

4156600

855214

FROM *SNEEDEN, INC.*
Mechanical Contractors

P. O. BOX 3548 • WILMINGTON, NORTH CAROLINA 28406-3548

RETURN REQUESTED - THIRD OR FOURTH CLASS

TO

OPERATION AND MAINTENANCE MANUAL
FOR
MEDICAL/DENTAL CLINIC
MARINE CORPS BASE, CAMP LEJEUNE, NC
CONTRACT NO. N62470-85-C-5214



ENG/SIX
ASSOCIATES

architects
engineers
planners

ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA 23511

APPROVED _____
APPROVED AS NOTED _____
DISAPPROVED _____

SUBJECT TO THE REQUIREMENTS OF
CONTRACT NO. N62470-85-C-5214

APPROVAL OF A SUBMITTAL DOES NOT INCLUDE
APPROVAL OF ANY DEVIATION FROM THE CON-
TRACT REQUIREMENTS UNLESS THE CONTRACTOR
CALLS ATTENTION TO AND SUPPORTS THE DEVI-
ATION... THE CONTRACTOR SHALL BE RESPONSIBLE
FOR PROVIDING PROPER PHYSICAL DIMENSIONS
& WEIGHTS, COORDINATION OF TRADES, ETC., AS
REQUIRED.

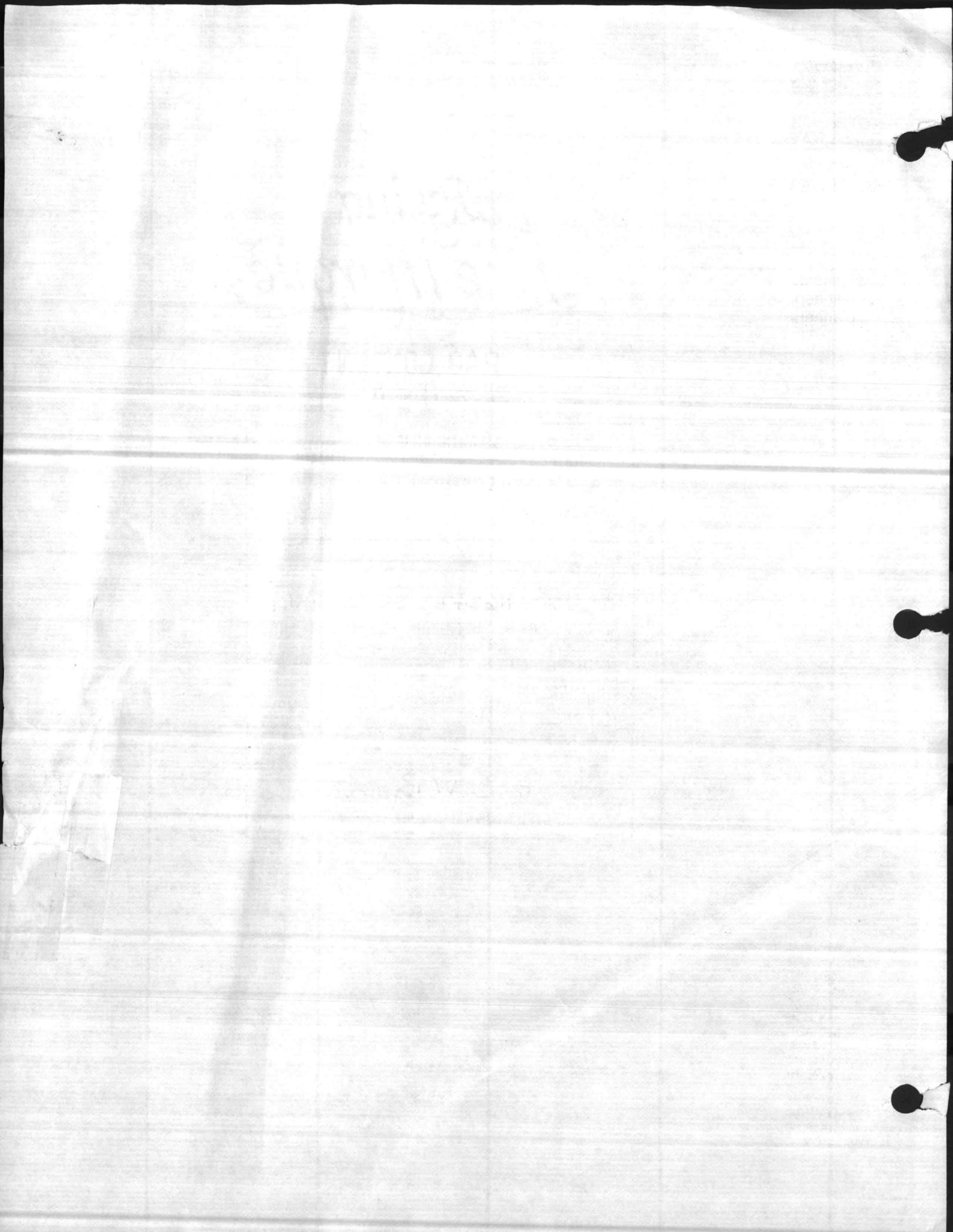
REVIEWER Barry W. Buelock DATE Nov. 10, 1988

