 5.

Adjustment for 1:1 Ratio Reverse-Acting:

1. Turn 1:1 ratio reverse-acting screw (Figure 5) all the way in using a 3/16-inch wrench.
2. Disconnect the direct-acting preload spring (Figure 5).
3. Slide the percent proportional band adjustment to 40% setting.

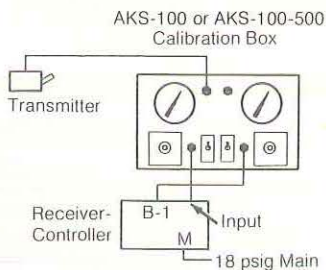


Figure 6.

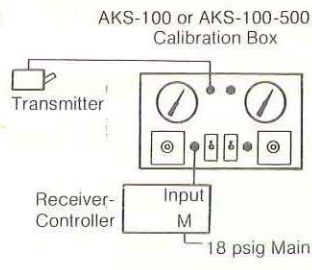


Figure 7.

Calibration as 1:1 Ratio Reverse-Acting:

1. Connect in the AKS-100 calibration box as shown in Figure 6.
2. Apply 18 psig MAIN to main connection of receiver-controller.
3. Move left hand toggle (for input) to calibration position.
4. Move right hand toggle (for B-1) to transmitter check position.
5. Adjust left hand (input) manual adjustor on the AKS-100 to obtain a 9 psig signal to the input (i.e., 100° on 0-200 scale of test gauge).
6. Adjust the setpoint screw of the receiver-controller until 9 psig (i.e., 100° on 0-200 scale) is read on the right hand gauge.
7. Move left hand toggle (for input) to trans. check position.

8. Note reading on left hand gauge using 0 to 200 scale (*Example:* reading is 40°). Subtract 40° from 200 (i.e., 200 - 40 = 160).
9. Reading on right hand gauge should equal value found in step 8. If not, adjust the receiver-controller setpoint screw. Note: No more than 1-1/2 turns of the setpoint screw should be required.
10. Calibration box can now be disconnected and transmitter and branch line connected to the receiver-controller.

Calibration When Used as Standard Receiver-Controller:

1. Set percent proportional band.
2. Select and apply proper setpoint scale decal provided with the receiver-controller. The scale decal must match the range of the transmitter.
3. Connect the transmitter line and "trans" connection on the RKS-5001 to calibration box as shown in Figure 7.
4. Position toggle switch to up (trans.) position.
5. When the transmitter is sensing stable temperature, humidity, pressure, measure the condition at the transmitter with an accurate measuring device.
6. Check calibration box gauge for specific range of transmitter used, compared to condition measured at the transmitter.
7. If reading is within $\pm 15^\circ\text{F}$ on 200° span transmitter, $\pm 4^\circ\text{F}$ on a 50° span transmitter, $\pm 6\%$ RH on an 80% RH span transmitter or $\pm .15$ -inch H_2O on the differential transmitter, proceed as follows. If reading is not within these limits on all transmitters except the differential pressure transmitter, refer to the transmitter general instructions and make sure it is installed properly or replace the transmitter. Note: There is no H_2O scale on the calibration box. Use the permanent gauge for the system.
8. Adjust all permanent receiver gauges to match the condition as measured with the accurate measuring device such as thermometer, etc. (**not** calibration box gauge).
9. Position toggle switches to down (calib.) position.
10. Check percent proportional band setting.
 - a. Adjust the signal to Input until 3 psig is read on the branch gauge. Note reading on the test gauge.
 - b. Adjust the signal to Input until the branch gauge indicates 13 psig. Note reading on the test gauge.
 - c. Determine difference between step a and b. If this difference is not correct for desired throttling range, adjust the percent proportional band adjuster and return to step 1 in calibration.
11. Adjust manual positioner until the permanent gauge indicates the desired setpoint.
12. Rotate setpoint screw until 8 psi ± 1 psi is obtained on branch pressure gauge.
13. Loosen setpoint scale, hold down screw, and slide the setpoint scale until the desired temperature (100°F in example) is read at the setpoint indicator. Tighten setpoint scale; hold down screw. Remove calibration box and reconnect transmitter.

Changing from Direct-Acting to Reverse-Acting:

1. Disconnect the D.A. preload spring (Figure 5).
2. Remove main air manifold (Figure 8).
3. Remove restriction cup and "O" ring from D.A. restrictor location (Figure 8) by prying on side of restrictor cup with small blade screwdriver or knife blade.
4. Re-install "O" ring and restrictor into R.A. restrictor location by gently pushing restriction cup and "O" ring in with thumb or handle of screwdriver.
5. Replace manifold and gasket. Note: Air connection on manifold should be in center of unit.

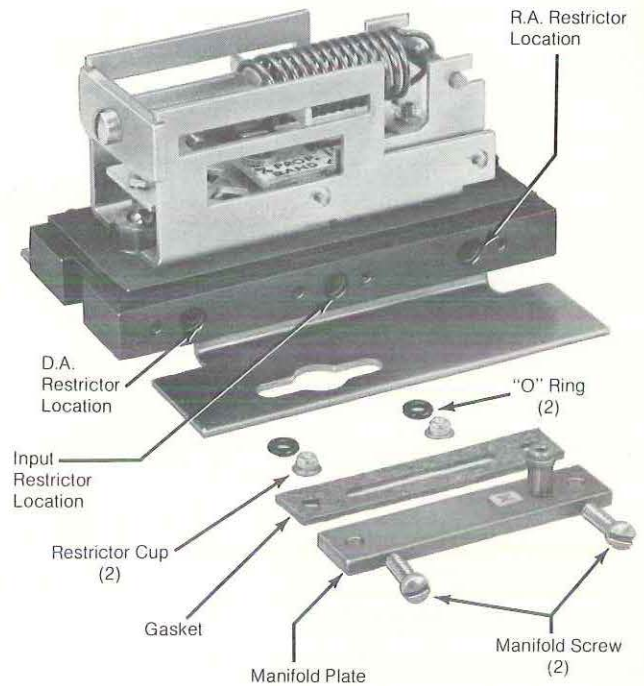


Figure 8.

Use of Blocking Gasket PNC-114 (Figure 9): On applications where the transmitter is more than 200 feet, a remote restrictor must be used. Blocking gasket PNC-114 is installed in place of the standard gasket PNC-113. If the unit is direct-acting and the PNC-114 and the manifold are installed as shown (position "A"), the restriction for the input is blocked and the main is fed only to the D.A. restriction. To use a remote restriction for the branch line making the receiver-controller a single pipe unit, install the manifold in position "B" and both restrictions will be blocked from the main connection. No main air is required to be connected to the receiver-controller. It is not necessary to remove the restrictors when installing the blocking gasket.

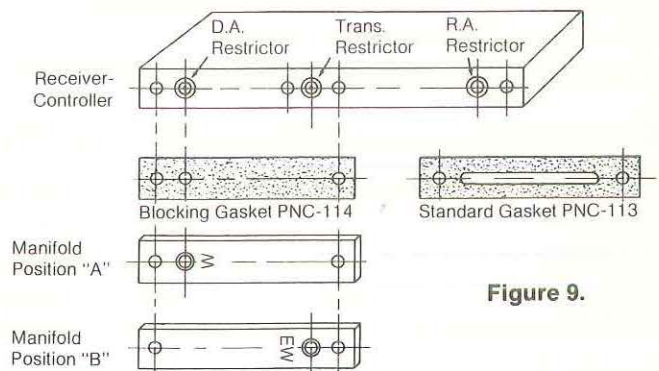


Figure 9.

CHECKOUT

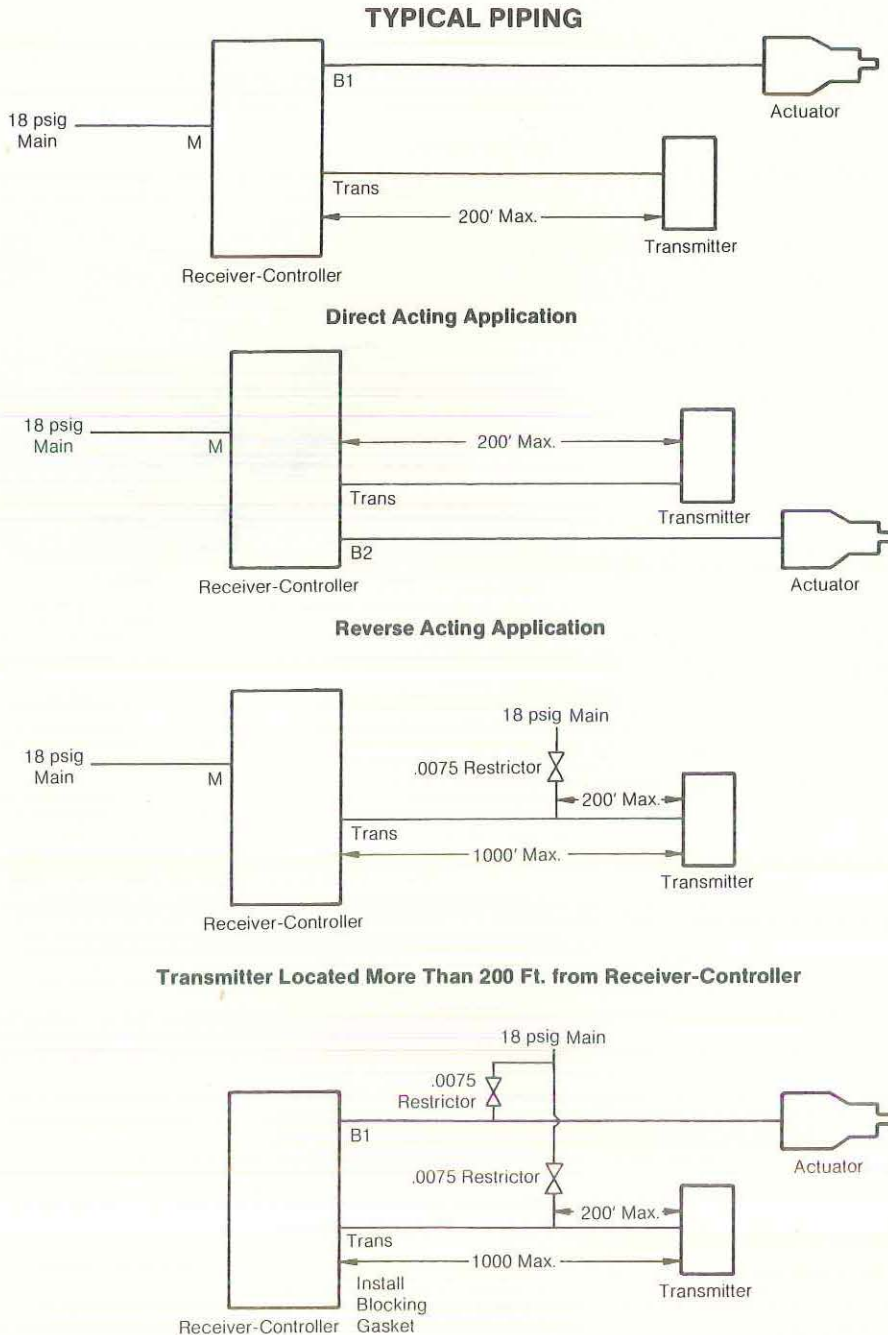
Connect the AKS-100 calibration box as shown in Figure 6 or 7. Position toggle switch to down (calibration) position. Rotate manual adjuster and observe output of unit. If the performance is not as desired, refer to calibration instructions and recalibrate unit. If unit still does not operate properly, refer to **REPAIR**.

MAINTENANCE

The unit requires no maintenance under normal conditions.

REPAIR

If the output remains at 0 or if no pressure is produced at the input connection, check unit for plugged restrictor and replace if necessary. Replace the unit if it still does not operate properly.



Unit Used as Single Pipe Unit

Figure 10.

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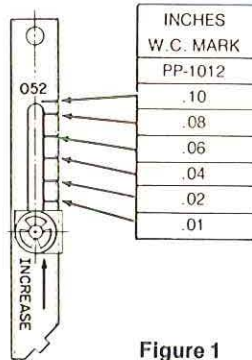
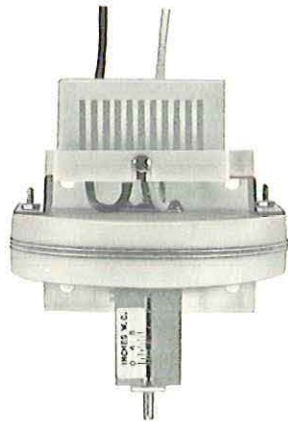


Figure 1

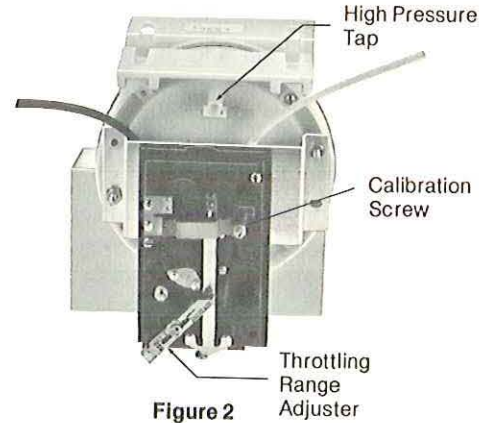


Figure 2

Device Information

This static pressure controller is designed for use with pneumatically actuated devices to control the static pressure in central fan systems or spaces supplied with air by a fan system.

It measures and converts low pressures into control pneumatic pressure. Since the construction of the device encloses the diaphragm on both sides, the pressure may be measured at two different locations. Therefore, it is possible to control differential pressure by mounting one pressure tap in an ambient which represents one pressure and connecting the other pressure tap to the controlled pressure.

Typical control applications include the control of static pressure in duct systems using motor actuated static pressure dampers. The 0 to 8 inches of water range is particularly useful for controlling static pressure in high velocity duct systems. The control of static pressure in critical areas such as white rooms and similar installations can be accomplished readily with this unit. The high sensitivity and ability to work above or below 0 static pressure permits the maintenance of the proper laboratory atmosphere.

A sensitive thin fabric filled diaphragm provides the

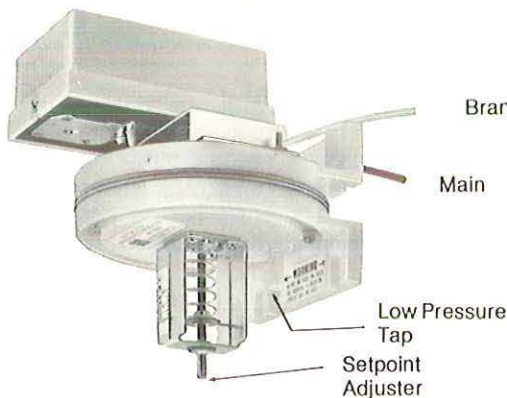


Figure 3

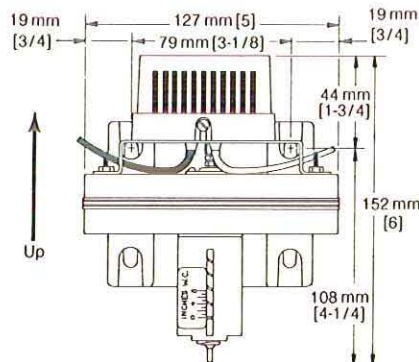


Figure 4

actuation to a piloted non-bleed relay. Linear pressure output is accomplished by internal pneumatic feedback.

Supply Air Pressure

30 psi maximum, 15 psig nominal.

Throttling Range

The PP-1012 is adjustable from .01 to .10 inches of water and is factory set at .04 inches of water. This throttling range is expressed in the amount of static pressure change required to change the branch line pressure output from 3 to 13 psi. See Figures 1 and 2.

Action

DA. An increase in measured differential produces an increase in output pressure when connected high pressure sensed media to high pressure connection. To obtain reverse action a reversing relay is required to be placed in the branch line of the controller.

Air Capacity (for sizing compressors)

Average air consumption is 0.012 standard cubic feet per minute (scfm). The maximum air requirement for sizing air mains is 16 cubic inches per minute.

Installation

INSTALLATION

Requirements

Controller must be installed in an upright position with the relay unit at the top and the setpoint adjustment at the bottom. See Figure 3. Mounting dimensions are shown in Figure 4.

Air Connection

Two plastic tubes reinforced with a coil spring to simplify installation. Black tube designates supply main, and white tube designates control branch line. This device can be best connected directly to plastic tubing by use of the APNT-101-1 adaptor coupling, or by the use of clear vinyl tubing 1/4-inch O.D. with 0.060 wall, and the insertion of the plastic tubing of the thermostat directly into the clear vinyl tubing.

Set Point Range

Adjustable 0 to 8 inches of water. Factory set at 2 inches of water.

Static Pressure Connection

Vinyl plastic tubing 1/4-inch I.D.

Run/Adjust

RUN/ADJUST

Theory of Operation

An increase in pressure on the high side of the diaphragm causes the diaphragm to move away from the relay assembly. The diaphragm post actuates the nozzle lever. The position of the nozzle lever over the nozzle determines the pilot diaphragm pressure in the relay system. An increase in pressure on the pilot diaphragm overcomes the preload force on the pilot diaphragm spring, the main valve plug spring and the air pressure on the plug, to move the supply main valve plug off its seat. Supply air pressure then flows into the branch chamber. The resulting pressure change is transmitted to the feedback chamber, where it exerts the force on the feedback plunger moving it up. The force is transmitted to the nozzle lever through the feedback levers and spring to balance the force exerted by the diaphragm. This action provides a linear relationship between pressure at the diaphragm and branch line pressure.

Adjustments

Pressure controllers are shipped from the factory, calibrated to provide an 8 psig control line pressure when the control point is equal to the set point. The set point is factory set at 2 inches of water. The throttling range is set at .04 inches of water.

Throttling Range

The throttling range should be set at the lowest value which will allow the static pressure controller to control the system, without cycling, under normal load conditions. The most satisfactory setting will vary with the type of system being controlled. The throttling range is changed by sliding the indicator located in the upper feedback lever (Figure 2) to the required setting. Calibration of the pressure controller should be checked after the throttling range has been changed.

Calibration

After the installation has been completed, and the throttling range adjustment completed, the unit should be checked for calibration. As a nominal calibration, the branch line control pressure should be 8 psig when the set point is equal to the static pressure at the static pressure probe as indicated on a satisfactory magnehelic pressure gauge. In some applications, a value other than 8 psig will be required to get the desired control results. In this case, the 8 psig designation should be changed in the calibration procedures.

1. Remove the cover by loosening the cover screw and raising the cover off the base.
2. Place a gauge in the plastic tubing branch line from the unit in order to read branch line pressure. In this instance, the AL-76 gauge adaptor tee can be used.
3. With the magnehelic gauge measure differential between sensing tips. Adjust the set point to this value.

NOTE: (Since static pressure can be controlled quite readily, it would be suggested that a pressure regulator be installed in the line to the damper actuator in order to enable you to adjust static pressure in the system which is being controlled. Using this pressure regulator, adjust the static pressure in the system to the value which you would like to control, and adjust the set point to this value.) For this method cap off branch line.

4. With a small screwdriver, adjust the calibration screw. See Figure 2. Turn the screw cw if the control pressure is below 8 psig and ccw if it is above 8 psig. Adjust the screw until the control pressure is 8 ± 1 psi.

NOTE: The hex nut on the set point adjusting screw is a tension device only. It should not be loosened to make any adjustments.

5. Adjust set point to desired value.
6. Remove the test gauge. (Reconnect the branch line to damper actuator if regulator method was used.)
7. Replace cover and tighten cover screw.

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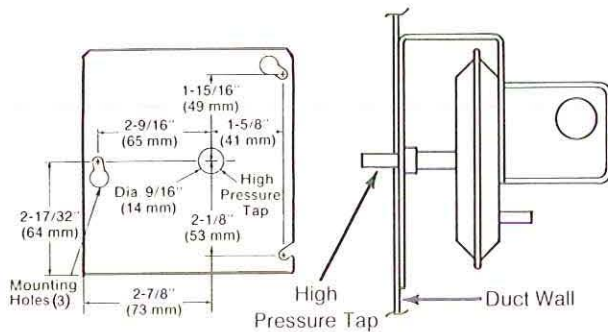
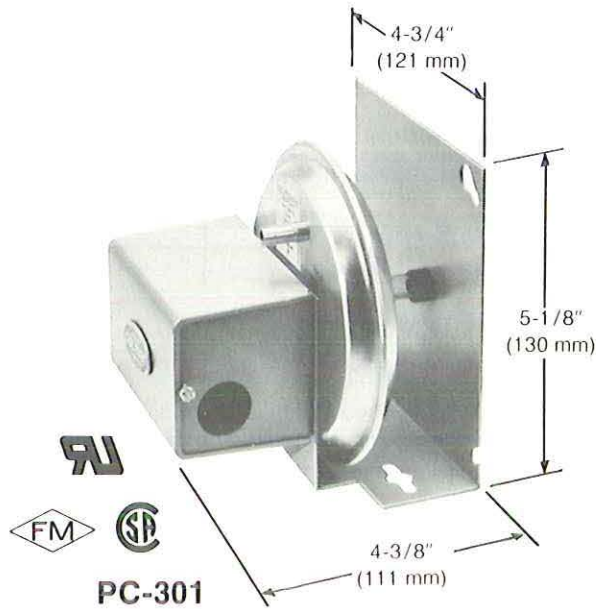


Figure 1. Direct Mounting of Probe

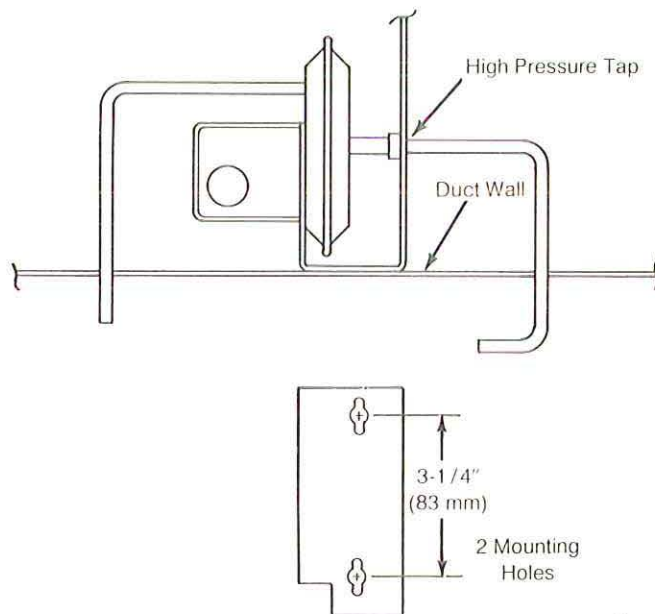


Figure 2. Remote Mounting of Probes

For low or line voltage control of static, velocity or total pressures, or differential static or total pressures of air and non-combustible gases only.

All metal construction with 1/2" conduit opening. SPDT snap action switch. Coded screw terminals.

PERFORMANCE

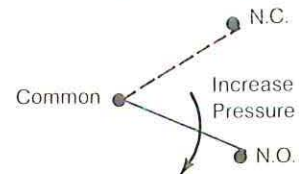
Maximum Safe Pressure: 12" W.C.

Setpoint: Field adjustable .05 to 1" W.C.

Differential: .04" W.C. at minimum setpoint to .1" W.C. at maximum setpoint.

Temperature Range: Ambient 35° to 140°F (0° to 60°C). Shipping -20° to 140°F (-29° to 60°C).

Mounting: Diaphragm must be mounted in a vertical plane.



N.O. makes on increase of pressure

Switch Rating

Vac	Full Load Amps	Locked Rotor Amps	Pilot Duty (VA)	Non-Inductive Amps
24V	—	—	60	—
120V	6.25	37.5	300	—
240V	3.1	18.6	300	—
277V	2.7	16.2	300	10

OPTIONS None

ACCESSORIES

- AP-301 Static probe for turbulent air
- AP-305 Static probe for low actuating pressure
- AT-208 Duct mounting kit for remote probes other than AP-301 or AP-305

INSTALLATION

CAUTION

For use with air or non-combustible gases only.

1. Select direct or remote mounting. For field mounting use mounting bracket as a template. For factory mounting use dimensions provided. See Figures 1 and 2.
2. Select appropriate probes from Tables 1 and 2.

PROBES

Probes can be constructed from 1/4" O.D. copper, brass, or aluminum tubing. The ends of the probes should be cut square to the sides of the tube and deburred. Total pressure probe must have the sensing end bent at 90°, approximately 1 to 3 inches (25 mm to 76 mm), from the tip. Use AT-208 kit to mount probe to duct.

Use AP-301 static probe in areas with air turbulence caused by filters, dampers, etc. Not included.

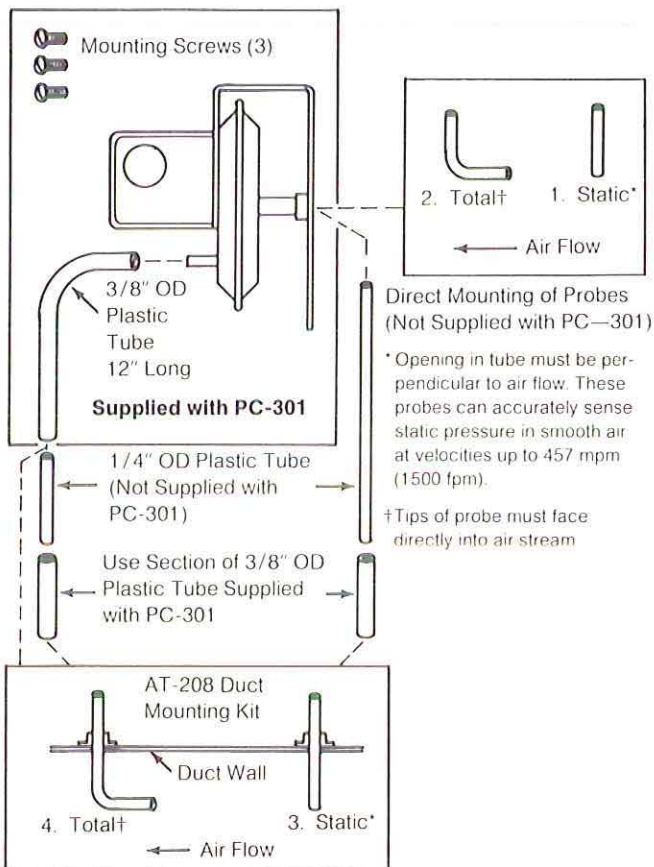
Use AP-305 static probe where there is very low actuating pressure.

3. Install probe. See Figure 3. Sampling probes should be located in areas of minimum air turbulence (6 to 8 duct diameters downstream from fan outlet, elbows, tees, or dampers). If this is not possible locate the probe tip as close to the center of the duct as possible.
4. Mount the PC-301. Note: The diaphragm must be mounted in a vertical plane and in a location free from vibration.
5. Connect the remote probe(s), if any, to the PC-301.
6. Make all connections in accordance with job wiring diagrams and in compliance with national and local codes. On an increase of air pressure to above setpoint, common contact of switch is made to normally open contact. On a decrease of air pressure to below setpoint, common contact of switch is made to normally closed contact.

Adjustment

To increase setpoint, turn adjustment screw clockwise. Adjustable .05 inch \pm .02 inch to 1.0 inch W.C. (1.25 mm \pm .5 mm to 25 mm W.C.). To decrease setpoint, turn adjustment screw counterclockwise. Note: Units are shipped at minimum setpoint.

If readjustment to minimum setpoint is required, proceed as follows without any air pressure applied to diaphragm.



Remote Mounting of Probes. Use AT-208 to Mount Probe to Duct.

(Above Items Not Supplied. Order AT-208 Separately.)

Figure 3.

1. Turn adjustment screw full CCW.
2. Push on spring at point A (Figure 5) and maintain pressure during steps 3 and 4.
3. Turn adjustment screw CW until common contact is made to normally open contact.
4. Turn adjustment screw CCW until common is made to normally closed contact. Then turn adjustment screw 1/8 turn more CCW.

Table 1. Direct Mount of One Probe

	Static	Velocity	Total	Δ Static	Δ Total
High Press. Tap*	Probe 1	Probe 2	Probe 2	Probe 1	Probe 2
Low Press. Tap	—	Probe 3 Remote	—	Probe 3 Remote	Probe 4 Remote

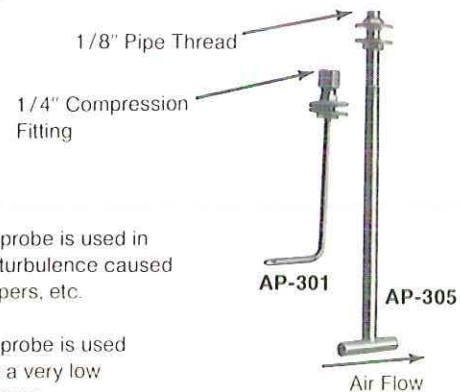
Table 2. Remote Mounting of Probe(s)

	Static	Velocity†	Total	Δ Static	Δ Total
High Press. Tap*	Probe 3	Probe 4	Probe 4	Probe 3	Probe 4
Low Press. Tap	—	Probe 3	—	Probe 3	Probe 4

*Highest (absolute) pressure should be applied to high pressure tap.

†Pitot can be used instead of two probes.

Δ = Differential



AP-301 static probe is used in areas with air turbulence caused by filters, dampers, etc.

AP-305 static probe is used where there is a very low actuating pressure.

Figure 4. Optional Probes

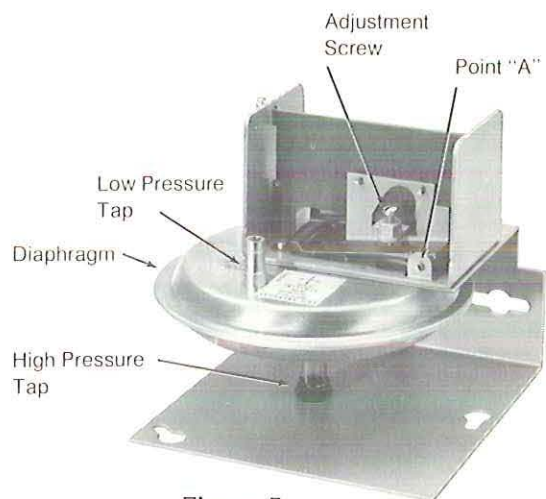


Figure 5.

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Loves Park, IL U.S.A. 61132-2940



General Instructions

Pressure Controls Electric Switches PC 110, PC 141, PC 151 PC 131-0-1, PC 132-0-1



DEVICE INFORMATION

Identification

The pressure electric switch model number and the date of manufacture (numerically, the week followed by the year) is stamped on the housing of the switch.

These pressure controls are used whenever it is necessary to close (or open) an electrical circuit on the basis of a predetermined air pressure signal. Typical applications include the control of air compressors, fans, pilot lights, etc.

The pressure controls incorporate a non-metallic diaphragm which is positioned by air pressure changes. The diaphragm in turn actuates a heavy duty electrical contact through a pivot mechanism.

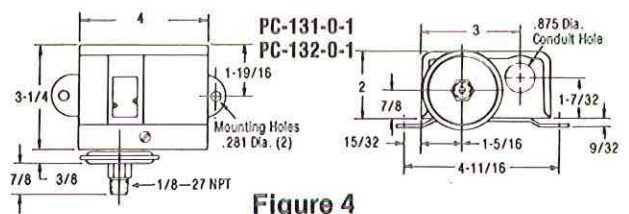
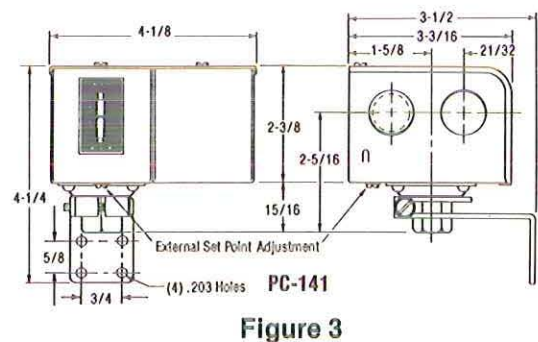
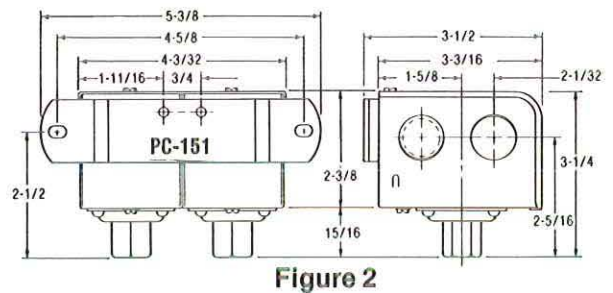
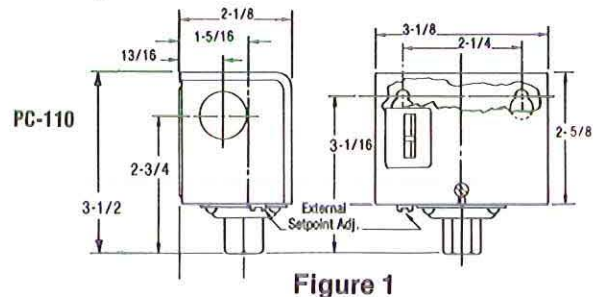
INSTALLATION

Procedure

These devices can be mounted in any position, refer to Figures 1 thru 4 for mounting dimensions.

1. Surface mounting.
 - a. PC-110: Remove device cover and knockouts from back of case. Secure to surface with 2 No. 10 screws.
 - b. PC-131-0-1, PC-132-0-1: Attach the mounting bracket to the back of the case with the 1/4-inch 10/32 screws provided. Secure to surface with 2 screws up to 1/4-inch in diameter.
 - c. PC-141: Secure the mounting bracket provided to the surface with 2 No. 10 screws. Clamp 1/8 FNPT fitting into the mounting bracket.
 - d. PC-151: Secure to the surface with 2 No. 10 screws.
2. Track Mounting (PC-110 only).
 - a. Mount device to PNC-112-1 bracket with 2 No. 8 x 1/4-inch sheet metal screws.
 - b. Insert PNC-112-1 into SYZE-567 track mounted (horizontal preferred) in the control cabinet.

3. Make air supply connections.
4. Remove device cover and make wiring connections to the switch terminals. Refer to Figures 5 thru 8 for terminal coding.
5. Replace the cover.



WIRING

All electrical wiring should be in compliance with national and local electrical codes. Electrical loads exceeding the rating of the control should be controlled by means of an intermediate relay or starter. PC-110 has one opening and PC-141 & PC-151 two openings for 1/2-inch. PC-131-0-1 and PC-132-0-1 have one opening for 1/2 or 3/4-inch conduit.

CHECKOUT

Using a test gauge, raise and lower the air pressure to verify the settings. Verify switch action by observing the action of the controlled device.

RUN/ADJUST

PRESSURE SETTING

PC-151 is factory set and no field adjustments can be made. PC-110 and PC-141: The adjustment of the set-point screw (Figures 5 and 7) establishes the control operating point on a pressure increase when used as a N.C. switch, or on a pressure decrease when used as a N.O. switch, and is indicated by the pointer of the graduated scale.

1. PC-110: Refer to Figure 5. Turn the adjuster with a screwdriver to move the indicator to the required setting on the scale. To change the differential from the 2 psi factory setting, loosen the lock screw and set the pointer at the required differential. Secure the lock screw.
2. PC-141: Refer to Figure 7. Remove cover and turn the adjuster with a screwdriver to move the indicator to the required setting on the scale.
3. PC-131-0-1, PC-132-0-1: The setting of the setpoint adjusting screw (Figure 6) establishes the control operating point on a pressure increase and is indicated by the pointer on the right side (cutout) of the graduated scale. Next, the differential adjusting screw should be turned until the desired switch operating point on a pressure decrease is established (as indicated by the scale pointer on the left).

For example, to properly set a PC-131-0-1 to open its contacts at 15 psig and close them at 12 psig, proceed as follows:

- a. Turn setpoint adjusting screw until the pointer on the right is at 15 psig on the graduated scale.
- b. Turn differential adjusting screw until the scale pointer on the left is at 12 psig.
- c. Raise and lower the air pressure to check the accuracy of the settings.

REPAIR

Field repair is not recommended. Replace a defective device.

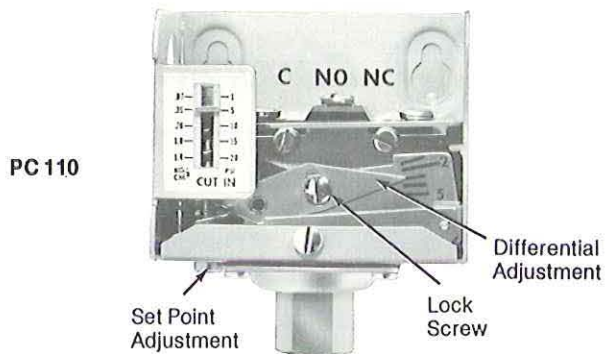


Figure 5

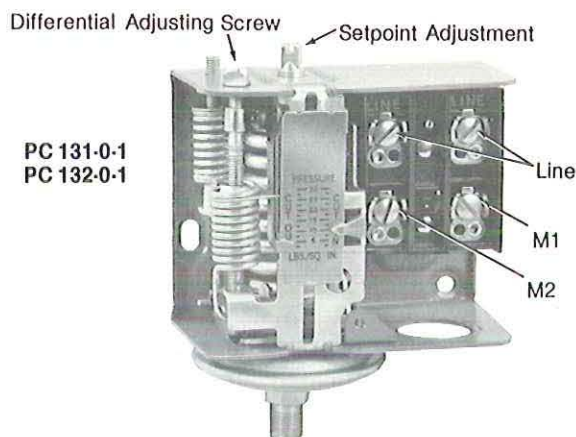


Figure 6

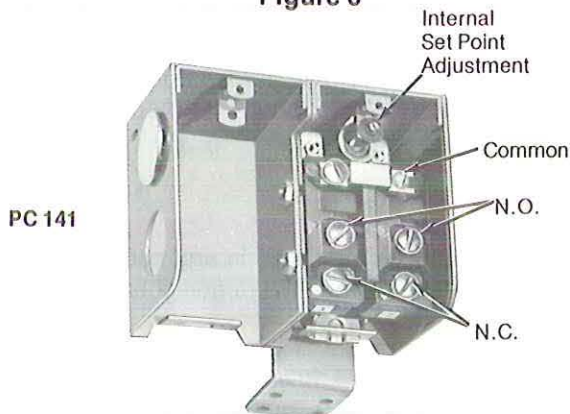


Figure 7

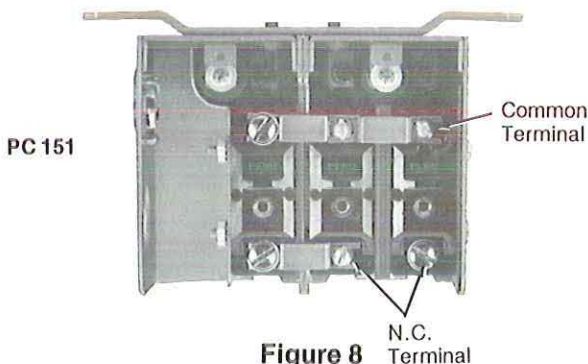


Figure 8

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LITHO IN U.S.A.



APPLICATION

For applications where an electrical circuit is used to control a pneumatically operated device. Used to direct supply air to a pneumatic device when the coil is energized or de-energized depending on the supply and exhaust air connections.

SPECIFICATIONS

Construction: Electrical coil is enclosed in a corrosion resistant metal housing with 1/2" conduit hole (except AL-109).

Power Consumption: 7 Watts (energized).

Maximum Inlet Air Pressure: 30 psig (207 kPa).

Flow Capacity: .5 scfm (236 ml/s) at 15 psig (103 kPa) supply with 1 psig (6.9 kPa) drop.

Ambient Limits:

Shipping Temperatures, -40 to 150°F (-40 to 65°C).

Operating Temperatures, 40 to 130°F (4 to 54°C).

Humidity, 5 to 95% RH, non-condensing.

Supply Air Temperature Limits: 40 to 130°F (4 to 54°C).

Air Connections: Three barbed fittings for 1/4" O.D. plastic tubing.

"N.O.", Normally Open.

"N.C.", Normally Closed.

"Com", Common.

Electrical Connections: 18" (457 mm) leads on the coil, except AL-110-201 which has 4-1/2' (1.4 m) 3-wire power cord.

Mounting: In any position to wall or subpanel of a cabinet.

Dimensions: 4-1/16" high × 4" wide × 2-1/2" deep (103 mm × 102 mm × 64 mm).

Dimensions in inches [] mm

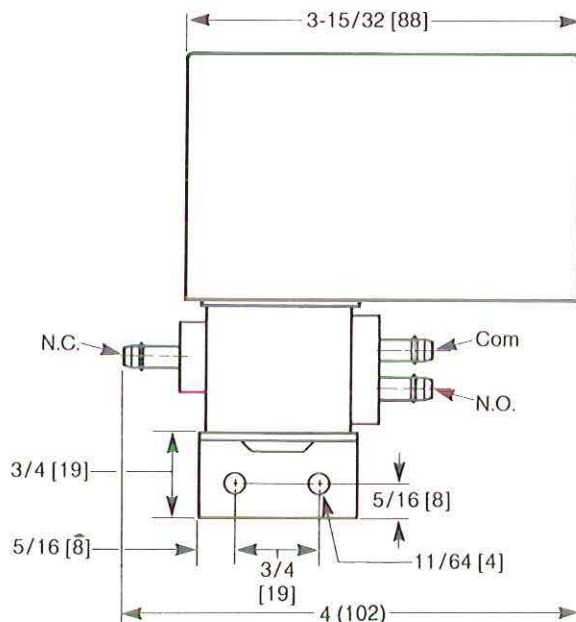


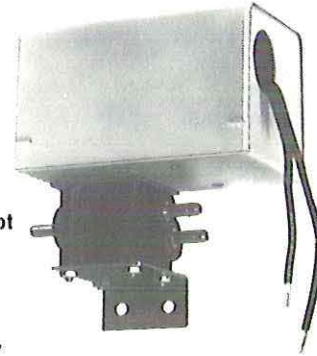
Figure 1. Mounting Dimensions and Air Connection Identification



All models except
AL-110-201
and AL-109



AL-110-201 only

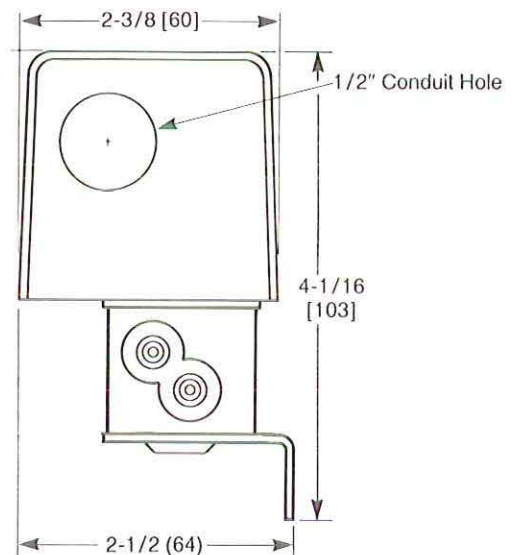


Solenoid Part No.	Voltage (AC 60 Hz)
AL-100	24
AL-109†	120
AL-110	120
AL-110-201	120
AL-120	208
AL-125	240
AL-140	480

†Unit has no solenoid enclosure.

ACCESSORIES

AK-52582 Auxiliary mounting plate for track mounting
AK-8953 Mounting track



INSTALLATION

Remote Mounting: Fasten to wall or duct with two #8 sheet metal screws or equivalent. This method requires the use of the enclosure on the coil. An integral mounting plate is provided or unit may be mounted to an AK-52582 auxiliary mounting plate.

Rotation of solenoid enclosure to position the wiring compartment, if required by application:

1. Remove cover.
2. Loosen coil hold down nut.
3. Rotate enclosure to desired position.
4. Tighten coil hold down nut.

CAUTION

Do not over-tighten as this may cause distortion of plunger tube or damage coil.

5. Replace cover.

Inside Cabinet Mounting: Fasten to subpanel of cabinet with two #8 sheet metal screws. An alternate method requires track mounting in AD-8953 mounting track. This method requires the use of the AK-52582 auxiliary mounting plate.

NOTE

When mounting inside of an approved electrical enclosure, the wiring enclosure of the solenoid may be removed to conserve panel space. UL listing is void if wiring enclosure of the solenoid is removed.

Inside-Outside Mounting: Install with electrical portion inside of an approved electrical enclosure and the valve body outside of the enclosure. This type of mounting requires a 9/16" (14 mm) dia. hole in the enclosure. Enclosure must be of 18 to 20 gage thickness (.0478" to .0359", 1.21 mm to .91 mm).

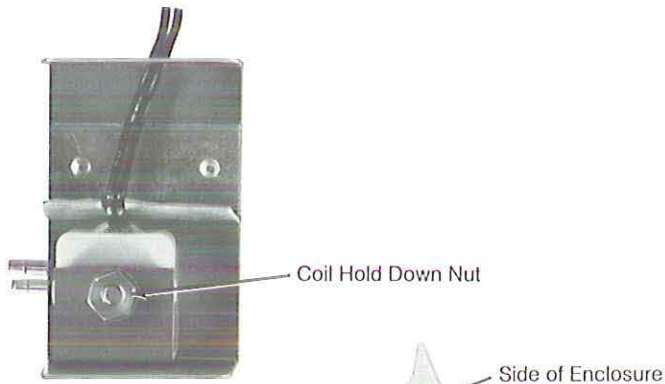


Figure 2. Coil Hold Down Nut Location

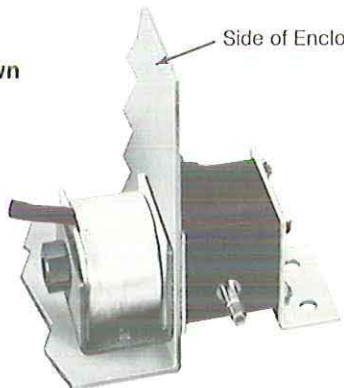


Figure 3. Solenoid Mounting Location

1. Remove cover.
2. Remove coil hold down nut. (See Figure 2.)
3. Remove coil and lower half of solenoid enclosure.
4. Install plunger tube through hole in electrical enclosure. (See Figure 3.)
5. Re-install coil and coil hold down nut; tighten nut.

CAUTION

Do not over-tighten as this may cause distortion of plunger tube or damage coil.

WIRING

Make all electrical connections according to job wiring diagrams and in compliance with national and local codes. A hole is provided in the metal enclosure for connection of 1/2" conduit. Enclosure may be used as a wiring compartment. Units are provided with 18" (.5 m) leads on the coil [except AL-110-0-0-1, which has 4-1/2' (1.4 m) 3-wire power cord].

MAINTENANCE

Regular maintenance of the total system is recommended to assure sustained optimum performance.

REPAIR

The only replacement part offered is the solenoid coil.

Solenoid Part No.	Voltage (AC)	Coil Part No.
AL-100-0-0-1	24	PNR-300-110
AL-109-0-0-1	120	PNR-300-120
AL-110-0-0-1	120	PNR-300-120
AL-120-0-0-1	208	PNR-300-130
AL-125-0-0-1	240	PNR-300-140
AL-130-0-0-1	277	PNR-300-150
AL-140-0-0-1	480	PNR-300-060

TYPICAL APPLICATION

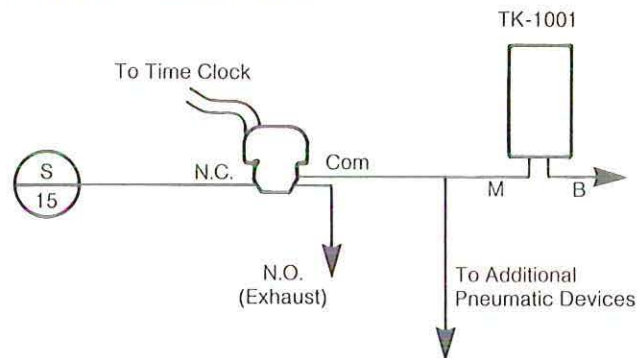


Figure 4. Typical Application

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Pneumatic Humidity Transmitter

DEVICE INFORMATION

Identification

The HKS transmitter is identified by the part number on the carton and also on the front and back of the transmitter. Stamped on the back of the transmitter is the date of manufacture (four digits, the first two representing the week of the year and the last two representing the year).

These transmitters are used with Barber-Colman RKS receiver-controllers for control of valve and damper actuators, humidifiers, etc., in heating, ventilating, and air conditioning systems. They may be used in conjunction with AKS receiver gauges for indication only.

Pre-Installation

The HKS-5033 wall type transmitter is shipped with mounting screws, one inch copper tubes, and insulator card.

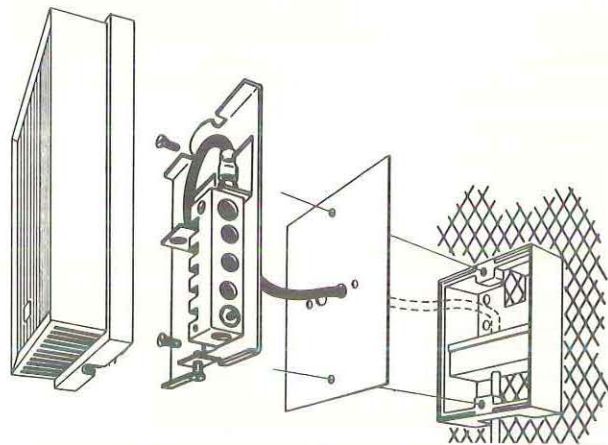


Figure 1. Mounting Wall Type Transmitter to AT-516 Wall Box

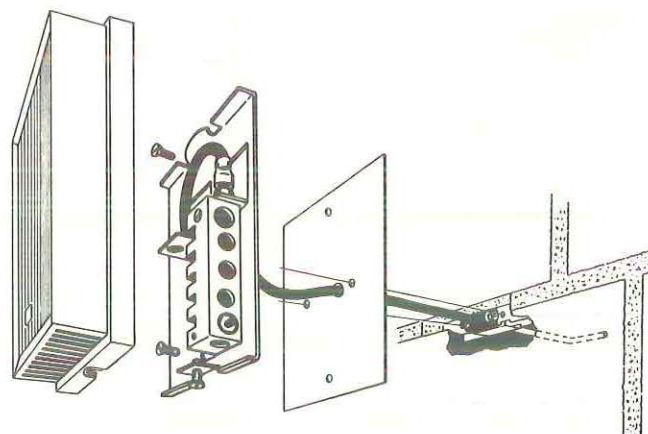
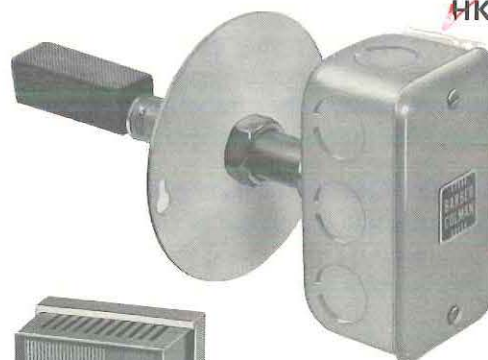


Figure 2. Mounting Wall Type Transmitter to AT-517 Mortar Joint Fitting



HKS-2033 Duct Type Transmitter



HKS-5033 Wall Type Transmitter

HKS-2033
HKS-5033

Wall fittings are ordered separately. Two types of fittings are available. The AT-516 (Figure 1) wall box fitting is for surface mounting on all wall surfaces and flush mounting on plastered or stud walls. The AT-517 (Figure 2) is for flush mounting on masonry walls. If it is desirable to locate the restrictor under the cover of the transmitter, the AT-506 or AT-507 can be used for the two air lines required. Parts required to mount the restriction under the cover are as follows:

- One AT-532-111-1-01 Restrictor Tee
- One APNT-11-011 Black Tube
- One APNT-11-021 White Tube
- Two APNT-93-030 Spring Inserts

The HKS-2033 duct type transmitter is shipped with mounting screws and a strain relief bushing. Order adaptor separately; APNT-101-1 for 1/4-inch plastic tubing or APNT-127-2 for 1/4- or 3/16-inch copper tubing.

Before installation make a visual inspection of the transmitter carton for obvious signs of damage.

INSTALLATION

Requirements

Air Consumption: 48 scfm for sizing air compressor.

Air Capacity: 36 scfm for sizing air mains.

Supply Air Pressure (when used for indication only): 18 psig.

Air Connection: One plastic tube to simplify installation.

Locate the transmitter where it will be exposed to unrestricted natural air circulation representative of the average conditions of the controlled space. Do not locate the transmitter near sources of heat or cold, such as lamps, motors, sunlight, concealed ducts, pipes, or in a position where a humidifier discharge will directly contact the unit.

Procedure

Mounting to AT-516 wall fitting: (Figure 1)

1. Remove and discard the cardboard cover plate on the wall box, after the wall is plastered.
2. If the transmitter plastic tubing is too long for easy coiling in the wall box, it can be cut to length. Cut at a 45° angle for ease in inserting the tubing into the "O" ring seal. Be sure to cut the coil spring off with the tubing.
3. Remove and discard the short plug inserted in the connector head of the wall box.
4. Insert the tube in the center hole in the connector. Do not use any lubricant on the plastic tubing.
5. Remove cover. Fasten the transmitter mounting plate to the wall box with the two mounting screws provided. Tighten the screws evenly.

To mount the HKS-5033 to a AT-517 Mortar Joint Fitting (Figure 2)

1. Remove the screws holding the protector block in the AT-517. Pry out and discard the protector block. Remove and discard the short plug inserted in the connector head by pulling it straight out from the holes.
2. Cut the plastic tube on the back of the humidity transmitter as follows:

Measure 4-7/8-inch from the back of the humidity transmitter, and use a side cutting or diagonal pliers to cut the tubing at a 45° angle to make the tubing slide into the connector head more easily.

Remove the coil spring from the tubing and cut off 7/8-inch.

Replace spring in the tubing.

Insert the short length of copper tubing supplied with the transmitter, into the plastic tubing to stiffen it so that it can be installed easily.

Do not lubricate the outside of the plastic tube.

3. Push the plastic air line into the right hand hole in the connector head. Using a slight back and forth circular motion, push the tubing firmly into the socket at least 1/4-inch.
4. Remove cover. Place the transmitter against the wall fitting and pull the excess tubing through the transmitter back plate being careful not to unplug it from the

fitting. Fasten the back plate to the wall fitting with the screws provided. Tighten the screws evenly. Replace cover.



Figure 3. AT-532-111-1-01 Restrictor Installed in HKS-5033

To mount the HKS-5033 to AT-506 or AT-507 Wall Fitting with Internal AT-532-111-1-01:

To install the AT-532-111-1-01 under the cover (Figure 4), proceed as follows: See Pre-Installation for parts required.

To Install; connect plastic tubing direct, push over barb as far as possible. No clamps are required.

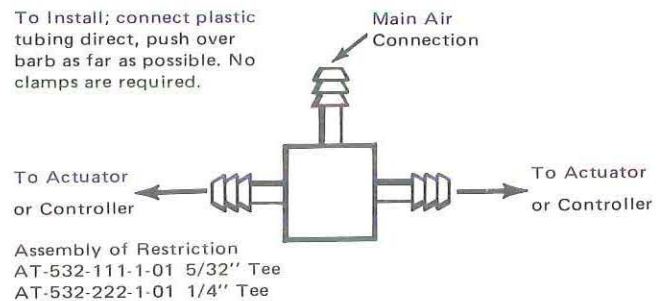


Figure 4.

1. Remove cover.
2. Remove the 5/32-inch tube on HKS from mounting plate. DO NOT remove the end which is in the tygon tube. Measure approximately 2-1/2 inches from the tygon and cut the 5/32-inch tube and spring.
3. Connect the tube to one side of the AT-532-111-1-01 restrictor tee (Figure 3).
4. Connect the APNT-11-011 black tube to the main connection of the AT-532-111-1-01 (Figure 3). Insert one APNT-93-030 spring into the tube. Cut off any excess spring.
5. Insert the black tube through a hole in the left hand side bracket and through the large oblong hole in the back plate (Figure 3).
6. Connect the APNT-11-021 white tube to the remaining side connection of the AT-532-111-1-01. Insert another APNT-93-030 spring to the white tube and cut off any excess spring.
7. Insert the white tube through a hole in the left hand bracket, and through the oblong hole in the back plate (Figure 3).

8. Install the insulator card, provided, inserting the black tube through the left hand hole and the white tube through the right hand hole.
9. Insert the black tube into the left hand hole in the wall fitting or connect to the main line.
10. Insert the white tube into the right hand hole in the wall fitting or connect to the transmitter (branch) output line.
11. Attach the transmitter back plate to the wall box with screws provided.
12. Replace cover and tighten cover screw.

Duct Transmitter

The duct transmitter is mounted directly to the duct with the sensing element tube located at the top. See Figure 5 for duct transmitter mounting dimensions. Tubing connection to air is made by using adapters for plastic tubing or for copper tubing. A strain relief and bushing is provided to secure plastic tubing where it enters the housing.

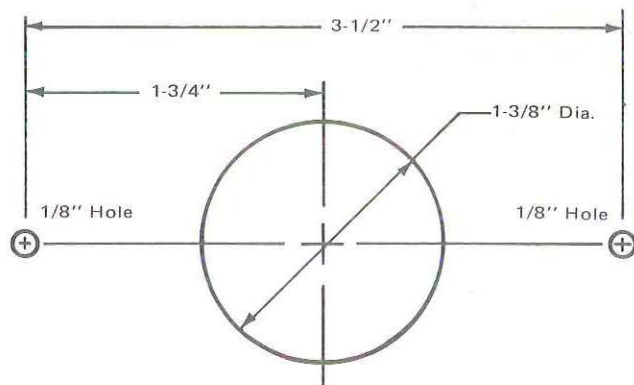


Figure 5. Duct Transmitter Mounting

1. Remove cover.
2. Remove a knockout and insert a metal bushing. Flatten tabs.
3. Connect tubing. Connect the field tubing and unit plastic tubing with a 1/4-inch barbed coupling. Push the tubing and fitting into the box. Clamp the strain relief around the field tubing and insert into metal bushing.

Copper field tubing: Solder a BPNT-67-1 to 1/4-inch copper, then make connection of plastic tubing to fitting. Strain relief cannot be used.

4. Replace cover.

CHECKOUT

1. Connect the calibration box into the transmitters No. 1 and 2 lines as shown in Figure 6 or Figure 7.
2. Move toggle switches to the up (transmitter) position.
3. After making sure the transmitters are sensing a stable humidity, measure the condition at the transmitter with an accurate measuring device.

4. Note reading on calibration box gauges for specific range of transmitter used, compared to condition measured at the transmitter.

Readings should be within $\pm 6\%$ RH on an 80% RH span transmitter. If readings are not within these limits, replace the transmitter.

RUN/ADJUST

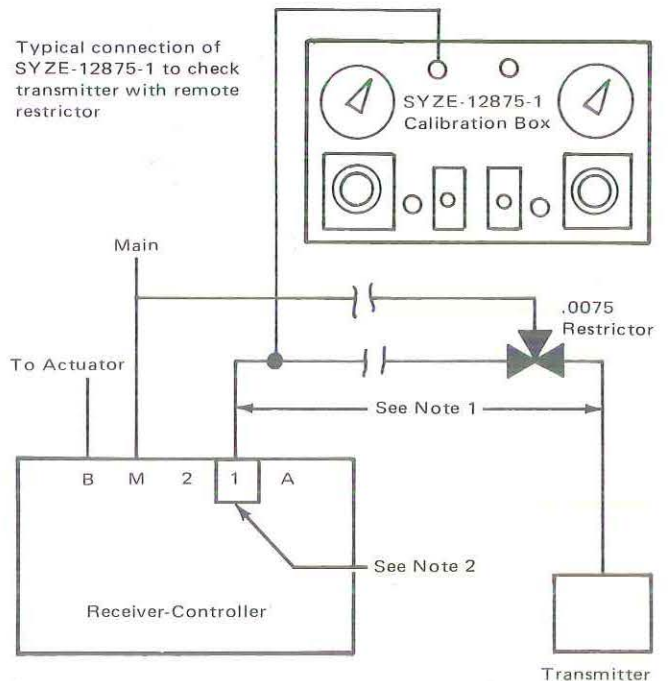
No adjustments are required on the transmitter.

MAINTENANCE

The unit requires no maintenance under normal conditions.

REPAIR

Field repair is not recommended. If the system is not operating correctly, and the reason is traced to the transmitter, it should be replaced.



- Note: 1. More than 200 ft. up to a max. of 1000 ft.
2. Block restriction in receiver-controller.

Figure 6

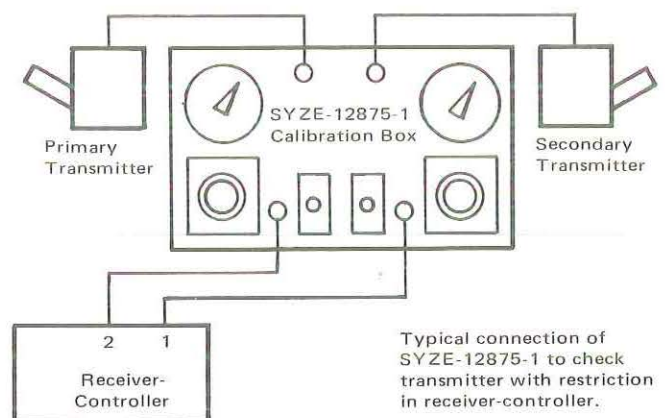


Figure 7.

APPLICATION OF RESTRICTOR

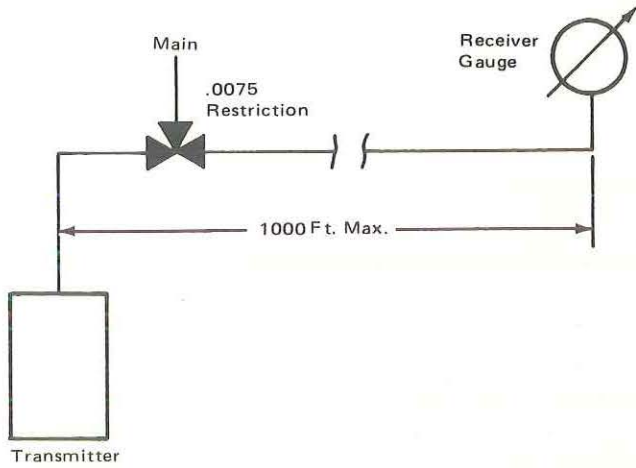


Figure 8. Type I: Supply (Main) Air Line Running Near Transmitter Location (Indication Only)

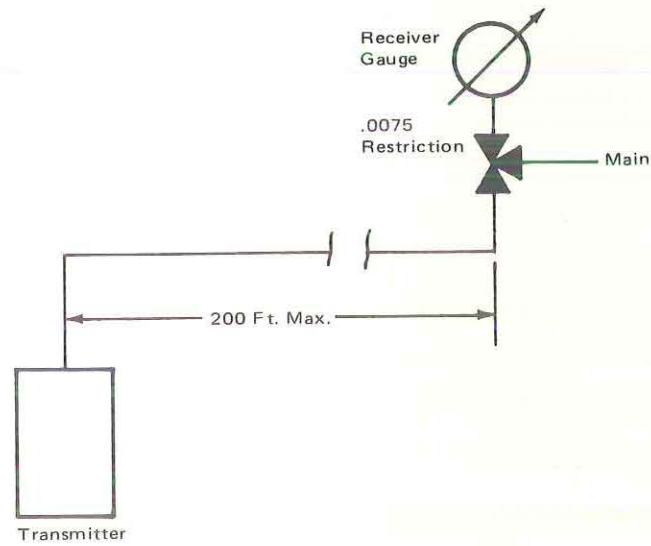
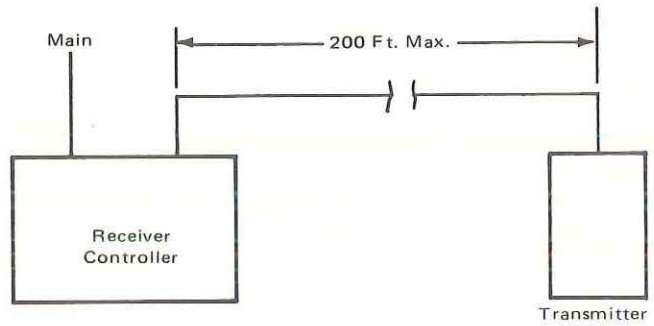
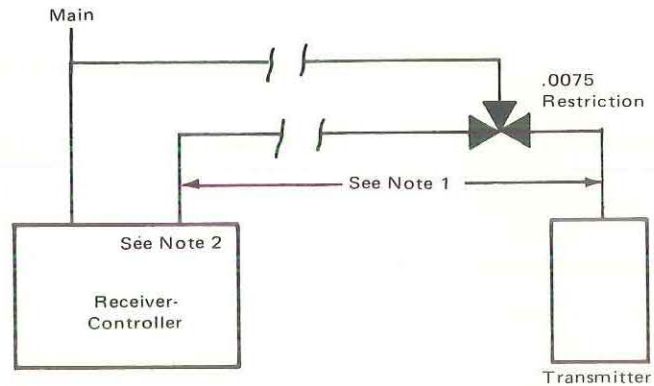


Figure 9. Type II: Supply (Main) Air Line Running Near Receiver Gauge Location (Indication Only)



Receiver-Controller up to 200 Feet From Transmitter



- Note:** 1. More than 200 ft, up to a max. of 1000 ft.
 2. Remove restriction from receiver-controller. See General Instructions F-14238.

Receiver-Controller Greater Than 200 feet and less than 1000 feet from transmitter.

Figure 10. Type III: Transmitter Used With Receiver-Controller

Barber-Colman Company
 ENVIRONMENTAL CONTROLS DIVISION
 1300 Rock Street, Rockford, Illinois, U.S.A., 61101



APPLICATION

Pneumatic gradual switching (non-snap acting) relay used in switching one of two pneumatic input pressures to a common output. The relay will also stop the air signal from a controller output, main line or bleed air from a controlled device in heating, ventilating and air conditioning systems.

SPECIFICATIONS

Action:

Increase of Pilot Pressure above Switch-Over Pressure,
Normally closed (NC) port is open to common (C) port.

Decrease of Pilot Pressure below Switch-Over Pressure,
Normally open (NO) port is open to common (C) port.

Construction:

Housing, Polysulfone.

Diaphragm, Neoprene.

Switch-Over Pilot Pressure: Adjustable 9.5 to 23 psig (66 to 159 kPa); factory set 17.5 psig (121 kPa) which is at the midpoint of the differential.

Differential (Switch-Over Pilot Pressure):

3 psig (21 kPa) max.

Pilot Pressure: Two-position. **Note:** The pilot pressure must have a two-position pressure change of at least 4 psig (28 kPa) or the relay will not function.

Air Supply:

Quality, Pneumatic control systems require clean, oil free, dry air.

Pressure,

Maximum 30 psig (207 kPa).

Operating 0 to 25 psig (0 to 172 kPa).

Ambient Limits:

Temperature,

Shipping and Storage -40 to 160°F (-40 to 71°C).

Operating 32 to 140°F (0 to 60°C).

Humidity, 5 to 95% RH, non-condensing.

Air Connection Code: See Figure 1.

Air Connections: Barbed for 1/4" O.D. plastic tubing.

Air Consumption for Sizing Air Compressor: None.

Air Capacity for Sizing Air Mains: None.

Flow Capacity: 0.15 scfm (70.8 ml/s) at 8 psig (55 kPa) supply with a 1 psig (7 kPa) pressure drop.

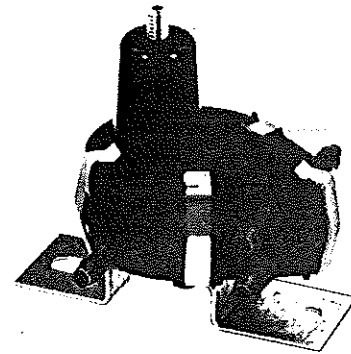
Mounting: Panel, wall or in-line; mounting plate and (2) two push-in fasteners are provided for securing to perforated metal subpanel.

Panel Space Required: 2-1/2" high x 2-1/2" wide x 3" deep (64 mm x 64 mm x 76 mm).

Dimensions: See Figures 2 and 3.

ACCESSORIES None

MAINTENANCE PARTS None



AK-40401
Shown with Mounting Bracket

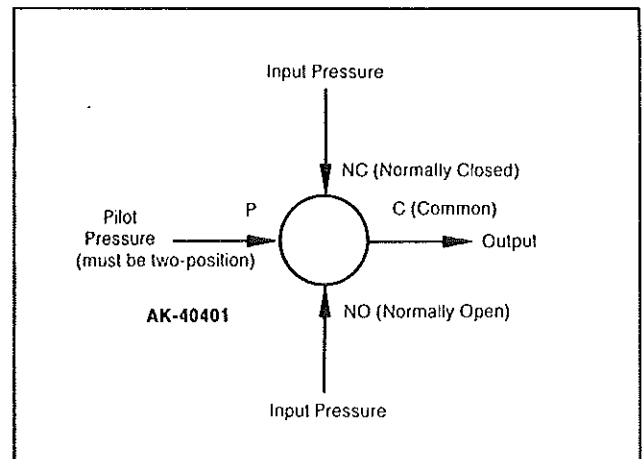


Figure 1. Piping Connections

PRE-INSTALLATION

Inspection

Visually inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious physical defects. Return damaged or defective products.

Required Installation Items

- Piping diagrams
- Tools (not provided):
 - 5/64" Allen wrench
 - Appropriate screwdriver for mounting screws
 - Appropriate drill and drill bit for mounting screws
- Mounting screws, two (2) #10, for unperforated subpanels are not provided

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Make all connections in accordance with the piping diagram.
3. Do not exceed ratings of the device.
4. Do not locate relay in areas subject to excessive vibration or corrosive atmospheres.

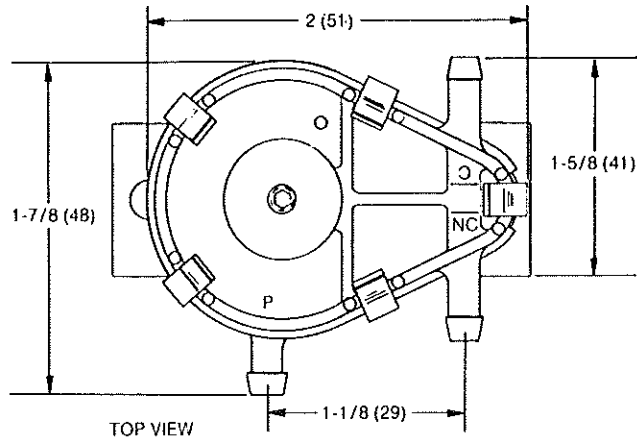
Mounting

IN-LINE

Pipe with 1/4" plastic tubing (no clamps required).

WITHIN CONTROL PANEL

1. Determine mounting location in control panel.
2. Drill mounting holes in subpanel per dimensions shown in Figure 3 or use mounting plate as a template.
3. Secure mounting plate with two (2) #10 screws (not provided) or use two (2) push-in fasteners (provided) if metal perforated subpanel is used.
4. Carefully push center post of AK-40401 into mounting bracket.
5. Pipe with 1/4" plastic tubing.



Dimensions in inches () mm

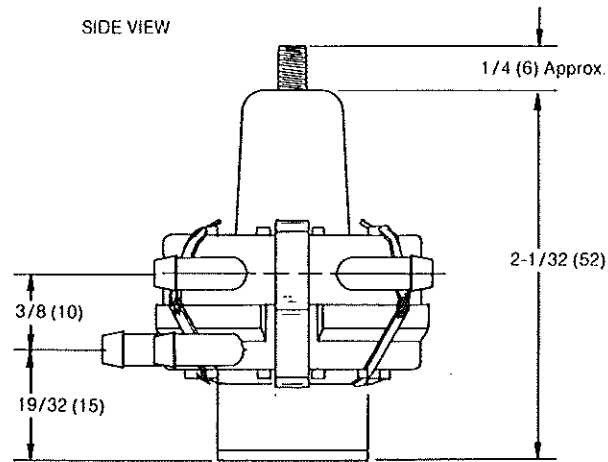


Figure 2. Mounting Dimensions

Dimensions in inches () mm

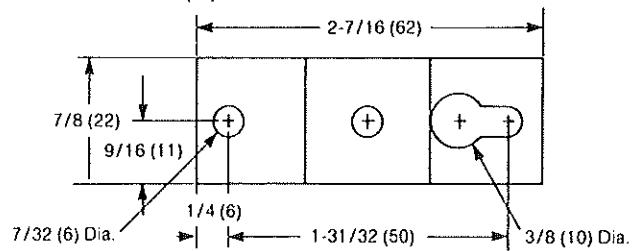


Figure 3. Mounting Bracket Dimensions

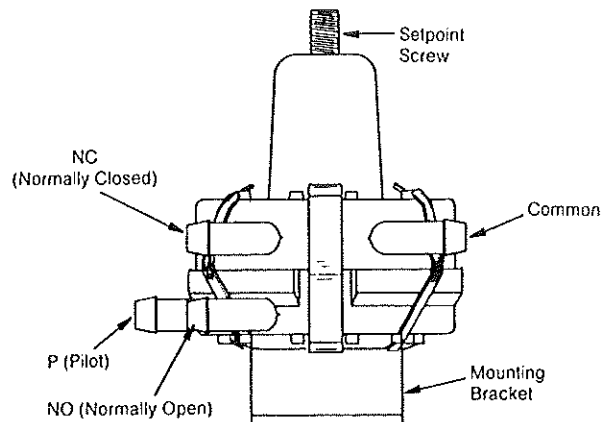


Figure 4. Port and Setpoint Identification

ADJUSTMENTS (See Figure 5)

Switch-over pilot pressure is factory adjusted to 17.5 psig (121 kPa). If a different switch-over pilot pressure is required proceed as follows:

1. Connect inputs to P, NC and NO ports of the AK-40401 (see Figure 5). Connect the output to COM port of the AK-40401.
2. Determine the switch-over pilot pressure required to connect the NC port to the COM port on an increase in pilot pressure to the AK-40401 [typically 15, 20 or 25 psig (103, 138 or 172 kPa)].
3. Position the selector switch (AL-2201) to the exhaust position.
4. Adjust the pressure regulator (AL-481) to provide a pressure equal to the switch-over pilot pressure determined in step 2.
5. Apply a pressure to AK-40401 NC input at least 5 psig (34 kPa) different from the pressure at NO input. The COM pressure should equal the NO pressure with zero pressure on the P port of the AK-40401.
6. Position selector switch (AL-2201) to apply the switch-over pilot pressure to port P of the AK-40401.
7. If the COM and NO pressures of the AK-40401 remain equal, go to step 8. If the COM and NO pressures are not equal, turn the switch-over pilot pressure screw in slowly (using a 5/64" Allen wrench) until the pressures at the COM and NO pressures are equal.
8. Turn the switch-over pilot pressure screw out until the NC and COM port pressures are equal.
9. Position the selector switch (AL-2201) to exhaust the air from port P of the AK-40401. The pressure at the COM port should equal the pressure at the NO port of the AK-40401.
10. Position the selector switch (AL-2201) to apply pressure to port P of the AK-40401. The pressure at COM port should equal that of the NC port.
11. The AK-40401 relay is now adjusted for the proper switch-over pressure.
12. Remove the adjustment piping from the AK-40401 and connect the ports as required by the application.

CHECKOUT

1. The pressure at the COM port of the AK-40401 should equal the pressure at the NO port with zero pressure applied to the pilot port.
2. Apply switch-over pressure to the pilot port of the AK-40401.
3. The pressure at the COM port should equal that of the NC port.
4. Follow the Adjustment procedure shown on this page if switching does not occur.
5. Consider the relay defective and replace if proper adjustment cannot be made.

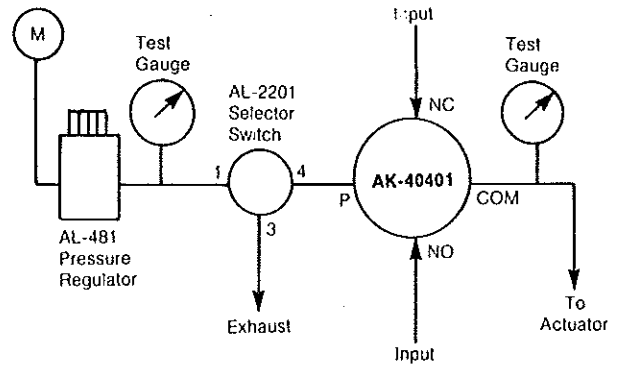


Figure 5. Typical Adjustment Piping

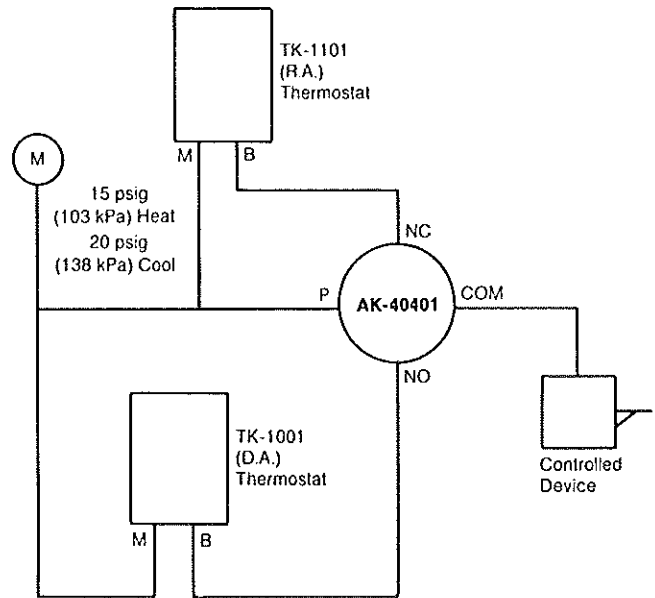


Figure 6. Typical Application Heating/Cooling Changeover

FIELD CALIBRATION

None required.

MAINTENANCE

Regular maintenance of the total system is recommended for sustained optimum performance.

CAUTION

Oil, dirt and/or water in the air supply will cause unwarranted damage to the relay.

FIELD REPAIR

Do not field repair. Replace with a functional relay.



General Instructions

AK-40605 Pneumatic Limiting Relay

APPLICATION

Pneumatic 1:1 ratio direct acting relay is used to limit minimum or maximum output pressure. The AK-40605 can also be used as a manual positioner, 1:1 ratio relay and the lowest of two pressures selector. Relay will also increase the capacity of a controller (except when used as maximum output limiter or lowest pressure selector).



AK-40605 (with Mounting Plate)

SPECIFICATIONS

Action: 1:1 direct.

Output: See Table 1.

Construction:

Housing, Polysulfone.

Diaphragm, Neoprene.

Adjustments: See Table 1 for outputs.

Air Pressure: Clean, oil free, dry air required.

Maximum, 30 psig (207 kPa).

Nominal Supply, 15 to 25 psig (103 to 138 kPa).

Ambient Limits:

Shipping and Storage Temperatures, -40 to 160°F (-40 to 71°C).

Operating Temperatures, 32 to 140°F (0 to 60°C).

Humidity, 5 to 95% RH, non-condensing.

Air Connection Code: See Table 1.

Air Connections: 1/4" barbed.

Air Consumption for Sizing Air Compressor: .002 scfm (0.9 ml/s).

Air Capacity for Sizing Air Mains: 16 scim (4.4 ml/s).

Mounting: Panel, wall or in-line; mounting plate and (2) two push-in fasteners for perforated metal subpanel provided.

Panel Space Required: 4" high x 2-7/16" wide x 1-3/4" deep (102 mm x 62 mm x 44 mm).

Dimensions: See Figures 2 and 3.

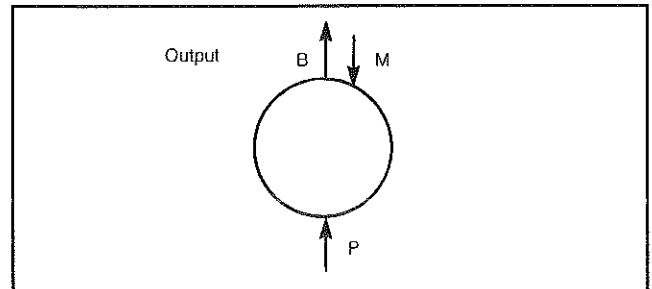


Figure 1. Piping Connections

OPTIONS None

ACCESSORIES

- AK-53098 0 to 20 psig scale and knob kit
- AK-53198 Min. — outside air scale and knob kit
- AK-53298 "Increase" CW scale and knob kit
- AK-53398 "Increase" CCW scale and knob kit
- AK-53498 "Close" CW scale and knob kit
- AK-53598 "Close" CCW scale and knob kit
- AK-53698 "Warmer" CW scale and knob kit
- AK-53798 "Warmer" CCW scale and knob kit

TABLE 1. SPECIFICATIONS

Description	Output	Typical Piping	Air Connection Code		
			Port P	Port B*	Port M
Minimum Output Limiting	Minimum Output Adjustable 0 to 20 psig (0 to 138 kPa)	Fig. 6	Pilot	Output	Main
Maximum Output Limiting	Maximum Output Adjustable 0 to 20 psig (0 to 138 kPa)	Fig. 8	Open to Atmosphere	Output	Input
Manual Positioner	Manually Selected from 0 to 20 psig (0 to 138 kPa)	Fig. 10	Open to Atmosphere	Output	Main
1:1 Ratio Relay	0 to 20 psig (0 to 138 kPa)	Fig. 12	Pilot	Output	Main
Lowest Pressure Selector	Lowest of Two Pressures 0 to 20 psig (0 to 138 kPa)	Fig. 14	Input	Output	Input

*Output pressure will drop to 0 when main air supply is reduced to 0. The reduced air pressure allows controlled device(s) to return to a "failsafe" condition when main air pressure to the AK-40605 is relieved.

PRE-INSTALLATION

Inspection

Visually inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious defects. Return damaged or defective products.

Required Installation Items

- Piping diagrams
- Tools (not provided):
 - Appropriate screwdriver for mounting screws
 - Appropriate drill and drill bit for mounting screws if unperforated subpanel is used
- Appropriate accessories
- Mounting screws (screws for unperforated subpanel are not provided)

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Make all connections in accordance with the piping diagram.
3. Do not exceed ratings of the device.
4. Do not locate relay in areas subject to excessive vibration or corrosive atmospheres.

Dimensions in inches () mm

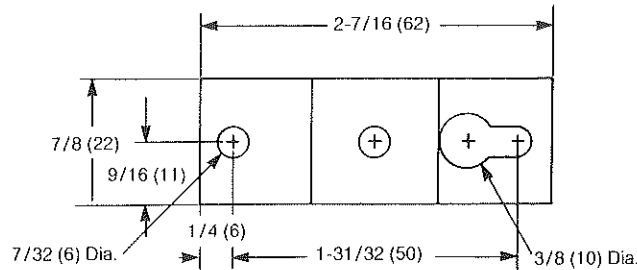


Figure 2. Mounting Bracket Dimensions

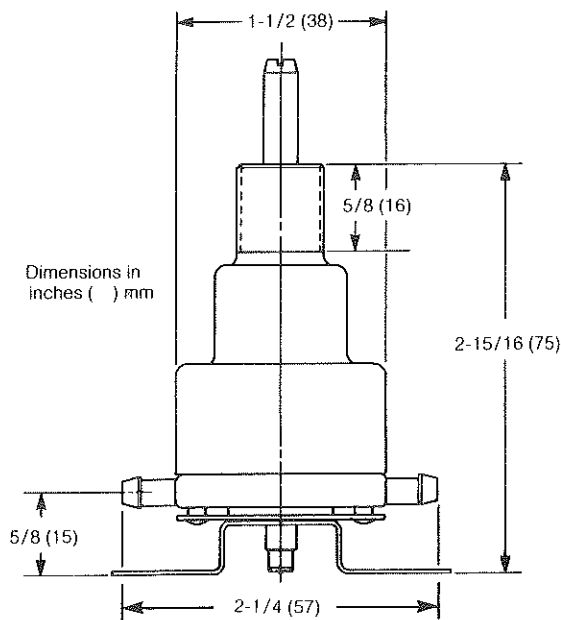


Figure 3. Mounting Dimensions

Mounting

In-Line

Pipe with 1/4" plastic tubing (no clamps required).

Within Control Panel

Scale and knob kits may be used on AK-40605 (see Accessories on page 1).

1. Determine mounting location in control panel.
2. Drill mounting holes in subpanel per dimensions shown in Figure 2 or use mounting plate as a template.
3. Secure mounting plate with field supplied screws or use two (2) push-in fasteners provided if metal perforated subpanel is used.
4. Push center post of AK-40605 into mounting bracket.
5. Pipe with 1/4" plastic tubing.
6. Mount one of the scale and knob kits on the top of the relay (if required by the application).

Face of Control Panel

See Figures 4 and 5 for panel space required and mounting hole dimensions.

NOTE

Maximum allowable panel thickness is 7/16" (11 mm).

1. Drill mounting hole in the panel door.
2. Mount the top of the relay to the face of the panel by using one of the scale and knob kits.
3. Pipe with 1/4" plastic tubing.

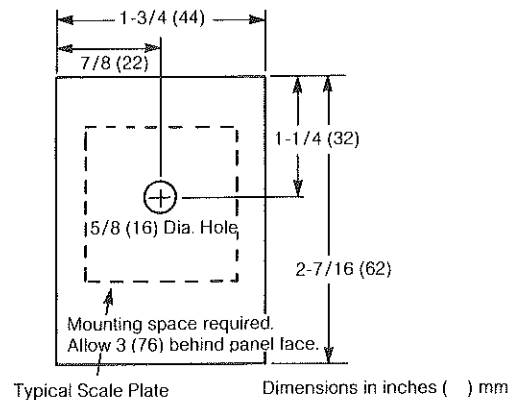


Figure 4. Panel Space and Mounting Hole Size

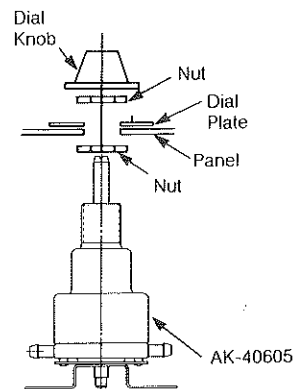


Figure 5. Mounting to Face of Control Panel

ADJUSTMENTS AND CHECKOUT

Minimum Output Pressure Application

(See Figures 6 & 7)

Unit without a Scale Plate

1. Disconnect the pilot (P) port connection and leave open to atmosphere.
2. Turn setpoint shaft to obtain the required minimum output.
3. Reconnect the pilot (P) port connection.

Unit with a Scale Plate

1. Disconnect the pilot (P) port connection and leave open to atmosphere.
2. Turn the setpoint shaft to obtain output pressure which is equal to midscale of the setpoint scale used.
3. Install knob at midscale and secure with 5/64" Allen wrench (TOOL-82).
4. Turn knob to required setpoint.
5. Reconnect the pilot (P) port connection.

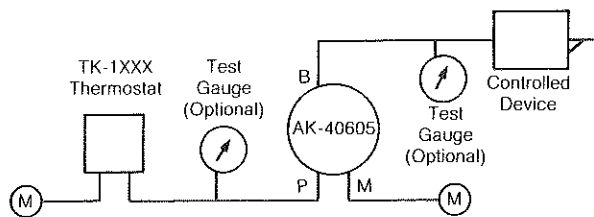


Figure 6. Typical Piping for Minimum Position Application

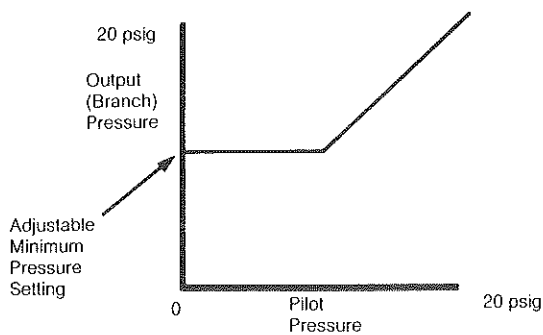


Figure 7. Pilot Pressure vs Output Pressure for Minimum Position Application

Maximum Output Pressure Application

(See Figures 8 & 9)

Unit without a Scale Plate

1. Apply full pressure to the main (M) port.
2. Turn the setpoint shaft to obtain the required maximum output.

Unit with a Scale Plate

1. Apply full pressure to the main (M) port.
2. Turn the setpoint shaft to obtain an output pressure which is equal to midscale of the setpoint scale used.
3. Install knob at midscale and secure with 5/64" Allen wrench (TOOL-82).
4. Adjust knob to the required setpoint.

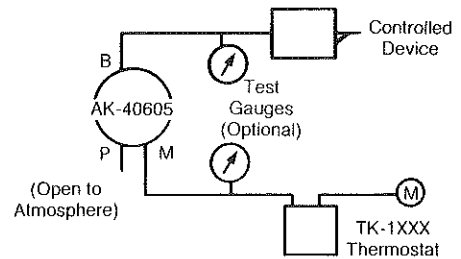


Figure 8. Typical Piping for Maximum Position Application

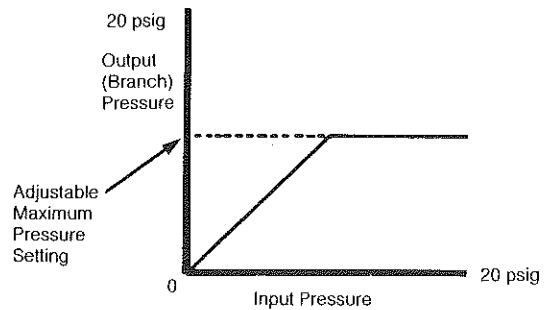


Figure 9. Input Pressure vs Output Pressure for Maximum Position Application

Manual Positioner Application

(See Figures 10 & 11)

1. Apply full pressure to the main (M) port.
2. Turn the setpoint shaft to obtain an output pressure which is equal to midscale of the setpoint scale used.
3. Install knob at midscale and secure with 5/64" Allen wrench (TOOL-82).
4. Adjust knob to the required setpoint.

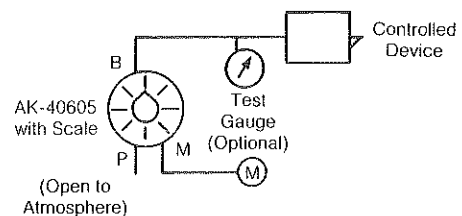


Figure 10. Typical Piping for Manual Position Application

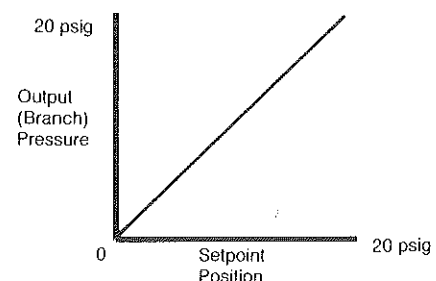


Figure 11. Pilot Pressure vs. Output Pressure for Manual Position Application

1:1 Ratio Relay Application (See Figures 12 & 13)

1. Apply full pressure to the main (M) port.
2. The setpoint shaft should be backed out or removed completely from the AK-40605.

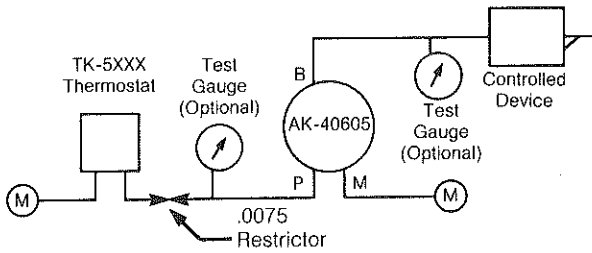


Figure 12. Typical Piping for 1:1 Ratio Application

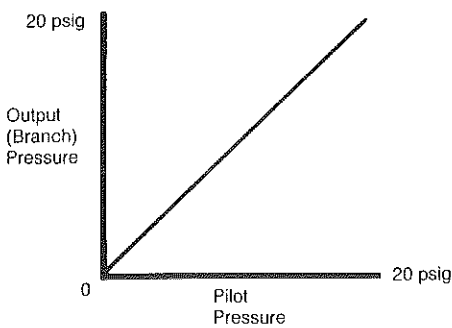
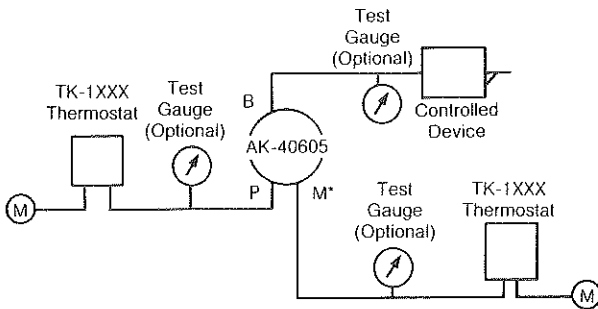


Figure 13. Pilot Pressure vs Output Pressure for 1:1 Ratio Application

Lowest Pressure Selector (See Figure 14)

1. The input with the greatest volume capacity is connected to the (M) port and the other input is connected to the (P) port.
2. The setpoint shaft should be backed out or removed completely from the AK-40605.
3. Adjust one of the inputs to maximum value and the other input to less than the maximum input value. The branch (output) pressure should be the same as the lowest input pressure.
4. Readjust the input controller setpoints to their required values.



*Input with greatest volume capacity.

Figure 14. Typical Piping for Lowest of Two Pressures Selector Application

FIELD CALIBRATION

None required.

MAINTENANCE

Regular maintenance of the total system is recommended for sustained optimum performance.

FIELD REPAIR

Do not field repair. Replace with a functional relay.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940



General Instructions

AK-40613 Pneumatic 1:1 Ratio Reversing Relay

APPLICATION

The AK-40613 1:1 ratio relay is used to reverse a controller signal for sequencing actuators. The relay is also used to increase the capacity of a controller.

SPECIFICATIONS

Action: 1:1 reverse (decrease in output with an increase of pilot pressure).

Output: See Figures 2, 3 and 7.

Construction:

Housing, Polysulfone.

Diaphragm, Neoprene.

Adjustments: Bias; see Figures 1, 2, 3 and 7.

Air Pressure:

Maximum, 30 psig (207 kPa).

Nominal Supply, 15 to 25 psig (103 to 138 kPa).

Ambient Limits:

Shipping and Storage Temperatures, -40 to 160°F (-40 to 71°C).

Operating Temperatures, 32 to 140°F (0 to 60°C).

Humidity, 5 to 95% RH, non-condensing.

Air Connection Code: See Figure 1.

Air Connections: 1/4" barbed.

Air Consumption for Sizing Air Compressor: .008 scfm (3.8 ml/s).

Air Capacity for Sizing Air Mains: 16 scim (4.4 ml/s).

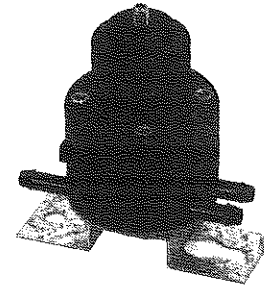
Mounting: Panel, wall or in-line; mounting plate and (2) two push-in fasteners for perforated metal subpanel provided.

Panel Space Required: 4" high x 2-7/16" wide x 1-3/4" deep (102 mm x 62 mm x 44 mm).

Dimensions: See Figures 4 and 5.

OPTIONS None

ACCESSORIES None



**AK-40613
(Shown with Mounting Bracket)**

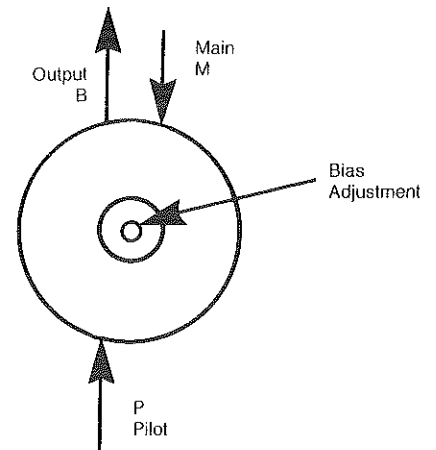


Figure 1. Piping Connections and Bias Adjustment

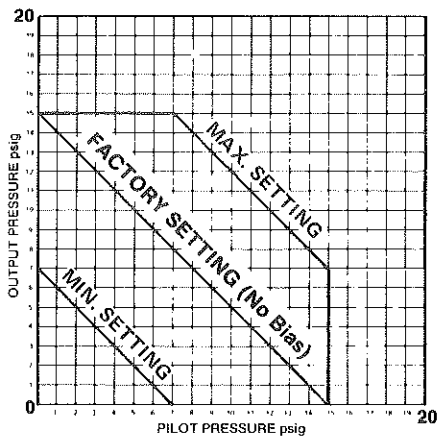


Figure 2. AK-40613 with 15 psig Supply

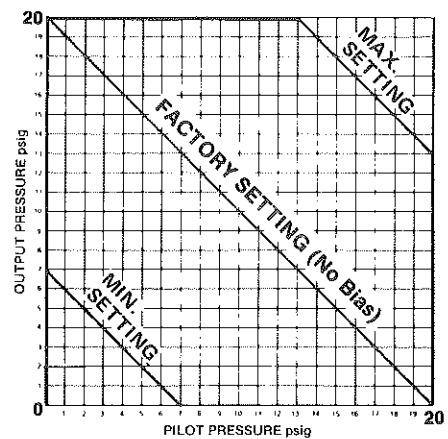


Figure 3. AK-40613 with 20 psig Supply

PRE-INSTALLATION

Inspection

Visually inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious defects. Return damaged or defective products.

Required Installation Items

- Piping diagrams
- Tools (not provided):
 - 5/64" Allen wrench
 - Appropriate screwdriver for mounting screws
 - Appropriate drill and drill bit for mounting screws
- Appropriate accessories
- Mounting screws (screws for unperforated subpanels are not provided)

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Make all connections in accordance with the piping diagram.
3. Do not exceed ratings of the device.
4. Do not locate relay in areas subject to excessive vibration or corrosive atmospheres.

Dimensions in inches () mm

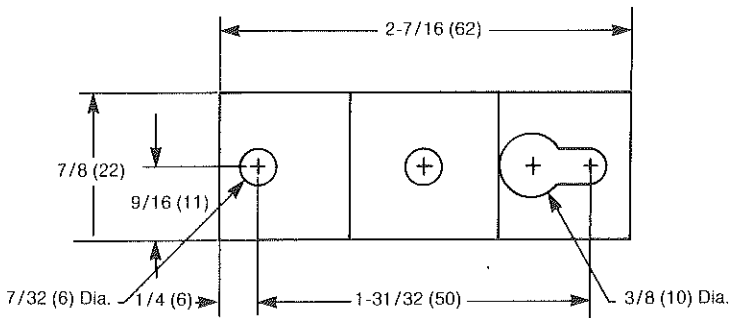


Figure 4. Mounting Bracket Dimensions

Dimensions in inches () mm

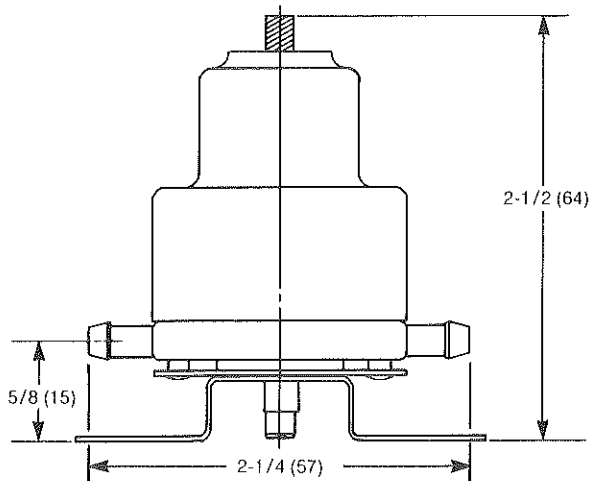


Figure 5. Mounting Dimensions

Mounting

In-Line

Pipe with 1/4" plastic tubing (no clamps required).

Within Control Panel

1. Determine mounting location in control panel.
2. Drill mounting holes in subpanel per dimensions shown in Figure 4 or use mounting plate as a template.
3. Secure mounting plate with field supplied screws or use two (2) push-in fasteners provided if metal perforated subpanel is used.
4. Push center post of AK-40613 into mounting bracket.
5. Pipe with 1/4" plastic tubing.

TYPICAL PIPING

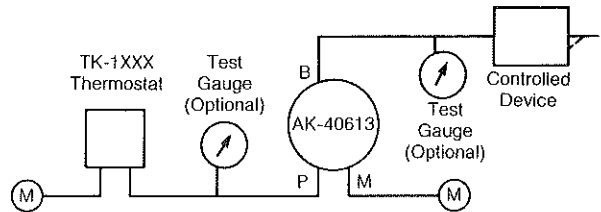


Figure 6. Typical Piping for Reversing Relay
(See Figure 7 for Output Pressures)

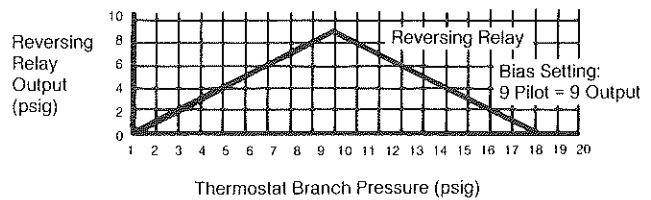
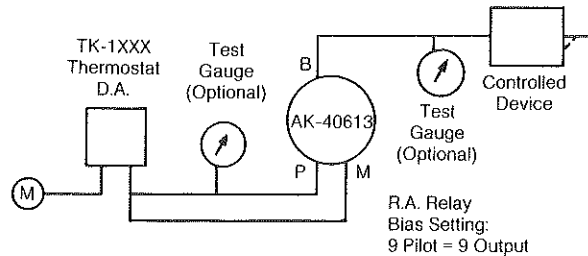


Figure 7. Typical Piping and Output Pressures for Heating and Cooling Applications

ADJUSTMENTS AND CHECKOUT

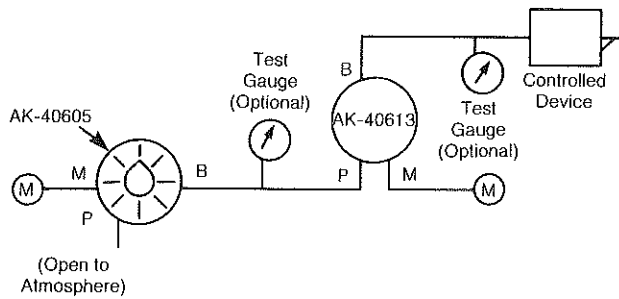


Figure 8. Typical Checkout Piping for Reversing Relay

This relay is field adjustable and normally is adjusted to follow the normal output curve as shown in Figure 2 when supplied with 15 psig (103 kPa) and Figure 3 when supplied with 20 psig (138 kPa). The relay may be adjusted to follow a different curve parallel to the normal curve within the upper and lower limits shown in Figures 2 and 3.