FOR OFFICER IN CHARGE OF CONSTRUCTION

1095 HENDERSONVILLE RD.
ASHEVILLE
NORTH CAROLINA
28803-1801
704•274•1551

AN ELLIS
NAEYAERT
GENHEIMER
ASSOCIATES, INC.
COMPANY

TROY, MI
RALEIGH, NC
ASHEVILLE, NC
N. CHARLESTON, SC



OPERATION AND MAINTENANCE MANUAL

MEDICAL/DENTAL CLINIC

MARINE CORPS BASE

CAMP LEJEUNE, NORTH CAROLINA

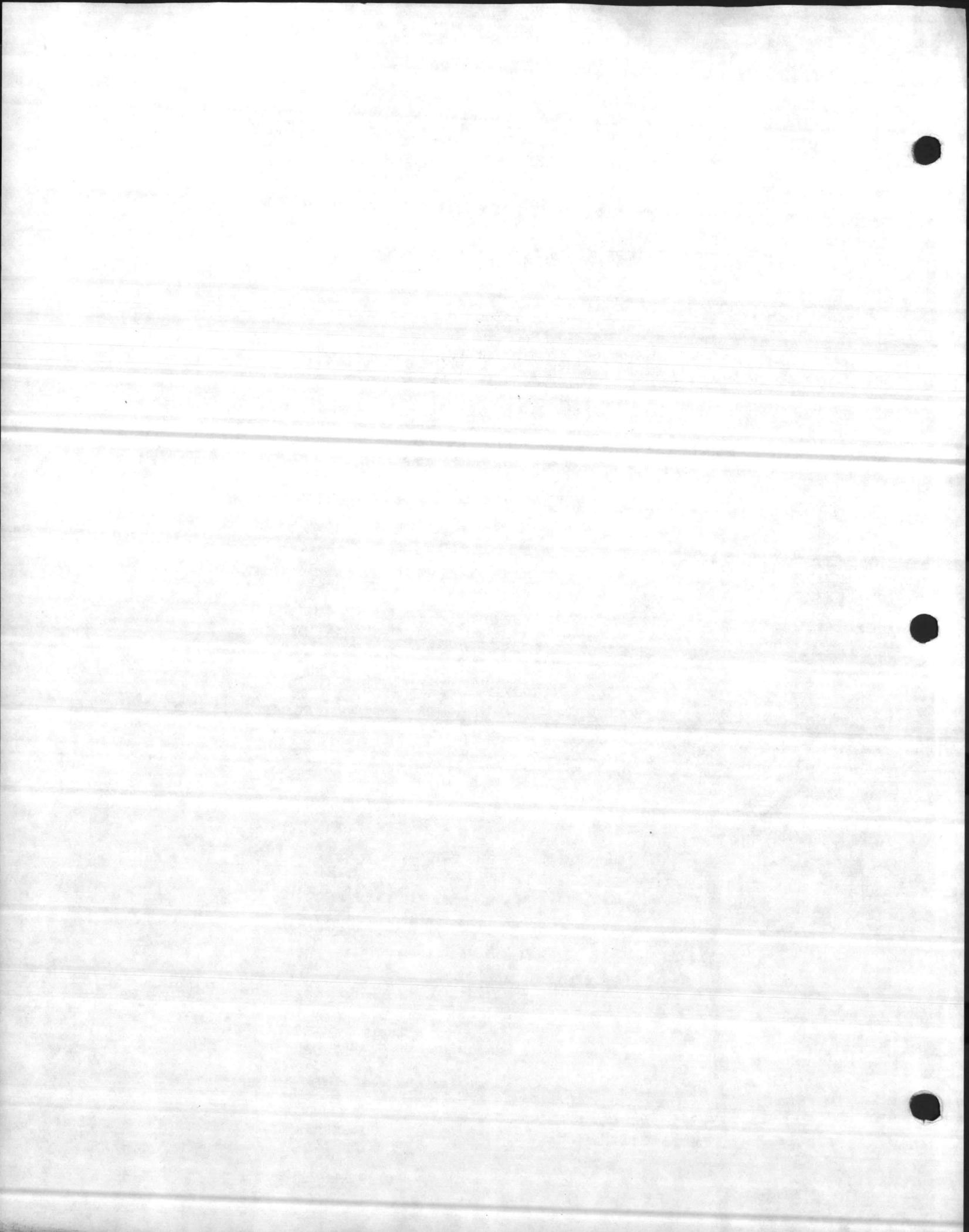
CONTRACT NO. N62470-85-C-5214

MECHANICAL CONTRACTOR

SNEEDEN, INC.

P. O. BOX 3548

WILMINGTON, NC 28406



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6. Low-Vac System
7. High-Vac System
8. Water and Steam Specialties, Converter, H.W. Heater and Pumps
9. Humidifier
10. Exhaust Fans
11. Chemical Treatment
12. Package Air to Air Energy Recovery Unit
13. Temperature Controls



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1. Local Representatives

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LOCAL REPRESENTATIVES - CONTINUED

11. Chemical Treatment

Industrial Maintenance Corp.
3520 Tryclan Drive
Charlotte, NC 28217
Phone:

12. Package Air to Air Energy
Recovery Unit

Jack Adams
Industrial Sales, Inc.
P. O. Box 311
Fuquay-Varina, NC 27576
Phone:

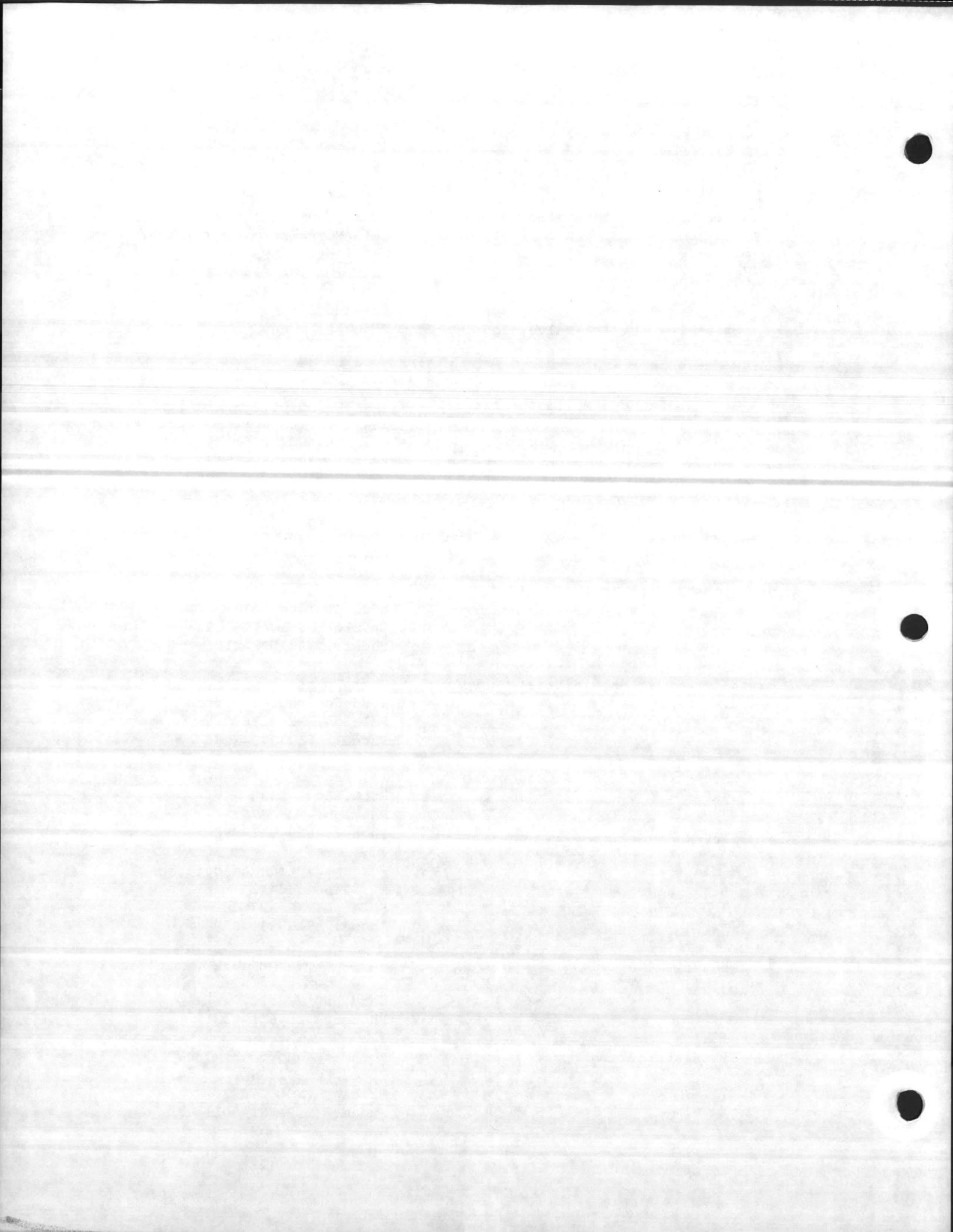
13. Temperature Controls

Triangle Automatic Controls, Inc.
6316 Angus Drive
Raleigh, NC 27612
Phone:



LOCAL REPRESENTATIVES

1. Pipe and Duct Insulation
Ellington Insulation Co., Inc.
2013 North Kerr Avenue
Wilmington, NC 28405
Phone: 919-791-7223
2. Plumbing Fixtures & Accessories,
Steam PRV, Relief Valve, and
Steam Flow Meter
Noland Company
P. O. Box 3069
Kinston, NC 28501
Phone: 800-362-7736
3. Carrier Package Multizon Unit
Thermo Industries, Inc.
1424 S. Bloodworth Street
Raleigh, NC 27611
Phone: 800-662-7548
4. Low-Vac System
Gulfstream Air, Inc.
2828 Gravey Drive
Atlanta, GA
Phone: 404-934-1061
5. High-Vac System
Patton's, Inc.
3201 Boulevard
Charlotte, NC 28209
Phone: 704-523-4122
6. Water Steam Specialties, Convertor,
H.W. Heater, Pumps
Heat Transfer Sales, Inc.
1005 Cedarhurst Drive
Raleigh, NC 27609
Phone: 919-876-3846
7. Underground Steam & Condensate
System
Del Paggio & Company
P. O. Box 25336
Raleigh, NC 27622
Phone: 919-781-6980
8. Humidifier
Morgan-Kirkman Associates
P. O. Box 33442
Raleigh, NC 27606
Phone: 919-851-0603
9. Exhaust Fans
Chet Adams Company
P. O. Box 5218
Cary, NC 27511
Phone: 919-851-6331
10. Air Distribution
Hoffman & Hoffman, Inc.
P. O. Box 32258
Raleigh, NC 27622
Phone: 919-781-8011