1. Apply full pressure to the main (M) port.
2. Connect a variable air supply to the pilot (P) port.
3. Adjust the pilot pressure to some value, i.e., 8 psig (55 kPa).

4. Determine the output pressure which the relay should be producing by using the normal curve or other determined curve.
5. If the output pressure is not correct:
 - To rise the output pressure, raise the adjustment screw located on the top of the relay using a 5/64" Allen wrench.
 - To lower the output pressure, lower the adjustment screw located on the top of the relay using a 5/64" Allen wrench.

The relay should then follow the curve used in Step 3 $\pm 1/4$ psig (1.7 kPa).

FIELD CALIBRATION

None required.

MAINTENANCE

Regular maintenance of the total system is recommended for sustained optimum performance.

FIELD REPAIR

Do not field repair. Replace with a functional relay.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940

APPLICATION

Pneumatic 1:1 ratio direct acting limiting relays are used to limit maximum or minimum output pressure. Relays will also increase the capacity of a controller.

SPECIFICATIONS

Action: Direct.

Output: Output pressure is equal to pilot pressure \pm .25 psig (2 kPa) until reaching high or low limit, then output will not rise above maximum or fall below minimum. See table.

Construction:

Housing, Noryl plastic.

Diaphragm, Neoprene coated, continuous fiber fabric diaphragm.

Adjustments: See table for output.

Air Pressure:

Maximum, 30 psig (207 kPa).

Nominal Supply, 15 to 20 psig (103 to 138 kPa).

Ambient Limits:

Shipping Temperatures, -40 to 150°F (-40 to 65°C).

Operating Temperatures, -20 to 150°F (-29 to 65°C).

Humidity, 5 to 95% RH, non-condensing.

Air Connection Code:

"1", Output.

"2", Pilot.

"3", Main.

"4", Output.

Air Connections: 1/8" FNPT.

Air Consumption for Sizing Air Compressor: .008 scfm (3.8 ml/s).

Air Capacity for Sizing Air Mains: 16 scim (4.4 ml/s).

Flow Capacity:

AK-50604, 346 scim (94.5 ml/s) at 15 psig (103 kPa) supply, 1 psi (7 kPa) drop.

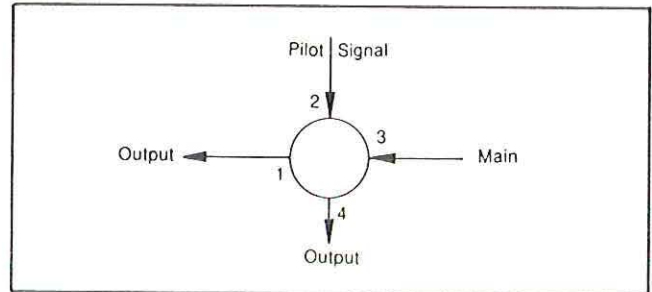
AK-50605, 259 scim (70.7 ml/s) at 15 psig (103 kPa) supply, 1 psi (7 kPa) drop.

Mounting: Panel, wall or track (AD-8953), mounting plate provided.

Panel Space Required: 5-1/2" high x 4" wide x 6" deep (140 mm x 102 mm x 152 mm).



AK-50604
AK-50605



Part Number	Output Limiting
AK-50604	Maximum Adjustable 0 to 20 psig (0 to 138 kPa)
AK-50605	Minimum Adjustable 0 to 20 psig (0 to 138 kPa)

OPTIONS None

ACCESSORIES

- AK-53098 0 to 20 psig scale and knob kit
- AK-53198 Min. — outside air scale and knob kit
- AK-53298 "Increase" CW scale and knob kit
- AK-53398 "Increase" CCW scale and knob kit
- AK-53498 "Close" CW scale and knob kit
- AK-53598 "Close" CCW scale and knob kit
- AK-53698 "Warmer" CW scale and knob kit
- AK-53798 "Warmer" CCW scale and knob kit
- AD-8953 Mounting track

PNEUMATIC

APPLICATION

Pneumatic switching relays used in switching one of two pneumatic input pressures to a common output. Relays will also stop the air signal from a controller output, main line or bleed air from a controlled device in heating, ventilating and air conditioning systems.

SPECIFICATIONS

Action:

Increase of Pilot Pressure above Setpoint, Normally closed port is open to common port.

Decrease of Pilot Pressure below Setpoint, Normally open port is open to common port.

Construction:

Housing, Noryl plastic (AK-50301 also aluminum die cast).

Diaphragm, Neoprene coated, continuous fiber fabric diaphragm.

Adjustments: See table.

Air Pressure:

Maximum, 30 psig (207 kPa).

Nominal Supply, 15 to 20 psig (103 to 138 kPa).

Ambient Limits:

Shipping Temperatures, -40 to 150°F (-40 to 65°C).

Operating Temperatures, -20 to 150°F (-29 to 65°C).

Humidity, 5 to 95% RH, non-condensing.

Air Connection Code:

"M", Main.

"B", Branch.

"Pilot", Pilot.

Air Connections: 1/8" FNPT.

Air Consumption for Sizing Air Compressor: .004 scfm (1.9 ml/s).

Air Capacity for Sizing Air Mains: 0 scim.

Flow Capacity:

AK-50301, 346 scim (94.5 ml/s) at 15 psig (103 kPa) supply, 1 psi (7 kPa) drop.

AK-50401, 259 scim (70.7 ml/s) at 15 psig (103 kPa) supply, 1 psi (7 kPa) drop.

Mounting: Panel, wall or track (AD-8953), mounting plate provided.

Panel Space Required: 5-1/2" high x 4" wide x 6" deep (140 mm x 102 mm x 152 mm).

OPTIONS None

ACCESSORIES

AD-8953 Mounting track

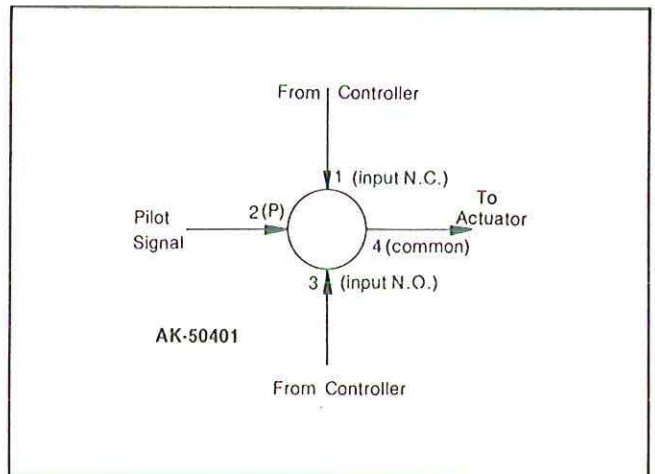
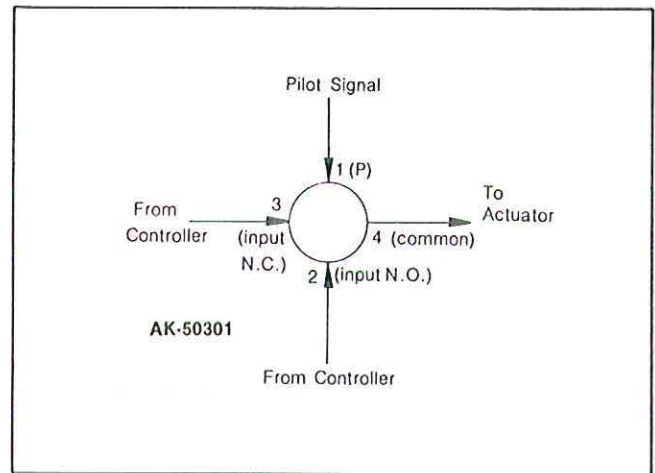


AK-50301



AK-50401

AK-50301
AK-50401



PNEUMATIC

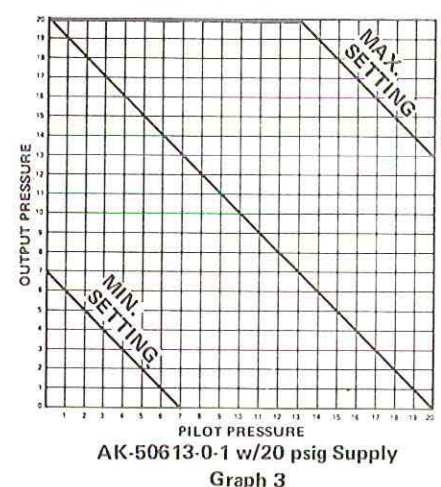
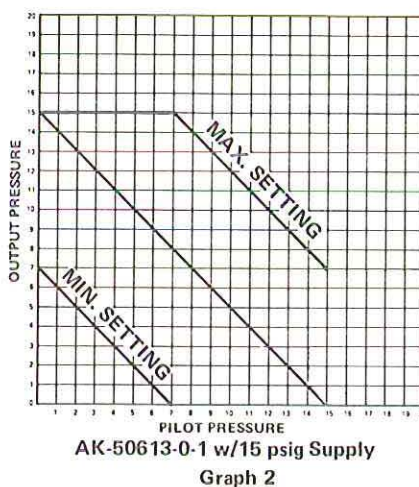
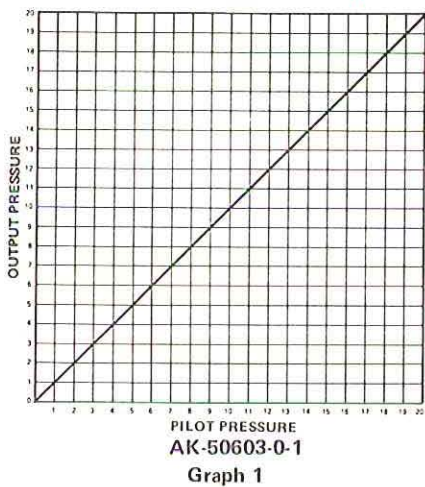
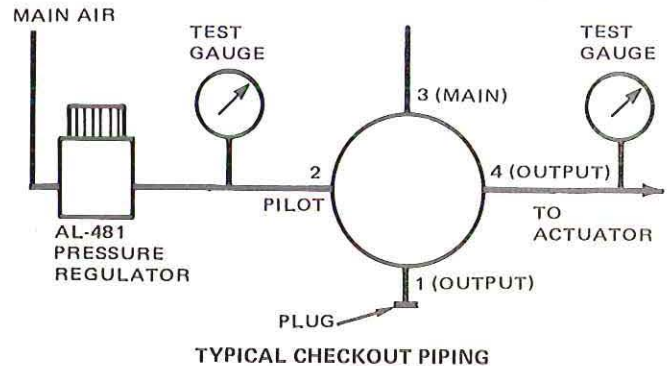
Part Number	Description	Setpoint (Pilot Signal)	Differential (Pilot Signal)	Pilot Signal	Air Connection Code			
					Port 1	Port 2	Port 3	Port 4
AK-50301	3-Way Snap Acting	Adjustable 3 to 20 psi Factory Set 11	Adjustable 1.5 to 6.5 psi Factory Set 1.5	2-Position or Proportional	Pilot	Normally Open	Normally Closed	Common
AK-50401	3-Way Non-Snap Acting	Adjustable 1.5 to 18.5 psi Factory Set 17	2 psi Max.	2-Position	Normally Closed	Pilot	Normally Open	Common



Product Information

Pneumatic Relays

AK-50603, AK-50613



AK-50603, 50613 – Units are 1:1 ratio relays used to increase the actuator capacity of a controller. AK-50603 is direct acting and increases its output with an increase in pilot pressure. AK-50613 is reverse acting and decreases its output with an increase in pilot pressure. The AK-50613 is also used to reverse a controller signal for sequencing of actuators.

ADJUSTMENTS

AK-50603 – This unit is nonadjustable and requires no checkout under most conditions. If it is desired to check the unit's operation proceed as follows:

1. Connect a variable air supply to the pilot (2) port.
2. As the pressure to port 2 is increased, the output pressure (port 2 & 4) should increase and equal the pressure applied to port 2 ± 0.25 psig. If not the relay should be replaced. The output curve is shown on Graph 1.

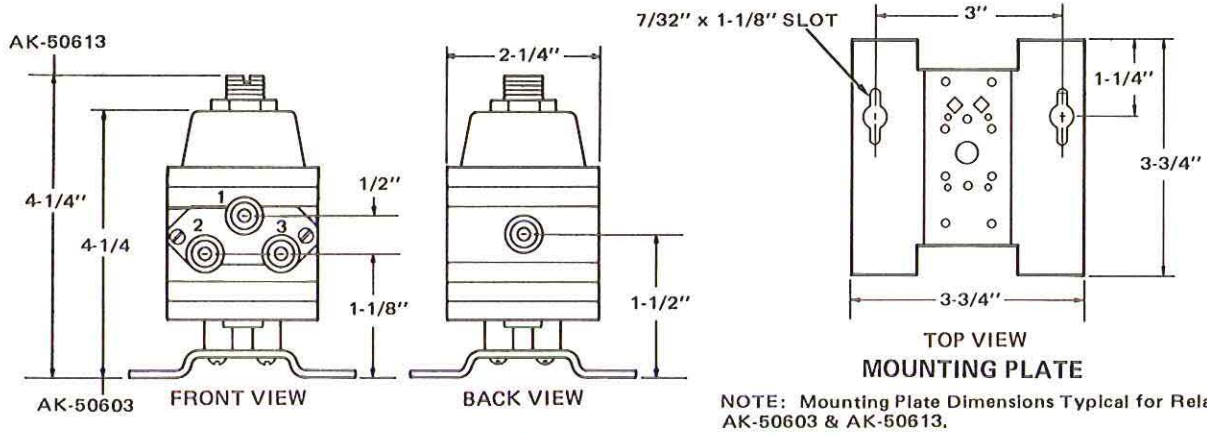
AK-50613 – This unit is field adjustable; it normally is adjusted to follow the normal output curve as shown on Graph 2 when supplied with 15 psig, and Graph 3 when supplied with 20 psig. The unit may be adjusted to follow a different curve parallel to the normal curve within the upper and lower limits shown on Graphs 2 and 3.

Air Connection Code			
Port 1	Port 2	Port 3	Port 4
Output	Pilot	Main	Output

To check the unit proceed as follows:

1. Connect a variable air supply to the pilot (2) port.
2. Adjust the pilot pressure to some value such as 8 psig.
3. Refer to Graph 2 or 3 depending on supply air pressure, and find using the normal curve or other determined curve the output pressure which the relay should be producing.
4. Measure the output pressure.
5. If the output pressure is not correct, adjust the adjustment screw inward to raise the output pressure, outward to lower it until the proper output is obtained. The unit should then follow the curve used in Step 3 ± 0.25 psig.

Installation – The relays are provided with a mounting plate which can be mounted to a panel or wall with the screws provided, or mounted in SYZE-567 track. Panel space required is 4 inches wide by 5-1/2 inches high by 6 inches deep. Air connections are: 1/8 FNPT.



DIMENSIONS AK-50603-0-1, AK-50613-0-1

Barber-Colman Company
 ENVIRONMENTAL CONTROLS DIVISION
 1300 Rock Street, Rockford, Illinois, U.S.A., 61101



AK-50301-0-1



AK-50401-0-1

AK-50301 — This relay is a snap-acting, three way switching relay. It is used to switch either of two input lines to a common output or to stop the air signal from a controller output or main air line and bleed the air from a controlled device. The pilot signal may be either two position or proportional.

ADJUSTMENTS

To adjust the AK-50301 proceed as follows:

1. Determine the pilot pressure at which it is desired to have the N.C. (3) port connected to the Com. (4) port, on an increase in pilot pressure.
2. Determine the pilot pressure at which it is desired to have the N.O. (2) port connected to the Com. (4) port on a decrease in pilot pressure.

NOTE

The difference between the pressures in Step 1 and Step 2 must be between 1.5 and 6.5 psig.

3. Referring to Figure 1, connect a pressure regulator in the pilot line and connect output to port 1.
4. Provide full supply pressure to the pressure regulator.
5. Adjust the signal to port 3 to its maximum value.
6. Adjust the signal to port 2 to its minimum value.
7. Adjust the pressure regulator to the value determined in Step 1.
8. If the pressure at port 4 equals that applied to port 2, adjust the setpoint screw out slowly until the unit switches and the pressure at port 4 equals that applied to port 3. If the pressure at port 4 equals that applied to port 3, adjust the setpoint in until the pressure at port 4 equals that applied to port 2, then adjust the setpoint screw out slowly until the unit switches back and the pressure at port 4 again equal that applied to port 3.

NOTE

Setpoint adjustable from 3 to 20 psig.

9. Gradually lower the pressure to port 1 (regulator) and note the pressure at which the port 4 pressure changes to equal that applied to port 2. Note the pressure should equal that determined in Step 2. If the pressure is too high, the differential needs to be increased. If the pressure is too low, the differential needs to be decreased. Raise the pressure to port 1 back to that set in Step 7.
10. Adjust the differential screw, clockwise to increase, counterclockwise to decrease differential, approximately 1 turn for each 1 psig change desired.
11. Repeat Steps 8 through 10 until the unit performs as desired.

NOTE

The minimum differential is 1.5 psig, maximum is 6.5 psig.

Air Connection Code			
Port 1	Port 2	Port 3	Port 4
Pilot	Normally Open	Normally Closed	Common

TYPICAL CHECKOUT PIPING

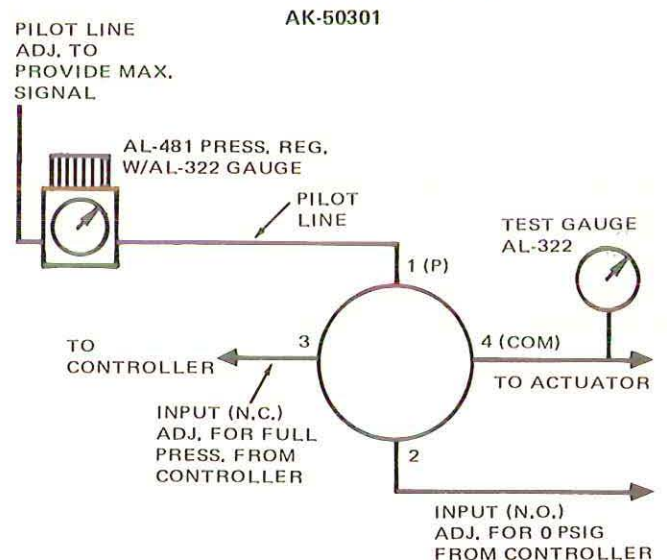
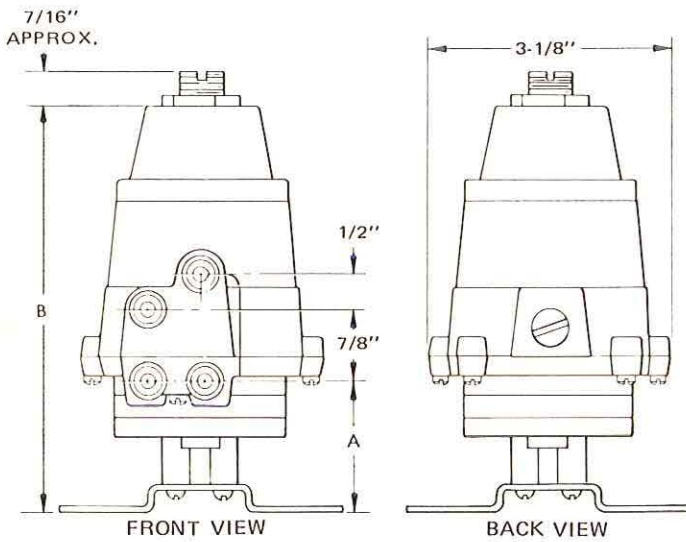
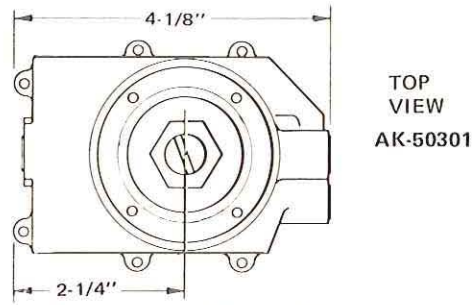


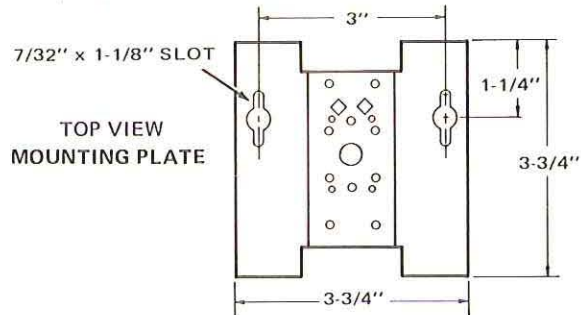
Figure 1



DIMENSIONS AK-50301-0-1



TOP VIEW
AK-50301

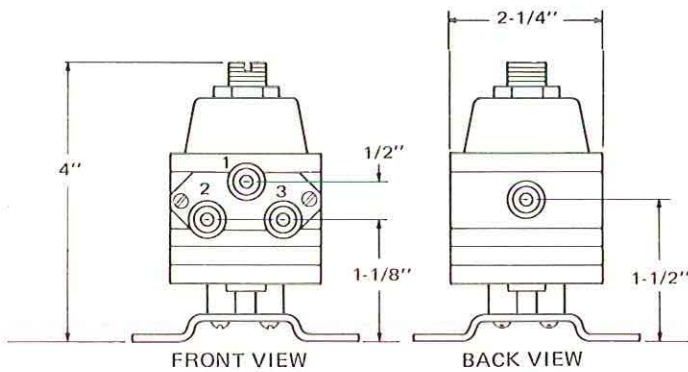


NOTE: Mounting Plate Dimensions Typical for Relays AK-50301 & AK-50401.

8. Position manual switch to exhaust the air from port 2. Port 4 output should equal port 3 input.
9. Position manual switch to apply pressure to port 2, port 4 output should equal port 1 input. If not repeat Steps 7 through 9 until the desired results are obtained.

NOTE

Setpoint is adjustable from 1.5 to 18.5 psig.



DIMENSIONS AK-50401-0-1

AK-50401 — This relay is a non-snap acting three way switching relay. It is used to switch either of two inputs to a common output or to stop the air signal from a controller output or main air line and bleed the air from a controlled device. The pilot signal **MUST** be a two position signal change of at least 3 psig.

ADJUSTMENTS

To adjust the AK-50401 proceed as follows:

1. Determine the pilot pressure at which it is desired to have the N.C. (1) port connected to the Com. (4) port, on an increase in pilot pressure.
2. Referring to Figure 2, connect manual switch in the pilot line, and connect to port 2, and supply it with air from a pressure regulator.
3. Adjust the pressure regulator to provide a signal to the manual switch equal to that determined in Step 1.
4. Adjust signal to port 1 to its maximum value and the signal to port 2 to its minimum value.
5. Position manual switch to apply pressure to port 2.
6. Port 4 output should equal port 1 input. If not adjust setpoint screw out until it does.
7. Adjust setpoint screw in slowly until port 4 output equals port 1 input.

Installation — The AK-50301 and AK-50401 are provided with a mounting plate which can be either mounted to a panel or wall with screws provided, or mounted in SYZE-567 track. Panel space required is 4 inches wide by 5-1/2 inches high by 6 inches deep. Air connections are: 1/8 FNPT.

Air Connection Code			
Port 1	Port 2	Port 3	Port 4
N.C.	Pilot	N.O.	Com.

TYPICAL CHECKOUT PIPING

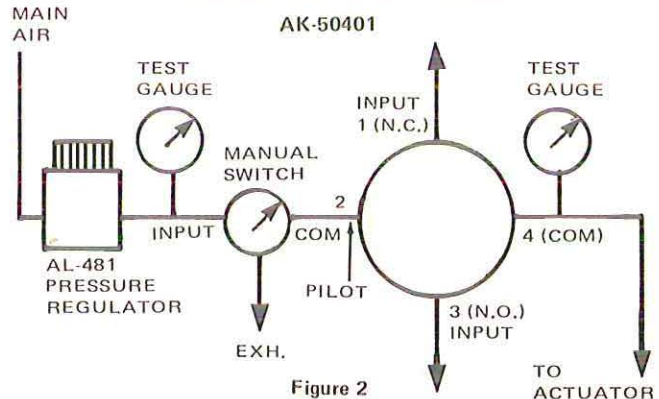


Figure 2

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940



General Information

These pressure selector relays are designed to select the higher or lower of the input signals and produce an output signal equal to the selected input signal.

Construction Molded noryl housing with coated Buna-N rubber diaphragms.

Air Consumption for Sizing Air Compressor .016 scfm (8 ml/s) at 15 psig (103 kPa) and .024 scfm (11 ml/s) at 20 psig (138 kPa) supply.

Air Capacity for Sizing Air Mains 36 scim (10 ml/s) at 15 psig (103 kPa) and 50 scim (14 ml/s) at 20 psig (138 kPa) supply.

Maximum Safe Pressure 30 psig (207 kPa).

Safe Ambient Temperature Limits
-20° to 150°F (-29° to 66°C).

Operating Ambient Temperature Limits
40° to 150°F (4° to 66°C).

Air Connections Barbed connectors for 1/4" O.D. plastic tubing. No clamps are required.

Dimensions 1-3/4" (44 mm) diameter x 2-1/4" (57 mm) high for two input; 3-3/4" (95 mm) high for six input; 4-3/4" (120 mm) high for 10 input.

Mounting Mount in line if tubing is able to properly support the weight of relay or on AK-52582 mounting plate (order separately). Two relays may be mounted on one AK-52582 plate. AK-52582 can snap into AD-8953 mounting track or can be mounted with two No. 8 or No. 10 sheet metal screws through holes provided. Refer to Figure 3 for details on AK-52582.

Options None.

Accessories

- AK-52582 Mounting plate for one or two relays
- AD-8953 Mounting track

Piping of the Relay with Less than Maximum Inputs

AK-51832/AK-52032: When using this unit with less than maximum inputs, the unused inputs are left open to atmosphere.

AK-51842/AK-52042: When using this unit with less than maximum inputs, the unused inputs are to be connected to the main air supply to the relay.

CHECKOUT

AK-51632, AK-51832, AK-52032, High Pressure Selector

1. Connect a constant 15 or 20 psig (103 or 138 kPa) main to the unit.
2. Connect one input signal to the unit, with other input(s) left open to atmosphere.
3. Connect a branch test gauge to the branch connection.
4. Adjust the input to a known value, i.e., 10 psig (69 kPa).



Part Number	Description	Output	Inputs
AK-51632	High Pressure Selector, 1:1 Ratio Relay	Output Pressure Equals Highest of Two Input Pressures	2
AK-51642	Low Pressure Selector, 1:1 Ratio Relay	Output Pressure Equals Lowest of Two Input Pressures	2
AK-51832	High Pressure Selector, 1:1 Ratio Relay	Output Pressure Equals Highest of Six Input Pressures	6 (max.)
AK-51842	Low Pressure Selector, 1:1 Ratio Relay	Output Pressure Equals Lowest of Six Input Pressures	6 (max.)
AK-52032	High Pressure Selector, 1:1 Ratio Relay	Output Pressure Equals Highest of Ten Input Pressures	10 (max.)
AK-52042	Low Pressure Selector, 1:1 Ratio Relay	Output Pressure Equals Lowest of Ten Input Pressures	10 (max.)

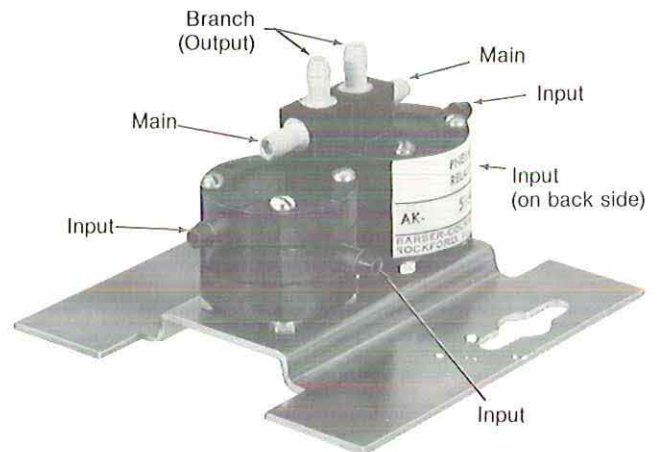


Figure 1. Air Connection Location for AK-51632/51642. Two Relays shown on AK-52582 Mounting Plate. (Order plate separately.)

5. The branch gauge should read the same as the input signal ± 2 psig (1 kPa). If not, check the test gauges used to insure that they read the same. If gauges read the same and the output of the relay is not acceptable for job conditions, replace the relay.
6. Repeat Steps 2 through 5 with other input(s).

AK-51642, Low Pressure Selector

1. Connect a constant 15 or 20 psig (103 or 138 kPa) main to the unit.
2. Connect the two input signals.
3. Adjust one of the signals to maximum value and the other input signal to 10 psig (69 kPa) or some value other than maximum.
4. Connect a branch test gauge to the branch connection. The branch test gauge should read the same as the lowest input signal ± 2 psig (1 kPa). If not, check the test gauges used to insure they read the same. If gauges read the same and the output of the relay is not acceptable for job conditions, replace the relay.

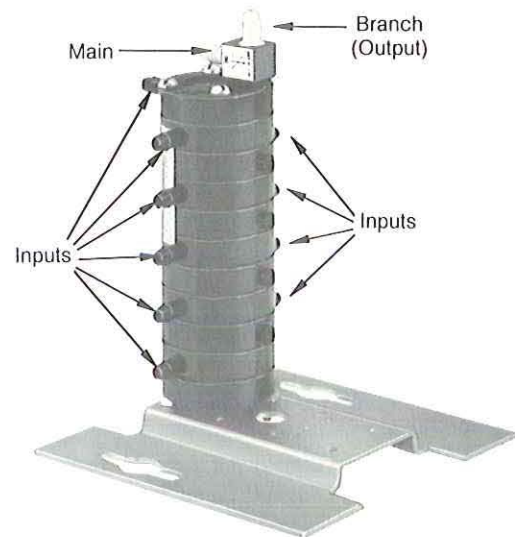


Figure 2. Air Connection Locations for AK-52032/52042. Single Relay shown on AK-52532 Mounting Plate. (Order plate separately.)

AK-52042, AK-51842, Low Pressure Selector

1. Connect a constant 15 or 20 psig (103 or 138 kPa) main to the unit.
2. Connect one input signal; connect the main to all other inputs.
3. Adjust the input signal to 10 psig (69 kPa) or some value other than maximum.
4. Connect a branch test gauge to the branch connection. The branch test gauge should read the same as the input signal ± 2 psig (1 kPa). If not, check the test gauges used to insure they read the same. If gauges read the same and the output of the relay is not acceptable for job conditions, replace the relay.
5. Repeat Steps 2 through 4 with other inputs.

MAINTENANCE

This is a quality product. Regular maintenance of the total system is recommended to assure sustained optimum performance.

REPAIR

Do not field repair pressure selector — replace with functioning unit.

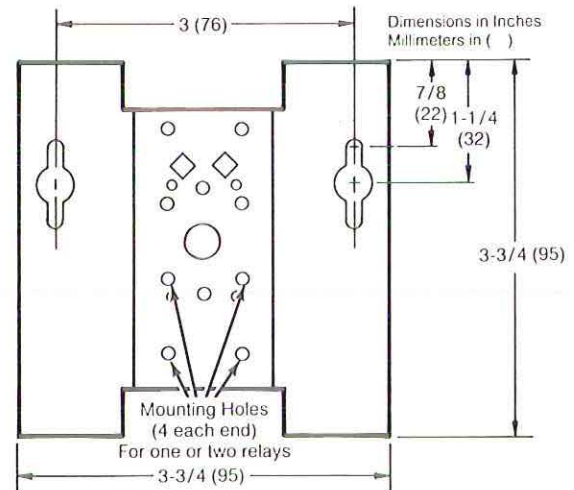
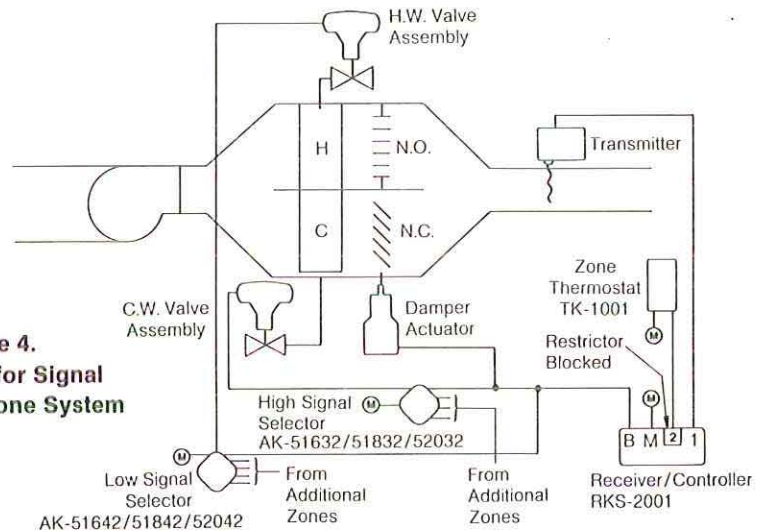


Figure 3. AK-52582 Mounting Plate Dimensions

Figure 4. Application for Signal Used in Multizone System



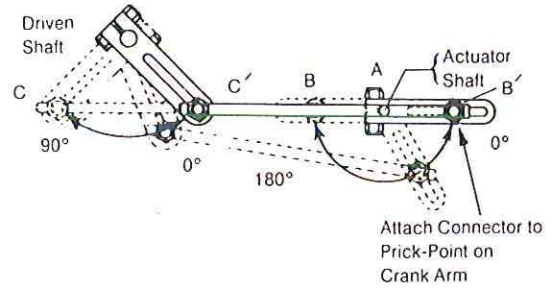
Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940

- AM-111
- AM-112
- ✓ AM-113
- AM-115
- AM-116

Crank Arms

Damper crank arms. Use AM-122 or AM-132 connectors. See drawing for driving a damper 90° from 180° actuator.



Part Number	Description	Construction
AM-111	Crank Arms	For 5/16" Diameter Shaft
AM-112		For 3/8" Diameter Shaft
AM-113		For 1/2" Diameter Shaft
AM-115		For 7/16" Diameter Shaft
AM-116		Spined for 1/2" Diameter Actuator Shaft
		Slot Provides for Adjustable Radius from 7/8" Minimum to 3-1/8" Maximum

AM-122

Straight Linkage Connectors

Straight type - 5/16" diameter hole. Use for linking parallel shafts.



AM-123

Damper Clip

Angle clip for attaching to damper blade. Use AM-122 or AM-132 connectors.



✓ **AM-125**

Damper Rod

5/16" diameter steel damper rod



Part Number	Description
AM-125	5/16" Dia. x 20" Zinc Plated
AM-125-048	5/16" Dia. x 48" Zinc Plated
AM-125-600	5 PCS 5/16" Dia. x 10' Zinc Pl.

AM-127

Spring Loaded Connecting Link

5/16" diameter rod, 20" long with one AM-122 connector and one spring loaded connector to provide overtravel of actuator for sequencing applications. Maximum damper area is 35 sq. ft. Not suitable for use with MP-2000 series.



✓ **AM-132**

Ball Joint Linkage Connector

Ball joint type - 5/16" diameter hole. Use for linking nonparallel shafts.



**PNEUMATIC
Accessories**

APPLICATION

Restrictors and fittings.



AT-531



AT-532-098-1-01



AT-532-098-1-02



AT-532-098-1-03



AT-532-111-1-01
AT-532-111-1-03



AT-532-222-1-01



AT-533-67



AT-533-101



AT-533-127



AT-533-129

- AT-531
- AT-532-098-1-01
- AT-532-098-1-02
- AT-532-098-1-03
- AT-532-111-1-01
- AT-532-111-1-03
- AT-532-222-1-01
- AT-532-222-2-01
- AT-533-67
- AT-533-101-0-1
- AT-533-127-0-1
- AT-533-129-0-1

PNEUMATIC

Part Number	Description	Application
AT-531	Needle Valve with 1/8" FNPT.	Use between Positive Positioner and Actuator to Adjust Speed of Actuator.
AT-532-098-1-01	.0075 Restrictor for use with 1/4" Copper Compression Fitting — White Color.	Used with Bleed Thermostats and Transmitters.
AT-532-098-1-02	.0045 Restrictor for use with 1/4" Copper Compression Fitting — Red Color.	Used to Slow Down Actuators. Typical Example: In Bleed Port or Solenoid Air Valve.
AT-532-098-1-03	.010 Restriction — Blue Color. Replacement for Restrictor in Solid-State-Pneumatic, Transducer.	Used on CP-5119, 5129, 511.
AT-532-111-1-01	.0075 Restriction Tee for 5/32" Plastic Tube. Includes Black and White Plastic Tubes and Springs.	Used with Bleed Room Thermostat and Transmitters Under Cover — Makes Unit Two Pipe.
AT-532-111-1-03	.010 Restriction Tee for 5/32" Plastic Tube.	Used on CP-8501, CP-8502.
AT-532-222-1-01	.0075 Restriction Tee for 1/4" Plastic Tube.	Used with Bleed Thermostats and Transmitters.
AT-532-222-2-1	Dual .0075 Restrictor Tee for 1/4" Plastic Tube.	Used with TK-5X5XX Thermostats.
AT-533-67	3/16" ID — 1/4" OD Sweat 1/4" Barb Connector — No Clamp Required. 1/4" Solder Coupling (not included) Required for 1/4" OD Sweat.	Used to Adapt from 3/16" or 1/4" Copper to 1/4" Plastic.
AT-533-101-0-1	1/4" x 5/32" Double Barbed Brass Connector — No Clamps Required.	Used on Connecting Room Thermostat Tube to 1/4" Plastic.
AT-533-127-0-1	3/16" ID — 1/4" OD Sweat x 5/32" Double Barbed Brass Connector — No Clamp Required.	Used to Adapt from 3/16" or 1/4" Copper to 5/32" Plastic.
AT-533-129-0-1	5/32" x 5/32" Double Barbed Brass Connector Coupling — No Clamp Required.	Used in Connecting 5/32" Tube to 5/32" Tube.

PNEUMATIC
Accessories

APPLICATION

Receiver gauges for continuous indication of temperature, pressure, enthalpy, or humidity in conjunction with a transmitter-receiver system.

SPECIFICATIONS

Air Pressure:

Input, 3 to 15 psig (21 to 103 kPa).

Maximum, 25 psig (172 kPa).

Accuracy: ±2% of full scale.

Construction:

Case, AKS-6000 series, plastic.

AKS-9000 series, steel with lacquer finish.

Lens, Clear plastic.

Dial Indicator: Field adjusted by screw on dial face.

Ambient Limits:

Shipping Temperatures, -40 to 150°F (-40 to 65°C).

Operating Temperatures, -20 to 150°F (-29 to 65°C).

Humidity, 5 to 95% RH, non-condensing.

Air Connections: 1/8" FNPT.

Mounting: Stem connected (1-1/2" size). Flush mount (3-1/2" size) with "U" clamp (3-3/4", 95 mm hole required) in panels up to 3/4" (19 mm) thick.

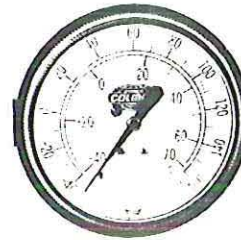
Dial Dimensions: AKS-6000 series, 1-3/4" diameter × 1-1/2" deep (44 mm × 38 mm); AKS-9000 series, 4" diameter × 1-3/4" deep (102 mm × 44 mm).

OPTIONS None

ACCESSORIES None



AKS-6000



AKS-9000

- AKS-6221
- AKS-6244
- AKS-6247
- AKS-6261
- AKS-6263
- AKS-6281
- AKS-9021
- ✓ AKS-9044
- AKS-9047
- ✓ AKS-9061
- ✓ AKS-9063
- ✓ AKS-9081
- AKS-9085
- ✓ AKS-9091
- ✓ AKS-9092
- AKS-9093
- AKS-9094

PNEUMATIC

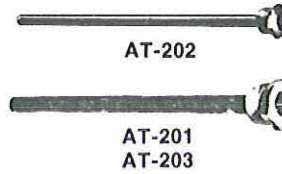
Part Number		Scale Range (Dual Marked)	For Use with the Following Transmitters
1-1/2" (38 mm) Gauge (Stem Mounted)	3-1/2" (89 mm) Gauge (Flush Panel Mounted)		
AKS-6221	AKS-9021	50 to 100°F (10 to 37°C)	TKS-5001, 6001, 7001
AKS-6244	✓ AKS-9044	0 to 100°F (-18 to +38°C)	TKS-4014, 8014, 9014
AKS-6247	AKS-9047	50 to 150°F (10 to 65°C)	TKS-4017, 9017
AKS-6261	✓ AKS-9061	-40 to +160°F (-40 to +71°C)	TKS-2031
AKS-6263	✓ AKS-9063	40 to 240°F (4 to 116°C)	TKS-8033
AKS-6281	✓ AKS-9081	10 to 90% RH	HKS-2033, 5033
—	AKS-9085	16 to 40 BTU/LB (37 to 93 KJ/Kg) Dry Air	HKS-8065
—	✓ AKS-9091	-.25 to +1.75" H ₂ O (-5 to +45 mm H ₂ O)	PKS-2011
—	✓ AKS-9092	1 to 3" H ₂ O (25 to 75 mm H ₂ O)	PKS-2011
—	AKS-9093	2.5 to 4.5" H ₂ O (60 to 110 mm H ₂ O)	PKS-2011
—	AKS-9094	4 to 6" H ₂ O (100 to 150 mm H ₂ O)	PKS-2011

APPLICATION

Immersion well for use with temperature bulbs.

SPECIFICATIONS

Ambient Temperature Limits: -40 to 350°F (-40 to 177°C).



✓ AT-201
✓ AT-202
✓ AT-203
✓ AT-206

Part Number	Material	Dimensions				Application Limitations at 250°F Fluid Temp.		Used With
		O.D. in. (mm)	Insertion Length in. (mm)	Wall Length in. (mm)	Fitting in.	Max. Recom. Velocity FPS (m/s)	Max. Recom. Static Pressure psig (kPa)	
AT-201	Copper	1/2 (13)**	9-1/2 (241)	10-1/4 (260)	3/4 MNPT	11 (3.3)	250 (1728)	MU-4X1XX, TC-2XX, TC-4X1X, TC-4X2X, TC-4X5X, TP-20X, TP-22X, TP-232, TP-231
AT-202	Copper	1/2 (13)**	13-1/4 (337)	14 (356)	3/4 MNPT	8 (2.4)	250 (1728)	TP-233
AT-203	Stainless Steel	1/2 (13)**	9-1/2 (241)	10-1/2 (267)	3/4 MNPT	20 (6.1)	500 (3448)	Same as AT-201
AT-206	Copper	1/2 (13)**	4-1/2 (114)	5-13/16 (148)	1/2 MNPT	11 (3.3)	250 (1728)	TC-4X1X, TC-4X2X, TC-4X5X

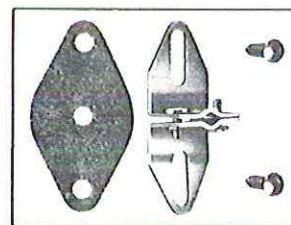
*Requires AT-209.
**For 3/8" (10 mm) diameter bulbs.

APPLICATION

Duct and liquid mounting kits for temperature bulbs.

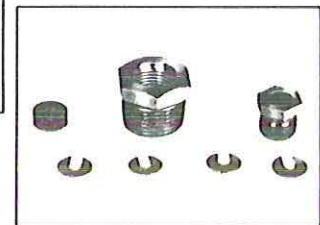
Part Number	Description	Application
AT-208	Duct Mounting Kit	Temperature Bulbs
AT-209*	Liquid Line or Tank Mounting Kit	TC-4X1X, TC-4X2X and TC-4X5X Series Bulb Thermostats

*A bulb well is recommended.



AT-208

✓ AT-208
✓ AT-209



AT-209

APPLICATION

Concealed setpoint adjustment plate for use with TC-41XX and TC-42XX series bulb thermostats or TC-2974 strap-on thermostat.



AT-210

APPLICATION

Outdoor bulb shield for mounting and protecting bulb from damage and foreign matter.

SPECIFICATIONS

Construction: Aluminum.

Mounting: Two 17/64" mounting holes in shield. Kit is furnished with bulb holding clip.



AT-211

Dimensions: 2" high × 11-3/4" wide × 1-1/8" deep (51 mm × 298 mm × 29 mm).

APPLICATION

Adaptors for current-to-obsolete linkages and for obsolete-to-current linkages.

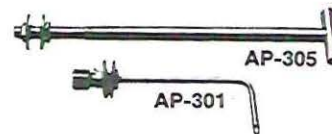


AM-602
AM-603

Part Number	Application	Specifications
AM-602	Adapts current actuators to obsolete linkages	Replace MA-521X-XXX or MA-521X-XXX-0-1 with MA-521X-XXX-0-2
AM-603	Adapts obsolete actuators to current linkage	Adapts MA-521X-XXX or MA-521X-XXX-0-1 to AV-600 or AV-601-0-0-1 linkages

APPLICATION

Duct static pressure sensing tips for use with PC-301 and PF-300 series.



✓ AP-301
AP-305

SPECIFICATIONS

Mounting Hardware: Provided.

Part Number	Type of End Fitting	Construction	Mounting Location	Dimensions in. (mm)
AP-301	1/4" Compression	Brass	In areas with air turbulence caused by filters, dampers, etc.	4-5/8 long x 2-1/8 wide (117 x 54) Insertion length 3-3/4 (95)
AP-305	1/8" Pipe Thread	Brass (S.S. Tee end)	Very low actuating pressure	8-3/4 long x 2-1/2 wide (222 x 64)

APPLICATION

Cover inserts (package of 24) used to convert a cover on TA-150X, TC-110X and TC-1191 with thermometer and setpoint dial into any -4XX combination.

AT-61-400-0-2
AT-61-401-0-2
AT-61-402-0-2
AT-61-403-0-2
AT-61-404-0-2

SPECIFICATIONS

Packed: 24.

Material: Brushed bronze metal.



AT-61-400-0-24 AT-61-401-0-24 AT-61-402-0-24 AT-61-403-0-24 AT-61-404-0-24

APPLICATION

Lock cover screw kit modifies room thermostats so as to prevent unauthorized tampering of either the dial setting or the internal mechanism. Works with all electric thermostats except TA-121, TA-130 series, TC-114 and TC-142.

Note: Two kits are required for duplex type thermostats.



AT-101

APPLICATION

Pressure gauges for continuous indication of air pressure in pneumatic control systems.



AL-323
Shown

- AL-322
- AL-323
- ✓ AL-327
- AL-353
- ✓ AL-362

SPECIFICATIONS

Air Pressure:

Input, 3 to 15 psig (21 to 103 kPa).

Maximum, 25 psig (172 kPa).

Accuracy: Within 2% of total scale range in middle half of scale and 3% elsewhere.

Construction:

Case, Rust resistant. See table for case material.

Dial Scale:

Numerical Intervals, 5 and 10 psi (50 and 100 kPa).

Graduation Marks, 1 psi (5 kPa) for 0 to 30 psi (0 to 200 kPa) and 2 psi (20 kPa) for 0 to 100 (0 to 689 kPa).

Ambient Limits:

Shipping Temperatures, -40 to 150°F (-40 to 65°C).

Operating Temperatures, -20 to 150°F (-29 to 65°C).

Humidity, 5 to 95% RH, non-condensing.

Air Connections: Back 1/8" FNPT.

Flush Panel Mounting: AL-323, 2-1/8" (54 mm) dia. hole required; AL-353, 3-3/4" (95 mm) dia. hole required.

Part Number	Mounting	Dial Diameter In. (mm)	Range psig (kPa)*
Steel Case			
AL-322	Stem	2 (51)	0-30 (0-200)
AL-323	Panel (Flush)	2 (51)	0-30 (0-200)
AL-327	Stem	2 (51)	0-100 (0-689)
Steel Case			
AL-353	Panel (Flush)	3-1/2 (89)	0-30 (0-200)
Plastic Case			
AL-362	Stem	1-1/2 (38)	0-30 (0-200)

*Gauges are dual scaled.

Dial Dimensions: See table.

OPTIONS None

APPLICATION

Safety valve with approximately 30 psig (207 kPa) blow off pressure.



✓ AL-412

SPECIFICATIONS

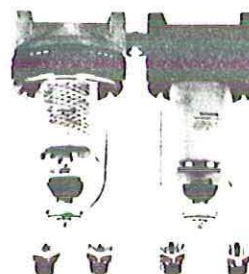
Relief Capacity: 24 scfm (11,326 ml/s).

Air Connections: 1/4" MNPT.

OPTIONS None

APPLICATION

Air filters used to provide clean, oil-free air for pneumatic control systems.



AL-437
AL-439

SPECIFICATIONS

Dual Filter Station: 5 micron absorbent pre-filter and a coalescing .03 micron oil removal filter will remove contamination to .015 PPM with 50 PPM inlet condition.

Construction:

Housing, Aluminum.

Bowl, Polycarbonate.

Drain, Automatic.

Maximum Operating Conditions:

Inlet Pressure, 250 psig (1728 kPa).

Temperature, 150°F (65°C).

OPTIONS None

Part Number	Pipe Size (In.)	Max. Flow Capacity scfm (ml/s)
AL-439	3/4"	80 (37,760)
AL-437	3/8"	15 (7080)

*NPT female adaptors are provided to reduce to 1/2" and 1/4" FNPT.

PNEUMATIC Accessories

APPLICATION

Pressure regulator with a large flow capacity to reduce supply air pressure from the compressor down to the requirements of the system.

These relieving type regulators prevent build-up of excessive pressure in regulated system.

SPECIFICATIONS

Construction:

Gauge Port, 1/8" FNPT.

Air Pressures:

Maximum Input, 400 psig (2758 kPa).

Output Range, 0 to 50 psig (0 to 345 kPa).

Ambient Temperature Limits: -40 to 200°F (-40 to 93°C), operating and shipping.

Mounting: In-line.

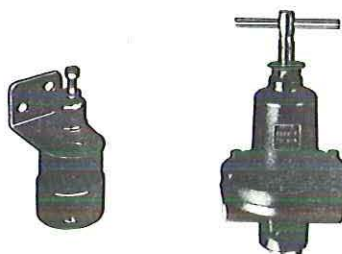
OPTIONS None

ACCESSORIES

AL-322 2" (51 mm) 0-30 psi (0-200 kPa) back connected gauge

AL-327 2" (51 mm) 0-100 psi (0-200 kPa) back connected gauge

AL-362 1-1/2" (38 mm) 0-30 psi (0-200 kPa) back connected gauge



AL-481

AL-48X

AL-481
AL-483
AL-484
AL-487

Part Number	Pipe Size (in.)	Capacity scfm (ml/s)
AL-481	1/8	1 (472)
AL-483	1/4	0-16 (0-7552)
AL-487	3/8	16-22 (7552-10,384)
AL-484	1/2	22-32 (10,384-15,104)

APPLICATION

Selector switch and scale plates. Selector switches function as remote instruments to deliver or stop a flow of air or to direct the air from one controller or another to selected pneumatically actuated valves and dampers.

SPECIFICATIONS

Dial Plates (order separately): Keyed for proper locating on the switch. Plates, furnished in white on black letters, are reversible with markings on both sides.

Flow Capacity: 580 scim (158 ml/s) at 20 psig (138 kPa) supply with 1 psi (7 kPa) drop.

Maximum Supply Air Pressure: 30 psig (207 kPa).

Construction:

Housing, Noryl plastic.

Diaphragm, Neoprene coated, continuous fiber fabric diaphragm.

Ambient Limits:

Shipping Temperatures, -40 to 160°F (-40 to 71°C).

Operating Temperatures, -20 to 160°F (-29 to 71°C).

Humidity, 5 to 95% RH, non-condensing.

Connection Code:

AL-2201, With knob at left, ports 1 and 2 connected, 3 and 4 connected. With knob at right, ports 1 and 4 connected, 2 and 3 connected.

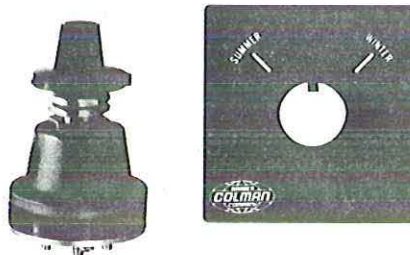
AL-2401, AL-2401-101, Port 5 is common, ports 1, 2, 3 and 4 are outputs. When four position switching is required, remove cap from 4 port.

AL-2401-101, Ports not connected to port 5 (common) are exhausted to atmosphere.

Connections: Barbed for 1/4" plastic tubing, no clamps required.

Mounting: Panel.

Dial Dimensions: 3-5/8" high x 2-1/4" dia. (92 mm x 57 mm).



AL-2201

AL-2203

AL-2201
AL-2202
AL-2203
AL-2204
AL-2302
AL-2303
AL-2304
AL-2305
AL-2401
AL-2401-101
AL-2402

SELECTOR SWITCHES

Part Number	Description
AL-2201	Two-Position
AL-2401	Three/Four-Position, Non-Exhausting
AL-2401-101	Three/Four Position, Exhausting

SCALE PLATES

Part Number	Description
AL-2202	Two-Position Manual Auto, Open Closed
AL-2203	Two-Position Occu-Unoccu, Summer-Winter
AL-2204	Two-Position Blank, On-Off
AL-2302	Three-Position, Open-Auto-Closed, On-Off-Auto
AL-2303	Three-Position, Occu-Auto-Unoccu, Summer-Auto-Winter
AL-2304	Three-Position, Summer-Off-Winter, Heat-Vent-Cool
AL-2305	Three-Position, 1-2-3, Blank
AL-2402	Four-Position, 1-2-3-4, Blank

PNEUMATIC



APPLICATION

Control cabinets for mounting of electric, electronic and pneumatic controls.

SPECIFICATIONS

Construction:

Doors, Locking type, supplied with keys, rigidly supported. The doors are easily removed for protection on job site installation or mounting of components.

Steel Gauge, See Table 1.

Knockouts, See Table 1. Aligned so that a short nipple may be used to couple the panels.

Appearance, Beige paint.

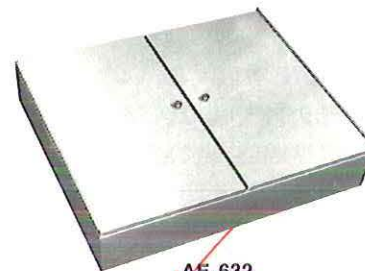
Mounting: Four extruded mounting holes 1/4" (6 mm).

Dimensions: See Table 1.

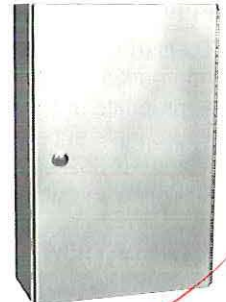
ACCESSORIES None



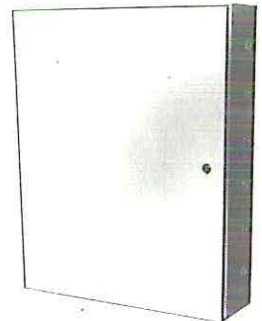
AE-629



AE-632



AE-630, AE-631



AE-662-501
AE-662-502



TABLE 1. SPECIFICATIONS

Part Number	Description	Opening	Steel Gauge	Subpanel	Knockouts	Dimensions in. (mm)
AE-629	Single Door, Continuously Hinged	Right or Left-handed	18	Obtain Locally	For 3/4" conduit, two on each side.	24 wide x 16 high x 7 deep (610 x 406 x 178)
AE-630	Single Door, Continuously Hinged	Right or Left-handed	18			16 wide x 24 high x 7 deep (406 x 610 x 178)
AE-631	Single Door, Continuously Hinged	Right or Left-handed	18			24 wide x 32 high x 7 deep (610 x 813 x 178)
AE-632	Double Door, Continuously Hinged	Right or Left-handed	16			42 wide x 36 high x 7 deep (1067 x 914 x 178)
AE-662-501	Single Door, Three Hinges	Left-handed	14	16 gauge, perforated for #8 Type A sheet metal screws, flanged	Five on top & bottom, six on each side for 3/4" or 1" conduit. Eight 3/8" dia. on top & bottom, ten on each side for 3/8 bulkhead barbed pneumatic fittings.	24 wide x 30 high x 7-1/2 deep (610 x 762 x 191)
AE-662-502	Single Door, Three Hinges	Left-handed	14	16 gauge, solid, flanged		

PRE-INSTALLATION

Inspection

Visually inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious defects. Return damaged or defective products. Check the part number on the unit to be sure the correct panel is being installed.

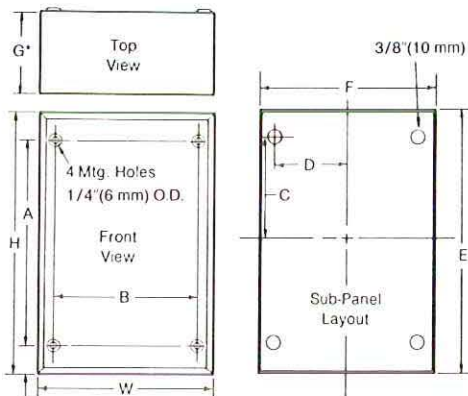
Required Installation Items

- Tools (not provided):
Appropriate screwdriver for mounting screws
Appropriate drill and drill bit for mounting screws
- Appropriate subpanel (provided only with AE-662-501 and AE-662-502)
- Mounting screws (not provided)

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Avoid locations where excessive moisture, corrosive fumes or vibration are present.



Cabinet Part Number	Dimensions (Inches)†								
	Cabinet					Subpanel			
	W	H	G*	A	B	C	D	E	F
AE-629	24	16	7	13	18-1/2	6-1/2	9-1/4	14	22
AE-630	16	24	7	18-1/2	13	9-1/4	6-1/2	22	14
AE-631	24	32	7	26-1/2	21	13-1/4	10-1/2	30	22
AE-632	42	36	7	33	39	16-1/2	18	34	40
AE-662-501 AE-662-502	24	30	7-1/2	23-1/4	19-1/4	11-5/8	9-5/8	27-1/4	22

†Metric Conversion: 1" = 25.4 mm.

*Usable depth 1/2" less than G dimension.

Figure 1. Mounting Dimensions

Grounding

CAUTION

Green grounding wire from conduit must be securely fastened to subpanel. Painted surface of subpanel must be broken to assure proper grounding.

Mounting

1. Remove panel door.
2. Mounting panel:
 - a. **To mount the wall section on a concrete, concrete block or masonry wall**, mark and drill tight-fitting holes for 1/4" lag bolts in lead anchors. The anchors should be placed in the block, brick or other masonry, not in mortar joints (Figure 2). To mount the unit on a wood frame, use 1/4" diameter lag bolts screwed into either the framing itself (Figure 3) or into 3/4" (19 mm) thick wood or plywood backing board securely fastened to the framing (Figure 3).
 - b. **To mount on metal framed walls**, mount the controller to a backing board as described in step 2a. or mount directly to framing (Figure 5). The backing board should be mounted to the framing with screws and expansion sleeves in drilled holes.
3. Replace panel door.

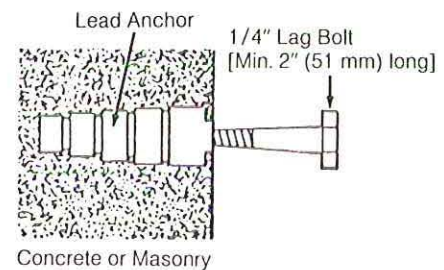


Figure 2. Mounting on Concrete, Concrete Block or Masonry Wall

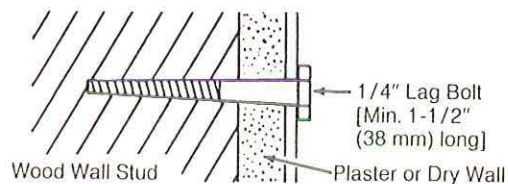


Figure 3. Mounting to Wood Framing

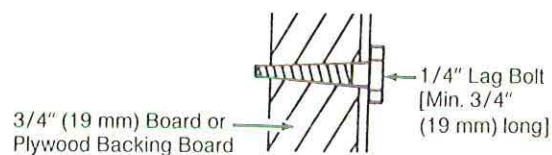


Figure 4. Mounting on Backing Board

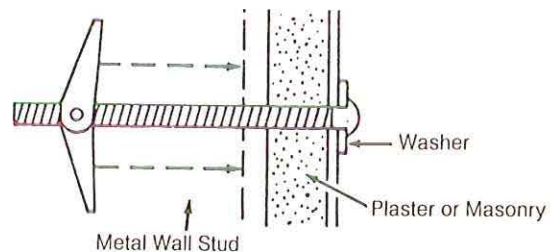


Figure 5. Mounting on Metal-Framed Wall

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940



Product Information

Accessories Miscellaneous Electrical Components For AE-629 to 632 Control Cabinets



Toggle Switch

Switches, Mounting and Position Indicating Plates (Order All Parts Separately)



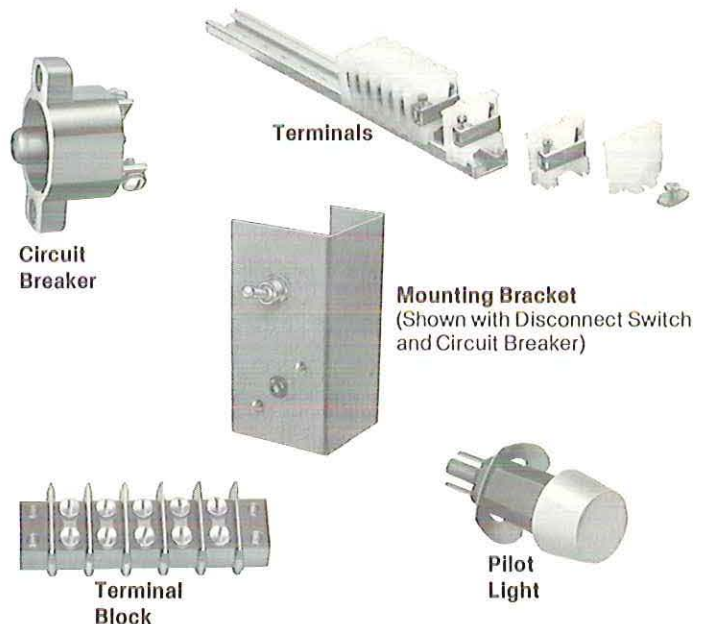
Toggle

Shown with Switch Plate and Indicating Plate

Switch Action	AC Rating		Switch Type	Switch Part No.	Mounting Plate (Flush)	Indicating Plate			
	Amp	Volt				Part No.	Position Markings	Size (inch)	
							Width	Height	
DPDT	10	250	Toggle 2 Position	CYZP-11-1	SYZE-52-3	SYZE-74-1 SYZE-75-1 SYZE-76-1 SYZE-102-1 SYZE-189-1 SYZE-271-1 SYZE-300-1	On-Off Summer-Winter None Day-Night Open-Close Manual-Auto Occupied-Unoccupied	1-1/8	2-1/16
4PDT	5	24	Toggle 2 Position	CYZP-105					
DPDT (Center Off)	10	250	Toggle 3 Position	CYZP-268					
4PDT (Center Off)	5	24	Toggle 3 Position	CYZP-427		SYZE-212-1 SYZE-255-1	On-Off-Automatic Summer-Off-Winter	1-7/8	2-1/16
SPST N.O.	5	125	Push Button Momentary Contact	CYZP-346					
SPST N.C.				CYZP-347					

NOTE: All switches mount to standard switch box. 1/2" mounting hole required.

Part Number	Description
AYZP-43-2	Circuit Breaker 10 Amp (Illustrated)
BYZP-145	12 Circuit Terminal Block (Illustrated)
BYZP-146	Marker Strip #1—12
BYZP-252	Marker Strip #13—24
BYZP-253	Marker Strip #25—36
BYZP-269-2	Mtg. Bracket for Circuit Breaker & Switch (Illustrated)
BYZP-599	Terminal End (Illustrated)
BYZP-600	Terminals (Approx. 4 per inch) (Illustrated)
BYZP-601	Terminal Channel (3') (Illustrated)
BYZP-602	Terminal Clamp (Illustrated)
BYZP-603	Terminal Marker (25') (Illustrated)
CYZR-818-2	Arc Suppressor for SPDT Floating Switching
EYZP-504-1	Lamp, 24V, 0.073 Amp, 1.7 Watts
EYZP-504-2	Lamp, 120V, 0.025 Amp, 3.0 Watts
EYZP-504-3	Lamp, 48V, 0.053 Amp, 2.5 Watts
EYZP-721	Lamp Socket with Clip
EYZP-722-1	Lens, Red
EYZP-722-2	Lens, Green
EYZP-722-3	Lens, Amber
EYZP-722-4	Lens, Blue
EYZP-722-5	Lens, White
TOOL-13	Contact Burnishing Tool



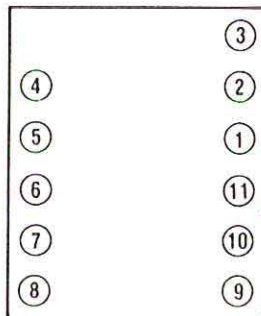
Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940



Part No.	Contacts	Coil	Std. Pkg. Qty.	Shp. Wt. Lbs. Per Pkg.	Use with Socket Part No.	Terminals	Std. Pkg. Qty.	Shp. Wt. Lbs. Per Pkg.
P-125-1-3	SPDT	24 Vac	5	1	P-100-4	11 Square	10	.5
P-125-2-3	SPDT	120 Vac	5	1	P-100-4			
P-126-4-3	SPDT	24 Vdc	5	1	P-100-4		10	.5
P-127-1-4	3PDT	24 Vac	5	1	P-100-4		10	.5
P-127-2-4	3PDT	120 Vac	5	1	P-100-4			
P-127-7-4	3PDT	208/240 Vac	5	1	P-100-4		10	.5
P-128-2-M	4PDT	120 Vac	1		P-110-8-M	14 Square	10	
P-186-8-2	DPDT (TDR) .3 sec. to 134 min.	24 Vac/Vdc 120 Vac	1	.5	P-100-2	11 Round	5	.5

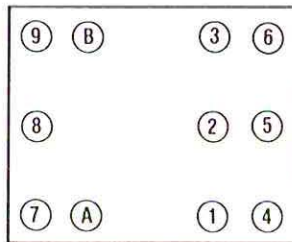
P-100's Sockets



P-100-2 Use with P-185 and P-186 Time Delay Relay
Requires P-603 2-7/8" Mounting Track

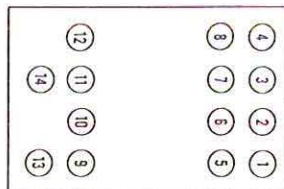
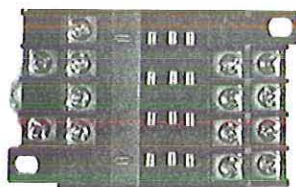


P-100-6 (5 pin)
P-100-3 (8 pin)
P-100-4 (11 pin)



Use with P-120's Control Relay
Requires P-605 3-3/8" Mounting Track

P-110-8-M Sockets (14 Pin)

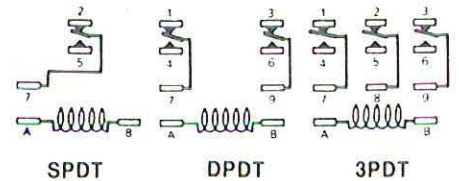


Use with P-128 Control Relay
Use P-610 Din Rail Mounting Track or base mount
without Din Rail

NOTE

Relay Sockets can be mounted directly without
Mounting Track if desired.

P-120's Enclosed Plug-in Relay



Contacts: 10 amps silver gold flash; 1/6 hp at 120 Vac,
1/3 hp at 240 Vac

Coils: 120 Vac or 24 Vac (SPDT and 3PDT), 24 Vdc
(DPDT) — VA rating 2.0

Connections: Square base plug-in mounting

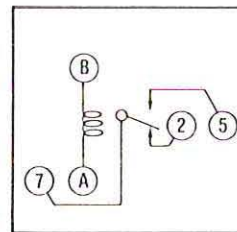
P-125 requires P-100-6 Socket

P-126 requires P-100-3 Socket

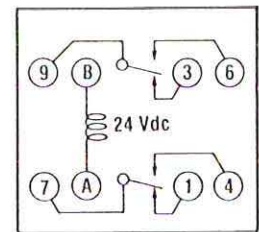
P-127 requires P-100-4 Socket

P-128 requires P-110-8 Socket

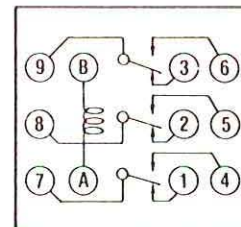
Installation Wiring Diagrams



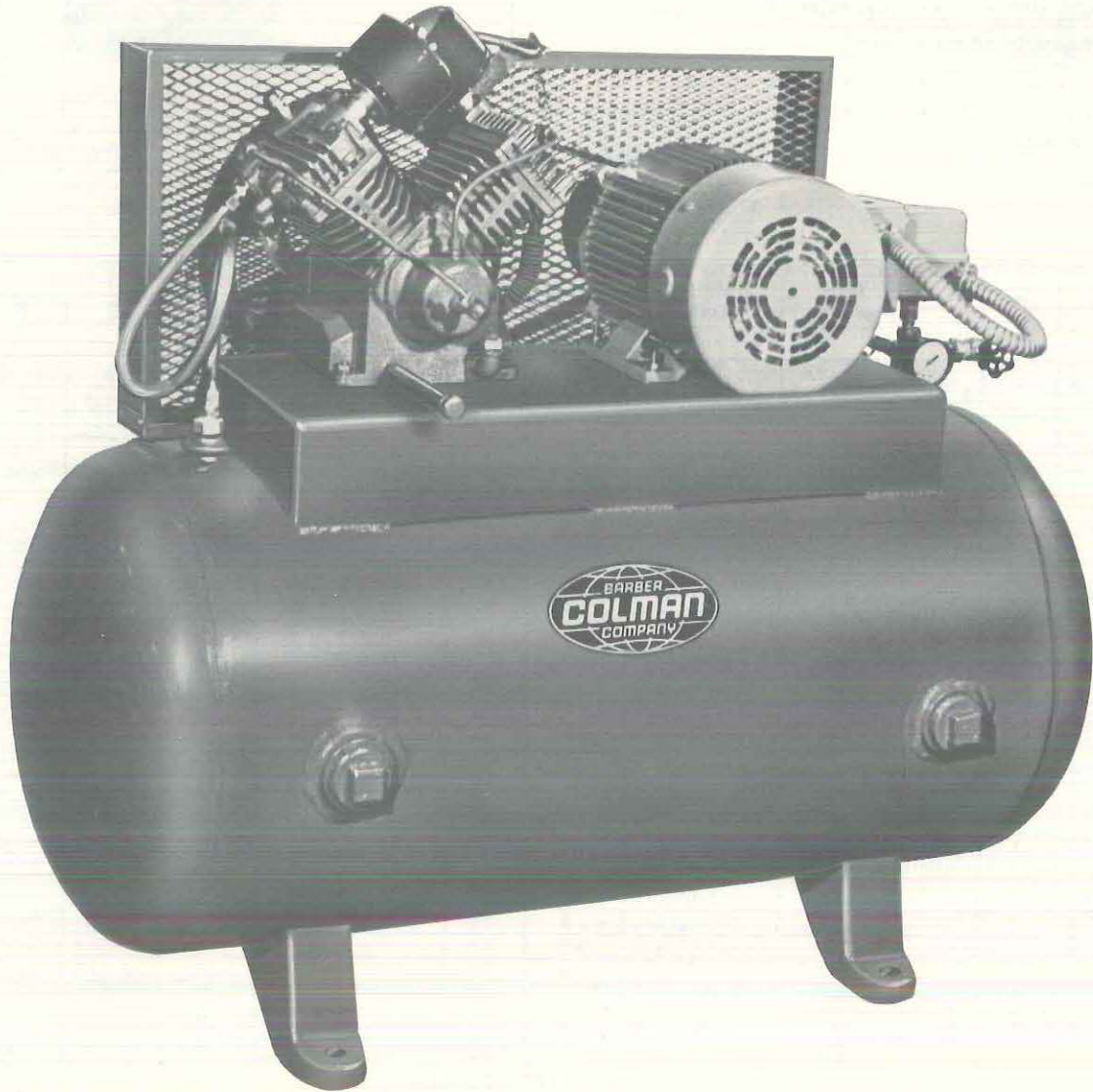
P-125 Relay
P-100-6 Socket



P-126 Relay
P-100-3 Socket



P-127 Relay
P-100-4 Socket

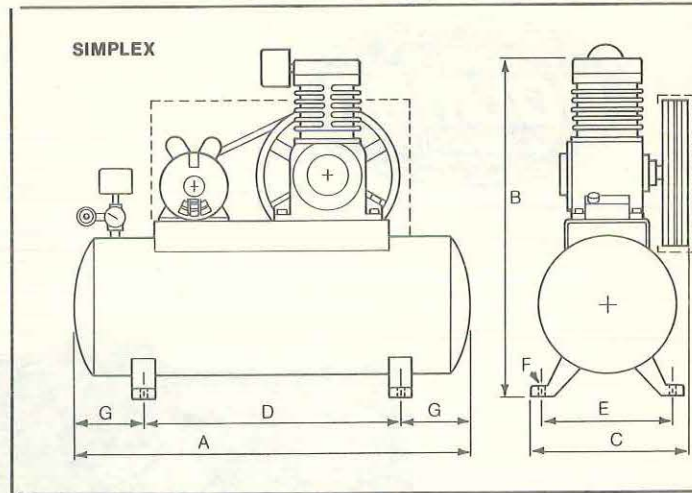


SUBMITTAL DATA
CLIMATE CONTROL AIR COMPRESSORS

SPECIFICATION FOR SINGLE STAGE CLIMATE CONTROL COMPRESSORS

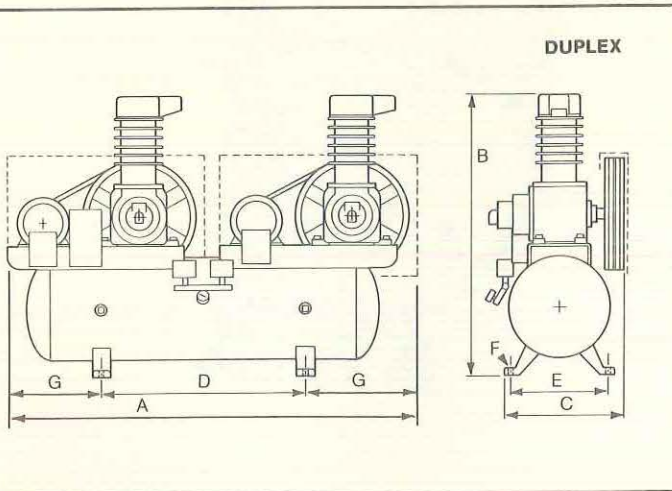
STANDARD EQUIPMENT

- Totally enclosed metal belt guard
- Cast iron compressor pump
- GE or equivalent motors
- Automatic overload protector standard on all single phase motors through 1 HP
- Magnetic starters standard on all 3 HP motors
- All electrical wiring enclosed in flexible metal cable
- Intake air filter — mufflers
- Pressure switch, gauge and check valve
- Safety valve, tank drain and outlet valve
- All tanks ASME



Model No.	HP	RPM	Tank Size (Gal.)	Motor Data	CFM @ 100 PSI	Dimensions (Inches)						
						A	B	C	D	E	F	G
SINGLE STAGE SIMPLEX												
K105-4-00-4	1/2	590	17	115-60-1	1.8	37	26	16	18	8	9/16	9-1/2
K105-5-00-4	1/2	590	30	115-60-1	1.8	38	34	19	22	13-3/4	9/16	8
K105-6-00-4	1/2	590	60	115-60-1	1.8	47	37	25	26	18-1/2	9/16	10-1/2
K106-4-00-4	1/2	590	17	208-60-3	1.8	37	26	16	18	8	9/16	9-1/2
K106-5-00-4	1/2	590	30	208-60-3	1.8	38	34	19	22	13-3/4	9/16	8
K106-6-00-4	1/2	590	60	208-60-3	1.8	47	37	25	26	18-1/2	9/16	10-1/2
K107-4-00-4	1/2	590	17	230/460-60-3	1.8	37	26	16	18	8	9/16	9-1/2
K107-5-00-4	1/2	590	30	230/460-60-3	1.8	38	34	19	22	13-3/4	9/16	8
K107-6-00-4	1/2	590	60	230/460-60-3	1.8	47	37	25	26	18-1/2	9/16	10-1/2
K108-4-00-4	3/4	400	17	115-60-1	2.7	37	26	16	18	8	9/16	9-1/2
K108-5-00-4	3/4	400	30	115-60-1	2.7	38	34	19	22	13-3/4	9/16	8
K108-6-00-4	3/4	400	60	115-60-1	2.7	47	37	25	26	18-1/2	9/16	10-1/2
K109-4-00-4	3/4	400	17	208-60-3	2.7	37	26	16	18	8	9/16	9-1/2
K109-5-00-4	3/4	400	30	208-60-3	2.7	38	34	19	22	13-3/4	9/16	8
K109-6-00-4	3/4	400	60	208-60-3	2.7	47	37	25	26	18-1/2	9/16	10-1/2
K110-4-00-4	3/4	400	17	230/460-60-3	2.7	37	26	16	18	8	9/16	9-1/2
K110-5-00-4	3/4	400	30	230/460-60-3	2.7	38	34	19	22	13-3/4	9/16	8
K110-6-00-4	3/4	400	60	230/460-60-3	2.7	47	37	25	26	18-1/2	9/16	10-1/2
K111-5-00-4	1	510	30	115-60-1	3.8	38	34	19	22	13-3/4	9/16	8
K111-6-00-4	1	510	60	115-60-1	3.8	47	37	25	26	18-1/2	9/16	10-1/2
K111-7-00-4	1	510	80	115-60-1	3.8	63	37	25	35	18-1/2	9/16	14
K112-5-00-4	1	510	30	208-60-3	3.8	38	34	34	22	13-3/4	9/16	8
K112-6-00-4	1	510	60	208-60-3	3.8	47	37	37	26	18-1/2	9/16	10-1/2
K112-7-00-4	1	510	80	208-60-3	3.8	63	37	37	35	18-1/2	9/16	14
K113-5-00-4	1	510	30	230/460-60-3	3.8	38	34	34	22	13-3/4	9/16	8
K113-6-00-4	1	510	60	230/460-60-3	3.8	47	37	37	26	18-1/2	9/16	10-1/2
K113-7-00-4	1	510	80	230/460-60-3	3.8	63	37	37	35	18-1/2	9/16	14
SINGLE STAGE DUPLEX												
K205-6-00-4	1/2	590	60	115-60-1	1.8	56	44	25	26	18-1/2	9/16	15
K206-6-00-4	1/2	590	60	208-60-3	1.8	56	44	25	26	18-1/2	9/16	15
K207-6-00-4	1/2	590	60	230/460-60-3	1.8	56	44	25	26	18-1/2	9/16	15
K208-6-00-4	3/4	400	60	115-60-1	2.7	56	44	25	26	18-1/2	9/16	15
K209-6-00-4	3/4	400	60	208-60-3	2.7	56	44	25	26	18-1/2	9/16	15
K210-6-00-4	3/4	400	60	230/460-60-3	2.7	56	44	25	26	18-1/2	9/16	15
K211-6-00-4	1	510	60	115-60-1	3.8	56	44	25	26	18-1/2	9/16	15
K211-7-00-4	1	510	80	115-60-1	3.8	68	44	25	35	18-1/2	9/16	16-1/2
K212-6-00-4	1	510	60	208-60-3	3.8	56	44	25	26	18-1/2	9/16	15
K212-7-00-4	1	510	80	208-60-3	3.8	68	44	25	35	18-1/2	9/16	16-1/2
K213-6-00-4	1	510	60	230/460-60-3	3.8	56	44	25	26	18-1/2	9/16	15
K213-7-00-4	1	510	80	230/460-60-3	3.8	68	44	25	35	18-1/2	9/16	16-1/2

SPECIFICATION FOR DUAL STAGE CLIMATE CONTROL COMPRESSORS

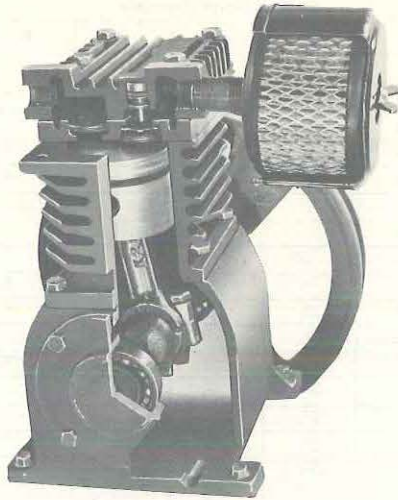


STANDARD EQUIPMENT

- Totally enclosed metal belt guard
- Cast iron compressor pump
- GE or equivalent motors
- Centrifugal loadless start
- Intake air filter — muffler
- Magnetic starter mounted and wired
- Multiple belt vee drive
- All air receivers ASME
- Intercooler and aftercooler
- Pressure switch, gauge, safety valve and check valve
- Tank drain and outlet valve
- All electrical wiring enclosed in flexible metal cable

Model No.	HP	RPM	Tank Size (Gal.)	Motor Data	CFM @ 100 PSI	Dimensions (Inches)						
						A	B	C	D	E	F	G
TWO STAGE SIMPLEX												
K114-6-00-4	1-1/2	520	60	208-60-3	7.1	47	39-1/2	25	26	18-1/2	9/16	10-1/2
K114-7-00-4	1-1/2	520	80	208-60-3	7.1	63	39-1/2	25	35	18-1/2	9/16	14
K115-6-00-4	1-1/2	520	60	230/460-60-3	7.1	47	39-1/2	25	26	18-1/2	9/16	10-1/2
K115-7-00-4	1-1/2	520	80	230/460-60-3	7.1	63	39-1/2	25	35	18-1/2	9/16	14
K116-6-00-4	2	570	60	208-60-3	7.6	47	39-1/2	25	26	18-1/2	9/16	10-1/2
K116-7-00-4	2	570	80	208-60-3	7.6	63	39-1/2	25	35	18-1/2	9/16	14
K117-6-00-4	2	570	60	230/460-60-3	7.6	47	39-1/2	25	26	18-1/2	9/16	10-1/2
K117-7-00-4	2	570	80	230/460-60-3	7.6	63	39-1/2	25	35	18-1/2	9/16	14
K118-7-00-4	3	490	80	208-60-3	11.1	63	42-3/4	25	35	18-1/2	9/16	14
K119-7-00-4	3	490	80	230/460-60-3	11.1	63	42-3/4	25	35	18-1/2	9/16	14
K122-6-00-4	5	560	60	208-60-3	17.5	47	47-1/2	25	26	18-1/2	9/16	10-1/2
K122-7-00-4	5	560	80	208-60-3	17.5	63	47-1/2	25	35	18-1/2	9/16	14
K122-8-00-4	5	560	120	208-60-3	17.5	69	47-1/2	25	42	21	9/16	13-1/2
K123-6-00-4	5	560	60	230/460-60-3	17.5	47	47-1/2	25	26	18-1/2	9/16	10-1/2
K123-7-00-4	5	560	80	230/460-60-3	17.5	63	47-1/2	25	35	18-1/2	9/16	14
K123-8-00-4	5	560	120	230/460-60-3	17.5	69	47-1/2	25	42	21	9/16	13-1/2
K126-7-00-4	7-1/2	618	80	208-60-3	29.9	63	45-1/2	25	35	18-1/2	9/16	14
K126-8-00-4	7-1/2	618	120	208-60-3	29.9	69	51-1/2	34	42	21	9/16	13-1/2
K127-7-00-4	7-1/2	618	80	230/460-60-3	29.9	63	45-1/2	25	35	18-1/2	9/16	14
K127-8-00-4	7-1/2	618	120	230/460-60-3	29.9	69	51-1/2	34	42	21	9/16	13-1/2
K130-7-00-4	10	710	80	208-60-3	35.4	63	45-1/2	25	35	18-1/2	9/16	14
K130-8-00-4	10	710	120	208-60-3	35.4	69	51-1/2	34	42	21	9/16	13-1/2
K131-7-00-4	10	710	80	230/460-60-3	35.4	63	45-1/2	25	35	18-1/2	9/16	14
K131-8-00-4	10	710	120	230/460-60-3	35.4	69	51-1/2	34	42	21	9/16	13-1/2
K134-8-00-4	15	525	120	208-60-3	57.6	69	65	34	42	21	9/16	13-1/2
K134-9-00-4	15	525	240	208-60-3	57.6	84	70	45	45	27	1	19-1/2
K135-8-00-4	15	525	120	230/460-60-3	57.6	69	65	34	42	21	9/16	13-1/2
K135-9-00-4	15	525	240	230/460-60-3	57.6	84	70	45	45	27	1	19-1/2
K138-8-00-4	20	672	120	208-60-3	73.8	69	65	34	42	21	9/16	13-1/2
K138-9-00-4	20	672	240	208-60-3	73.8	84	70	45	45	27	1	19-1/2
K139-8-00-4	20	672	120	230/460-60-3	73.8	69	65	34	42	21	9/16	13-1/2
K139-9-00-4	20	672	240	230/460-60-3	73.8	84	70	45	45	27	1	19-1/2
K142-8-00-4	25	778	120	208-60-3	83.0	69	65	34	42	21	9/16	13-1/2
K142-9-00-4	25	778	240	208-60-3	83.0	84	70	45	45	27	1	19-1/2
K143-8-00-4	25	778	120	230/460-60-3	83.0	69	65	34	42	21	9/16	13-1/2
K143-9-00-4	25	778	240	230/460-60-3	83.0	84	70	45	45	27	1	19-1/2

Model No.	HP	RPM	Tank Size (Gal.)	Motor Data	CFM @ 100 PSI	Dimensions (Inches)						
						A	B	C	D	E	F	G
TWO STAGE DUPLEX												
K214-6-00-4	1-1/2	520	60	208-60-3	7.1	56	44	25	26	18-1/2	9/16	15
K214-7-00-4	1-1/2	520	80	208-60-3	7.1	68	44	25	35	18-1/2	9/16	16-1/2
K215-6-00-4	1-1/2	520	60	230/460-60-3	7.1	56	44	25	26	18-1/2	9/16	15
K215-7-00-4	1-1/2	520	80	230/460-60-3	7.1	68	44	25	35	18-1/2	9/16	16-1/2
K216-6-00-4	2	570	60	208-60-3	7.6	56	44	25	26	18-1/2	9/16	15
K216-7-00-4	2	570	80	208-60-3	7.6	68	44	25	35	18-1/2	9/16	16-1/2
K217-6-00-4	2	570	60	230/460-60-3	7.6	56	44	25	26	18-1/2	9/16	15
K217-7-00-4	2	570	80	230/460-60-3	7.6	68	44	25	35	18-1/2	9/16	16-1/2
K218-6-00-4	3	490	60	208-60-3	11.1	76	48	25	26	18-1/2	9/16	25
K218-7-00-4	3	490	80	208-60-3	11.1	76	48	25	35	18-1/2	9/16	20-1/2
K219-6-00-4	3	490	60	230/460-60-3	11.1	76	48	25	26	18-1/2	9/16	25
K219-7-00-4	3	490	80	230/460-60-3	11.1	76	48	25	35	18-1/2	9/16	20-1/2
K222-6-00-4	5	560	60	208-60-3	17.5	76	51	25	26	18-1/2	9/16	25
K222-7-00-4	5	560	80	208-60-3	17.5	76	51	25	35	18-1/2	9/16	20-1/2
K222-8-00-4	5	560	120	208-60-3	17.5	80	58	34	42	21	9/16	19
K223-6-00-4	5	560	60	230/460-60-3	17.5	76	51	25	26	18-1/2	9/16	25
K223-7-00-4	5	560	80	230/460-60-3	17.5	76	51	25	35	18-1/2	9/16	20-1/2
K223-8-00-4	5	560	120	230/460-60-3	17.5	80	58	34	42	21	9/16	19
K226-7-00-4	7-1/2	618	80	208-60-3	29.9	80	53	25	35	18-1/2	9/16	22-1/2
K226-8-00-4	7-1/2	618	120	208-60-3	29.9	80	57	34	42	21	9/16	19
K227-7-00-4	7-1/2	618	80	230/460-60-3	29.9	80	53	25	35	18-1/2	9/16	22-1/2
K227-8-00-4	7-1/2	618	120	230/460-60-3	29.9	80	57	34	42	21	9/16	19
K230-7-00-4	10	710	80	208-60-3	35.4	80	53	25	35	18-1/2	9/16	22-1/2
K230-8-00-4	10	710	120	208-60-3	35.4	80	57	34	42	21	9/16	19
K231-7-00-4	10	710	80	230/460-60-3	35.4	80	53	25	35	18-1/2	9/16	22-1/2
K231-8-00-4	10	710	120	230/460-60-3	35.4	80	57	34	42	21	9/16	19
K234-8-00-4	15	525	120	208-60-3	57.6	112	68	34	42	21	9/16	35
K234-9-00-4	15	525	240	208-60-3	57.6	112	68	45	45	27	1	33-1/2
K235-8-00-4	15	525	120	230/460-60-3	57.6	112	68	34	42	21	9/16	35
K235-9-00-4	15	525	240	230/460-60-3	57.6	112	68	45	45	27	1	33-1/2
K238-8-00-4	20	672	120	208-60-3	73.8	112	68	34	42	21	9/16	35
K238-9-00-4	20	672	240	208-60-3	73.8	112	68	45	45	27	1	33-1/2
K239-8-00-4	20	672	120	230/460-60-3	73.8	112	68	34	42	21	9/16	35
K239-9-00-4	20	672	240	230/460-60-3	73.8	112	68	45	45	27	1	33-1/2
K242-8-00-4	25	778	120	208-60-3	83.0	112	68	34	42	21	9/16	35
K242-9-00-4	25	778	240	208-60-3	83.0	112	68	45	45	27	1	33-1/2
K243-8-00-4	25	778	120	230/460-60-3	83.0	112	68	34	42	21	9/16	35
K243-9-00-4	25	778	240	230/460-60-3	83.0	112	68	45	45	27	1	33-1/2



SINGLE STAGE

VALVE — Large area quick acting, hardened and ground swedish steel disc. Stainless steel spring. Cast iron seats for long life and accurate seating. No special tools required.

PISTON RINGS — Automotive type.

WRIST PIN — Hardened and ground.

PISTON — Precision machined alloy aluminum.

CONNECTING RODS — Alloy aluminum "H" section rods —extra large bearing surface.

CRANKCASE — Dust tight — enclosed.

MAIN BEARINGS — Oversize ground precision ball type —support both ends of crankshaft.

INTAKE UNLOADERS — Brass and stainless — built into head.

VALVE PLATE — One piece — complete exchange in minutes.

COMBINATION FILTER/MUFFLER — Highly efficient filtering of air plus noise reduction (F series — insert filter type).

COOLING FINS — Large area — on cast iron. Bored and honed cylinder.

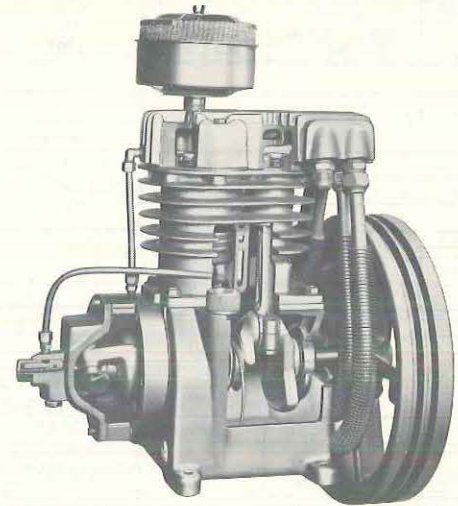
FLYWHEEL — Fan type.

CASTING — Close-grain cast iron.

LUBRICATION — Automatic splash type — trouble free and positive action.

HI LEVEL OIL FILL — Cannot be "over filled".

OIL DRAIN — Easily accessible.



TWO STAGE

CRANKSHAFT — Counter balanced, with super-finished bearing surfaces.

CENTRIFUGAL UNLOADER — An efficient, durable device for pressure relief to insure no-load starting.

OIL GAUGE & FILLER — Oil level is quickly checked. Larger oil fill opening is located for easy, quick compressor lubrication.

COMBINATION FILTER-SILENCER — Highly efficient filtering of air and noise reduction.

MULTIPLE VALVES — High efficiency, wafer-type valves (with minimum of parts) designed for long service life.

CYLINDERS — Deep, thin fins to dissipate heat, precision bored and finished to a micro-surface.

FLYWHEEL — Fan-bladed type, statically balanced.

IMPROVED INTERCOOLERS — Larger radiating fins. Pressure drop reduced by higher air flow capacity.

MAIN BEARINGS — Tapered roller or ball bearings. Crankshaft supported at both ends.

LUBRICATION SYSTEM — Positive controlled splash feed oiling to every wearing surface.

CRANKCASE — Totally enclosed.

IMPROVED HEAD DESIGN — Gives higher efficiency. Large direct air passages permit free flow of air, reducing pressure drop; greater cooling in valve areas.

CASTINGS — Close-grain iron.

PISTONS — Precision ground.

WRIST PIN BEARINGS — Roller type to withstand greater bearing load.

CLIMATE CONTROL CORPORATION

Barber-Colman Company
ENVIRONMENTAL SYSTEMS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940

HANKISON

SERIES 80

Refrigerated Compressed Air Dryers

STANDARD FEATURES FOR THESE DRYERS INCLUDE:

- Power On Light (green)—Indicates power to unit
- High Air Temperature Warning Light (red)—Gives indication of refrigeration system malfunction or overloading
- Hankison Designed & Manufactured Pilot Operated Automatic Condensate Drain Trap
- Facility for Wall Mounting Models 8010 thru 8035—Models 8010 & 8015 feature exclusive "one man" wall mounting bracket assembly
- Integral 3 Micron Particulate Afterfilter—Assures clean air downstream
- Provisions for Connection of Remote Alarm

Hankison Series 80 dryers are complete with: non-fouling, smooth surface, tube-in-tube heat exchangers; non-cycling, hermetically sealed refrigeration system; self-regulating hot gas by-pass valve to maintain constant dew point from no load to full load; mechanical condensate separator; integral 3 micron in-depth afterfilter; and pilot operated automatic condensate drain trap.

All units can handle additional capacity (scfm) when inlet air pressure is higher than 100 psig, inlet air temperature is lower than 100°F, ambient air or condenser cooling water temperature is lower than 100°F or if elevated dew points (up to 50°F) are suitable for the application.



Typical Series 80 Dryer* (Model 8010 shown with optional air by-pass valve)

*Model 8010 can be purchased as a package complete with Hankison Air By-Pass Valve (model 1701), Aerolescer[®] oil removal filter, pressure regulator and pressure gauges.

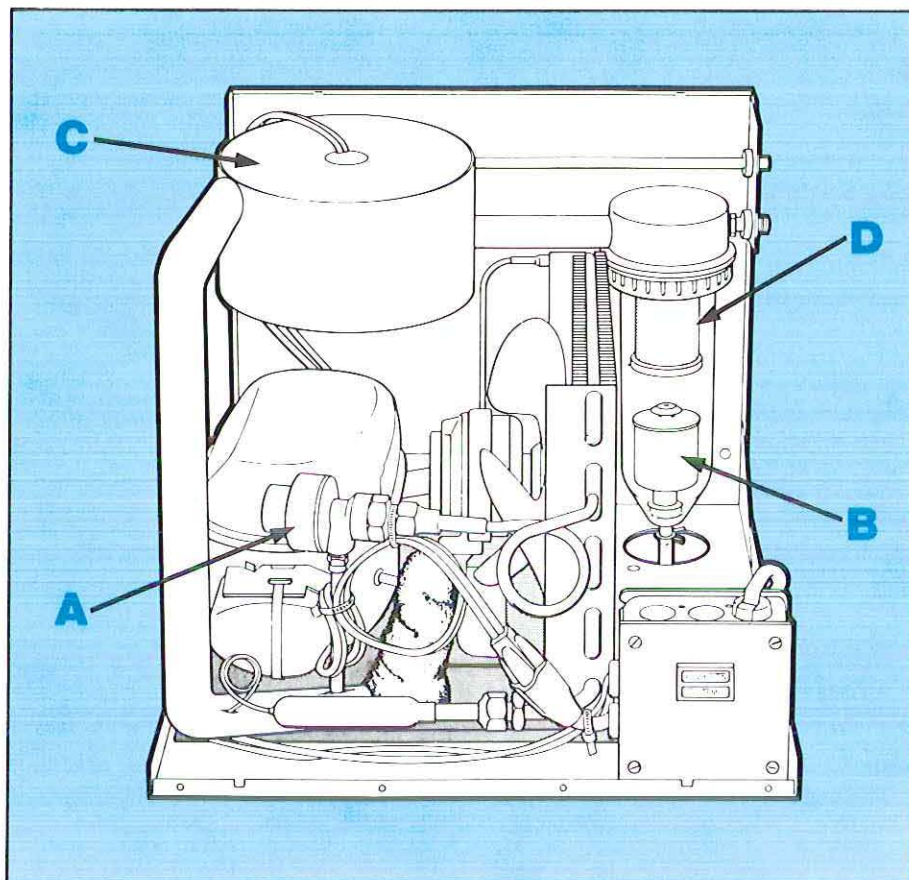
MODEL NO.	8010	8015	8025	8035	8045	8055	8070	80100	80125
OPERATING CONDITIONS									
Flow Capacity (scfm)* @ 35°F pressure dew point With air-cooled condensing unit (1)	10	15	25	35	45	55	70	100	125
With water-cooled condensing unit (2)	Not Available		Not Available		48	59	75	107	134
Flow Capacity (scfm)* @ 50°F pressure dew point With air-cooled condensing unit (3)	16	24	40	52	72	82	112	149	186
With water-cooled condensing unit (3)	Not Available		Not Available		77	88	120	159	199
Maximum Working Pressure (MWP)	150 psig (10 bar) Standard 175 psig (12 bar) Available 300 psig (21 bar) Available				175 psig (12 bar) Standard 300 psig (21 bar) Available				
ENGINEERING DATA									
Refrigeration Compressor Nominal Horsepower	1/6	1/5	1/3	1/3	1/2	1/2	3/4	3/4	3/4
kW @ 35°F Evaporator and 100°F Ambient (4)	.250	.415	.478	.478	.910	.910	1.260	1.260	1.260
Power Requirements (5)	115V, 1 phase, 60 Hz 230V, 1 phase, 60 Hz 240/220, 1 phase, 50 Hz				115V, 1 phase 60 Hz 230/208V, 1 phase, 60 Hz 240/220V, 1 phase, 50 Hz				
DIMENSIONS & WEIGHT									
Airline Connections - In (in)	3/8 OD tube	3/8 OD tube	5/8 OD tube	5/8 OD tube	1 1/8 OD tube	1 1/8 OD tube	1 1/8 OD tube	1 1/8 OD tube	1 1/2 NPTM
Airline Connections - Out (in)	3/8 OD tube	3/8 OD tube	1/2 NPTM	5/8 OD tube	1 NPTF	1 1/8 OD tube	1 NPTF	1 1/8 OD tube	1 1/2 NPTM
Height (in)	14	14	16	16	22 1/4	22 1/4	22 1/4	22 1/4	22 1/4
Width (in)	16 1/8	16 1/8	22 1/16	22 1/16	32 1/4	32 1/4	32 1/4	32 1/4	32 1/4
Depth (in)	15	15	16	16	19 1/2	19 1/2	19 1/2	19 1/2	19 1/2
Weight (lb)	57	65	97	100	181	201	203	223	230

*Convert scfm to Metric units as follows: 1 scfm = 1.735 m³/h.

- (1) Rated Flow Capacity—Conditions for rating dryers are in accordance with Compressed Air and Gas Institute (CAGI) Standard for Rating and Testing Compressed Air Dryers and National Fluid Power Association (NFPA) Recommended Standard NFPA/T3.27.2-1975. Conditions for rating above dryers are: 100 psig (6.9 bar) and 100°F (37.8°C) ambient air, and a maximum 5 psi (.35 bar) pressure drop. Actual dew point may vary from the stated nominal value depending on site conditions and operating parameters. All units can handle additional flow at higher inlet pressures, lower inlet air or ambient temperatures, or higher dew points.
- (2) Water-cooled condensers should be specified when dryer is to be installed in ambients above 110°F (43°C) or in extremely dirty environments where air-cooled condensers would be readily fouled. Water control valve is factory set for 90°F (32°C) maximum cooling water temperature.
- (3) Flow capacities at 50°F pressure dew point are established at 100 psig (6.9 bar) and 100°F (37.8°C) saturated inlet air, 100°F (37.8°C) ambient air for air-cooled models or 90°F (32°C) cooling water for water-cooled models. Pressure drop may exceed 5 psi.
- (4) Figures shown are condensing unit manufacturer's published ratings.
- (5) For other power requirements, contact factory.

HANKISON® Compressed Air Dryers are first for dependability because of the extra performance features built into them.

A dependable supply of clean, dry air is necessary to assure trouble-free operation of pneumatic equipment. Hankison dryers are designed to produce that dependable supply of clean, dry air. Installed on all of your jobs, they reduce maintenance while letting pneumatic components work more efficiently and last longer.



**A. DEPENDABLE—
Hot gas by-pass valve**

A hot gas by-pass valve maintains consistently low dew points over a wide range of compressed air flows and ambient conditions. By closely controlling compressed air temperatures in the dryer, you are assured of a reliable, consistent supply of dry air downstream.

**B. DEPENDABLE—
Snap-Trap® automatic
condensate drain**

Hankison's Snap-Trap drain mechanism features a patented design that includes magnetic action and pilot valve operation. The result—positive discharge of condensates, without air leakage between cycles. Reliability of the drain mechanism is further assured because the liquid to be drained has already been cleaned by the Centriflex separator/filter.