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2. Subcontractors

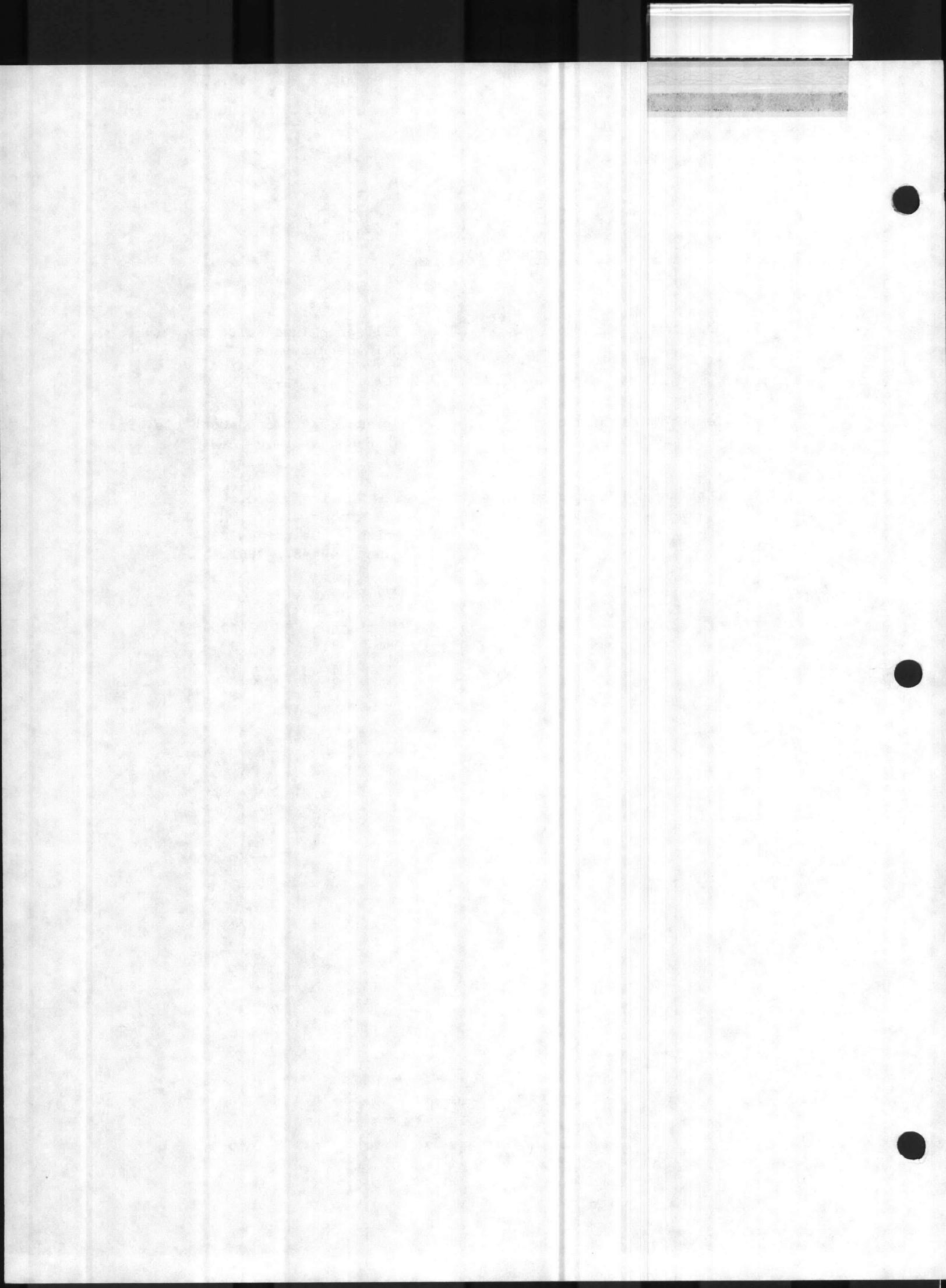
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SUBCONTRACTORS