**C. DEPENDABLE—
Smooth surface heat
exchangers**



Hankison heat exchangers are made from non-fouling, self-cleaning, smooth surface copper tubes. This assures that the high heat transfer efficiency and low pressure drop built into your dryer are still there after years of service. And because heat transfer efficiency is maintained, so is your supply of dry air.

**D. DEPENDABLE—
Separator/Filter system**



Hankison's Centriflex® separator/filter provides positive protection for your pneumatic system.

In the first of two stages in the Centriflex, a cleanable, stainless steel separator core uses centrifugal force and impaction to remove bulk liquids.

In the second stage, a replaceable, in-depth filter sleeve removes 100% of all solids and liquids 3 microns and larger in size. The filter sleeve is composed of an in-depth medium that resists oil varnish clogging and collects large amounts of solid particles, allowing the sleeve to have a long service life.

But even better—this unique separator/filter combination maintains its high efficiency from no flow to full flow. There is no reduction in efficiency at less than rated flows, a common occurrence in purely centrifugal separators. Hankison's new separator/filter consistently removes 99% of all water droplets and 40% of all oil aerosols through a full range of flows, providing consistently dry, clean, trouble-free compressed air to downstream pneumatic components.

HANKISON CORPORATION, Canonsburg, Pa. 15317, Phone (412) 745-1555, Telex: 81-2452, Cable: HANKORP

PRICE AND ORDERING INFORMATION AVAILABLE FROM:



Printed in U.S.A.

HANKISON® AEROLESCER® Coalescing Type Oil Removal Filters

99.999+ % efficient in removing oil aerosols from compressed air lines.

Why remove oil?

Compressor oil downstream—it can contaminate the end product, decrease the efficiency of the production process by ruining paint jobs, gumming up air tools, motors, etc., or clog the tiny orifices in instruments or fluid logic components. Oil from a lubricated compressor is subjected to high temperatures during the compression cycle. This alters its characteristics so that it does not adequately lubricate downstream pneumatic components. It's best to take this oil out of the system and add the proper lubricant at the point of use.

Are special filters required to remove oil?

In a typical 90 psig air system 72% by weight of the oil aerosols present are less than 5 microns in size. 50% are below 1 micron in size. Droplets of this size blow right through a mechanical separator. Air line filters (particulate filters e.g. a 5 micron filter) can't trap the bulk of the aerosols either. To adequately remove oil, a special filter is required. The Hankison Aerolescer filter has been designed to remove oil by means of coalescence.

The result—an oil free compressed air system

The Hankison Aerolescer filter, when used within its rated design conditions, will eliminate the oil aerosols contained in a compressed air stream. Exhaustive tests verify a liquid oil removal efficiency of 99.999+%. In most instances, this means that the filtered air will contain less than .1 ppm of oil by weight. It assures virtually oil free air without the expense and maintenance headaches of non-lubricated compressors.

*U. S. Patent No. 3,802,160

**Excessive solid matter accumulation will limit life. Prefilters are available to prolong life. Request Bulletin 3100 covering HANKISON 3100 Series Air Line Filters.

Features:

- Unique continuously stabilized filter media plus outer foam sleeve ensure 99.999+ % efficiency for the life of the cartridge
- Removes: 100% of particles .025 micron and larger in size; some particles as small as .01 micron
- Cartridge replacement made easy by removable bowls or convenient bottom flange opening
- Rugged thru-bolt cartridge construction

The Patented* AEROLESCER Cartridge—designed for 99.999+ % efficiency and long life

Oil aerosols moving through the filtering media (B), a maze of submicronic glass fibers with specific densities and diameters, are concentrated and coalesced into large droplets. High efficiency is achieved by stabilizing the filtering media between a rigid perforated cylinder (C) and an inner foam sleeve (A), which compensates for fluctuating flow rate and aerosol concentration. This design assures uniform distribution of oil aerosols which prevents liquid pocketing, fiber clotting, and subsequent air channelling. The coalesced oil droplets are collected by the outer foam sleeve (D). Having an enormous non-absorbing surface area, this sleeve allows oil droplets to drain to the bottom of the sleeve and then drop to the bottom of the housing for removal from the air system. When removing oil the life of the cartridge is indefinite.** The cartridge continuously coalesces and separates oil aerosols from your system.

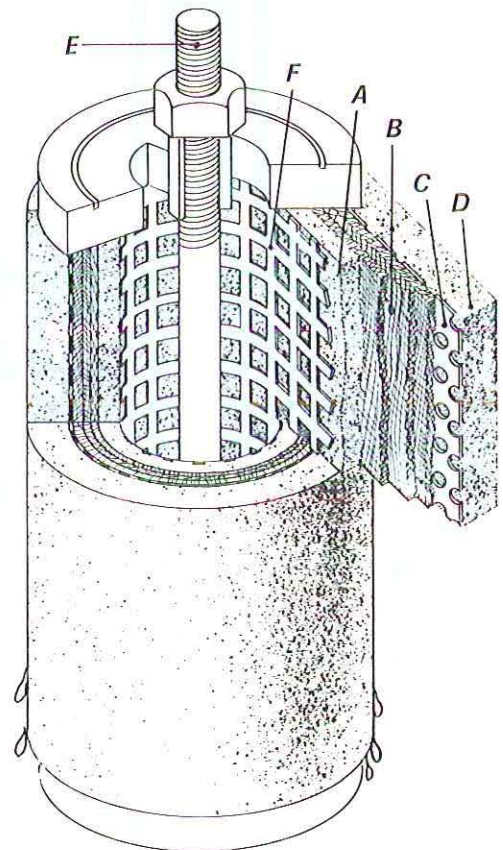
Thru bolt construction (E) assures structural strength and prevents liquid by-passing of the filter media. There is no reliance on adhesives to hold the unit together. An inside support (F) offers positive protection in case flow is accidentally reversed through the cartridge.

MODELS from
10 SCFM to 6000 SCFM



300 SCFM MODEL

900 SCFM MODEL



Maximum Flow (SCFM)* at Various Inlet Pressures

MODEL NUMBER	20 PSIG 1.4 BAR	30 PSIG 2.1 BAR	40 PSIG 2.8 BAR	60 PSIG 4.1 BAR	80 PSIG 5.5 BAR	100 PSIG 6.9 BAR	120 PSIG 8.3 BAR	150 PSIG 10.3 BAR	200 PSIG 13.8 BAR	250 PSIG 17.3 BAR	300 PSIG 20.7 BAR
1302	3.0	3.9	4.8	6.5	8.2	10.0	11.7	14.3	18.7	23.1	27.4
1303	6.0	7.8	9.6	13.0	16.4	20.0	23.4	28.6	37.4	46.2	54.9
1304	15.1	19.5	23.8	32.5	41.3	50.0	58.6	71.7	93.6	116	137
1305	30.0	39.0	48.0	65.1	82.0	100	117	143	187	231	274
1306	60.0	78.0	96.0	130	164	200	234	286	374	462	548
1307	90.7	117	143	195	248	300	352	431	562	693	823
1317	150	195	238	326	412	500	587	718	936	1154	1372
1308	190	246	300	412	520	632	740	906	1180	1460	1720
1309	285	369	450	618	780	948	1110	1359	1770	2190	2580
1310	380	492	600	824	1040	1264	1480	1812	2360	2920	3440
1311	475	615	750	1030	1300	1580	1850	2265	2950	3650	4300
1312	760	984	1200	1648	2080	2528	2960	3624	4720	5840	6880
1313	1045	1353	1650	2266	2860	3476	4070	4983	6490	8030	9460
1314	1330	1722	2100	2884	3640	4424	5180	6342	8260	10220	12040
1315	1805	2337	2850	3914	4940	6004	7030	8607	11210	13870	16340

*Convert scfm to metric units as follows: 1 scfm = 1.736 m³/h.

When ordering Aerolescer filters do not choose by pipe size. Make selection by flow rate and operating pressure only.

Pressure drop: Initial pressure drop (dry) is 1 psid (.07 bar) nominal. At rated flow conditions, when removing liquids, pressure drop will normally range from 3 psid (.21 bar) to 6 psid (.41 bar) depending on the quality of the influent air. Further pressure drop will occur only as the cartridge(s) become contaminated with solid particles.

Cartridge replacement: It is recommended that filter cartridge(s) be replaced for maximum filtration efficiency if pressure drop exceeds 10 psid (.7 bar).

Max. temp.: Temperatures in excess of 120°F (49°C) are not recommended since filtration efficiency may decrease and certain filter assembly material may be adversely affected. Polycarbonate bowls have a max. operating temperature of 120°F.

HANKISON® AEROLESCER® Filters

MODEL NUMBER	MANUAL DRAIN	AUTO DRAIN	NOMINAL AIR FLOW (SCFM) @ 100 PSIG	AIR INLET/OUTLET CONNECTION	HOUSING (BOWL/VESSEL) TYPE	WIDTH (INLET TO OUTLET) & HEIGHT (IN)	WT. (LB)	MAX. OPERATING PRESSURE (PSIG)		REPLACEMENT FILTER CARTRIDGE No.
								MANUAL DRAIN	AUTO DRAIN	
1302-1			10	3/8" NPTF	8 oz. polycarbonate (4)	3 1/4 x 6 1/4	1 1/8	150	—	0713-2
1302-2	1302-3		10	3/8" NPTF	16 oz. polycarbonate (4)	3 1/4 x 10 1/4	2 1/2	150	150	0713-2
1302-4	1302-5		10	3/8" NPTF	16 oz. metal	3 1/4 x 9 3/8	3 3/8	300	175	0713-2
1302-6			10	3/8" NPTF	8 oz. metal c/w sight glass	3 1/4 x 6 5/8	2 1/2	250	—	0713-2
1303-1	1303-2		20	1/2" NPTF	16 oz. polycarbonate (4)	3 1/4 x 10 1/4	2 1/2	150	150	0713-3
1303-3	1303-4		20	1/2" NPTF	16 oz. metal	3 1/4 x 9 3/8	3 3/8	300	175	0713-3
1304-1	1304-2		50	3/4" NPTF	32 oz. metal	4 1/16 x 11 1/2	5 5/8	300	175	0713-4
1305-1	1305-2		100	1" NPTF	100 oz. metal	4 1/16 x 22 5/8	13 1/4	300	175	0713-5
1306-1	1306-2		200	1 1/2" NPTF	205 oz. metal	5 1/4 x 30 1/4	21	300	175	0713-6
1307-1	1307-2		300	1 1/2" NPTF	381 oz. metal	5 1/4 x 36 1/4	29 1/4	300	175	0713-7
1317-1	(3)		500	2 1/2" coupling (1)	8" pressure vessel	22 1/2 x 37 1/16	211	200 (2)	(3)	0713-12-2
1308-11	(3)		600	3" coupling (1)	8" pressure vessel	22 1/2 x 42 3/4	225	200 (2)	(3)	0713-11-2
1309-5	(3)		900	3" flange	10" pressure vessel	16 5/8 x 44 3/16	321	200 (2)	(3)	0713-11-3
1310-3	(3)		1200	4" flange	12" pressure vessel	20 x 51 1/8	324	200 (2)	(3)	0713-11-4
1311-4	(3)		1500	4" flange	12" pressure vessel	20 x 51 1/8	329	200 (2)	(3)	0713-11-5
1312-3	(3)		2400	6" flange	16" pressure vessel	24 x 52 5/8	495	200 (2)	(3)	0713-11-8
1313-2	(3)		3300	6" flange	20" pressure vessel	28 x 59 1/8	620	200 (2)	(3)	0713-11-11
1314-2	(3)		4200	6" flange	20" pressure vessel	28 x 59 1/8	625	200 (2)	(3)	0713-11-14
1315-2	(3)		6000	8" flange	24" pressure vessel	33 x 63 7/16	1135	200 (2)	(3)	0713-11-19

(1) Flanges are available.

(2) Units with maximum operating pressures of 300 psig (21 bar) are available. 500 scfm (1317) and larger models are ASME Code Constructed and Stamped.

(3) Drain plugs are standard. For manual draining a valve is recommended. For automatic draining Hankison automatic drain traps are available. For models 1317 (500 scfm) through 1311 (1500 scfm) use a Snap Trap[®] or model 505 Trip-L-Trap[®]. For model 1312 (2400 scfm) use model 505 Trip-L-Trap. For models 1313 (3300 scfm) through 1315 (6000 scfm) use model 506 Trip-L-Trap.


(4) Polycarbonate bowls are furnished with bowl guards.

HANKISON CORPORATION, Canonsburg, Pa. 15317, Phone (412) 745-1555, Telex: 81-2452, Cable: HANKORP


PRICE AND ORDERING INFORMATION AVAILABLE FROM:



OPEN TYPE


	Volts 60 Hz	Cat. No.	Price
	24	47AB10AJ	
	120	47AB10AF	
	200	47AB10AD	
	240	47AB10AG	
	480	47AB10AH	
600	47AB10AE		

NEMA 1

	Volts 60 Hz	Cat. No.	Price
	24	47AB10BJ	
	120	47AB10BF	
	200	47AB10BD	
	240	47AB10BG	
	480	47AB10BH	
600	47AB10BE		

NEMA 1 outline dimensions, $6\frac{1}{32} \times 4\frac{1}{8} \times 3\frac{1}{8}$

NEMA 4

	Volts 60 Hz	Cat. No.	Price
	24	47AB10EJ	
	120	47AB10EF	
	200	47AB10ED	
	240	47AB10EG	
	480	47AB10EH	
600	47AB10EE		

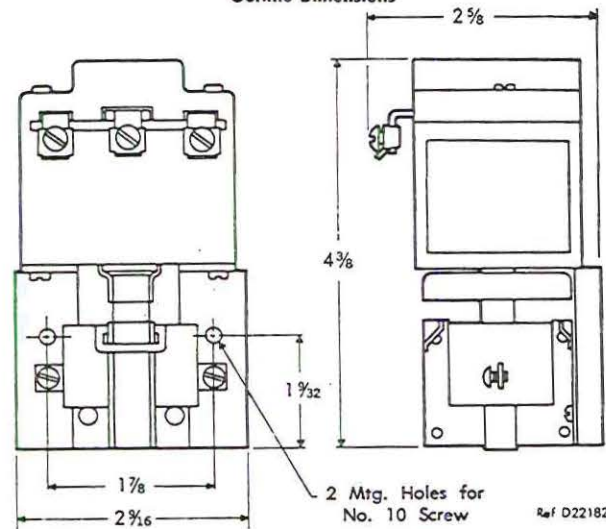
NEMA 4 outline dimensions, $9\frac{1}{2} \times 7\frac{1}{2} \times 3\frac{7}{8}$

RATINGS

AC Volts	Make	Break	Continuous
0-120	60 amps	6 amps	10 amps
120-600	7200 VA	720 VA	

OPEN TYPE

Outline Dimensions



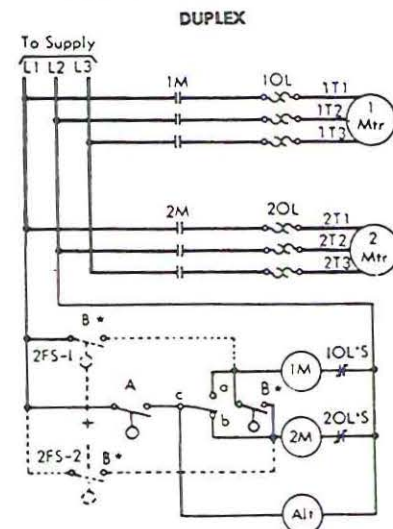
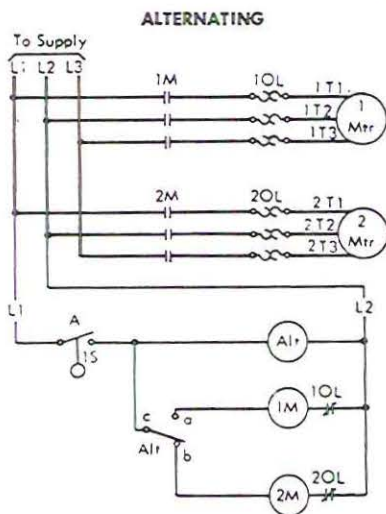
Shipping Weight: 1 1/4 lbs.

This compact alternator of industrial relay quality is designed specifically for pump and compressor applications. It is easily installed and wired in control panels, pump panels or as an enclosed unit for surface mounting to be used with standard enclosed starters.

The alternator has single pole double throw heavy duty silver cadmium oxide contacts enclosed in a transparent dust cover. The snap action contacts transfer when the coil is de-energized.

The alternator is wired in the circuit to operate the other motor the next time the operation is started. Usually the circuit is designed for the idle motor to cut in if the running motor does not have the capacity to handle the load.

TYPICAL ALTERNATING CONTROL CIRCUITS



* For added safety, replace the single pole float switch with a 2-pole auxiliary (B) float switch. (See dotted wiring.)



K-331 Automatic Drain Trap

GENERAL

When condensate level rises, float lifts, allowing air under pressure to flow through the hollow stem into the Auto-Drain where a diaphragm distends with increasing pressure and opens a large scavenger-action dumping valve. Float drops and the control unit waits for the next accumulation.

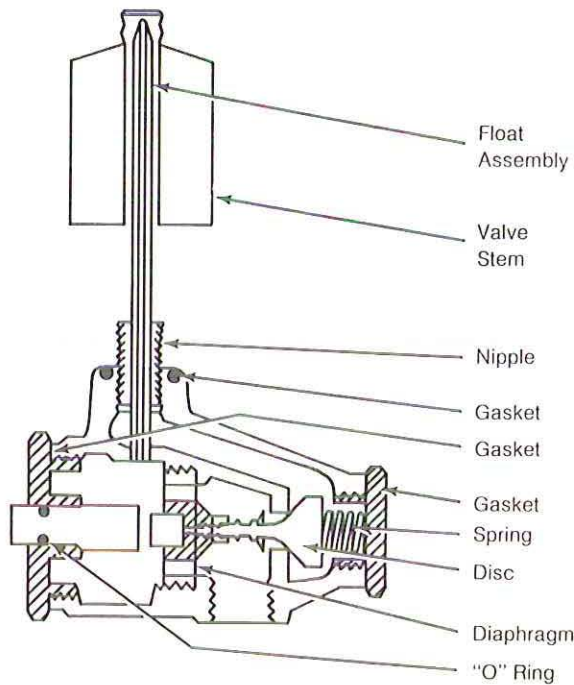


Figure 1.

FEATURES

- Indestructible cellular float
- Foolproof pilot principle
- No linkage to corrode or plug
- Extra large dumping valve
- Automatic for draining drain trap and expelling:
 - Condensed moisture
 - Emulsified oil
 - Viscous condensate



Figure 2.

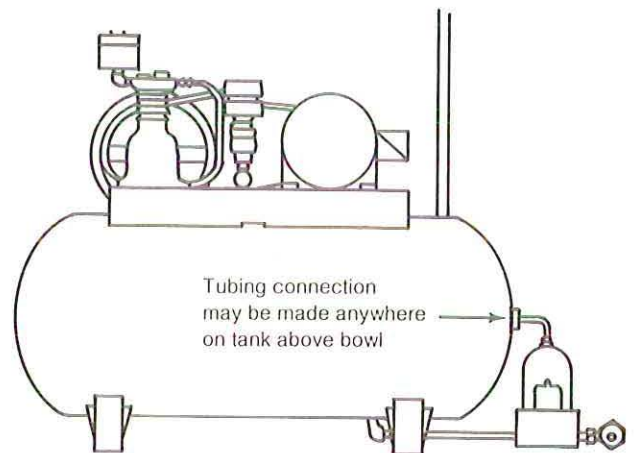


Figure 3.

K-332 PRV Station

GENERAL

Cartridge-style filter element removes dirt to one-micron size plus oil vapor and moisture.

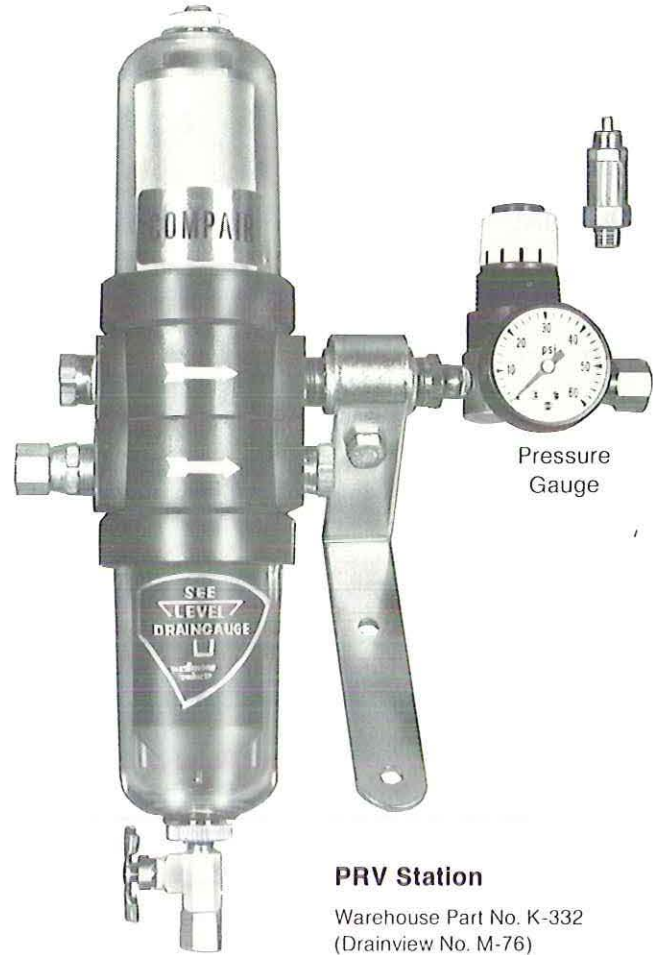
Replace element without need for tools when white cellulose surface darkens.

Features

- Coalescent type oil removal filter
- Automatic drain trap
- Pressure regulator
- Safety relief

Assembly includes wall mounting bracket, spare filter cartridge and 3/8" copper tube fittings.

This complete PRV combination is designed for air flow rates and pressure regulation up to 8 SCFM and 30 psi. The pressure relief valve is adjustable up to 35 psi.



PRV Station

Warehouse Part No. K-332
(Drainview No. M-76)

Figure 4.

K-333 Final Filter

Disposable final filter removes oil aerosols, smoke, condensed moisture and solid particles.

Maximum operating pressure 150 PSI

30 CFM at 100 PSI

40 sq. inches of filtering material

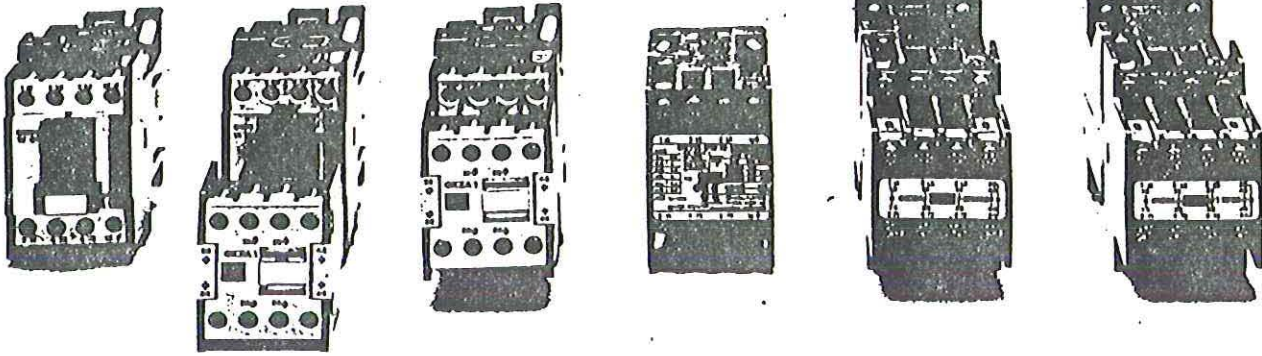
1/4" NPT connections



Figure 5.


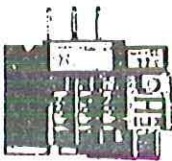

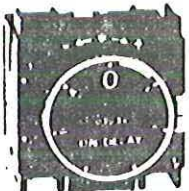

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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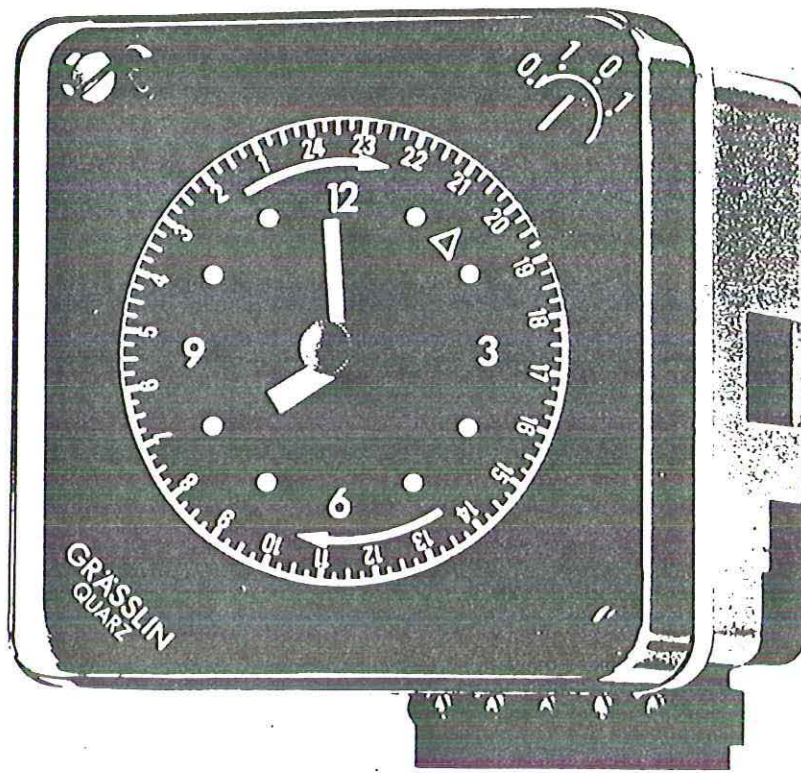
84-1418 MO

Selection table

Size		OK 00	OK 0	OK 01	OKYM 0	OKYM 01	OKYM 1
Rated operational voltage	V	660	660	660	660	660	660
Insulation class	IEC-158 V	750	750	750	750	750	750
	VDE 0660 V	1000	1000	1000	1000	1000	1000
Rated thermal current	A	25	25	25	25	32	32
Rated operational current (380V, AC3) I _e max	A	9	12	16	16	20	24
Rated motor output for AC 3 duty (50...60 Hz) I _{make} = 6 x I _e I _{Break} = I _e	220 V	2.2	4	4.5	4	5.5	7.5
	380 V	4	5.5	7.5	5.5	7.5	11
	415 V	4.5	6	8	6	10	11
	440 V kW	4.8	6.3	8.5	6.3	10	11
	500 V	5.5	7.5	10	7.5	10	11
	660 V	5.5	7.5	7.5	7.5	7.5	15
1000 V							
Electrical life of main contacts	Million oper.	1.0	1.0	1.0	1.5	1.5	1.0
Type	aux. contacts	OK 00 W 10	OK 0 W 10	OK 01 W 10	OKYM 0 W 10	OKYM 01 W 10	OKYM 1 W 10
	1 No - 0 Nc	OK 00 W 01	OK 0 W 01	OK 01 W 01	OKYM 0 W 01	OKYM 01 W 01	OKYM 1 W 01
	0 No - 1 Nc				OKYM 0 W 11		
	1 No - 1 Nc						
	2 No - 2 Nc				OKYM 0 W 32	OKYM 01 W 32	OKYM 1 W 32
	3 No - 2 Nc						
Thermal overload relays		 PATAM 1 D__ B 0.12 to 25 Amps <small>84-1400 MO</small>		 PATAM 1 D__ 0.12 to 25 Amps <small>82-1184 MO</small>			
Mechanical interlock attachments		OKZM 1			OKYZX 45		
Auxiliary contact block		 <small>84-1420 MO</small>		Convertible OKZA 1 2 No - 2 Nc ¹⁾ 1 No - 3 Nc 3 No - 1 Nc	Include to the basic contactor		
Timers and mechanical latch for OK-contactors		Timer  <small>84-1421 MO</small>		On-Energization OKZT 1-3 0.1-3 sec. OKZT 1-30 0.1-30 sec. OKZT 1-180 10-180 sec. De-Energization OKZT 2-3 0.1-3 sec. OKZT 2-30 0.1-30 sec. OKZT 2-180 10-180 sec.	 <small>84-1419 MO</small> Latch OKZL 1 coil voltages 24...660V		

P-310-1-S

Time Switches by Grasslin

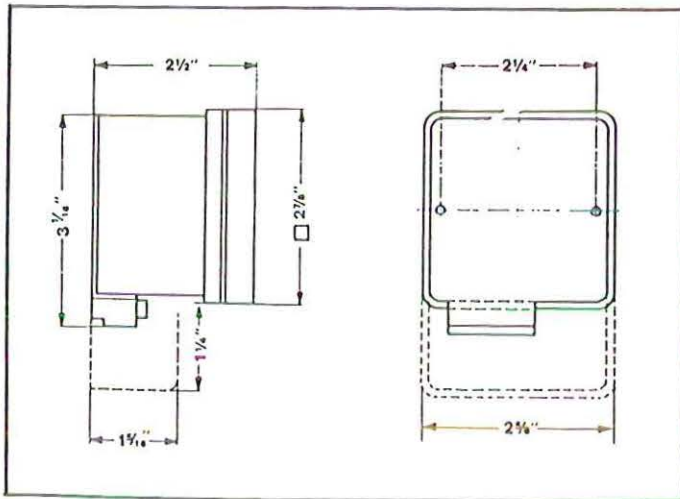


ENERGY CONTROL WITH SWITCHING ACCURACY

- Compact size
- Genuine clock face
- Daily or weekly program
- Running reserve option
- High rated gold-plated silver contacts
- Modern dustproof design
- Manual override with Indicator
- Easy programming

Technical Data	Synchronous Model	Quartz Stabilized Model
<ul style="list-style-type: none"> ● Clock Drive 24V, 120V or 240V 60Hz ● Switching Contacts, SPDT, 10Amp, 250V ● Switching Time <ul style="list-style-type: none"> Weekly Program, 1 Hour Intervals, 3 Hour min. Daily Program, 15 Minute Intervals, 30 Minute min. ● Running Reserve ● Synchronous Motor Power Consumption ● Quartz Stabilized Stepping Motor Power Consumption ● Ambient Temperature Range ● Surface or Flush Mount with Plug-in Base ● CSA approval 	<p style="text-align: center;">Yes</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">Optional - 12 Hrs.</p> <p style="text-align: center;">2 Watts</p> <p style="text-align: center;">---</p> <p style="text-align: center;">-4° to 130° F</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">yes</p>	<p style="text-align: center;">Yes</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">12 Hrs.</p> <p style="text-align: center;">---</p> <p style="text-align: center;">5.5 Watts</p> <p style="text-align: center;">-4° to 122° F</p> <p style="text-align: center;">Yes</p> <p style="text-align: center;">yes</p>

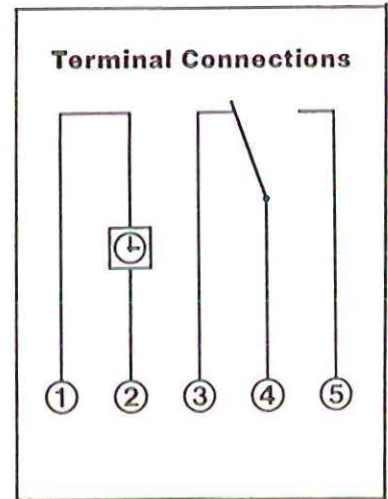
Application: Time based on/off control for HVAC, lighting, security and industrial processes. Snap-on bases for printed circuit board soldering are available.



Legend for ordering MIL 2008

- ✓ SF = Synchronous
- ✓ QF = Quartz
- ✓ R = Reserve
- ✓ W = Weekly Program
- ✓ T = Daily Program
- ✓ u = SPDT Switch (standard)
- ✓ E = Flush Mount Bracket

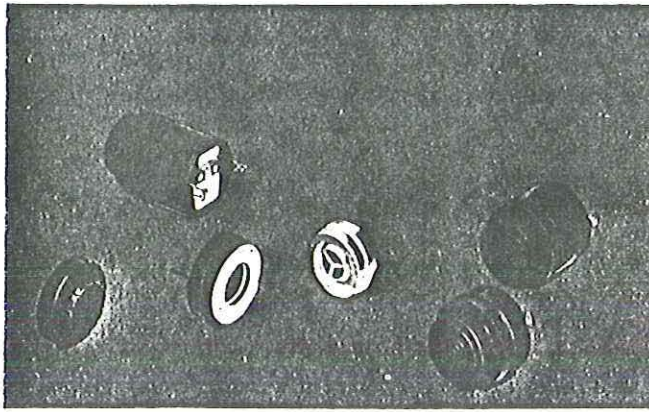
e.g.
MIL 2008 QFRWu - 120 Volts
Quartz stabilized weekly time switch
with reserve, SPDT switch.
Note: Specify voltage



Distributed by:

GRASSLIN CONTROLS CORPORATION
45 Spear Road, Ramsey, NJ 07446
Tel: 201-825-9696

SWITCH OVER TO GRASSLIN!



Mallory Sonalert® signals produce an audible tone by electronic means when voltage is applied. Voltages from 1V to 250V may be used depending upon the model.

Electrical power is converted to sound by means of a piezoelectric transducer operating substantially at resonance in a solid state oscillator resulting in efficient power conversion.

Sonalert signals may be powered by many electrical sources ranging from single cell batteries to industrial power lines. Little electrical power is required making them ideally suitable for portable battery operated equipment. This low power feature allows the Sonalert signal to be turned on or off with a low power transistor, SCR, or integrated circuit. Completely solid state with no moving parts, no arcing, and no mechanical wear, the Mallory Sonalert signals should give you many years of trouble-free service.

Audio and electrical specifications

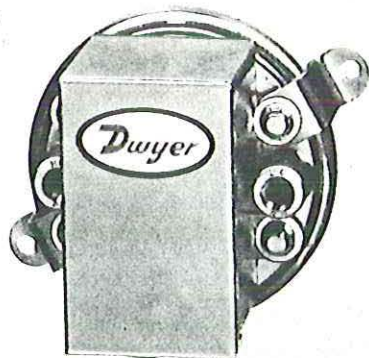
Continuous Tones					Minimum Sound Pressure dB (A) at Two Feet		Operating Voltage *AC/DC Non-polar All Others DC Only		Typical Operating Current MA	
Part and Model Number	Loudness Category	Mounting Method	Case Style	Frequency ±500Hz	Minimum Sound Pressure		Operating Voltage		Typical Operating Current	
					At Min. V	At Max. V	Min.	Max.	At Min. V	At Max. V
SC110N	LOUD	PANEL	D	2900	80	95	*30	120	8	28
SC616N	LOUD	PANEL	C	2900	80	95	6	16	4	16
SC616NL	LOUD	PANEL	C-3	2900	80	95	6	16	4	16
SC628AN	LOUD	PANEL	D	2900	80	95	*6	28	8	28
SC648AN	LOUD	PANEL	D	2900	80	95	*10	48	8	28
SBM2	MEDIUM	PRINTED BOARD	F	2900	55	68	1	5	2	12
SBM428	MEDIUM	PRINTED BOARD	F	2900	64	78	4	28	2	14
SNP2	MEDIUM	SNAP IN PANEL	B	2900	55	68	1	5	2	12
SNP428	MEDIUM	SNAP IN PANEL	B	2900	64	78	4	28	2	14
SC110V	MEDIUM	PANEL	D	2900	68	80	*30	120	4	16
SC110D	MEDIUM	PANEL	D	1900	60	75	*30	120	4	16
SC110H	MEDIUM	PANEL	D	4500	68	80	*30	120	4	16
SC250	MEDIUM	PANEL	D	2900	68	80	*60	250	4	16
SC250D	MEDIUM	PANEL	D	1900	60	75	*60	250	4	16
SC250H	MEDIUM	PANEL	D	4500	68	80	*60	250	4	16
SC628	MEDIUM	PANEL	C	2900	64	80	4	28	3	14
SC628A	MEDIUM	PANEL	D	2900	68	80	*6	28	4	16
SC628AD	MEDIUM	PANEL	D	1900	60	75	*6	28	4	16
SC628AH	MEDIUM	PANEL	D	4500	68	80	*6	28	4	16
SC628D	MEDIUM	PANEL	C	1900	60	75	6	28	3	14
SC628H	MEDIUM	PANEL	C	4500	68	80	6	28	3	14
SC628L	MEDIUM	PANEL	C-3	2900	68	80	6	28	3	14
SC648	MEDIUM	PANEL	C	2900	68	80	10	48	3	14
SC648A	MEDIUM	PANEL	D	2900	68	80	*10	48	4	16
SC648AD	MEDIUM	PANEL	D	1900	60	75	*10	48	4	16
SC648AH	MEDIUM	PANEL	D	4500	68	80	*10	48	4	16
SC648D	MEDIUM	PANEL	C	1900	60	75	10	48	3	14
SC648H	MEDIUM	PANEL	C	4500	68	80	10	48	3	14
SC1.5	SOFT	PRINTED BOARD	A	3500	60 @ 1.5 V		1	4	4 @ 1.5 V	
SC6	SOFT	PRINTED BOARD	A	3500	70 @ 6 V		4	8	12 @ 6 V	
SC12	SOFT	PRINTED BOARD	A	3500	70 @ 12 V		8	15	14 @ 12 V	
SC18	SOFT	PRINTED BOARD	A	3500	70 @ 18 V		14	22	16 @ 18 V	
SC24	SOFT	PRINTED BOARD	A	3500	70 @ 24 V		20	30	16 @ 24 V	
SNP428F	SOFT	SNAP IN PANEL	B	2900	55	70	4	28	0.5	3
SC110E	SOFT	PANEL	D	1900	55	65	*30	120	3	14
SC110F	SOFT	PANEL	D	2900	55	70	*30	120	1	4
SC250E	SOFT	PANEL	D	1900	55	65	*60	250	3	14
SC250F	SOFT	PANEL	D	2900	55	70	*60	250	1	4
SC628AE	SOFT	PANEL	D	1900	55	65	*6	28	3	14
SC628AF	SOFT	PANEL	D	2900	55	70	*6	28	1	4
SC628E	SOFT	PANEL	C	1900	55	68	6	28	3	8
SC628F	SOFT	PANEL	C	2900	55	70	6	28	0.5	3



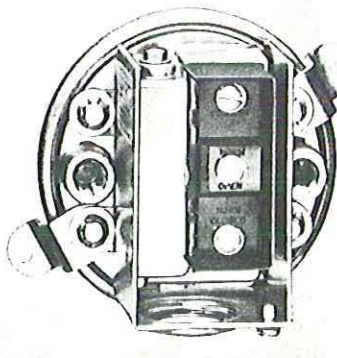
SERIES
1900*

Compact Low Differential Pressure Switches

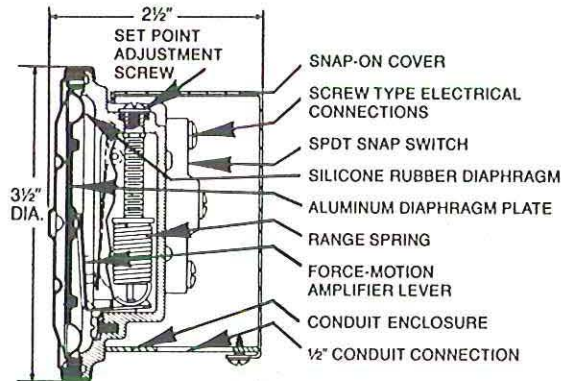
Our smallest, lowest cost precision switches. Six standard ranges – Set points from 0.07" to 20" W.C. Repetitive accuracy within 3%, U.L. and C.S.A. listed, F.M. approved.



Series 1910 pressure switch. All pressure and electrical connections and set point adjustments are on one side for easy installation.



Series 1910 switch with conduit enclosure off. Shows electric switch and set point adjustment screw.



The Dwyer-engineered force-motion amplifier increases the leverage of diaphragm movement and results in a switch with excellent sensitivity and repeatability.

Our most popular series combines advanced design and precision construction to make these switches capable of performing many of the tasks of larger, costlier units. Designed for air conditioning service, they also serve many fluidics, refrigeration, oven and dryer applications. For use with air and non-combustible gases. Series 1900 switches are available with set points of 0.07 to 20 inches water column. Set point adjustment can be made easily – before or after installation. Range screw is inside conduit enclosure to help prevent tampering. For easy mounting and access, pressure and electrical connections and set point adjustment are located on one side. This permits installation in corners or spaces too small for other switches.

SPECIAL MODELS AND ACCESSORIES

(See also OEM models on page 2).

MODEL 1900-5-MR DUCT PRESSURE KIT

Includes special 1.4-5.5" w.c. range 1900 pressure switch with manual reset snap switch. Prevents duct blowout by shutting down blower when excess pressure occurs. Won't allow start-up again until condition is corrected and switch is manually reset. Includes switch, duct pressure sensor, tubing and tubing adapters.

P/N A-329 ALUMINUM STREET ELL

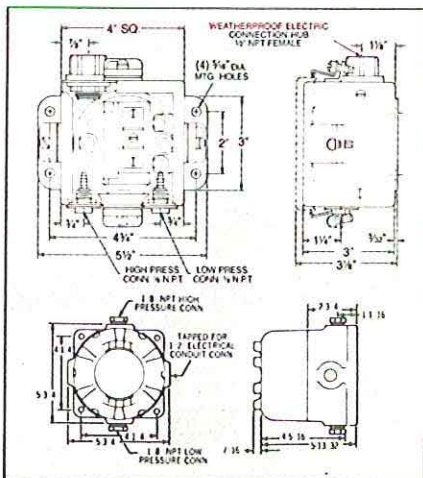
Special close coupled street ell simplifies applications requiring right angle pressure connections. Two required for differential pressures.

Weatherproof Enclosure:

16 ga. steel enclosure for unusually wet or oily conditions. Withstands 200 hour salt spray test. Gasketed cover. Weight 5 lbs. Switch must be installed at factory. Specify "WP" in addition to switch catalog number.

Explosion-Proof Housing:

Cast iron base and aluminum dome cover. Approximate weight 7 lbs. Specify "EXPL" in addition to switch catalog number.



PHYSICAL DATA

Temperature limits: -30°F for dry air or gas to 180°F.

Maximum surge pressure: 10 psig.

Rated pressure: 45" H₂O.

Pressure connections: 1/8" NPT.

Electrical rating: 15 amps, 120-480 volts, 60 Hz. A.C. Resistive 1/8 H.P. @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C. Derate to 10 amps for operation above 130°F or at high cycle rates.

Wiring connections: 3 screw type,

common, normally open and normally closed.

Set point adjustment: Screw type inside conduit enclosure.

Housing: Zinc die casting and steel stamping. Zinc plated for 200 hour salt spray resistance.

Diaphragm: Molded Silicone rubber. Aluminum diaphragm plate.

Calibration spring: Stainless steel.

Weight: 1 lb.

Installation: Diaphragm vertical.

CAUTION: FOR USE ONLY WITH AIR OR COMPATIBLE GASES.

MODEL 1910 SWITCHES: OPERATING RANGES AND DEAD BANDS.

To order specify Model Number	Operating Range Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1910-00	0.07 to 0.15	.04	.05
1910-0	0.15 to 0.5	0.10	0.15
1910-1	0.4 to 1.6	0.15	0.20
1910-5	1.4 to 5.5	0.3	0.4
✓ 1910-10	3.0 to 11.0	0.4	0.5
1910-20	4.0 to 20.0	0.4	0.6

Suggested Specification

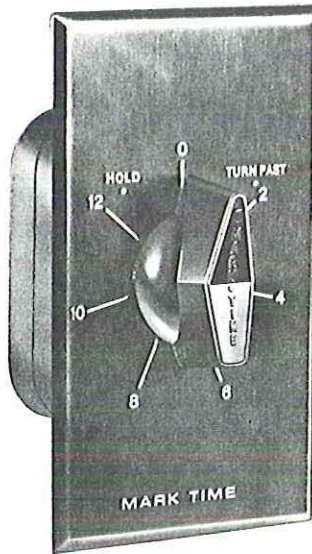
Differential pressure switches shall be diaphragm operated with 3 1/2" diaphragm to actuate a single pole double throw snap switch. Motion of the diaphragm shall be restrained by a calibrated spring that can be adjusted to set the exact pressure differential at which the electrical switch will be actuated. Motion of the diaphragm shall be transmitted to the switch button by means of a direct mechanical linkage. Switches shall be Dwyer Instruments, Inc. Catalog No. 1910-_____ for the required operating ranges.

*Patent No. 3,566,060



MARK-TIME

A COMPLETE LINE OF PORTABLE AND BUILT-IN TIME SWITCHES AND BELL TIMERS FOR HOME, INDUSTRY, AND OEM'S.



90000 series

HOLD FEATURE: Holds current "ON" without operation of timing mechanism; timing begins when knob is turned to a time period.

"OFF" type switch breaks circuit at end of time period.

"ON" type switch also available.

WALL BOX TIME SWITCH

The popular Mark-Time 90000 series automatically turns "OFF" ventilating fans, heaters, heat lamps, lights, and can operate as a thermostat by-pass. Saves ENERGY, MONEY, and wear and tear of equipment. Adds convenience to installations in hotels, motels, hospitals, schools, offices, churches, industrial plants, and homes.

As easy to install as a toggle switch. Individually packed with wood grain finish metal calibrated switch plate, knob, and mounting hardware. Attractive brushed aluminum gang plates are available to accommodate either a toggle switch, duplex outlet, or three despards.

Rated 20 amps, 125V.A.C., 1 h.p.; 10 amps, 250V.A.C., 1 h.p.; 10 amps, 277V.A.C., 7 amps, 125V.A.C. tungsten rating. SPST, UL & CSA listed.

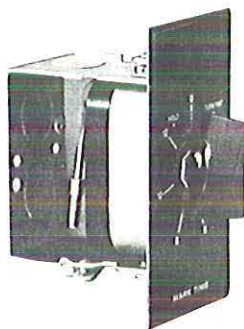
OFF TYPE WITHOUT HOLD		OFF TYPE WITH HOLD	
Cat. No.	Time Cycle	Cat. No.	Time Cycle
90004	0 - 5 min.	90021	0 - 3 min.
90005	0 - 15 min.	90030	0 - 5 min.
90006	0 - 30 min.	90032	0 - 30 min.
90008	0 - 60 min.	90024	0 - 60 min.
90007	0 - 6 hrs.	90017	0 - 6 hrs.
90001	0 - 12 hrs.	90015	0 - 12 hrs.

PNEUMATIC TIME SWITCH

These time switches have been engineered for use in lieu of electrical wiring to operate PE switches, pneumatic relays, and air switching valves for actuator functions, such as in heating, cooling, and ventilating equipment in hotels, motels, schools, hospitals, industrial plants, and office buildings.

Standard Catalog Numbers For Pneumatic Switches

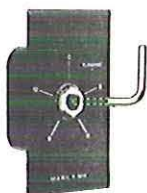
Cat. No.	Timing	Hold Feature	Valve Normal Position at Time "0"
90909	1 hr.	Without	Closed
90907	3 hr.	Without	Closed
90906	6 hr.	Without	Closed
90905	3 hr.	Without	Open
90903	12 hr.	With	Open
90901	12 hr.	Without	Open
90908	12 hr.	Without	Closed



90900 series

KEY OPERATED WALL BOX TIME SWITCH

The key operation feature is available on our 90000 series listed above at a slightly higher cost. A removable key is used to wind and set the timer. Key operated switches are frequently used in schools, banks, and other locations where unauthorized people should not operate the time switch.



90800 series

TABLE 1. Select Valve Body including P Code (Valve Size, Cv Rating, Port Code) or select **Valve Assembly** with correct Input Signal (see Table 2 also) less Actuator Code (XXX) including the **P Code** (Size, Cv Rating, Port Code). (See Pages V59-63 for Valve Sizing).

Size		APPLICATION			
		Chilled or Hot Water 281°F Max. 35 psig Steam		Hot Water 300°F Max. 100 psig Steam	Hot Water 366°F Max. 150 psig Steam
		Screw	Flange	Screw	
Normally Open Valves		1/2"–2"	2-1/2"–6"	1/2"–2"	1/2"–2"
Valve Body		VB-9213-0-4-P	VB-9213-0-5-P	VB-9253-0-4-P	VB-9273-0-4-P
Valve Assembly Pneumatic		VK-9213-XXX-4-P	VK-9213-XXX-5-P	VK-9253-XXX-4-P	VK-9273-XXX-4-P
Valve Assembly Pneumatic w/Positive Positioner		VK4-9213-XX1-4-P	VK4-9213-XX1-5-P	VK4-9253-XX1-4-P	VK4-9273-XX1-4-P
Normally Closed Valves		1/2"–2"	2-1/2"–6"	1/2"–2"	1/2"–2"
Valve Body		VB-9223-0-4-P	VB-9223-0-5-P	VB-9263-0-4-P	VB-9283-0-4-P
Valve Assembly Pneumatic		VK-9223-XXX-4-P	VK-9223-XXX-5-P	VK-9263-XXX-4-P	VK-9283-XXX-4-P
Valve Assembly Pneumatic w/Positive Positioner		VK4-9223-XX3-4-P	VK4-9223-XX3-5-P	VK4-9263-XX3-4-P	VK4-9283-XX3-4-P

NOTE: These charts are color coded as shown below to assist valve selection. Note it is possible to select either a valve assembly or component parts (actuator, valve linkage, valve body).

ORDERING EXAMPLES:

- 1. Valve Assembly** VK4-9213-601-4-11
- 2. Valve Body** VB-9213-0-4-11
- Actuator** MK-6801
- Linkage** AV-430
- Positive Positioner** AK-52309-500

Valve Body Data less P Code (Size, Cv Rating, Port Code) or **Valve Assembly** less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)

P Code (Size, Cv Rating, Port Code)

Actuator or **Actuator Code (XXX)** for Valve Assemblies

Valve Linkage

Material	Flow Type	Equal %	Equal %	Equal %	Equal %
	Body	Bronze	Cast Iron	Bronze	Bronze
	Seat	Bronze	Bronze	Stainless Steel	Stainless Steel
	Stem	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
	Plug	.Brass	Brass	Stainless Steel	Stainless Steel
	Packing	Spring Loaded Teflon "V" Rings	Spring Loaded Teflon "V" Rings	Spring Loaded Teflon "V" Rings	Spring Loaded Teflon "V" Rings
Disc	Composition	Composition	Teflon	None	

STEAM					
Pressure (psig)	Static	250	125	250	250
	Inlet	35	35	100	150
	Recom. Diff.*	20	20	35	50
Fluid Temp. °F (°C)	Max.	281° (138°)	281° (138°)	340° (171°)	366° (180°)





WATER					
Pressure (psig)	Static	250	125	250	250
	Recom. Diff.*	35	35	35	50
Fluid Temp. °F (°C)	Min.	40° (4°)	40° (4°)	40° (4°)	40° (4°)
	Max.	281° (138°)	281° (138°)	300° (149°)	366° (180°)

TO SELECT A PORT CODE (P)

P Code	Valve Size	Cv		
-1	1/2"	.4	.4	.4
-2		1.3	1.3	1.3
-3		2.2	2.2	2.2
-4		3.6	3.6	3.6
-5	3/4"	5.0	5.0	5.0
-6		6.2	6.2	6.2
-7	1"	8.2	8.2	8.2
-8		11.0	11.0	11.0
-9		16.0	16.0	16.0
-10	1-1/4"	25.0	25.0	25.0
-11	2"	40.0	40.0	40.0
-12	2-1/2"		56	
-13	3"		85	
-14	4"		145	
-15	5"		235	
-16	6"		350	




*Maximum recommended differential pressure in full open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected.
NOTE: Do not exceed close-off rating

TABLE 2. 1/2"—2" Valves, select Actuator or Actuator Code (XXX) with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select Valve Linkage and Positive Positioner if required.