1. Insulation Work
Ellington Insulation Co., Inc.
2013 Kerr Avenue
Wilmington, NC 28405
Phone 919-791-7223
2. Temperature Controls
Triangle Automated Controls, Inc.
6316 Angus Drive
Raleigh, NC 27612
3. Testing and Balancing Air
TAB Services, Inc.
539 Armour Circle, N.E.
Atlanta, Georgia 30324
Phone 404-872-1861
4. Utility Work
Ogden Utilities
Route 4, Box 621
Wilmington, NC 28405
Phone 919-686-7418



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3. maintenance

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TROUBLE SHOOTING AND MAINTENANCE

The following information on trouble shooting a complaint of no heating or cooling is given as a guide for someone to use. It does not list all possible troubles but does list the most common ones.

The following information on maintenance is given as a guide for the owner to use in setting up a specific maintenance schedule that will fit his particular system. This guide should be used in conjunction with and to supplement the respective manufacturer maintenance data.

The owner should note that the guide enclosed most likely contains information on some equipment that was not used in his system. This information might be useful to the owner on other buildings or systems that he maintains.

For any heating and air conditioning system to continue to operate in an energy efficient manner it is very important that the temperature control system continue to operate properly. To insure this, it is very important to perform maintenance checks on the system.



Trouble Shooting

The list described below is not meant to be an exact and complete list but is intended to give the maintenance personnel a place to start. The items listed below are the most common causes of trouble.

(A) Complete Heating and Cooling System Not Operating

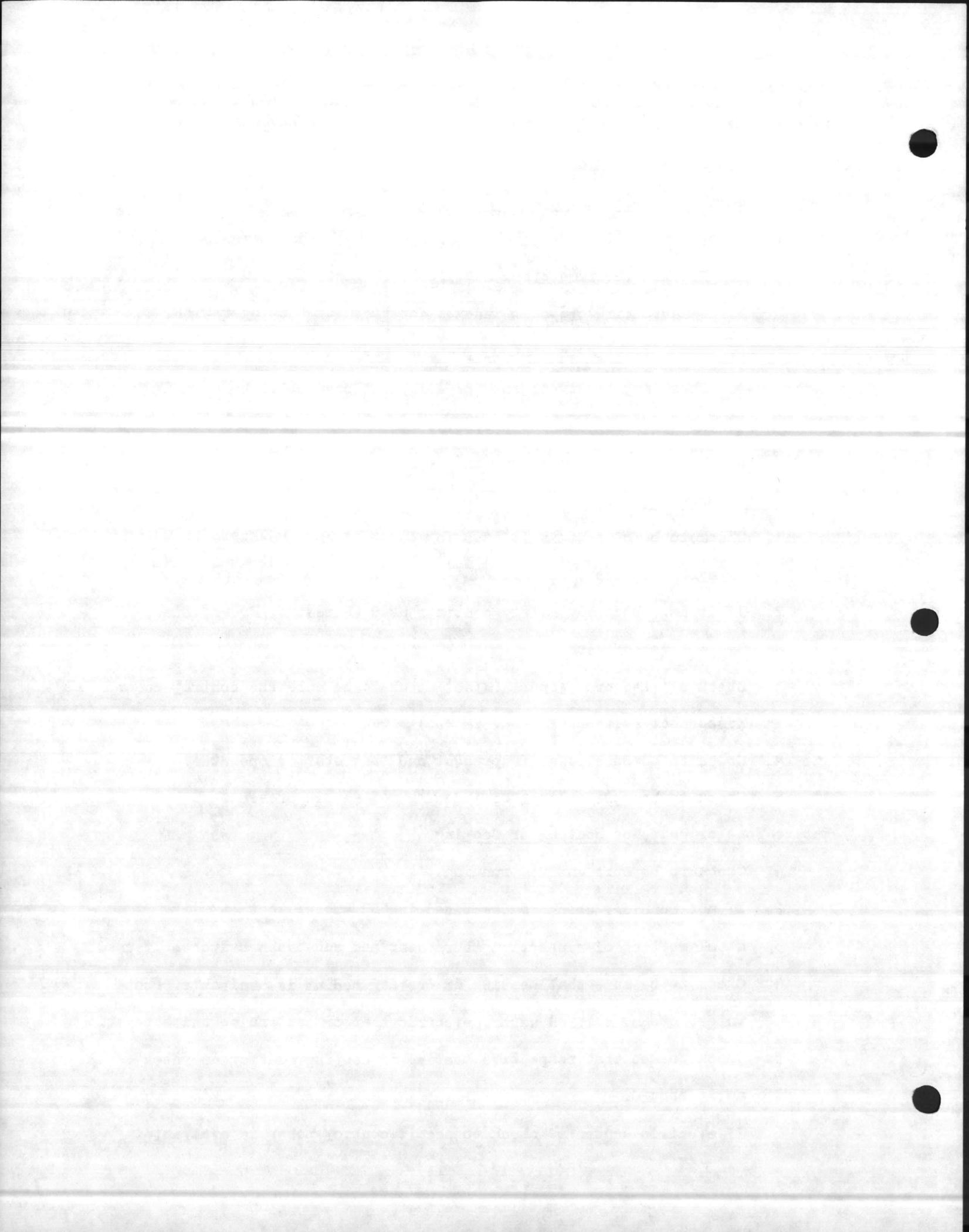
1. If the system is time clock controlled, check the following:
 - a. Be sure the time clock setting is correct.
 - b. Be sure time clock is indexed for "Day" or "On" operation.
 - c. Check to be sure control power is present.
 - d. Check any safety or outside air limit control to be sure it is operating and set properly.
 - e. Check indexing switches if used.

(B) A.H.U. Not Operating

1. Check to be sure it is indexed to operate from respective time clock or system control.
2. If it is, check any safety controls used (Firestat, Freezerstat, Smoke detector, etc.)
3. Check starter over loads. (Also, check to be sure the control power disconnect switch, if used, is on.)
4. Check to be sure power is present and that starter operates.
5. Check to be sure control or indexing voltage is present.

(C) Entire Zone or Unit Not Heating or Cooling

1. Check to be sure unit is running.
2. If not running, check as described in "B" above.
3. Check setting of respective thermostat and sub-bases switches if used.
4. Check to be sure that heating or cooling medium is available. (Hot water, steam, chilled water, electric heat or condensing unit operation.)
5. Check to see that respective heating or cooling control operates as it should.
6. If electric controls, check to see if control power is available.



If pneumatic controls, check to see if air pressure is available.