																											
Effective Area		6 Sq. In.		11 Sq. In.		11 Sq. In.		50 Sq. In.																			
Valve Linkage		AV-400		AV-401		AV-430			AV-430																		
Positive Positioner		None		None		AK-52309-500			AK-52309-500																		
Factory Available Assembly with Positive Positioner		N.O. Valves		None		None		Yes	No	No	Yes	No	No														
		N.C. Valves		None		None		No	No	Yes	No	No	Yes														
Actuator Code (XXX)		201	202	203	301	302	303	351	352	353	601	602	603														
Actuator		MK-2690			MK-4601	MK-4611	MK-4621	MK-4701	MK-4711	MK-4721	MK-6801	MK-6811	MK-6821														
Spring Range (psig)		3-7		5-10		8-13		3-6		5-10		10-13															
CLOSE-OFF PRESSURE RATING†																											
Normal Position	Factory Available Valve Assemblies	Valve Body	P Code	Size	Supply Air Pressure (psig)				Supply Air Pressure (psig)				Supply Air Pressure (psig)				Supply Air Pressure (psig)										
					15	20	15	20	15	20	15	20	15	20	15	20	15	20	15	20							
Normally Open	VK-9213-XXX-1-P	VB-9213-0-4-P	-1-2-3-4	1/2"	170	250	90	220	140	250	250	180	250	35	250	250	250	180	250	35	250	250	250	250	250	250	250
	VK4-9213-351-1-P		-5-6	3/4"	75	130	40	95	60	180	250	80	180	15	120	120	225	80	180	15	120	250	250	250	250	140	250
	VK-9253-XXX-1-P*		-7-8	1"	40	75	20	55	35	100	165	40	100	5	65	65	125	40	100	5	65	250	250	250	250	75	250
	VK4-9253-351-1-P		-9	1-1/4"	25	45	10	35	20	60	100	25	60		40	40	80	25	60		40	225	250	165	250	50	225
	VK4-9253-601-1-P		-10	1-1/2"												25	55	15	40		25	160	250	115	230	30	160
	VK-9273-XXX-1-P*		-11	2"												20	30	10	20		10	90	160	60	125	15	90
	VK4-9273-351-1-P																										
VK4-9273-601-1-P																											
Normally Closed	VK-9223-XXX-1-P	VB-9223-0-4-P	-1-2-3-4	1/2"	15		110	180	60	180	250	60	180	250	60	180	250	250	250	250	250	250	250	250	250	250	
	VK4-9223-353-1-P		-5-6	3/4"		40	70	15	65	180	15	65	130	190	250	250	190	250	250	250	250	250	250	250	250		
	VK4-9223-603-1-P		-7-8	1"		20	35	5	30	100	5	30	65	95	220	250	95	220	250	250	250	250	250	250	250		
	VK-9263-XXX-1-P*		-9	1-1/4"		10	20		15	60		15	40	65	135	250	65	135	250	250	250	250	250	250	250		
	VK4-9263-353-1-P		-10	1-1/2"									5	25	40	85	170	5	25	40	85	170	170	170	170	170	170
	VK4-9263-603-1-P		-11	2"										10	20	50	85	10	20	50	85	85	85	85	85	85	
	VK-9283-XXX-1-P*																										
VK4-9283-353-1-P																											
VK4-9283-603-1-P																											

*Not available with MK-2690's. †Close-off pressure ratings apply when valves are installed with pressure under the seat.

TABLE 2. 2-1/2"—6" Valves, select Actuator or Actuator Code (XXX) with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select Valve Linkage and Positive Positioner if required.

																						
Effective Area		50 Sq. In.		100 Sq. In.		100 Sq. In.																
Valve Linkage		AV-495		AV-496		AV-496																
Positive Positioner		AK-52309-500		AK-52309-500		AK-52309-500																
Factory Available Assembly with Positive Positioner		N.O. Valves		Yes	No	No	Yes	No	No													
		N.C. Valves		No	No	Yes	No	Yes	No	Yes												
Actuator Code (XXX)		601	602	603	801	—	803	811	—	813												
Actuator		MK-6801	MK-6811	MK-6821	MK-8801	MK-8811	MK-8821	MK-8901	MK-8911	MK-8921												
Spring Range (psig)		3-8		5-10		8-13		3-8		5-10												
CLOSE-OFF PRESSURE RATING†																						
Normal Position	Factory Available Valve Assemblies	Valve Body	P Code	Size	Supply Air Pressure (psig)				Supply Air Pressure (psig)				Supply Air Pressure (psig)									
					15	20	15	20	15	20	15	20	15	20	15	20						
Normally Open	VK-9213-60X-5-P	VB-9213-0-5-P	-12	2-1/2"	60	110	40	91	9	60	125	125	91	125	30	125						
	VK4-9213-601-5-P		-13	3"	41	75	27	62	5	41	90	125	62	125	19	90						
	VK4-9213-801-5-P*		-14	4"	22	41	14	33	2	22	48	89	33	73	10	48						
	VK4-9213-811-5-P*		-15	5"													31	56	20	46	5	31
			-16	6"													21	38	14	31	3	21
Normally Closed	VK-9223-60X-5-P	VB-9223-0-5-P	-12	2-1/2"	9	30	60	30	70	125												
	VK4-9223-603-5-P		-13	3"	5	19	41	19	48	90												
	VK4-9223-803-5-P*		-14	4"	2	10	22	5	25	49												
	VK4-9223-813-5-P*		-15	5"											5	15	31					
			-16	6"											3	10	21					

*Factory valve assemblies only available with positive positioner. For N.O. valves VK4-9213-801-5 and VK4-9213-811-5-P; for N.C. valves VK4-9223-803-5-P and VK4-9223-813-5-P.

†Close-off pressure ratings apply when valves are installed with pressure under the seat.

VALVES

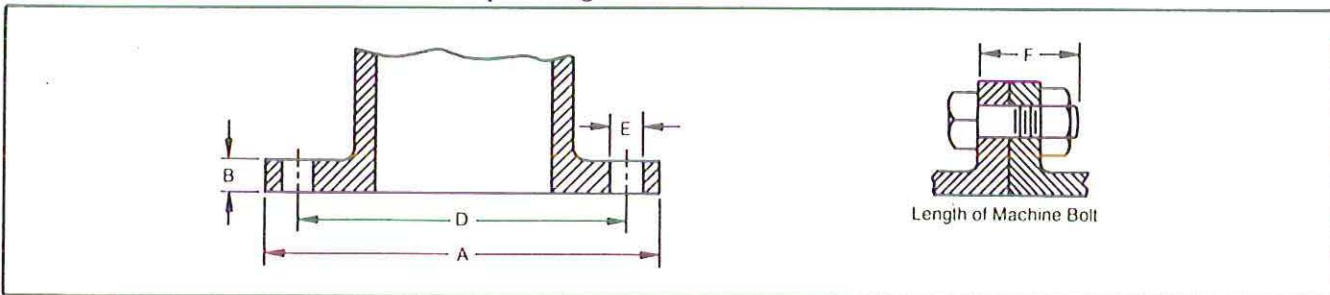
TABLE 3. Optional Input Signal Interface to Pneumatic

Input Signal Type	Interface Module Required
2-Position, SPST (Electric)	AL-100, 110, 120, 125, 140
2-Position, SPDT Snap Acting (Electric)	AL-100, 110, 120, 125, 140
Slidewire (Series 90)	CP-8502-XXX
Voltage 2-15 Vdc System 8000	CP-8511-XXX
Current Input 4-20 mA etc.	CP-8511-XXX, CP-8551, CP-8561

TABLE 4. Dimensions

Part Number	DIMENSIONS (Inches)								
	Valve Body				Actuator Series				
	Size	A	B	C	200	300	350	600	8XX
					MK-2690	MK-46X1	MK-47X1	MK-68X1	MK-8XX1
				E	E	E	E	E	
VK-9213-XXX-4-P VK-9253-XXX-4-P VK-9273-XXX-4-P VK4-9213-XX1-4-P VK4-9253-XX1-4-P VK4-9273-XX1-4-P	1/2"	3		1	5-1/16	5-5/16	11-9/16	13-15/16	
	3/4"	3-5/8		1-3/8	5-9/16	5-13/16	12-1/16	14-7/16	
	1"	4-5/8		1-1/2	5-15/16	6-3/16	12-7/16	14-13/16	
	1-1/4"	4-5/8		1-5/8	5-7/8	6-1/8	12-3/8	14-3/4	
	1-1/2"	6-1/8		2-1/2			13-5/16	15-11/16	
	2"	6-1/8		2-1/2			13-5/16	15-11/16	
VK-9213-XXX-5-P VK4-9213-XX1-5-P	2-1/2"	8-1/2		3-1/2				16-1/4	20-3/4
	3"	9-1/2		3-3/4				16-5/8	21-1/2
	4"	11-1/2		4-1/2				17-7/8	22-3/8
	5"	13		5					25-7/8
	6"	14		5-1/2					26-1/2
VK-9223-XXX-4-P VK-9263-XXX-4-P VK-9283-XXX-4-P VK4-9223-XX3-4-P VK4-9263-XX3-4-P VK4-9283-XX3-4-P	1/2"	3		1-7/16	5-1/16	5-5/16	11-9/16	13-15/16	
	3/4"	3-5/8		1-3/4	5-1/8	5-3/8	11-5/8	14	
	1"	4-5/8		2	5-3/8	5-5/8	11-7/8	14-1/4	
	1-1/4"	4-5/8		2	5-3/8	5-5/8	11-7/8	14-1/4	
	1-1/2"	6-1/8		3-3/16			12-5/8	15	
	2"	6-1/8		3-3/16			12-5/8	15	
VK-9223-XXX-5-P VK4-9223-XX3-5-P	2-1/2"	8-1/2		4-1/8				15-7/8	20-3/4
	3"	9-1/2		4-1/8				16-1/4	21
	4"	11-1/2		5-1/6				16-7/8	21-5/8
	5"	13		6-3/4					24-1/2
	6"	14		7-3/8					25-1/2

American Standard 125 lb. Cast Iron Pipe Flanges



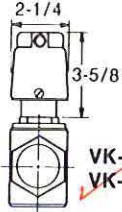
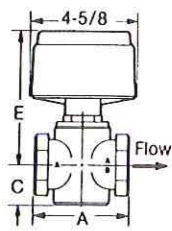
Flange Detail

Dimensions in Inches

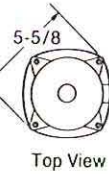
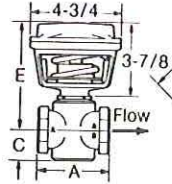
Nominal Pipe Size	Flanges		Drilling		Bolting		Length of Machine Bolts F
	Flange Diameter A	Flange Thickness B	Diameter of Bolt Circle D	Diameter of Bolt Holes E	Number of Bolts	Diameter of Bolts	
2-1/2	7	11/16	5-1/2	3/4	4	5/8	2-1/2
3	7-1/2	3/4	6	3/4	4	5/8	2-1/2
4	9	15/16	7-1/2	3/4	8	5/8	3
5	10	15/16	8-1/2	7/8	8	3/4	3
6	11	1	9-1/2	7/8	8	3/4	3-1/4

Dimensions in Inches

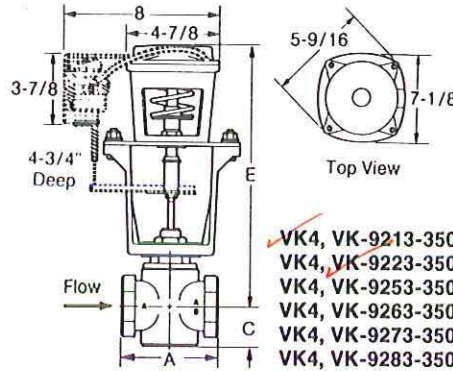
NOTE: Allow 3 inches clearance above actuator for removal.



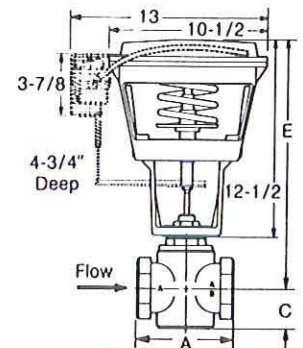
VK-9213-200-4
VK-9223-200-4



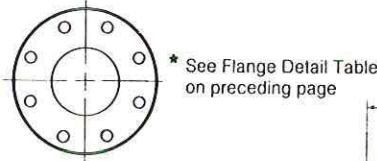
VK-9213-300-4-P
VK-9223-300-4-P
VK-9253-300-4-P
VK-9263-300-4-P
VK-9273-300-4-P
VK-9283-300-4-P



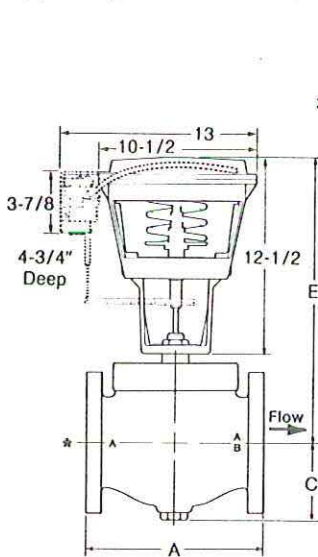
VK4, VK-9213-350-4-P
VK4, VK-9223-350-4-P
VK4, VK-9253-350-4-P
VK4, VK-9263-350-4-P
VK4, VK-9273-350-4-P
VK4, VK-9283-350-4-P



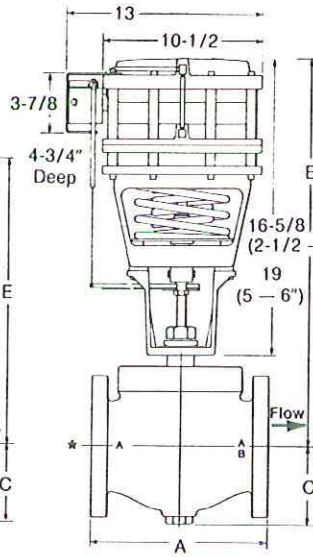
VK4, VK-9213-600-4-P
VK4, VK-9223-600-4-P
VK4, VK-9253-600-4-P
VK4, VK-9263-600-4-P
VK4, VK-9273-600-4-P
VK4, VK-9283-600-4-P



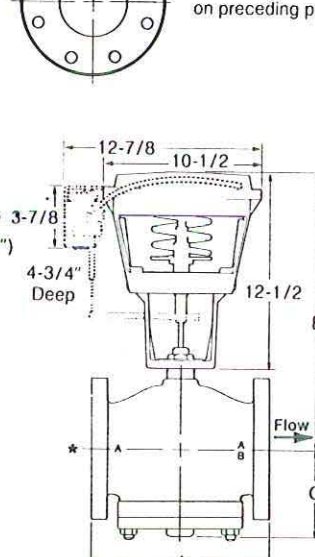
* See Flange Detail Table on preceding page



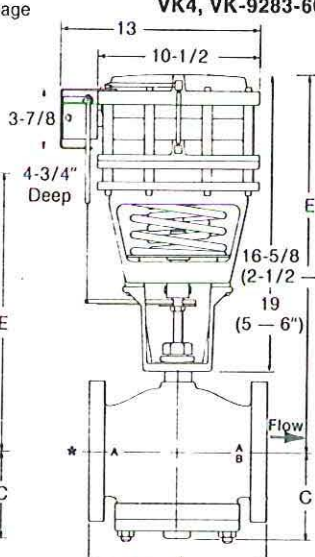
VK4, VK-9213-600-5-P



VK4-9213-800-5-P



VK4, VK-9223-600-5-P







VK4-9223-800-5-P

VALVES

TABLE 5. Fluid Temperature Versus Ambient Temperature

		TEMPERATURES °F (°C)				
Actuator Code (XXX)		2XX	3XXX	35X	6XX	8XX
Actuator		MK-2690	MK-46X1	MK-47XX	MK-68X1	MK-8XX1
Maximum Ambient		220° (104°)	220° (104°)	220° (104°)	220° (104°)	220° (104°)
Resultant Fluid		250° (121°)	250° (121°)	250° (121°)	250° (121°)	250° (121°)
VB-9213-0-4-P VB-9213-0-5-P VB-9223-0-4-P VB-9223-0-5-P	Maximum Fluid	281° (138°)	281° (138°)	281° (138°)	281° (138°)	281° (138°)
	Resultant Ambient	160° (71°)	160° (71°)	160° (71°)	160° (71°)	160° (71°)
VB-9253-0-4-P VB-9263-0-4-P	Maximum Fluid	—	340° (171°)	340° (171°)	340° (171°)	—
	Resultant Ambient	—	100° (37°)	100° (37°)	100° (37°)	—
VB-9273-0-4-P VB-9283-0-4-P	Maximum Fluid	—	366° (186°)	366° (186°)	366° (186°)	—
	Resultant Ambient	—	100° (38°)	100° (38°)	100° (38°)	—

TABLE 1. Select Valve Body including P Code (Valve Size, Cv Rating, Port Code) or select Valve Assembly with correct Input Signal (see Table 2 also) less Actuator Code (XXX) including the P Code (Size, Cv Rating, Port Code). (See Pages V59-63 for Valve Sizing.)

		APPLICATION			
		Chilled or Hot Water			
		Screw	Flange	Screw	Flange
					
		1/2"–2"	2-1/2"–6"	1/2"–2"	2-1/2"–6"
Valve Body		VK-9313-0-4-P	VB-9313-0-6-P	VB-9323-0-4-P	VB-9323-0-6-P
Valve Assembly Pneumatic without Positive Positioner		VK-9313-XXX-4-P	VK-9313-XXX-6-P	VK-9323-XXX-4-P	VK-9323-XXX-6-P
Valve Assembly Pneumatic with Positive Positioner		VK-9313-XXX-4-P	VK-9313-XXX-6-P	VK-9323-XXX-4-P	VK-9323-XXX-6-P
Normal Position		Stem Up Flow "B" to "AB"	Stem Up Flow "B" to "AB"	Stem Up Flow "B" to "AB"	Stem Up Flow "C" to "L"
Flow Type		Mixing	Mixing	Diverting	Diverting
Material	Body	Bronze	Iron	Bronze	Iron
	Seat	Bronze	Bronze	Bronze	Bronze
	Stem	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
	Plug	Brass	Brass	Stainless Steel	Stainless Steel
	Packing	Spring Loaded Teflon "V" Rings	Spring Loaded Teflon "V" Rings	Spring Loaded Teflon "V" Rings	Grafoil
	Disc	None	None	None	None
WATER					
Pressure (psig)	Static	250	125	250	125
	Recomm. Diff.*	35	35	35	35
Fluid Temp. °F (°C)	Min.	40° (4°)	40° (4°)	40° (4°)	40° (4°)
	Max.	281° (138°)	300° (149°)	281° (138°)	300° (149°)

NOTE: These charts are color coded as shown below to assist valve selection. Note it is possible to select either a valve assembly or component parts (actuator, valve linkage, valve body).

ORDERING EXAMPLES:

- 1. Valve Assembly VK-9313-602-4-11
- 2. Valve Body VB-9313-0-4-11
- Actuator MK-6811
- Linkage AV-430

Valve Body Data less P Code (Size, Cv Rating, Port Code) or Valve Assembly less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)

P Code (Size, Cv Rating, Port Code)

Actuator or Actuator Code (XXX) for Valve Assemblies



Valve Linkage

TO SELECT A PORT CODE

P Code	Valve Size	Cv			
-2	1/2"	2			
-4		4		6	
-6	3/4"	6.8		8	
-8	1"	12		12	
-9	1-1/4"	16		16	
-10	1-1/2"	33		30	
-11	2"	55		42	
-12	2-1/2"		74		
-13	3"		101		
-14	4"		170		
-15	5"		290		
-16	6"		390		
					Port
					"U" "L"
					68 75
					85 95
					160 180
					195 220
					250 275




*Maximum recommended differential pressure in full open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected.
NOTE: Do not exceed close-off rating.

TABLE 2A. 1/2"—1-1/4" Valves without Positive Positioners, select **Actuator** or **Actuator Code (XXX)** having sufficient close-off for the application. If selecting Component Parts, select **Valve Linkage**.

																						
Effective Area				6 Sq. In.						11 Sq. In.												
Valve Linkage				AV-400						AV-401												
Positive Positioner				None						None												
Factory Assembly with Positive Positioner				None						None												
Actuator Code (XXX)				201		202		203		301		302		303								
Actuator				MK-2690						MK-4601		MK-4611		MK-4621								
Spring Range (psig)				3-7		5-10		8-13		3-6		5-10		10-13								
CLOSE-OFF PRESSURE RATING**																						
Supply Air Pressure (psig)				15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20	
Stem Position†				SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD	
Valve Assembly	Valve Body	P Code	Size																			
✓ MK-2690 XXX - P	P	✓ -2-4	1/2"	5	100	185	45	50	130	100	5	85	35	250	250	100	110	250	250	25	170	
		-6	3/4"				20	25	70	45			45	15	140	230	50	60	130	155	12	90
		-8	1"				10	15	45	30			30	8	95	155	30	40	90	100	7	60
		-9	1-1/4"				6	9	30	15			15	4	60	100	15	25	55	60	3	38
MK-2690 XXX - P	P	-4	1/2"				250		250	250												
		-6	3/4"				250		250	250												
		-8	1"				250		250	250												
		-9	1-1/4"				250		250	250												



**Close-off ratings for mixing or sequencing valves: (SU = "A" port, SD = "B" port). "A" port (SU) ratings equal pressure at port "A" minus pressure at port "B"; "B" port (SD) ratings equal pressure at port "B" minus pressure at port "A".
 †SU — Stem Up; SD — Stem Down. See Table 5 for flow pattern, port designations, and normal position.

TABLE 2B. 1/2"—4" Valves, select **Actuator** or **Actuator Code (XXX)** having sufficient close-off for the application. If selecting Component Parts, select **Valve Linkage**. (Also see Table 3C.)

																								
Effective Area				11 Sq. In.						50 Sq. In.						50 Sq. In.								
Valve Linkage VB-9313-0-4-P				AV-430						AV-430						—								
Valve Linkage VB-9313-0-5-P				—						AV-495						—								
Valve Linkage VB-9323-0-X-P				AV-430						AV-430						AV-430								
Positive Positioner				AK-52309-500						AK-52309-500						AK-52309-500								
Factory Valve Assembly with Positive Positioner				No		Yes		Yes		No		Yes		Yes		Yes								
Actuator Code (XXX)				✓ 351		352		353		601		✓ 602		603		652								
Actuator				MK-4701		MK-4711		MK-4721		MK-6801		MK-6811		MK-6821		MK-6911								
Spring Range (psig)				3-8		5-10		8-13		3-8		5-10		8-13		5-10								
CLOSE-OFF PRESSURE RATING**																								
Supply Air Pressure (psig)				15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20			
Stem Position†				SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD			
Valve Assembly	Valve Body	P Code	Size																					
✓ MK-4701 XXX - P ✓ MK-4711 XXX - P	P	✓ -2-4	1/2"	35	170	250	100	110	250	200	25	170	250	250	250	250	250	250	225	250				
		-6	3/4"	15	90	190	50	60	130	100	12	90	150	250	250	250	250	250	250	100	250			
		-8	1"	8	60	120	30	40	90	65	7	60	125	250	250	250	250	250	250	65	250			
		-9	1-1/4"	4	35	75	15	25	55	40	3	38	80	225	250	160	160	250	250	40	225			
		✓ -10	1-1/2"				4	5	20	12		12	29	85	160	60	60	130	105	14	85			
MK-4701 XXX - P MK-4711 XXX - P	P	-11	2"				4	5	20	12		12	29	85	160	60	60	130	105	14	85			
		-12	2-1/2"										9	60	110	30	40	91	60	9	60			
		-13	3"										5	41	75	19	26	62	41	5	41			
MK-4701 XXX - P MK-4711 XXX - P	P	-14	4"									2	22	41	10	13	33	22	2	22				
		-4	1/2"	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250			
		-6	3/4"	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250			
		-8	1"	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250			
		-9	1-1/4"	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250			
		-10	1-1/2"							250	250	250	250	250	250	250	250	250	250	250	250			
MK-4701 XXX - P MK-4711 XXX - P	P	-11	2"									250	250	250	250	250	250	250	250	250				
		-12	2-1/2"												125	125	125	125		125				
		-13	3"												125	125	125	125		125				
		-14	4"																		125	125	125	
MK-4701 XXX - P MK-4711 XXX - P	P	-15	5"																		125	125	125	
		-16	6"																		125	125	125	

**Close-off ratings for mixing or sequencing valves: (SU = "A" port, SD = "B" port). "A" port (SU) ratings equal pressure at port "A" minus pressure at port "B"; "B" port (SD) ratings equal pressure at port "B" minus pressure at port "A".
 †SU — Stem Up; SD — Stem Down. See Table 5 for flow pattern, port designations, and normal position.

TABLE 2. 2-1/2"—6" Valves, select Actuator or Actuator Code (XXX) having sufficient close-off for the application. If selecting Component Parts, select Valve Linkage.

																					
Effective Area				100 Sq. In.				100 Sq. In.													
Valve Linkage				AV-496				AV-496													
Positive Positioner				AK-52309-500				AK-52309-500													
Factory Valve Assembly with Positive Positioner				No	Yes	Yes	No	Yes	Yes	No	Yes	Yes									
Actuator Code (XXX)				—	802	803	—	812	813	—	812	813									
Actuator				MK-8801	MK-8811	MK-8821	MK-8901	MK-8911	MK-8921	MK-8901	MK-8911	MK-8921									
Spring Range (psig)				3-8	5-10	8-13	3-8	5-10	8-13	3-8	5-10	8-13									
CLOSE-OFF PRESSURE RATING**																					
Supply Air Pressure (psig)				15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20						
Stem Position†				SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD						
Valve Assemblies	Valve Body	P Code	Size																		
VK4-9313-802-5-P*	V8-9313-0-5-P	-12	2-1/2"	30	125	125	70	91	125	125	30	125									
VK4-9313-803-5-P*		-13	3"	19	90	125	48	62	125	90	19	90									
VK4-9313-812-5-P*		-14	4"	10	49	89	25	33	73	49	10	49									
VK4-9313-813-5-P*		-15	5"										5	31	56	15	20	46	31	5	31
		-16	6"										3	21	38	10	14	31	21	3	21

*Factory valve assemblies are only available with positive positioner.
 **Close-off ratings for mixing or sequencing valves: (SU = "A" port, SD = "B" port). "A" port (SU) ratings equal pressure at port "A" minus pressure at port "B"; "B" port (SD) ratings equal pressure at port "B" minus pressure at port "A".
 †SU — Stem Up; SD — Stem Down. See Table 5 for flow pattern, port designations, and normal position.

TABLE 3. Optional Input Signal Interface to Pneumatic

Input Signal Type	Interface Module Required
2-Position, SPST (Electric)	AL-100, 110, 120, 125, 140
2-Position, SPDT Snap Acting (Electric)	AL-100, 110, 120, 125, 140
Slidewire (Series 90)	CP-8502-XXX
Voltage 2-15 Vdc System 8000	CP-8511-XXX
Current Input 4-20 mA etc.	CP-8511-XXX, CP-8551, CP-8561

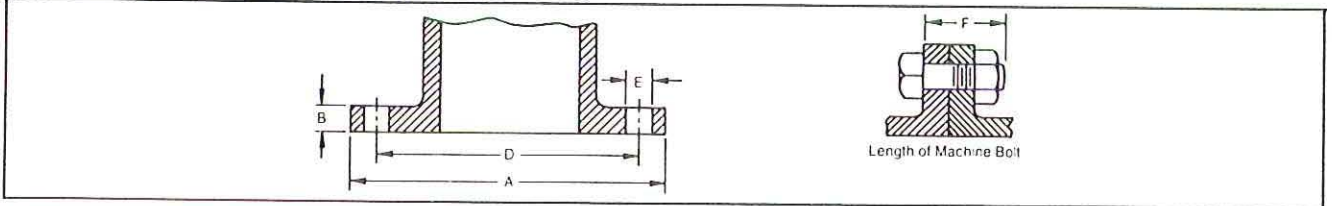
TABLE 4. Dimensions

Valve Body				DIMENSIONS (Inches)					
				Actuator Code (XXX), (Actuator)					
Part Number	Size	A	C	2XX (MK-2690)	30X (MK-46X1)	35X (MK-47X1)	60X (MK-68X1)	652 (MK-6911)	80X (MK-88X1)
VK-9313-XXX-4-P VK4-9313-XXX-4-P VK-9323-XXX-4-P VK4-9323-XXX-4-P	1/2"	3	1-7/16	4-13/16	5-1/16	11-5/16	13-11/16		
	3/4"	3-5/8	1-7/8	5-1/8	5-3/8	11-5/8	14		
	1"	4-5/8	2-1/4	5-3/8	5-5/8	11-7/8	14-1/4		
	1-1/4"	4-5/8	2-3/4	5-3/8	5-5/8	11-7/8	14-1/4		
	1-1/2"	6-1/8	3-7/8			12-5/8	15		
	2"	6-1/8	3-7/8			12-5/8	15		
VK-9313-XXX-5-P VK4-9313-XXX-5-P	2-1/2"	8-1/2	5-3/8				15-5/8		20-3/4
	3"	9-1/2	6-3/8				16-1/4		21
	4"	11-1/2	8-1/2				16-7/8		21-5/8
	5"	13	8-3/4						24-1/2
VK-9323-XXX-5-P VK4-9323-XXX-5-P	6"	14	9-3/4						25-1/2
	2-1/2"	9	7				17-1/8		
	3"	10	8				18		
	4"	12	10					21	
	5"	13	10-1/2					21-1/2	
	6"	14-1/8	11-1/8					22-1/8	

TABLE 5. Flow Pattern

Body Part Number	Flow Type	Stem Up (SU) (Normal Position)		Stem Down (SD)	
		Flow	Closed Port	Flow	Closed Port
VB-9313-0-4-P	Mixing	B to AB	A	A to AB	B
VB-9323-0-4-P	Diverting	B to AB	A	B to A	AB
VB-9313-0-5-P	Mixing	B to AB	A	A to AB	B
VB-9323-0-5-P	Diverting	C to L	U	C to U	L

American Standard 125 lb. Cast Iron Pipe Flanges



Flange Detail

Dimensions in Inches

Nominal Pipe Size	Flanges		Drilling		Bolting		Length of Machine Bolts F
	Flange Diameter A	Flange Thickness B	Diameter of Bolt Circle D	Diameter of Bolt Holes E	Number of Bolts	Diameter of Bolts	
2-1/2	7	11/16	5-1/2	3/4	4	5/8	2-1/2
3	7-1/2	3/4	6	3/4	4	5/8	2-1/2
4	9	15/16	7-1/2	3/4	8	5/8	3
5	10	15/16	8-1/2	7/8	8	3/4	3
6	11	1	9-1/2	7/8	8	3/4	3-1/4

Dimensions in Inches NOTE: Allow 3 inches clearance above actuator for removal.

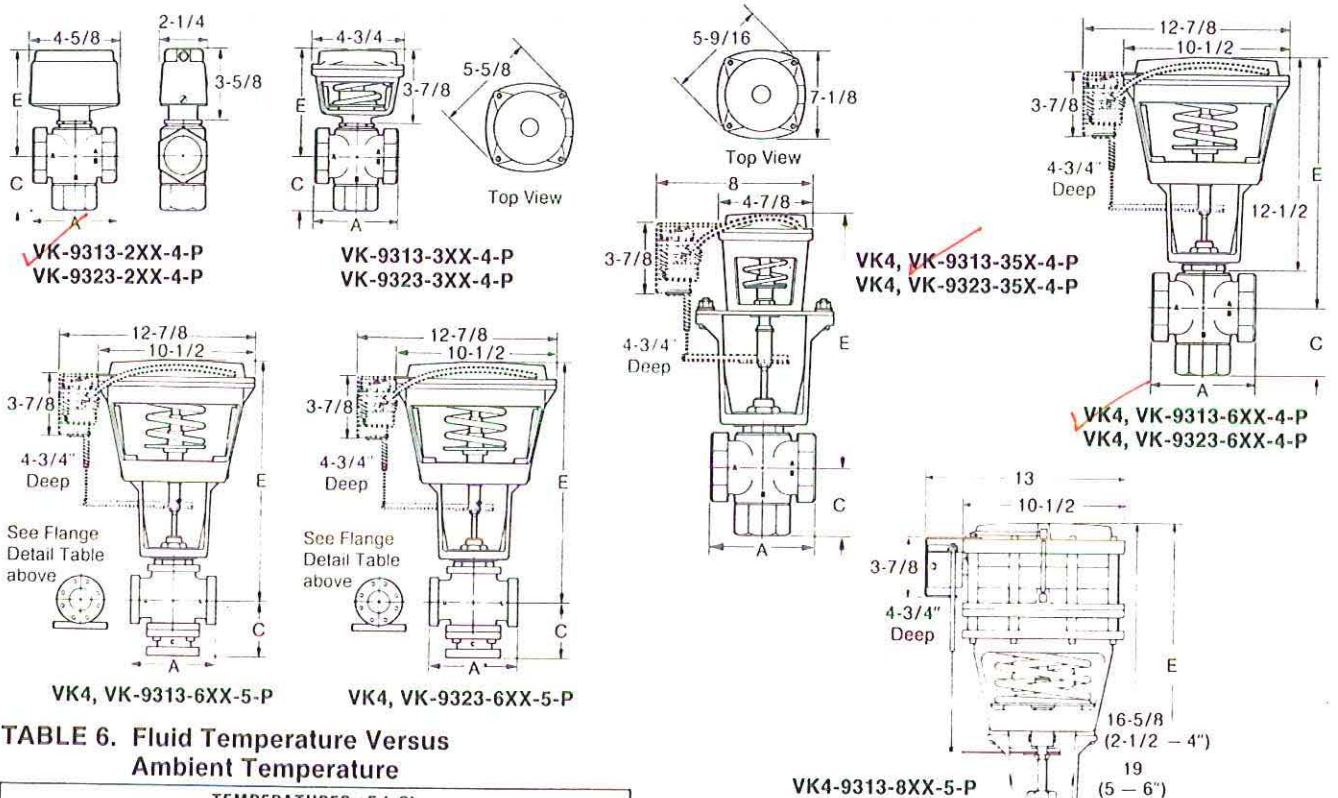


TABLE 6. Fluid Temperature Versus Ambient Temperature

TEMPERATURES °F (°C)		
Actuators		All
Maximum Ambient		220° (104°)
Resultant Fluid		250° (121°)
VB-9313-0-5-P	Maximum Fluid	300° (149°)
VB-9323-0-5-P	Resultant Ambient	100° (38°)
VB-9313-0-4-P	Maximum Fluid	281° (138°)
VB-9323-0-4-P	Resultant Ambient	160° (71°)

QTY	PART NO.	DESCRIPTION
31	TK-1001	ROOM THERMOSTAT
6	AK-51632	HIGHEST OF 2 PRESS.
8	AK-51642	LOWEST OF 2 PRESS.
8	CLIPPARD MTY-3	SWITCH
8	MK-3121	DAMPER ACTUATOR
8	AM-113	CRANK ARM
8	AM-125	ROD
8	AM-132	CONNECTOR
2	VK-9313-201-4-4	1/2" 3-WAY HEAT VALVE
29	VK-9313-201-4-2	1/2" 3-WAY HEAT VALVE

SEQUENCE OF OPERATION FOR U OF K GULCK EQUINE RESEARCH LEXINGTON, KENTUCKY

HOODS AND ATB BOXES - GENERAL
 SWITCH ON HOOD OPENS DAMPER ON HOOD AND SETS BOX TO HIGHER MINIMUM CFM TO MEET EXHAUST REQUIREMENTS. EXHAUST BOXES (EB) OPERATE TO KEEP ROOM AT NEGATIVE PRESSURE.

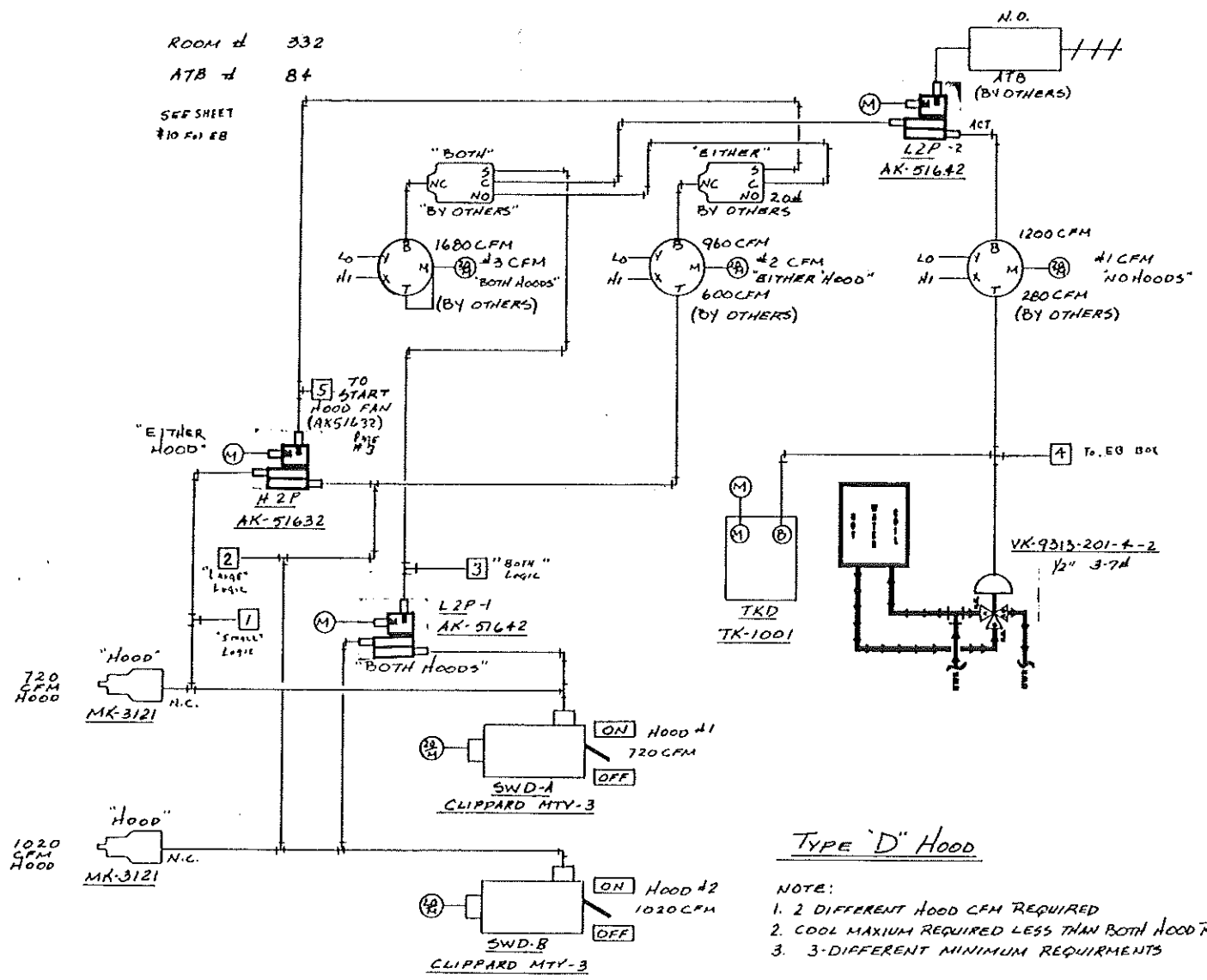
HOODS AND ATB BOXES ROOM 332 "CONTROL TYPE D"
 WHEN HOODS ARE OFF ROOM THERMOSTAT MODULATES IN SEQUENCE THE NORMALLY OPEN HOT WATER VALVE AND ATB BOX FROM MINIMUM TO MAXIMUM CFM. WHEN BOTH HOODS ARE ON ATB BOX POSITIONS TO A CFM THAT IS HIGHER THAN ROOM REQUIREMENTS. #1 HOOD AND #2 HOOD HAVE DIFFERENT AIR REQUIREMENTS. WHEN ONE HOOD IS ON, ATB BOX POSITIONS TO MINIMUM FOR HOOD SELECTED, WHICH IS LESS THAN ROOM REQUIREMENTS. ROOM THERMOSTAT MODULATES ATB BETWEEN HOOD MINIMUM AND ROOM MAXIMUM REQUIRED.

HOOD AND ATB BOXES ROOMS 412 & 416 "CONTROL TYPE E" (2 HOODS)
 WHEN HOODS ARE OFF ROOM THERMOSTAT MODULATES IN SEQUENCE THE NORMALLY OPEN HOT WATER VALVE AND ATB BOX FROM MINIMUM TO MAXIMUM CFM. WHEN BOTH HOODS ARE ON ATB POSITIONS TO MAXIMUM CFM SETTING, WHICH IS EQUAL TO MAXIMUM ROOM REQUIREMENTS. #1 HOOD AND #2 HOOD HAVE DIFFERENT AIR REQUIREMENTS. WHEN ONE HOOD IS ON ATB POSITIONS TO MINIMUM FOR HOOD SELECTED, WHICH IS LESS THAN MAXIMUM ROOM REQUIREMENTS. ROOM THERMOSTAT MODULATES ATB BETWEEN HOOD MINIMUM AND ROOM MAXIMUM REQUIRED.

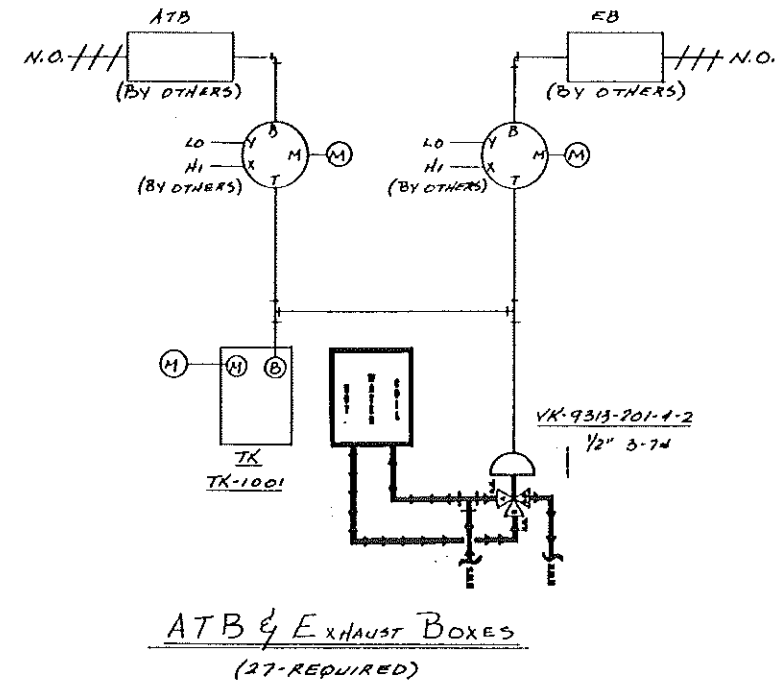
HOOD AND ATB BOX ROOM 114 "CONTROL TYPE F" (2 HOODS)
 WHEN HOODS ARE OFF ROOM THERMOSTAT MODULATES IN SEQUENCE THE NORMALLY OPEN HOT WATER VALVE AND ATB BOX FROM MINIMUM TO MAXIMUM CFM. WHEN BOTH HOODS ARE ON ATB POSITIONS TO MAXIMUM CFM REQUIRED, WHICH IS GREATER THAN ROOM REQUIREMENTS. #1 HOOD AND #2 HOOD HAVE EQUAL AIR REQUIREMENTS. WHEN EITHER HOOD IS ON ATB POSITIONS TO REQUIRED MINIMUM, WHICH IS LESS THAN MAXIMUM ROOM REQUIREMENTS. ROOM THERMOSTAT MODULATES ATB BETWEEN HOOD MINIMUM AND ROOM MAXIMUM AS REQUIRED.

ATB AND EXHAUST BOX (EB)
 ROOM THERMOSTAT SEQUENCE ATB, EB AND VALVE TO MAINTAIN TEMPERATURE AND NEGATIVE PRESSURE IN ROOM.

ROOM # 332
 ATB # 84
 SHEET #10 F1 EB



TYPE "D" HOOD
 NOTE:
 1. 2 DIFFERENT HOOD CFM REQUIRED
 2. COOL MAXIMUM REQUIRED LESS THAN BOTH HOOD REQUIRED
 3. 3-DIFFERENT MINIMUM REQUIREMENTS



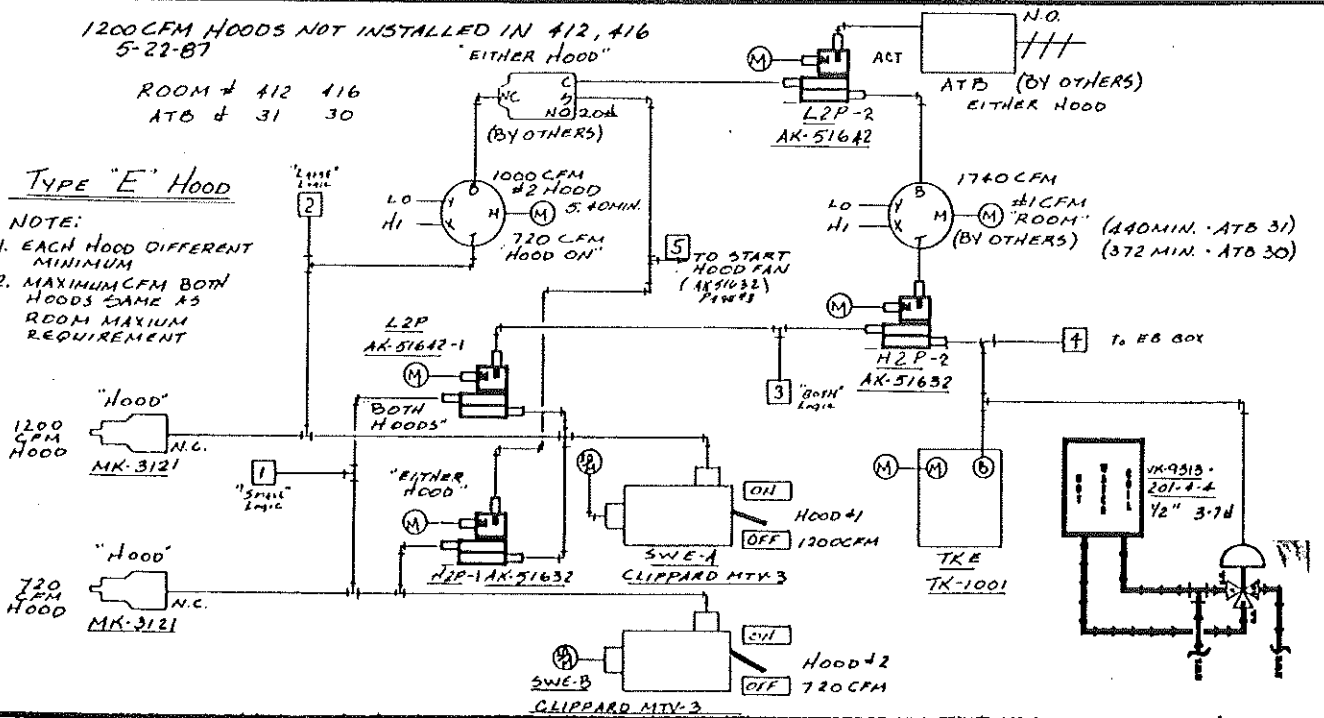
ATB & Exhaust Boxes
 (27-REQUIRED)

1200 CFM HOODS NOT INSTALLED IN 412, 416
 5-22-87

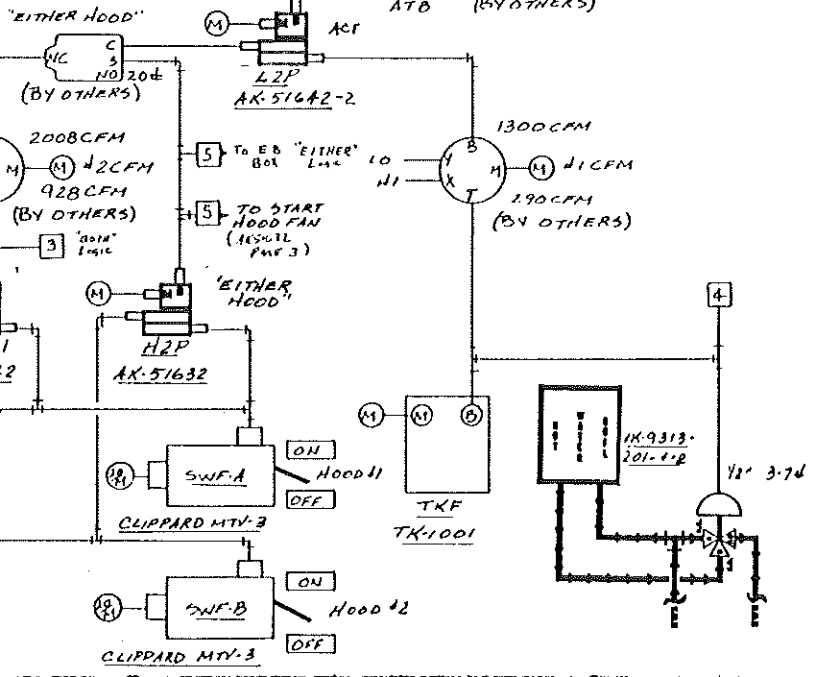
ROOM # 412 416
 ATB # 31 30

TYPE "E" HOOD

- NOTE:
 1. EACH HOOD DIFFERENT MINIMUM
 2. MAXIMUM CFM BOTH HOODS SAME AS ROOM MAXIMUM REQUIREMENT



ROOM # 114
 ATB # 12



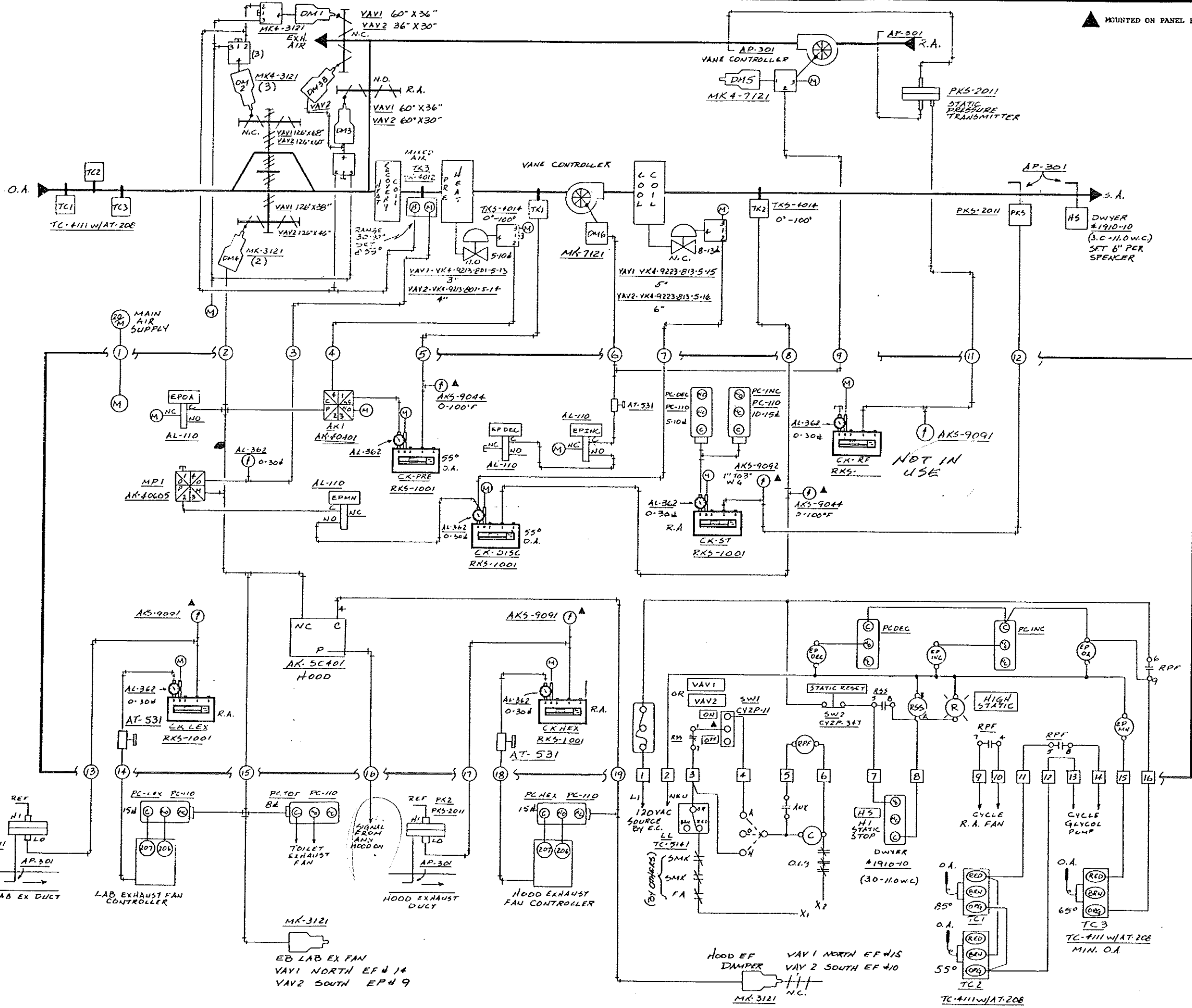
TYPE "F" HOOD
 1. BOTH HOODS - HIGHER HOOD REQUIREMENT THAN COOL
 2. 1 HOOD - COOL REQUIREMENT IS HIGHER THAN HOOD

SEE SHEETS 6, 8 & 10

GOLMAN COMPANY
 LOUISVILLE BRANCH
 1651 WATSON TRAIL
 JEFFERSONTOWN, KY 40299
 1-502-267-5003

DATE	CHANGES	JOB NAME
1-15-81	HLS-W	U OF K GULCK EQUINE RESEARCH
	222	LOCATION: LEXINGTON, KENTUCKY
		ARCHITECT: BICKEL GIBSON ASSOCIATES
		ENGINEER: PROCTOR - DAVIS - RAY
		CONTRACTOR: JEANES BROTHERS MECHANICAL, INC.
		DRAWN BY: JLF
		CHECKED BY: KR
		DATE: 4/21/86

MOUNTED ON PANEL FACE



GENERAL NOTES AND EQUIPMENT SCHEDULE		
QTY	PART NO.	DESCRIPTION
10	MK-3121	DAMPER ACTUATORS
10	MK-3121	DAMPER ACTUATOR
22	AK-112	CRANK ARM
22	AK-132	ROD
2	TK-4012	CONNECTOR
6	TC-4111W/AT-208	BULB THERMISTAT
2	TC-5141	LOW LIMIT THERMISTAT
4	TKS-4014	DUCT SENSOR
8	PKS-2011	STATIC/DIFFERENTIAL PRESSURE
12	AP-301	PRESSURE TAPS
2	DWYER #1910-10	PRESSURE GAUGE
2	AE-632	LOCAL CONTROL PANEL
12	RKS-1001	RECEIVER CONTROLLER
2	AKS-9091	- .25/1.75" W.G.
10	AL-110	EP SWITCH
2	AT-531	NEEDLE VALVE
4	AK-40401	SWITCHING RELAY
2	AK-40605	LIMITING RELAY
1	AK-50401	SWITCHING RELAY
3	AKS-9044	0-100 F GAUGE
2	AKS-9092	1-3" GAUGE
22	AL-362	0-30H GAUGE
4	AKS-9091	- .25 to 1.75" GAUGE
10	PC-110	PC SWITCH
2	CYZP-11	2-POSITION SWITCH
2	CYZP-347	NORMALLY CLOSED SWITCH
4	P-127-2-4W/P-100-4	RELAY
2	EY2P-504-2	LAMP
2	EY2P-721	SOCKET
2	EY2P-722-1	RED LENS
1	VK4-9213-801-5-13	3" 2-WAY N.O. HEAT VALVE
1	VK4-9213-801-5-14	4" 2-WAY N.O. HEAT VALVE
1	VK4-9223-813-5-15	5" 2-WAY N.C. COOL VALVE
1	VK4-9223-813-5-16	6" 2-WAY N.C. COOL VALVE
6	MK-7121	DAMPER ACTUATOR
2	MK-7121	DAMPER ACTUATOR

SEQUENCE OF OPERATION FOR U OF K GLUCK EQUINE RESEARCH
LEXINGTON, KENTUCKY

NORTH AND SOUTH VAV SYSTEMS (VAV 1 AND 2)
WHEN SAFETY DEVICES ARE IN NORMAL STATE, SMOKE DETECTORS, LOW LIMIT, HIGH STATIC, UNIT CAN BE STARTED BY AN ON/OFF SWITCH LOCATED ON THE FRONT OF LOCAL CONTROL PANEL. RESPECTIVE RETURN AIR FANS, HOOD FANS AND EXHAUST FANS WILL OPERATE WHEN SUPPLY FANS ARE STARTED. MINIMUM OUTDOOR AIR DAMPER WILL OPEN WHEN OUTDOOR AIR IS BELOW 65° MAXIMUM OUTDOOR AIR DAMPER, RETURN AIR DAMPER AND EXHAUST AIR DAMPER WILL BE CONTROLLED IN SEQUENCE WITH THE NORMALLY CLOSED CHILLED WATER VALVE TO MAINTAIN A DISCHARGE TEMPERATURE OF 55°F. WHEN OUTDOOR AIR IS ABOVE 65°F, THE MAXIMUM OUTDOOR AIR, RETURN AIR AND EXHAUST AIR DAMPERS WILL BE AT A MINIMUM POSITION. CHILLED WATER VALVE WILL MAINTAIN DISCHARGE TEMPERATURE. A NORMALLY OPEN PREHEAT VALVE WILL BE CONTROLLED BY A SENSOR IN THE PREHEAT COIL DISCHARGE, SET TO MAINTAIN 55°F. VALVE WILL BE CLOSED WHEN FAN IS SHUTDOWN. A LOW LIMIT THERMOSTAT SET AT 55°F, MOUNTED IN THE MIXED AIR WILL PREVENT MIXED AIR TEMPERATURE BELOW 55°F. THE HEAT RECOVERY FUND WILL RUN IF FAN IS OPERATING AND OUTDOOR AIR TEMPERATURE IS BELOW 55°F (ADJUSTABLE), OR ABOVE 80°F (ADJUSTABLE). A SEPARATE ADJUSTABLE STATIC HIGH LIMIT IS PROVIDED TO STOP SUPPLY FAN. A MANUAL RESET BUTTON IS PROVIDED TO RESET SYSTEM. A STATIC PRESSURE CONTROLLER OPERATES THE INLET VANES OF THE SUPPLY AND RETURN FANS.

LAB EXHAUST FANS EP9 AND EP14
EXHAUST FANS ARE STARTED WHEN VAV SYSTEMS ARE STARTED. EXHAUST FAN DAMPER OPENS AND STATIC PRESSURE CONTROLLER SENDS SIGNAL TO FAN SPEED CONTROLLER TO MAINTAIN NEGATIVE STATIC.

HOOD EXHAUST FANS EP10 AND EP15
EXHAUST FANS WILL OPERATE ONLY IF VAV SYSTEM IS ON AND ONE OR MORE HOODS ARE OPEN. EXHAUST FAN DAMPER OPENS STATIC PRESSURE CONTROLLER SENDS SIGNAL TO FAN SPEED CONTROLLER TO MAINTAIN A NEGATIVE STATIC.

EP10 - EP OUTSIDE AIR
EPDEC - CLOSE VANES
EPINC - OPEN VANES
RSS - RELAY STATIC/STOP

COLMAN
7431 0744

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VAV 1
VAV 2

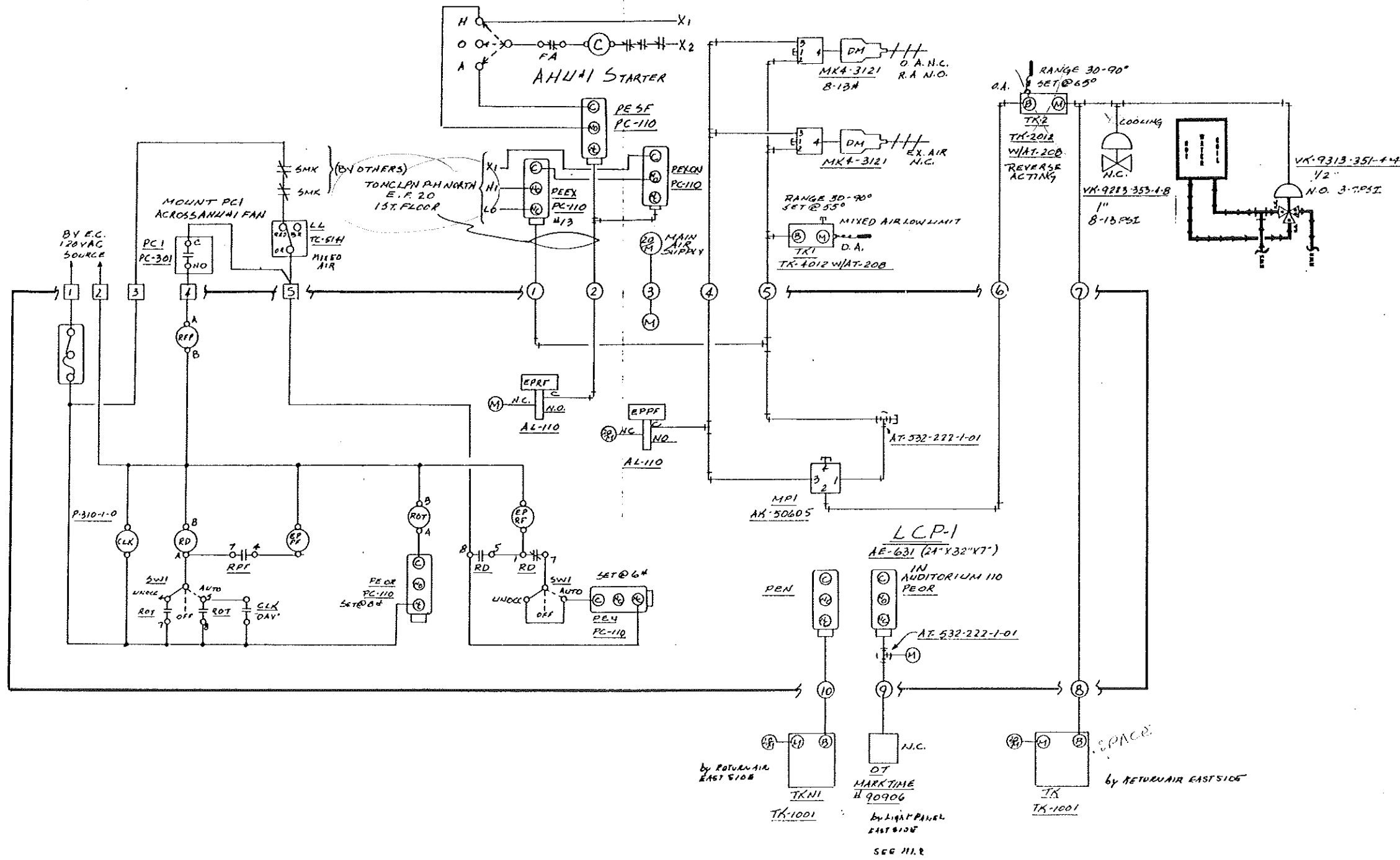
— REVISIONS —

DATE	CHANGES	JOB NAME
4/24/86	AS BUILT	U OF K GLUCK EQUINE RESEARCH
7/16/88	ADDED TO	LOCATION: LEXINGTON, KENTUCKY
7/16/88	CHANGED	ARCHITECT: BICKEL GIBSON ASSOCIATES
7/16/88	CHANGED	ENGINEER: PROCTOR-DAVIS-RAY
7/16/88	CHANGED	CONTRACTOR: JEANES BROTHERS MECHANICAL, INC.
7/16/88	CHANGED	DRAWN BY: JLP
7/16/88	CHANGED	CHECKED BY: KR
7/16/88	CHANGED	DATE: 4/24/86

DRAWING NO. 85-77011-5

PARALLEL LAB AND HOOD EXHAUST FANS
REQUIRED FOR NORTH PENTHOUSE
REQUIRED FOR SOUTH PENTHOUSE

PE SF, PE EX, PE XON IN VAVI PANEL



GENERAL NOTES AND EQUIPMENT SCHEDULE		
QTY	PART NO.	DESCRIPTION
1	TC-5141	LOW LIMIT THERMOSTAT
2	MK4-3121	DAMPER ACTUATOR
2	AM-113	CRANK ARM
2	AM-125	ROD
2	AM-132	CONNECTOR
1	TK-4012w/AT-208	BULB STAT w/ MOUNTING KIT
1	VK-9213-353-4-8	1" N.C. 2-WAY COOL VALVE
1	VK-9113-351-4-4	1" N.O. 3-WAY HEAT VALVE
2	TK-1001	ROOM STAT
1	MARKTIME #90906	OVERRIDE TIMER
1	AK-50605	LIMITING RELAY
2	AT-532-222-1-01	RESTRICTOR TEE
4	PC-110	PE SWITCH
2	AL-110	EP SWITCH
1	P-310-1-0	TIME CLOCK
3	P-127-2-4w/P-100-4	RELAY
1	CYZP-268	SWITCH
1	AE-631	LOCAL CONTROL PANEL
1	TK-2012w/AT-208	BULB STAT w/MOUNTING KIT
1	PC-301	FLOW SWITCH

SEQUENCE OF OPERATION FOR U OF K GLUCK EQUINE RESEARCH LEXINGTON, KENTUCKY

AIR HANDLING UNIT #1 AUDITORIUM ROOM #110

AN AUTO-OFF-UNOCCUPIED SWITCH IS LOCATED ON FRONT OF LOCAL CONTROL PANEL IN STORAGE ROOM #110B. WHEN THE SWITCH IS IN OFF POSITION AIR HANDLING UNIT REMAINS OFF. AUTO POSITION ALLOWS CLOCK TO TURN AIR HANDLING UNIT ON AND OFF. UNOCCUPIED POSITION ALLOWS NIGHT THERMOSTAT TO CYCLE FAN AT A REDUCED TEMPERATURE. OVERRIDE TIMER OPERATES IN THE AUTO-ON-UNOCCUPIED POSITION. OUTDOOR AIR DAMPERS ARE CLOSED DURING UNOCCUPIED CYCLES. DURING OCCUPIED CYCLE OUTDOOR AIR WILL BE OPEN TO MINIMUM WHEN OUTDOOR AIR TEMPERATURE IS BELOW 65°. A ROOM THERMOSTAT WILL CONTROL IN SEQUENCE A 3-WAY HOT WATER VALVE AND OPERATE OUTDOOR AIR AND RETURN AIR DAMPERS THROUGH A LOW LIMIT THERMOSTAT SET AT 55°. IN THE MIXED AIR TO MAINTAIN SPACE TEMPERATURE. WHEN OUTDOOR AIR IS ABOVE 65° ROOM THERMOSTAT WILL CONTROL THE 3-WAY HOT WATER VALVE AND NORMALLY CLOSED CHILLED WATER VALVE IN SEQUENCE AND OUTDOOR AIR WILL BE AT A MINIMUM. EXHAUST FAN EF#20 WILL RUN ON LOW SPEED WHEN SYSTEM IS RUNNING AND IN OCCUPIED MODE. FAN WILL SHIFT TO HIGH SPEED WHEN OUTDOOR AIR IS 100% OPEN. MANUAL RESET LOW TEMPERATURE THERMOSTAT SET AT 38°. IN MIXED AIR AND SMOKE DETECTORS WILL STOP FANS.

- CLK - CLOCK
- RD - RELAY DAY
- RPT - RELAY FAN PROVE
- ROT - RELAY OVERRIDE TIMER
- EPRF - EP RUN FAN
- EPPF - EP PROVE FAN
- PE - PE NIGHT
- PEOR - PE OVERRIDE TIMER
- MPI - MINIMUM POSITIONER

	LOUISVILLE BRANCH 1651 WATTERSON TRAIL JEFFERSONTOWN, KY 40299 1-502-267-5003	AHU #1
	U OF K GLUCK EQUINE RESEARCH LEXINGTON, KENTUCKY BICKEL GIBSON ASSOCIATES PROCTOR-DAVIS-RAY JEANES BROTHERS MECHANICAL, INC.	
DATE: 12/1/87 12/4/87 12/10/87 12/18/87	CHANGES: LOC. AS BUILT AS BUILT LEGEND	JOB NAME: U OF K GLUCK EQUINE RESEARCH LOCATION: LEXINGTON, KENTUCKY ARCHITECT: BICKEL GIBSON ASSOCIATES ENGINEER: PROCTOR-DAVIS-RAY CONTRACTOR: JEANES BROTHERS MECHANICAL, INC. DRAWN BY: JLF CHECKED BY: KR DATE: 4/10/85
DRAWING NO. 85-77011-7		

GENERAL NOTES AND EQUIPMENT SCHEDULE

QTY	PART NO.	DESCRIPTION
1	K-222-7-00-4	AIR COMPRESSOR
1	FURNAS 47AB10BF	ALTERNATOR
1	HANKINSON 1302-3	FILTER
1	HANKINSON 8010	DRYER
1	NE57W	DRAIN TRAP
1	AL-327	0-100# GAUGE
1	AL-483	PRESSURE REGULATOR
1	AL-412	SAFETY VALVE
4	AL-362	0-30# GAUGE
1	TKS-8033w/AT-201	SENSOR/WELL
1	TKS-2031	SENSOR
4	PC-110	P/E SWITCH
1	AKS-9063	40-240 GAUGE
1	AKS-9061	-40-160 GAUGE
1	P74FA-1	FLOW SWITCH
1	RKS-3002	RECEIVER CONTROLLER
2	CLIPPAID MTV-3	SWITCH
1	TK-1001	ROOM THERMOSTAT
2	AL-110	EP SWITCH
1	AK-40605	LIMITING RELAY
2	MK-3121	DAMPER ACTUATOR
2	AM-113	CRANK ARM
2	AM-125	ROD
2	AM-132	CONNECTOR
1	STROMBERG #OK-01-W-10	CONTACTOR W/ENCLOSURE
1	TK-2012w/AT-208	BULB STAT/MOUNTING KIT
5	TA-1101	ROOM THERMOSTAT
1	AT-532-222-1-01	RESTRICTOR TEE

SEQUENCE OF OPERATION FOR U OF K GLUCK EQUINE RESEARCH LEXINGTON, KENTUCKY

PRIMARY HOT WATER CONTROL

PRIMARY HOT WATER PUMPS ARE CONTROLLED FROM ON/OFF SWITCH. OUTDOOR AIR AND HOT WATER SENSOR RESET THE RECEIVER CONTROLLER. 1/3 AND 2/3 CAPACITY VALVES MODULATE TO CONTROL TEMPERATURE OF HOT WATER ACCORDING TO SCHEDULE WHEN PUMPS ARE ON, WHEN PUMPS ARE OFF STEAM VALVES WILL CLOSE.

UNIT HEATERS 141, 242, NORTH AND SOUTH PENTHOUSES ROOM THERMOSTAT WILL CYCLE BLOWER TO MAINTAIN TEMPERATURE.

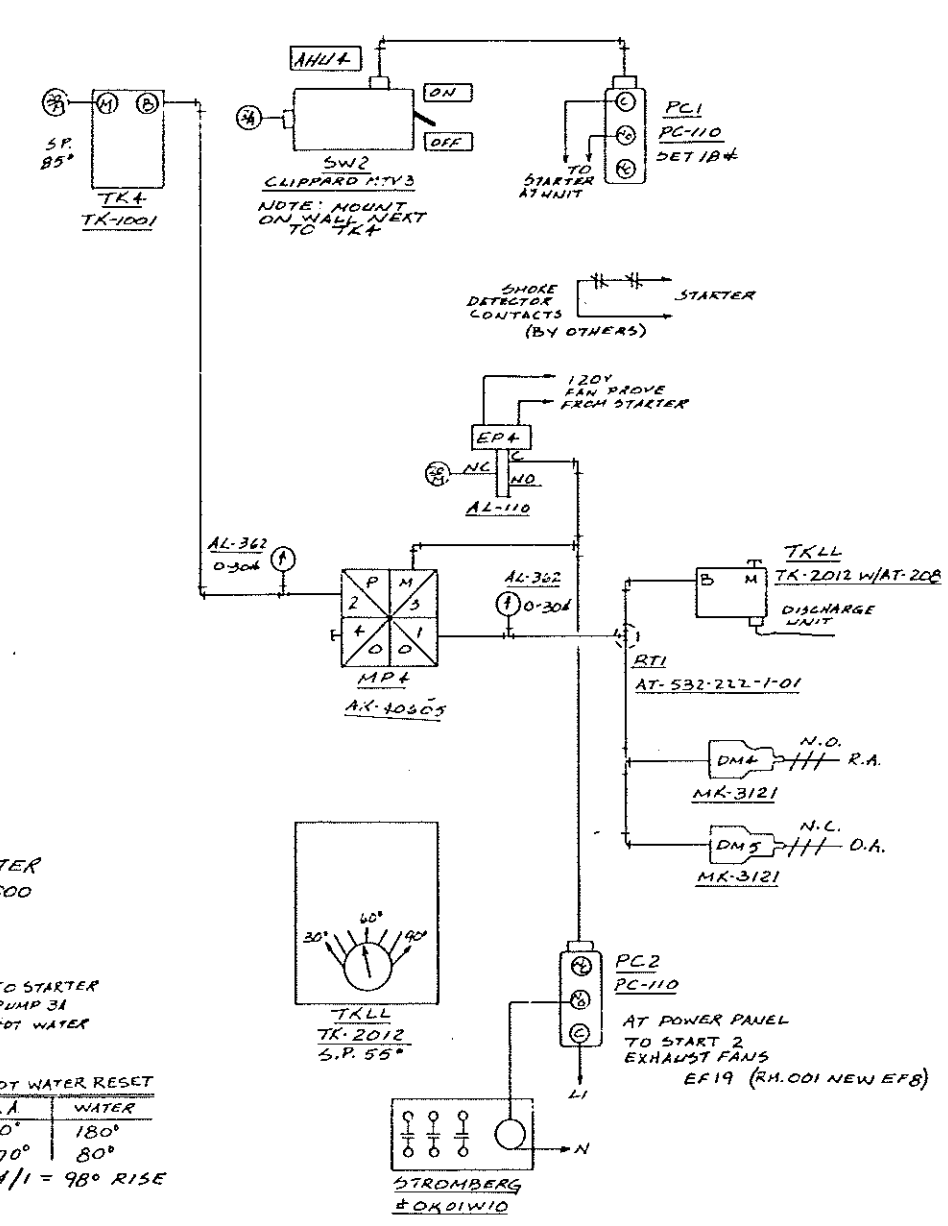
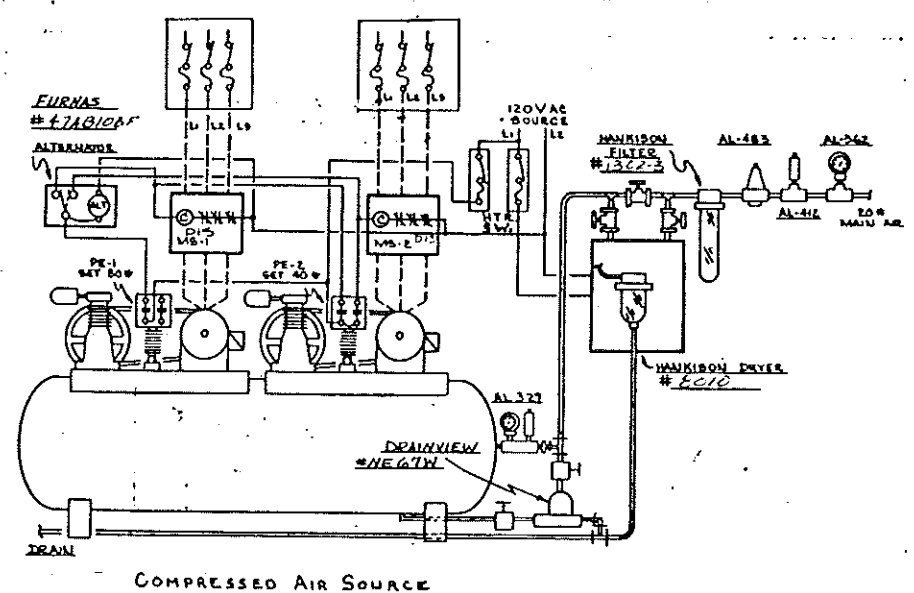
AIR HANDLING UNIT #4 "000" "A" BASEMENT AN ON/OFF SWITCH LOCATED BY ROOM THERMOSTAT WILL START THE SYSTEM. ROOM THERMOSTAT WILL MODULATE THE OUTDOOR AIR AND RETURN AIR DAMPERS. A LOW LIMIT SET AT 55°F, WILL PREVENT LOWER TEMPERATURE BY OVERRIDING MINIMUM POSITIONER AND ROOM THERMOSTAT EF19, 8, AND ADDED FAN WILL BE STARTED WHEN AIR HANDLING UNIT #4 IS STARTED.



LOUISVILLE BRANCH
1651 WATSON TRAIL
JEFFERSONTOWN, KY 40299
1-502-267-5003

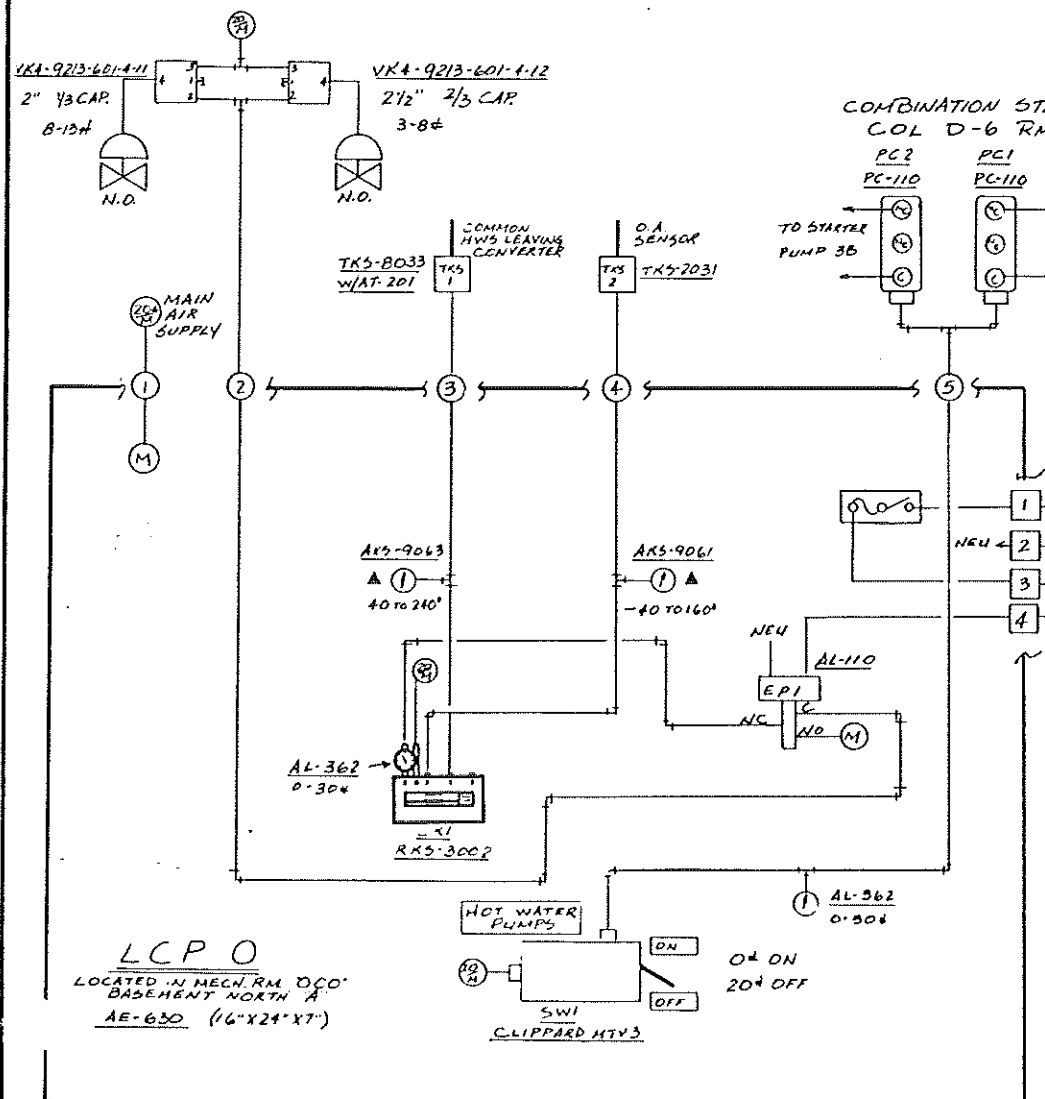
HOT WATER CONTROL UNIT HEATERS AHU #4

REVISIONS		JOB NAME
DATE	CHANGES	U OF K GLUCK EQUINE RESEARCH
9/30/88	LOC	LOCATION LEXINGTON, KENTUCKY
1/21/89	NOTES	ARCHITECT BICKEL GIBSON ASSOCIATES
2/29/89	ADD	ENGINEER PROCTOR-DAVIS-RAY
7/1/88	DISCONNECT	CONTRACTOR JEANES BROTHERS MECHANICAL INC.
10/89	ADD	DRAWN BY JLF
		CHECKED BY KR
		DATE 4/18/86
		DRAWING NO. 85-77011-4



AHU #4 CONTROL ROOM "000"

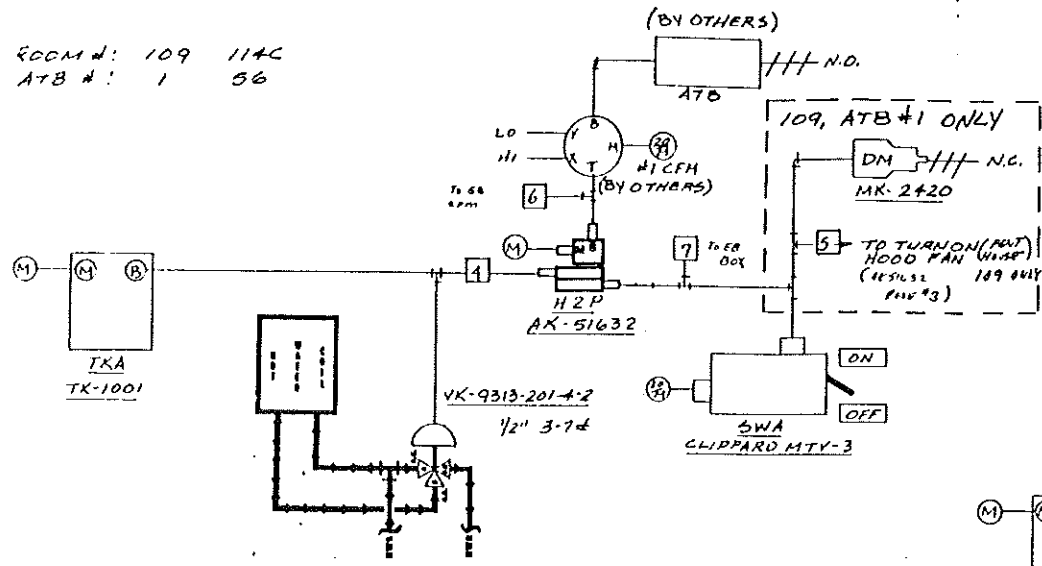
UNIT HEATERS (5 REQUIRED)
RM. 141, 241, BUILDING "B" (2-241)
NORTH & SOUTH PENTHOUSE BUILDING "A"



LCP 0
LOCATED IN MECH. RM. 000
BASEMENT NORTH A
AE-630 (16" X 24" X 7")

114C PERCHLORIC FUME HOOD HAS OWN EXHAUST FAN

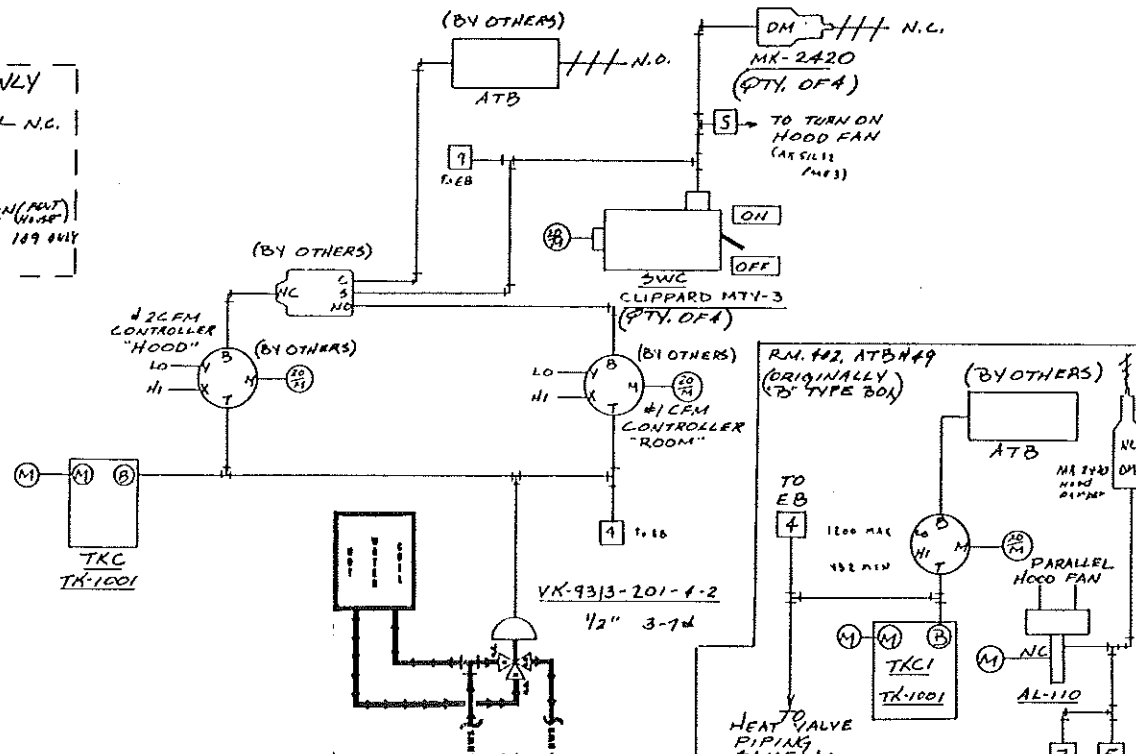
ROOM #: 109 114C
ATB #: 1 56



TYPE "A" HOOD
(3-REQUIRED)

NOTES:
1. HOOD REQUIREMENTS ARE SAME AS ROOM COOL REQUIREMENTS.

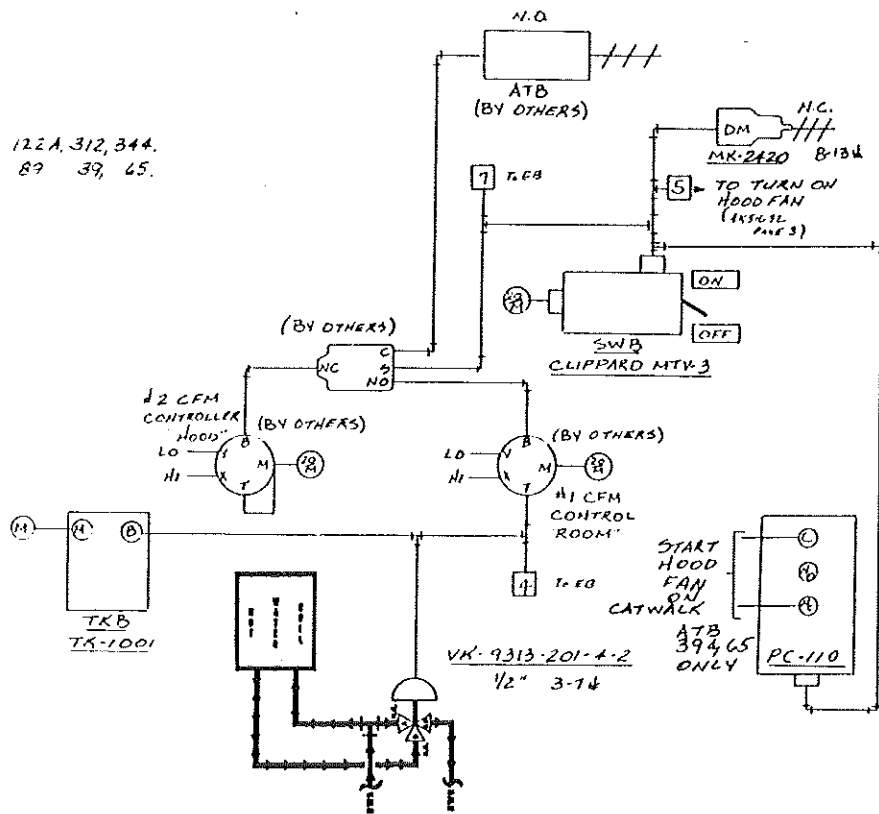
HOODS NOT INSTALLED
ROOM #: 302, 324, 328, 340, 346, 440, 444, 448, 450 318
ATB #: 17, 72, 35, 50, 27, 45, 62, 28, 63 14



TYPE "C" HOOD
(18-REQUIRED)

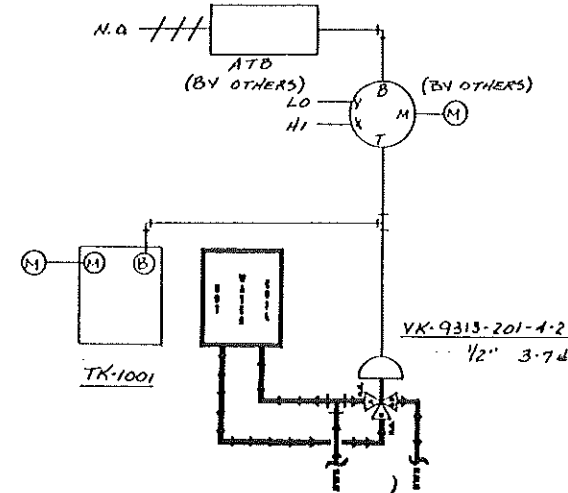
NOTES:
1. ROOM COOL REQUIREMENTS ARE GREATER THAN HOOD REQUIREMENTS.
2. SET BOTH MAX. THE SAME.
3. SET EACH MIN. AS REQUIRED FOR THIS TYPE.
4. 2 MAX. & 2 MIN. AVAILABLE.

ROOM #: 122A, 312, 344.
ATB #: 89, 39, 45.

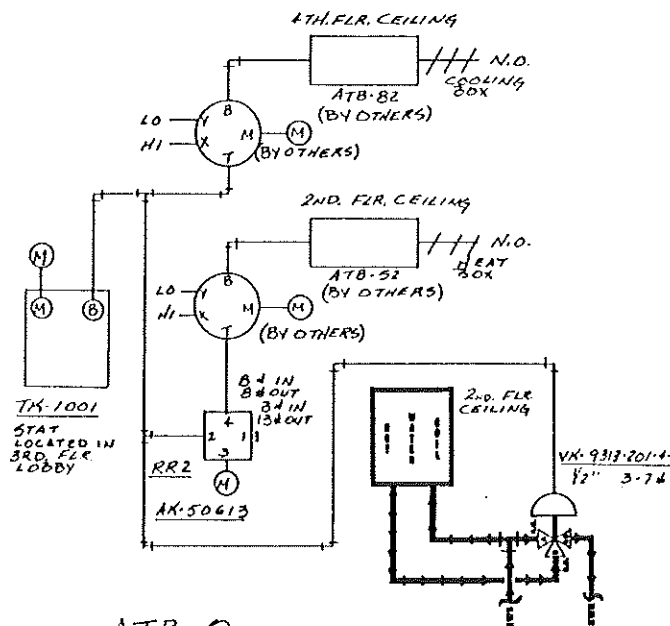


TYPE "B" HOOD
(3-REQUIRED)

NOTES:
1. HOOD REQUIREMENTS ARE GREATER THAN ROOM REQUIREMENTS.
2. SET MIN. & MAX. SAME ON #2 CFM (HOOD).
3. SET #1 CFM FOR REQUIRED MIN. & MAX.
4. 2 MAX. & 2 MIN. AVAILABLE.



ATB ONLY
(42-REQUIRED)



ATB ONLY
(ROOM 309 LOUNGE)

GENERAL NOTES AND EQUIPMENT SCHEDULE		
QTY	PART NO.	DESCRIPTION
58	TK-1001	ROOM THERMOSTAT
1	AK-51632	HIGHEST OF 2 PRESS.
10	CLIPPARD MTY-3	SWITCH
9	MK-2420	DAMPER ACTUATOR
9	AK-113	CRANK ARM
9	AK-125	ROD
9	AK-132	CONNECTOR
1	AK-50613	REVERSING RELAY
58	VK-9313-201-4-2	3-WAY 1/2" HEAT VALVE
1	AL-110	E/P SWITCH
2	PC-110	PE SWITCH
1	PP-1012	AP SWITCH

SEQUENCE OF OPERATION FOR GLUCK EQUINE RESEARCH
LEXINGTON, KENTUCKY

HOODS AND ATB BOXES - GENERAL
SWITCH ON HOOD OPENS DAMPER ON HOOD AND SETS BOX TO HIGHER MINIMUM CFM TO MEET EXHAUST REQUIREMENTS. EXHAUST BOXES (EB) OPERATE TO KEEP ROOM AT A NEGATIVE PRESSURE.

HOODS AND ATB BOXES ROOMS 109 AND 114C "CONTROL TYPE A" #340A
WHEN HOOD IS OFF ROOM THERMOSTAT MODULATES IN SEQUENCE THE NORMALLY OPEN HOT WATER VALVE AND ATB BOX FROM MINIMUM TO MAXIMUM CFM. WHEN HOOD IS ON ATB BOX POSITIONS TO THE REQUIRED MINIMUM CFM AND ROOM THERMOSTAT CONTROLS HEAT VALVE. HOOD AND MAXIMUM COOL REQUIREMENTS ARE THE SAME CFM.

HOODS AND ATB BOXES ROOMS 122A, 312, 344, 4390A "CONTROL TYPE B"
WHEN HOOD IS OFF ROOM THERMOSTAT MODULATES IN SEQUENCE THE NORMALLY OPEN HOT WATER VALVE AND ATB BOX FROM MINIMUM TO MAXIMUM CFM. WHEN HOOD IS ON ATB BOX POSITIONS TO THE REQUIRED MINIMUM CFM. THERMOSTAT CONTROLS HEAT VALVE. HOODS IN THIS GROUP HAVE A HIGHER CFM REQUIREMENTS THAN THE ROOM. PE SWITCH TURNS ON EXHAUST FAN ON ATB 39 & 45.

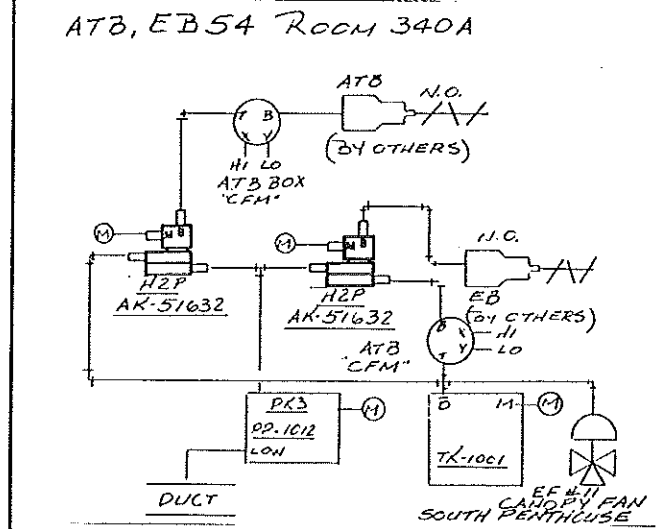
HOODS AND ATB BOXES ROOMS 302, 324, 328, 340, 346, 440, 444, 448, & 450 & 318 "CONTROL TYPE C"
WHEN HOOD IS OFF ROOM THERMOSTAT MODULATES IN SEQUENCE THE NORMALLY OPEN HOT WATER VALVE AND ATB BOX FROM MINIMUM TO MAXIMUM CFM. WHEN HOOD IS ON ATB BOX POSITIONS TO THE REQUIRED MINIMUM CFM. HOODS IN THIS GROUP HAVE A LOWER CFM REQUIREMENT THAN THE ROOM.

ATB ONLY
ROOM THERMOSTAT SEQUENCES ATB AND VALVE TO MAINTAIN TEMPERATURE.

HOODS AND ATB BOX ROOM 402 ATB #49 CONTROL TYPE C1
WHEN HOOD IS OFF ROOM THERMOSTAT MODULATES IN SEQUENCE THE NORMALLY OPEN HOT WATER VALVE AND ATB BOX FROM MINIMUM TO MAXIMUM CFM. WHEN ELECTRIC FAN IN HOOD IS TURNED ON AN EP SWITCH IN UNIT IS ACTUATED AND OPENS DAMPER IN OUTLET OF HOOD AND CAUSES EB BOX TO OPERATE AT A DIFFERENT MINIMUM TO MAXIMUM CFM.

GENERAL NOTES:
HOOD SWITCHES SELECT CFM CONTROLLERS BY USE OF SWITCHING RELAYS AND CHANGING SIGNALS TO HIGHEST OR LOWEST SELECTOR RELAYS.

SEE SHEETS 7, 8 & 10



LOUISVILLE BRANCH
1651 WATSON TRAIL
JEFFERSONTOWN, KY 40299
1-502-267-5003

HOODS & ATB BOXES TYPES A, B & ATB ONLY 2nd 340A

REVISIONS		JOB NAME	
DATE	CHANGES	U OF K GLUCK EQUINE RESEARCH	
1/5/87	REV E	LOCATION: LEXINGTON, KENTUCKY	
7/24/87	AS BUILT	ARCHITECT: BICKEL GIBSON ASSOCIATES	
		ENGINEER: PROCTOR - DAVIS - RAY	
		CONTRACTOR: JEANES BROTHERS MECHANICAL, INC.	
		DRAWN BY: JLP	DRAWING NO.
		CHECKED BY: KR	
		DATE: 4/21/85	85-77011-6


GENERAL NOTES AND EQUIPMENT SCHEDULE

LEGEND

RM	ROOM
HD	HOOD
N	NORTH
S	SOUTH
H	HEAT
C	COOL
<	LESS THAN
>	GREATER THAN
EXH	EXHAUST
RET	RETURN

ROOM # HOOD #	VAV N OR S	CFM FROM CORR.	#1 HOOD ON EXHAUST	#2 HOOD ON EXHAUST	EB CFM	EB TO	ATB MIN. CFM	ATB MAX. CFM	HOOD POSITION	ATB #/ EB #	HOOD -UP TYPE	COMMENTS
#14 HD RM. 109	N 1ST. FLR. ML.2	+72 +72 +72	-720 0 0		-72 -432 -792	VAV RET	+720 +360 H	+720 C	HOOD ON HOOD OFF H HOOD OFF C	ATB 1 EB 1	TYPE A MAX COOL = HOOD ON	
#16 & #18 HD RM. 114	S 1ST. FLR. ML.3	+152 +152 +152 +152	-1080 -1080 0 0	-1080 0 0 0	0 -372 -442 -1452	LAB EXH	+2008 +928 +290 H	+1300 +1300C	BOTH HOODS ON HOOD ON H HOOD ON C HOOD OFF H	ATB 12 EB 12	TYPE F 2 HOOD MAX COOL & HOOD ON ATBDIFF	
RM. 114C	S 1ST. FLR. ML.2	+100 +100 +100	-1080 0 0	SEPARATE PERCHLORIC HOOD FAN	0 -250 -1080	LAB EXH	+980 +150 H	+980 C	HOOD ON HOOD OFF H HOOD OFF C	ATB 56 EB 56	TYPE A 1 HOOD MAX COOL = HOOD ON	
RM. 122A	S 1ST. FLR. ML.3	+70 +70 +70	-1080 0 0		0 -395 -720	LAB EXH	+1010 +325 H	+650 C	HOOD ON HOOD OFF H HOOD OFF C	ATB 89 EB 89	TYPE B MAX COOL < HOOD	
RM. 302	N 3RD. FLR. ML.5	+140 +140 +140 +140	-720 -720 0 0		0 -828 -540 -1548	EXH	+580 +400 H	+1408 +1408 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 17 EB 17	TYPE C 1 HOOD MAX COOL > HOOD ON	
RM. 312	N 3RD. FLR. ML.5	+65 +65 +65	-1140 0 0	ISOTOPE INTERGAL FAN&HI FILT	0 -170 -780 -1232	LAB EXH	-1075 -105 H	+715 C +1776 C	HOOD ON HOOD OFF H HOOD OFF C	ATB 39 EB 39	TYPE B 1 HOOD MAX COOL < HOOD	AIR QTY. CHANGED 5/22/87
RM. 324	N ML.5	+176 +176 +176 +176	-720 -720 0 0		0 -539 -1952	LAB EXH	+544 +363	+1776 C +1776 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 72 EB 72	TYPE C 1 HOOD MAX COOL > HOOD ON	
RM. 328	S ML.6	+168 +168 +168 +168	-720 -720 0 0		-1124 0 -506 -1844	LAB EXH	+552 +338	+1676 +1676 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 35 EB 35	TYPE C 1 HOOD MAX COOL > HOOD ON	AIR QTY. CHANGED 7/17/87
RM. 332	S ML.6	+120 +120 +120 +120 +120 +120	-720 -720 -720 0 -1080 -1080	-1080 0 0 -1080 0 0	0 -600 0 -240 -400 -1320	LAB EXH	+1680 +600 +960 +280	+1200 +1200 +1200 +1200	BOTH HOOD ON #1 HOOD ON H #1 HOOD ON C #2 HOOD ON H #2 HOOD ON C HOODS OFF H HOODS OFF C	ATB 84 EB 84	TYPE D 2 HOODS	
RM. 340	S ML.6	+114 +114 +114 +114	-720 -720 0 0		-530 0 -246 -1250	LAB EXH	+606 +132	+1136 +1136 C	HOODS ON C HOODS ON H HOOD OFF H HOOD OFF C	ATB 50 EB 50	TYPE C 1 HOOD 1 MAX 2 MIN	TABLE TOP HOOD DELETED 5/22/87
RM. 344	S ML.6	+56 +56 +56	-960 0 0		0 -224 -616	LAB EXH	+904 +168	+560 +560 C	HOOD ON C HOOD OFF H HOOD OFF C	ATB 27 EB 27	TYPE B 1 HOOD	
RM. 346	S ML.6	+126 +126 +126 +126	-960 -960 0 0		-422 0 -396 -1382	LAB EXH	+834 +270	+1256 +1256 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 27 EB 27	TYPE C 1 HOOD 1 MAX 2 MIN	
RM. 412	S ML.7	+180 +180 +180 +180	0 0 0 0	-720 -720 0 0	0 -1200 -620 -1920		+540 +440	+1740 +1740	#2 HOOD ON H #2 HOOD ON C HOOD OFF H HOOD OFF C		#2 SMALL HOOD TYPE E	LARGE HOOD DELETED (1200) 5/22/87
RM. 416	S ML.7	+180 +180 +180 +180	0 0 0 0	-720 -720 0 0	0 -1200 -620 -1920		+540 +440	+1740 +1740	#2 HOOD ON H #2 HOOD ON C HOOD OFF H HOOD OFF C		#2 SMALL HOOD TYPE E	LARGE HOOD DELETED (1200) 5/22/87
RM. 440	S ML.8	+150 +150 +150 +150	-1200 -1200 0 0		-450 0 -512 -1650	LAB EXH	+1050 +362	+1500 +1500 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 45 EB 45	TYPE C 1 MAX 2 MIN	HOOD DELETED 5/22/87 CONTROLS LEFT IN PLACE
RM. 444	S ML.8	+150 +150 +150 +150	-1200 -1200 0 0		-450 0 -401 -1650	LAB EXH	+1050 +251	+1500 +1500 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 62 EB 62	TYPE C 1 MAX 2 MIN MAX COOL > HOOD ON	HOOD DELETED 5/22/87 CONTROLS LEFT IN PLACE
RM. 448	S ML.1	+160 +160 +160	-1200 -1200 0		0 -411 -1760	LAB EXH	+1040 +251	+1600 +1600 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 28 EB 28	TYPE C 1 MAX 2 MIN MAX COOL > HOOD ON	HOOD DELETED 5/22/87 CONTROLS LEFT IN PLACE
RM. 450	S ML.8	+150 +150 +150 +150	-1200 -1200 0 0		-450 0 -429 -1650	LAB EXH	+1050 +279	+1500 +1500 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 63 EB 63	TYPE C 1 MAX 2 MIN MAX COOL > HOOD ON	HOOD DELETED 5/22/87 CONTROLS LEFT IN PLACE
RM. 340A	S ML.6	+91 +91 +91	-1105 0 0		0 -1105 -223	LAB EXH	+1014 +132	+1014 +1014 C	EX FAN ON H6C EX FAN OFF C EX FAN OFF H	ATB 54	EF #11 FAN IN PENTHOUSE TYPE A	
RM. 318	N ML.5	+242 +242 +242 +242	-960 -960 0 0		-1690#2 0 -605 #1 -2650	LAB EXH	+718 +363	+2408 +2408 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 14	TYPE C	
RM. 402	N ML.7	+300 +300 +300 +300	-400 -400 0 0		-1100#2 -332 -732 -1500#1		+432 +432	+1200 +1200 C	HOOD ON C HOOD ON H HOOD OFF H HOOD OFF C	ATB 49	TYPE C1	

SEE SHEETS 6, 7 & 10

		LOUISVILLE BRANCH 1651 WATSON TRAIL JEFFERSONTOWN, KY 40299	
Field Office		1-502-267-5003	
--- REVISIONS ---			
DATE	CHANGES	JOB NAME	U OF K GLUCK EQUINE RESEARCH
4/22/87	AS BUILT	LOCATION	LEXINGTON, KENTUCKY
7/11/88	REV. 402	ARCHITECT	BICKEL GIBSON ASSOCIATES
	REV. 412 & 16	ENGINEER	PROCTOR - DAVIS - RAY
		CONTRACTOR	JEANES BROTHERS MECHANICAL, INC.
		DRAWN BY	JLF
		CHECKED BY	KR
		DATE	4/22/86
		DRAWING NO.	85-77011-8

GENERAL NOTES AND EQUIPMENT SCHEDULE

QTY	PART NO.	DESCRIPTION
1	TC-5141	LOW LIMIT THERMOSTAT
1	VK4-9313-602-4-10	1 1/2" 3-WAY HEAT VALVE
1	TKS-4014/AT-208	DISCH. SENSOR/MOUNTING KIT
7	MK-4421	DAMPER ACTUATOR
7	AM-113	CRANK ARM
7	AM-125	ROD
7	AM-132	CONNECTOR
1	AE-631	LOCAL CONTROL PANEL
1	AL-110	EP SWITCH
1	CYZP-11	SWITCH
3	PC-110	PE SWITCH
1	RKS-1001	RECEIVER CONTROLLER
7	AL-362	0-30# GAUGE
1	AKS-9044	0-100" GAUGE
1	AK-50301	SWITCHING RELAY
5	AK-51832	HIGHEST OF 6 PRESSURE
1	AK-51632	HIGHEST OF 2 PRESSURE
1	AK-40401	SWITCHING RELAY

▲ MOUNTED ON PANEL FACE

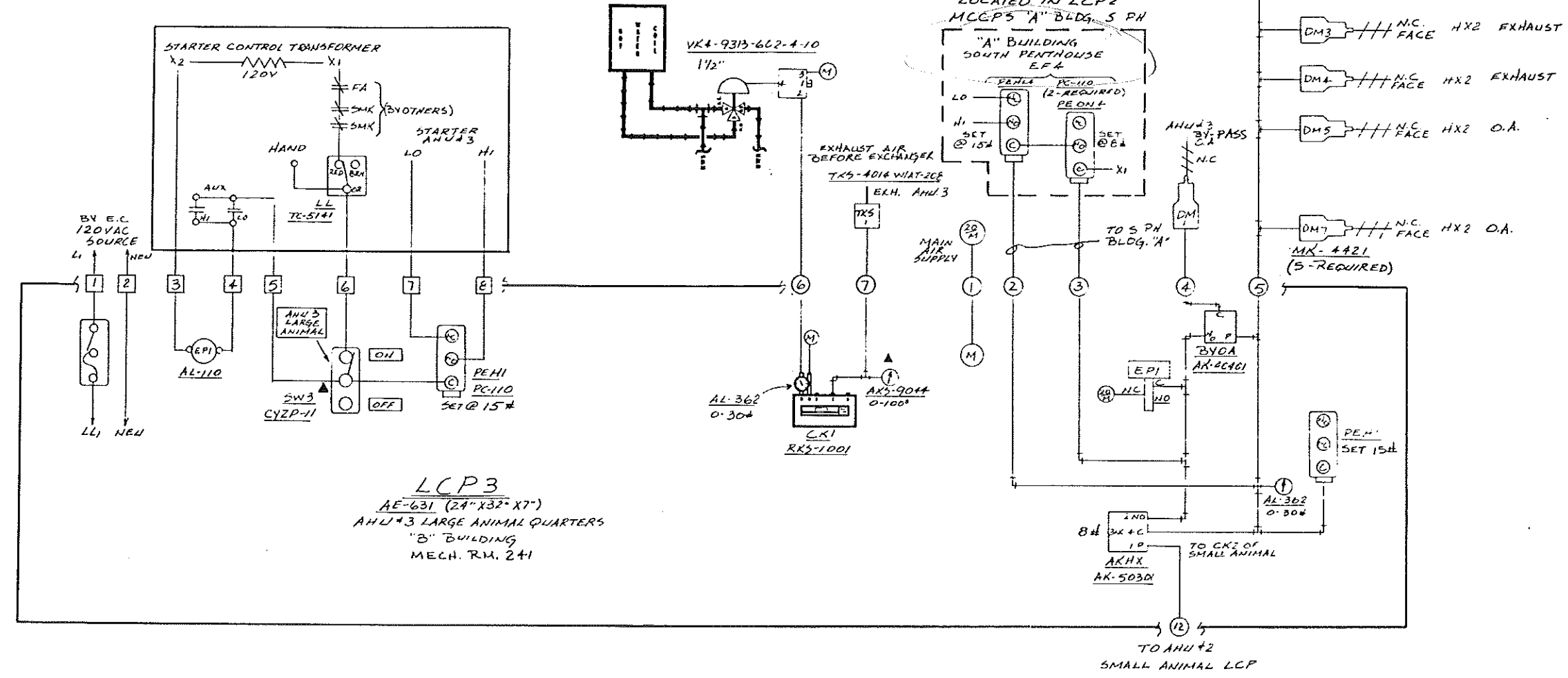
SEQUENCE OF OPERATION FOR U OF K GLUCK EQUINE RESEARCH LEXINGTON, KENTUCKY

AIR HANDLING UNIT #3 LARGE ANIMAL QUARTERS BUILDING "B"

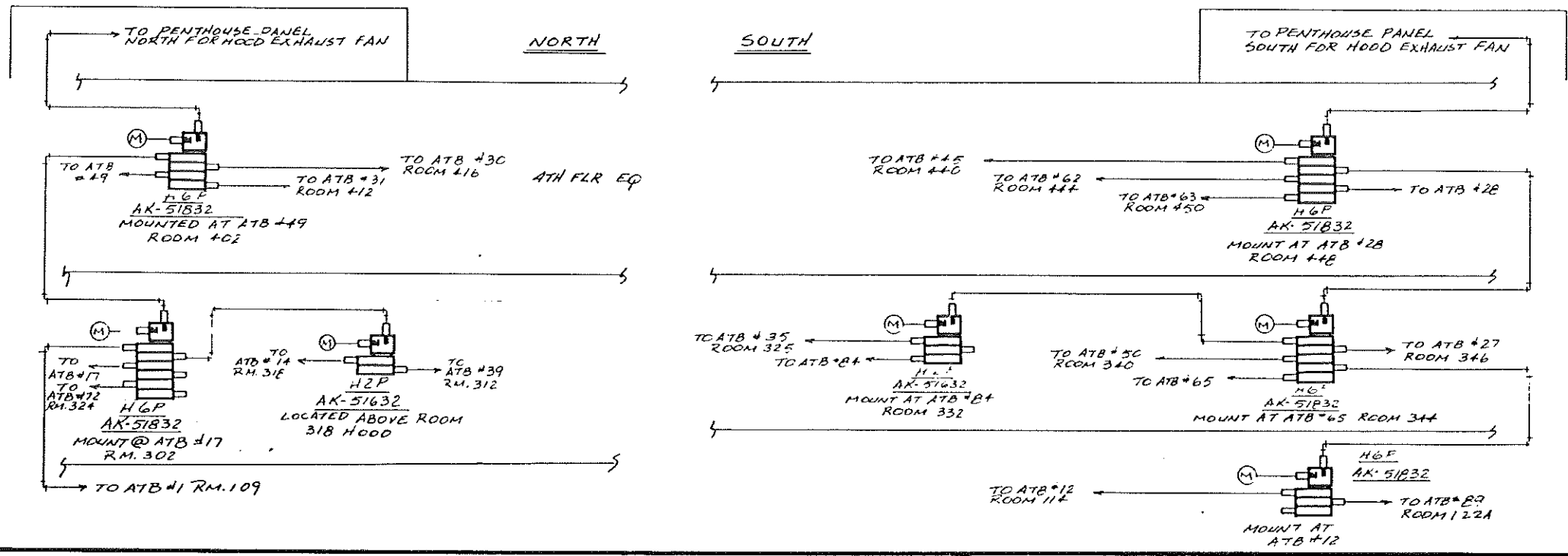
EXHAUST FAN EP4 LOCATED IN SOUTH PENTHOUSE IN "A" BUILDING WILL BE STARTED WHEN ON/OFF SWITCH IS IN THE ON POSITION. OUTDOOR AIR DAMPER WILL BE 100% OPEN. A SENSOR IN THE EXHAUST AIR WILL CONTROL THE NORMALLY OPEN 3-WAY HOT WATER VALVE. WHEN OUTDOOR AIR IS BELOW 50° FACE DAMPERS ARE OPEN TO THE HEAT EXCHANGER HX-2 AND AIR HANDLING UNIT #3 FAN RUNS ON HIGH SPEED. WHEN OUTDOOR AIR IS ABOVE 50° HX-2 IS BY-PASSED AND AIR HANDLING UNIT #3 FAN RUNS ON LOW SPEED. SMOKE DETECTION IN THE SUPPLY AND EXHAUST AIR AND LOW LIMIT SET AT 38° IN THE DISCHARGE OF AIR HANDLING UNIT #3 WILL STOP AIR HANDLING UNIT AND CLOSE THE OUTDOOR AIR.

HOOD EXHAUST FAN CONTROL NORTH AND SOUTH
HOOD EXHAUST FANS WILL OPERATE ONLY IF VAV SYSTEM IS ON AND ONE OR MORE HOODS ARE OPEN. EXHAUST FAN DAMPER OPENS, STATIC PRESSURE CONTROLLER SENDS SIGNAL TO FAN SPEED CONTROLLER TO MAINTAIN A NEGATIVE STATIC.

AHU 3
IN MCCPB MECH. RM. 241 "B" BLDG.



LCP3
AE-631 (24" X 32" X 1")
AHU #3 LARGE ANIMAL QUARTERS
"B" BUILDING
MECH. RM. 241

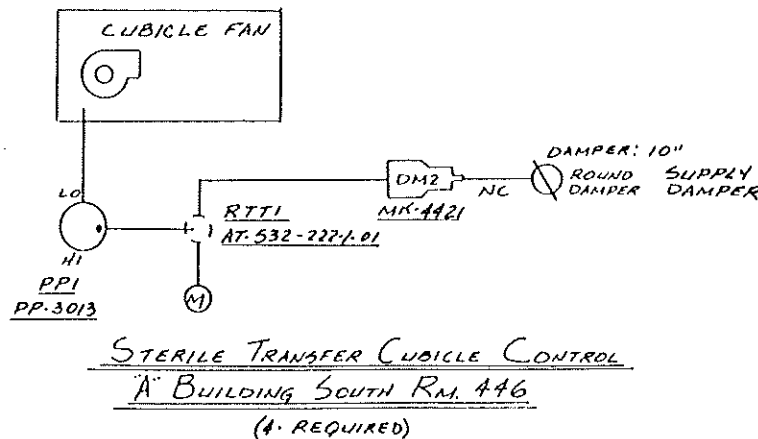
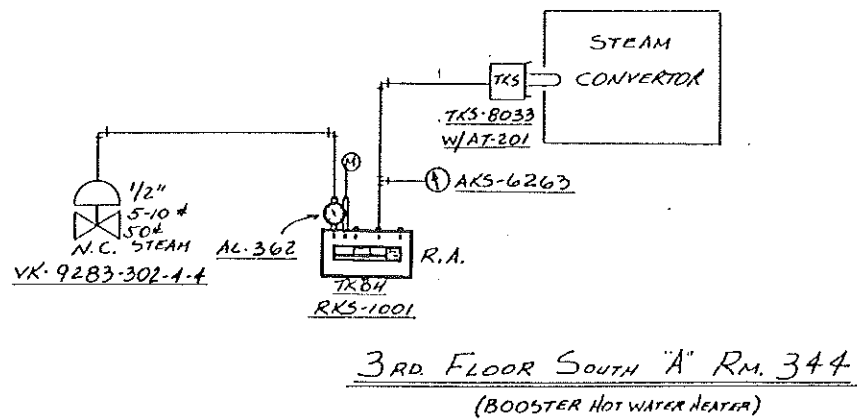
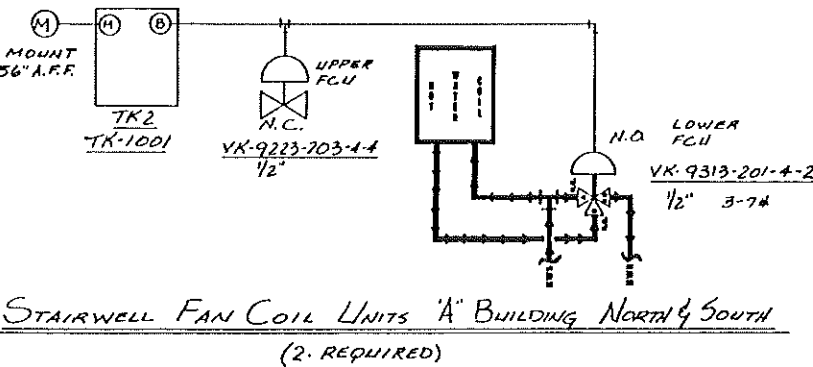
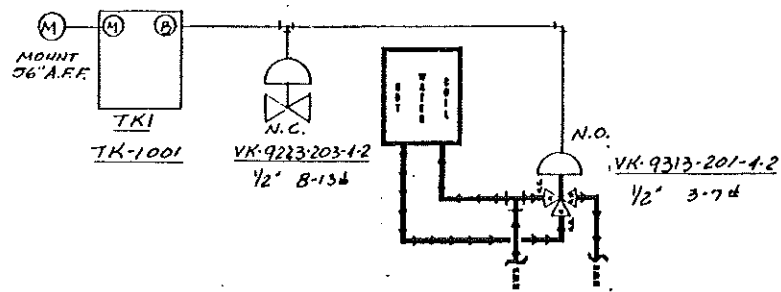
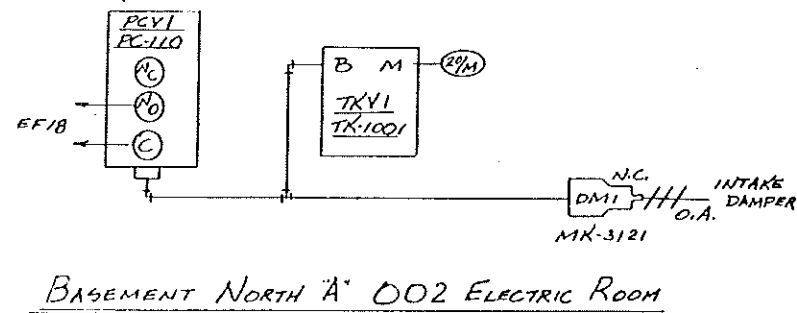
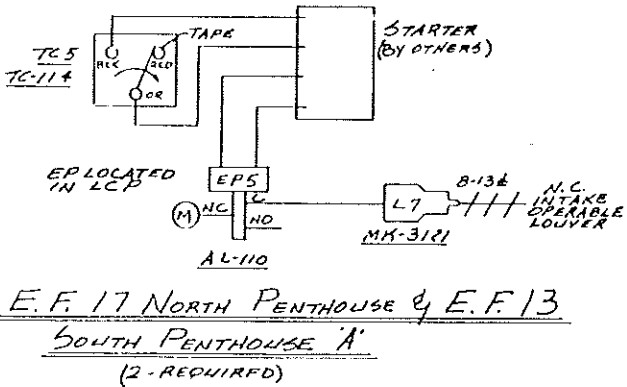
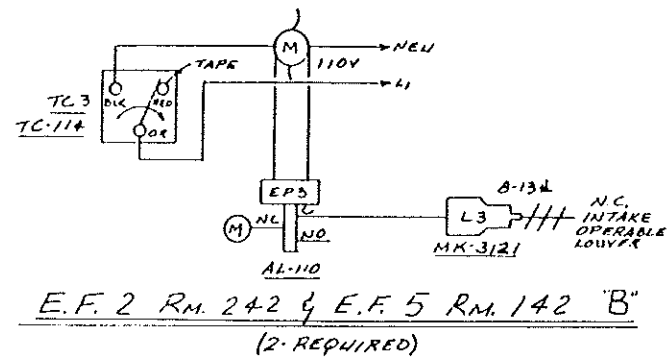


Full Office

LOUISVILLE BRANCH
1651 WATFERTON TRAIL
JEFFERSONTOWN, KY 40299
1-502-267-5003

AHU #3
RIZER TO
START EXHAUST
HOODS "A"
BUILDING

REVISIONS		JOB NAME	U OF K GLUCK EQUINE RESEARCH
DATE	CHANGES		
12/18/77	REVISED	LOCATION	LEXINGTON, KENTUCKY
7/20/77	REVISED	ARCHITECT	BICKEL GIBSON ASSOCIATES
7/14/77	ADDED STARTER	ENGINEER	PROCTOR-DAVIS-RAY
7/11/77	NOTE: SEE SHEET 85-77011-2 FOR WIRING	CONTRACTOR	JEANES BROTHERS MECHANICAL, INC.
4/30/77	REVISED	DRAWN BY	JLF
		CHECKED BY	KR
		DATE	4/30/86
		DRAWING NO.	85-77011-3



GENERAL NOTES AND EQUIPMENT SCHEDULE

QTY	PART NO.	DESCRIPTION
2	AL-362	0-30# GAUGE
4	TC-114	ROOM THERMOSTAT
5	AL-110	EP SWITCH
5	MK-3121	DAMPER ACTUATOR
15	AM-113	CRANK ARM
14	AM-125	ROD
15	AM-132	CONNECTOR
1	HA-405	DAMPER ACTUATOR
4	TK-1001	ROOM THERMOSTAT
1	RKS-1001	RECEIVER CONTROLLER
1	TKS-8033 W/AT-201	TRANSMITTER W/GAUGE
1	AT-201	WELL
3	YK-9313-201-4-2	1" 3-WAY VALVE
1	YK-9283-302-4-4	1/2" 2-WAY VALVE
1	YK-9223-203-4-2	1/2" 2-WAY VALVE
2	YK-9223-203-4-4	1/2" 2-WAY VALVE
1	PC-110	P/E SWITCH
4	MK-4421	DAMPER ACTUATOR
4	PP-3013	PRESSURE CONTROL
1	AT-532-222-1-01	RESTRICTOR TEE

SEQUENCE OF OPERATION FOR U OF K GLUCK EQUINE RESEARCH
LEXINGTON, KENTUCKY

MECHANICAL ROOM VENTILATION NORTH AND SOUTH PENTHOUSES BUILDING "B"
ROOM THERMOSTAT WILL CYCLE FAN AND OPEN OUTDOOR AIR LOUVER ON
TEMPERATURE RISE.


FAN COIL UNIT (FCU-1) ROOM 004/005 BASEMENT
ROOM THERMOSTAT MODULATES A NORMALLY OPEN 3-WAY HEATING VALVE AND NORMALLY
CLOSED CHILLED WATER VALVE IN SEQUENCE TO MAINTAIN SPACE TEMPERATURE.
OUTDOOR AIR DAMPER OPENS WHEN FAN IS ENERGIZED BY MANUAL ON/OFF SWITCH.

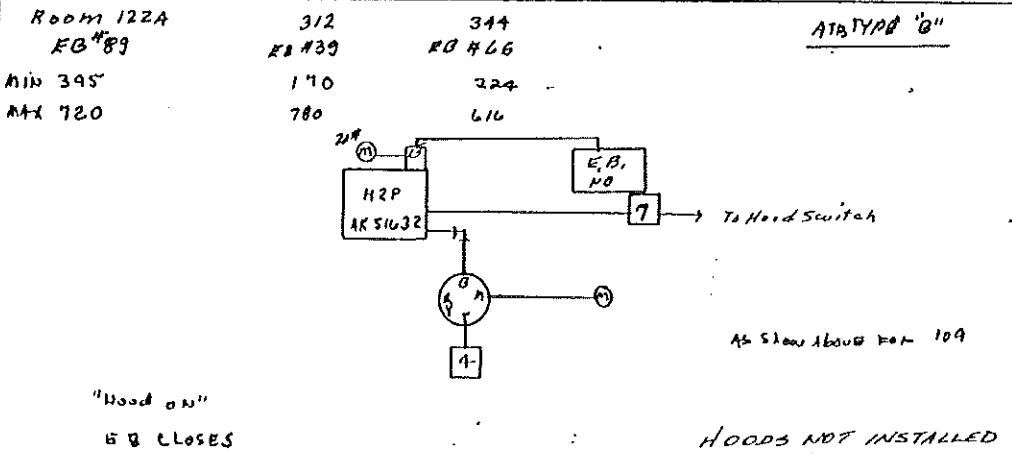
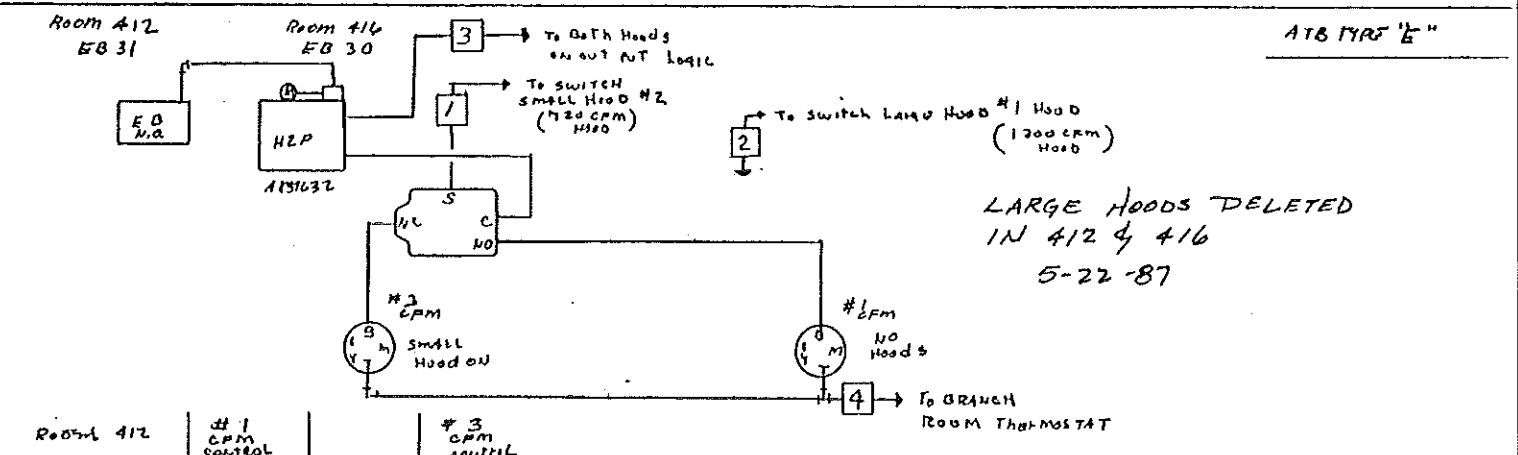
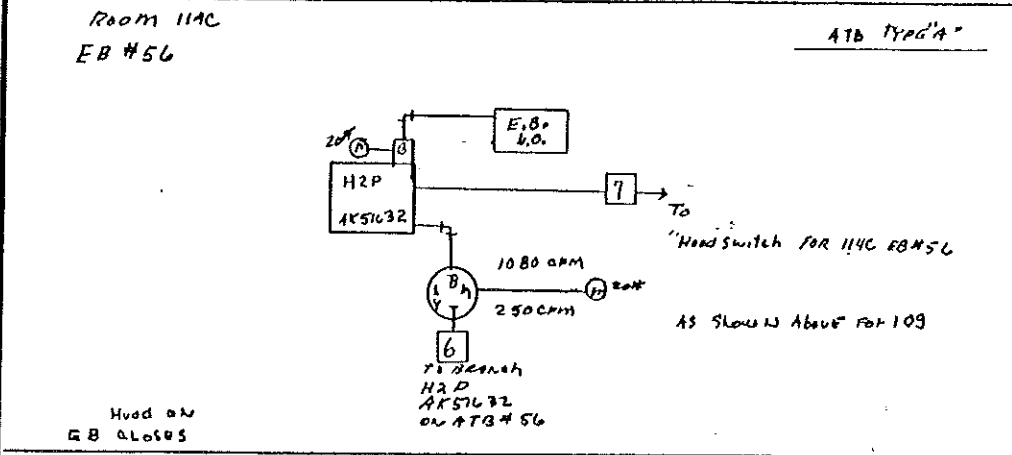
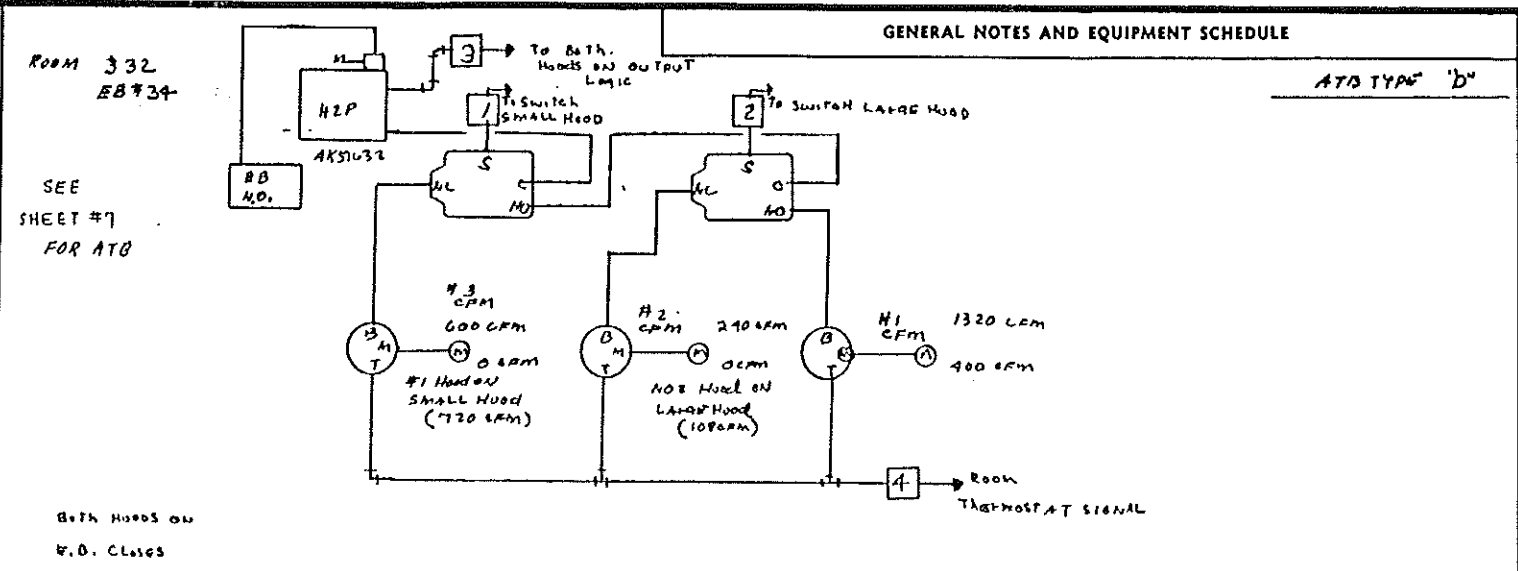
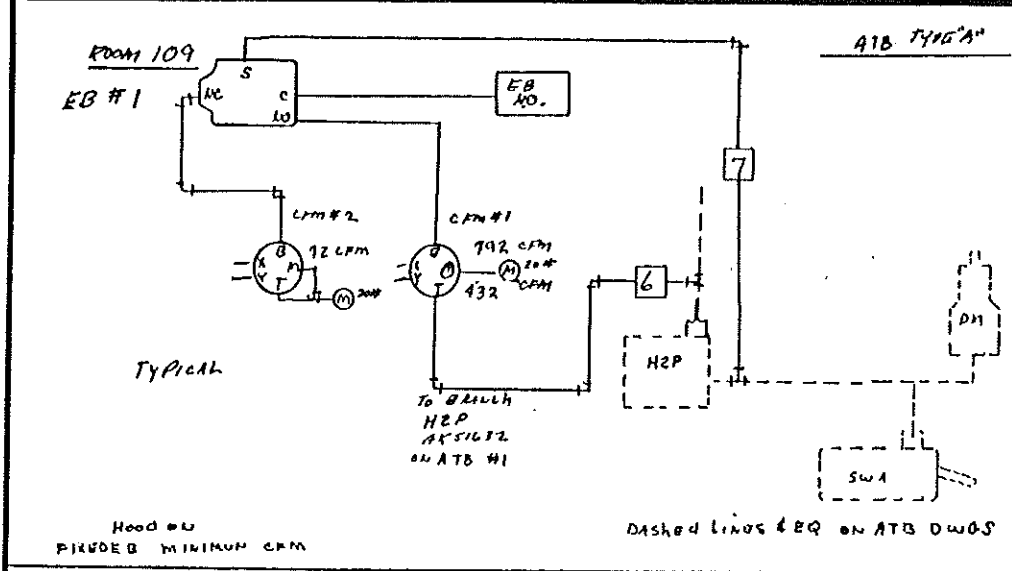
EXHAUST SYSTEM ROOM 002 EFF#18 ELECTRIC ROOM
ELECTRIC ROOM THERMOSTAT WILL CYCLE EFF#18 AND OPEN OUTDOOR AIR LOUVER L10

STEAM/HOT WATER BOOSTER HEAT CONTROL
A REVERSE ACTING THERMOSTAT (180°) WILL MODULATE A NORMALLY CLOSED STEAM
VALVE TO MAINTAIN TEMPERATURE.

STERILE TRANSFORMER CUBICLE CONTROL (ROOM 446)
WHEN CUBICLE FAN IS ENERGIZED SUPPLY DAMPER WILL OPEN.

STAIRWELL FAN COIL NORTH AND SOUTH
ROOM THERMOSTAT MODULATES NORMALLY CLOSED CHILLED WATER ON UPPER FAN COIL
UNIT AND NORMALLY OPEN 3-WAY HOT WATER VALVE ON LOWER FAN COIL UNIT TO
MAINTAIN TEMPERATURE.

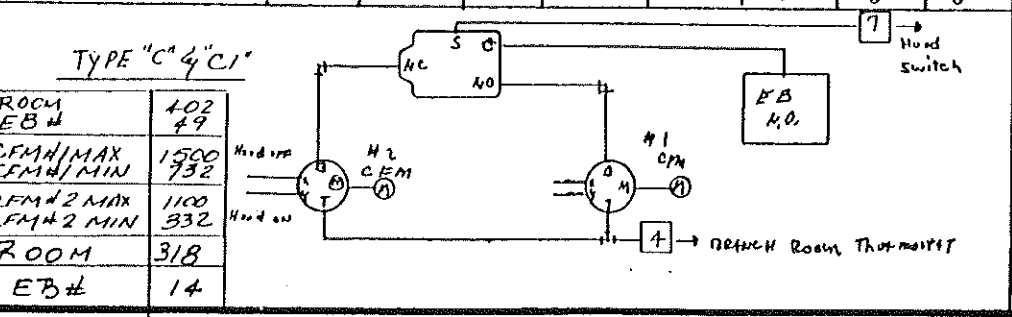
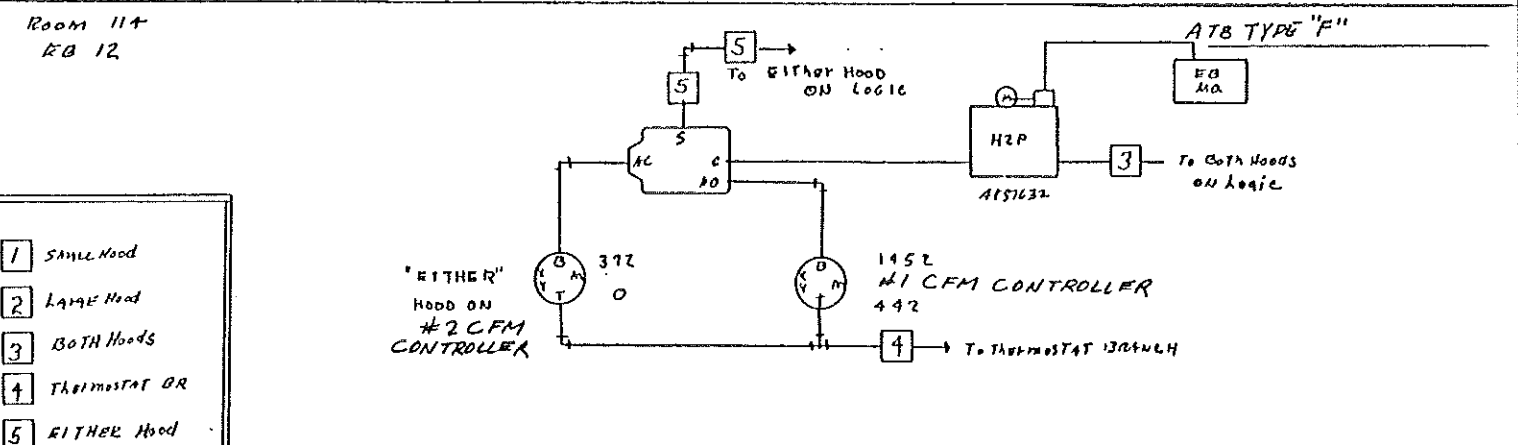
		LOUISVILLE BRANCH 1651 WATTERSON TRAIL JEFFERSONTOWN, KY 40299 1-502-267-5003	FAN COILS EXHAUST FANS HOT WATER HEATERS
— REVISIONS —			
DATE	CHANGES	JOB NAME U OF K GLUCK EQUINE RESEARCH	
4/17/85	AS BUILT	LOCATION LEXINGTON, KENTUCKY	
2/16/85	ADDP	ARCHITECT BICKEL GIBSON ASSOCIATES	
	TKBNG	ENGINEER PROCTOR-DAVIS-RAY	
	STEAM...	CONTRACTOR JEANES BROTHERS MECHANICAL INC.	
	CONTROL	DRAWN BY JLF	
	DELET	CHECKED BY KR	
	REN HW	DATE 4/17/85	
	SEQUEN	DRAWING NO. 85-77011-9	



Room	#1 CFM CONTROL	#3 CFM CONTROL
Room 412 EB CFM MAX 31 CFM MIN	1920 620	1200 0
Room 416 EB CFM MAX 30 CFM MIN	1920 552	1200 0

SMALL HOOD ON

Rooms	302	324	328	318	346	440	444	448	450
EB#	17	72	35	14	27	15	62	28	43
CFM #1 MAX	1548	1952	1896	2650	1382	1650	1650	1760	1650
CFM #1 MIN	540	539	458	605	396	512	401	411	429
CFM #2 MAX	828	1232	1176	1690	422	450	450	560	450
CFM #2 MIN	0	0	0	0	0	0	0	0	0

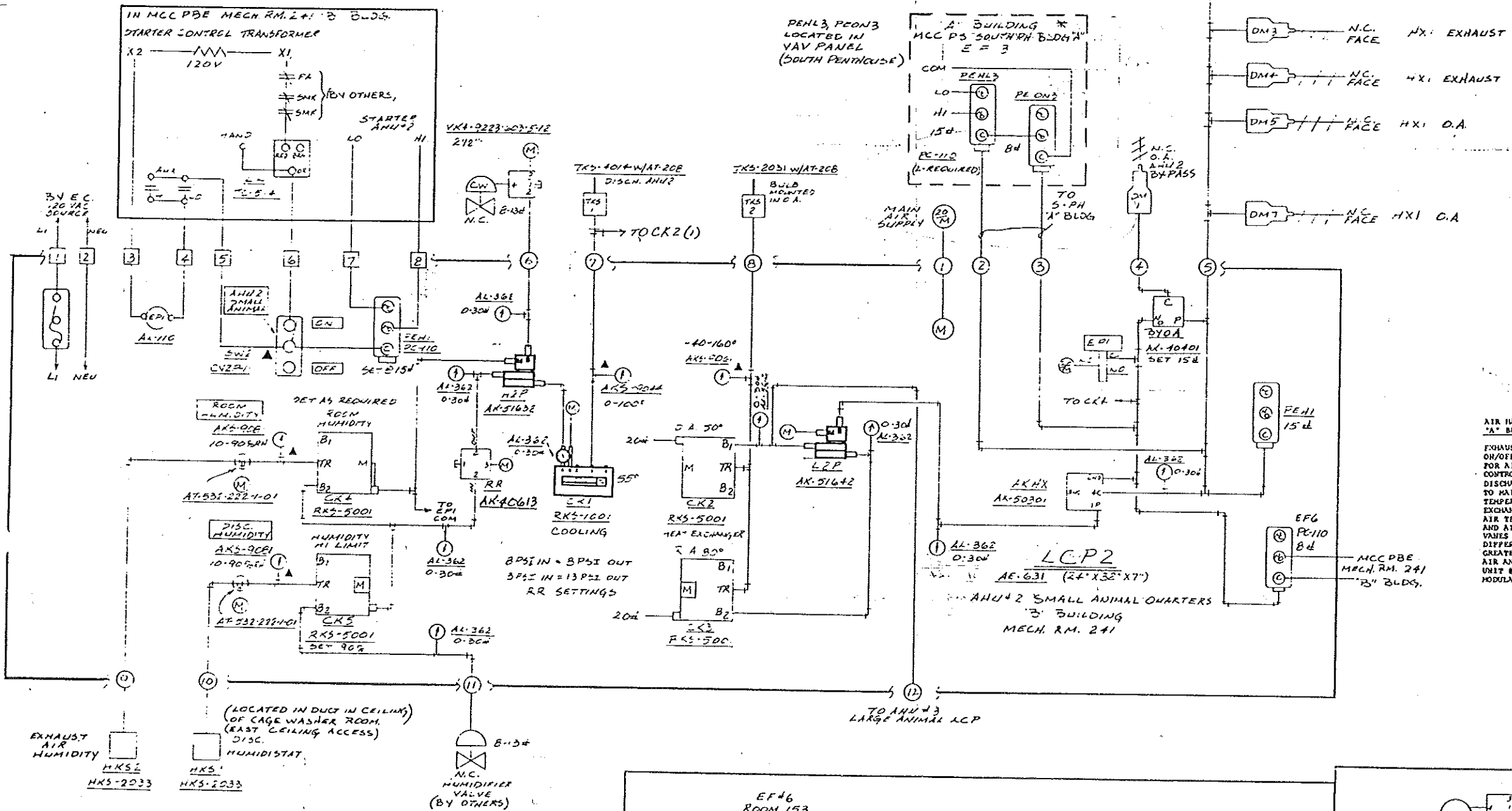


SEE SHEETS 6, 7 & 8 FOR ADDITIONAL INFO

REVISIONS		DATE	CHANGES
10-10-81	11, 46, 42, 318, 340A		
2/6/88	TYPE C/C1		
11/87	NOTES		

JOB NAME	U OF K GLUCK EQUINE RESEARCH	LOUISVILLE BRANCH	1651 WATTERSON TRAIL
LOCATION	LEXINGTON, KENTUCKY	JEFFERSONTOWN, KY	40299
ARCHITECT	BICKEL GIBSON ASSOCIATES		
ENGINEER	PROCTOR - DAVIS - RAY		
CONTRACTOR	JEANES BROTHERS MECHANICAL,		

EB BOXES	
DRAWN BY	KR
CHECKED	KR
DATE	5-22-86
	85-77011 10



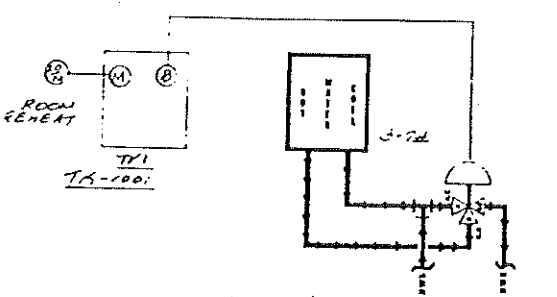
GENERAL NOTES AND EQUIPMENT SCHEDULE

QTY	PART NO.	DESCRIPTION
1	TC-5141	LOW LIMIT THERM TAT
1	VK4-9223-603-5-12	2" N.C. COOL VALVE
1	TKS-4014W/AT-208	DISCH. SENSOR W/MOUNTING KIT
1	TKS-2031W/AT-208	SENSOR W/MOUNTING KIT
7	MK-4421	DAMPER ACTUATOR
7	AM-113	DAMPER ARM
7	AM-25	ROD
7	AM-132	CONNECTOR
2	HKS-2033	HUMIDITY CONTROLLER
6	VK-9313-201-4-4	1" 3-WAY HEAT VALVE
3	VK-9313-201-4-2	1/2" 3-WAY HEAT VALVE
9	TK-1001	ROOM THERMOSTAT
1	PP-1012	DIFFERENTIAL PRESSURE
1	SC-110 SONALERT	ALARM
1	AK-40401	SWITCHING RELAY
1	VK4-9213-351-4-9	1 1/2" N.O. 2-WAY VALVE
1	AE-631	LOCAL CONTROL PANEL
1	CY2P-11	SWITCH
5	PC-110	PE SWITCH
1	AK-51632	HIGHEST OF 2 PRESSURE
1	AK-51642	LOWEST OF 2 PRESSURE
1	RKS-1001	RECEIVER CONTROLLER
4	RKS-5001	RECEIVER CONTROLLER
2	AT-532-222-1-01	RESTRICTOR TEE
2	AKS-9081	10-90% RELATIVE HUMIDITY
1	AK-50301	SWITCHING RELAY
4	AL-362	0-30# GAUGE
1	AKS-9061	-40-160° TEMPERATURE
1	AKS-9044	0-200° TEMPERATURE
2	AL-110	EP RELAYS
1	AK-40613	REVERSING RELAY

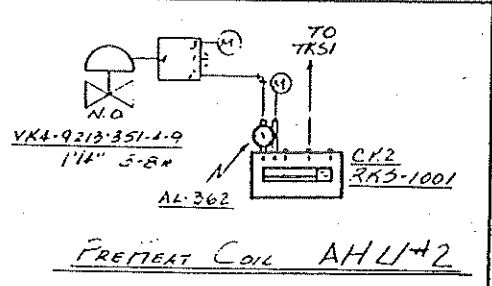
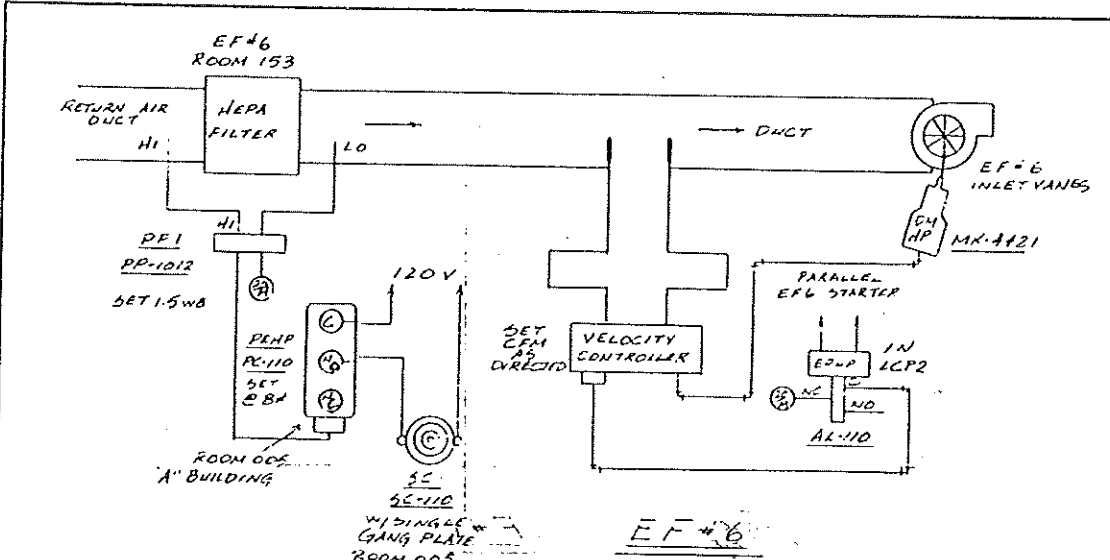
SEQUENCE OF OPERATION FOR U OF K GLUCK EQUINE RESEARCH LEXINGTON, KENTUCKY

AIR HANDLING UNIT #2 SMALL ANIMAL LAB BUILDING "B" (LOCATED IN SOUTH PENTHOUSE "A" BUILDING)

EXHAUST FAN EF#3 AND INFECTED ANIMAL ROOM 153 EXHAUST FAN#3 WILL BE STARTED WHEN ON/OFF SWITCH FOR AIR HANDLING UNIT #2 IS IN THE ON POSITION, OUTDOOR AIR DAMPER FOR AIR HANDLING UNIT #2 WILL BE 100% OPEN. THE SENSOR IN FAN DISCHARGE WILL CONTROL THE FREHEAT COIL FOR 45°F. A SENSOR IN THE FAN DISCHARGE AND ROOM HUMIDISTAT WILL CONTROL THE NORMALLY CLOSED CHILLED WATER VALVE TO MAINTAIN A 55° DISCHARGE OR LOWER HUMIDITY SPACE CONDITIONS. WHEN OUTDOOR AIR TEMPERATURE IS BELOW 50° OR ABOVE 80°, FACE DAMPERS ARE OPEN TO HX-1 HEAT EXCHANGER AND AIR HANDLING UNIT #2 SUPPLY FAN RUNS ON HIGH SPEED. WHEN OUTDOOR AIR TEMPERATURE IS ABOVE 50° AND BELOW 80° AIR HANDLING UNIT #2 RUNS ON LOW SPEED AND AIR BY-PASSES HX-1. A CONTROLLER ON EF#2 IN ROOM 153 WILL POSITION INLET VANES OF FAN TO MAINTAIN CONSTANT EXHAUST VOLUME OF AIR AS FILTER LOADS UP. A DIFFERENTIAL PRESSURE SWITCH WILL SOUND AN ALARM IN ROOM 005 WHEN DELTA P IS GREATER THAN 1.5" W.G. ACROSS PREFILTER. SHOCK DETECTION IN THE SUPPLY AND EXHAUST AIR AND LOW TEMPERATURE LIMIT SET TO 38° LOCATED IN THE DISCHARGE OF AIR HANDLING UNIT #2 WILL STOP THE AIR HANDLING UNIT AND CLOSE THE OUTDOOR AIR. ROOM THERMOSTAT MODULATES 3-WAY NORMALLY OPEN VALVES OR REHEAT COILS TO MAINTAIN SPACE TEMPERATURE.



- REHEAT COILS (9-REQUIRED)
- HCI VK-9313-201-4-4 (12") (5-REQUIRED)
 - HCL VK-9313-201-4-2 (12") (12-REQUIRED)
 - HCB VK-9313-201-4-4 (12") (1-REQUIRED)
 - HCA VK-9313-201-4-2 (12") (1-REQUIRED)
 - HCS VK-9313-201-4-2 (12") (1-REQUIRED)



LOUISVILLE BRANCH
1651 WATSON TRAIL
JEFFERSONTOWN, KY 40299
1-502-267-5003

AHU #2 REHEAT COILS
PREHEAT COIL
EF #6

— REVISIONS —

DATE	CHANGES
1/21/87	LOC. UGTE
6/19/87	AS BUILT
7/14/88	AS BUILT
7/11/88	AS BUILT
11/89	AS BUILT

JOB NAME: U OF K GLUCK EQUINE RESEARCH
LOCATION: LEXINGTON, KENTUCKY
ARCHITECT: BICKEL GIBSON ASSOCIATES
ENGINEER: PROCTOR-DAVIS-RAY
CONTRACTOR: JEANES BROTHERS MECHANICAL, INC.
DRAWN BY: JLF
CHECKED BY: KR
DATE: 4/30/86
DRAWING NO.: 85-77011-2