(D) A Single Zone Not Heating or Cooling

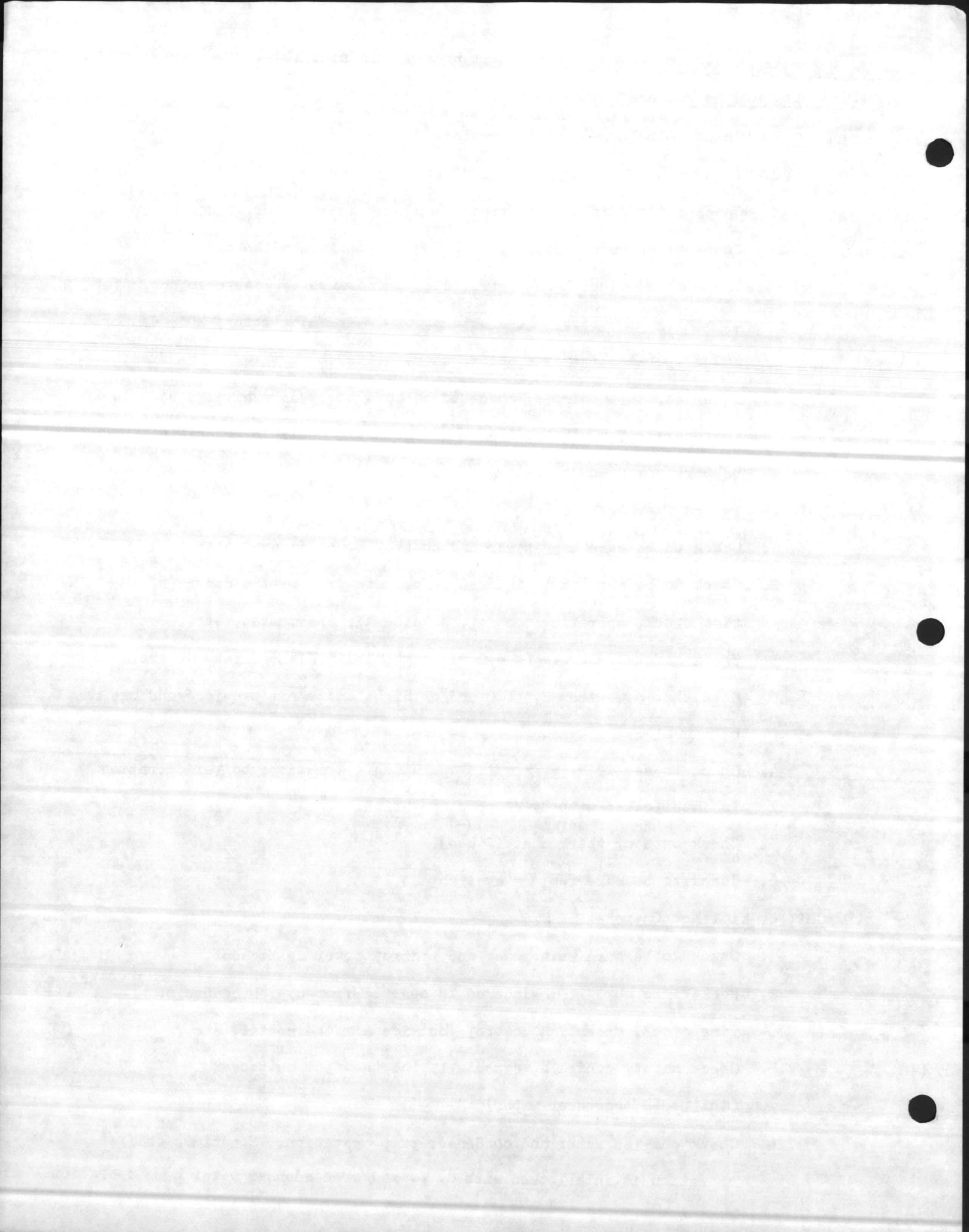
1. Check to be sure unit is running.
2. If not running, check as described in "B" above.
3. Check setting of zone thermostat and sub-base switch if used.
4. Check to be sure heating or cooling medium is available.
5. Check to see that zone control device operates (Variable volume motor on mixing box motor; H. W., steam, or C. W. valve motor; zone damper motor) operates from respective thermostats.
6. If electrical controls, check to be sure power is available to that particular zone control. If pneumatic controls, check to be sure air pressure is available.

(E) Boiler Will Not Operate

1. Check to be sure main power and control power is available.
2. Check to be sure it is indexed to operate from system controls, time clock, operating control, outside air thermostat, etc..
3. Check safety controls (L.W.C.O., High Limit, Flame Safety Controls).
Note that sometimes 2, LWCO and/or High Limits are provided and one may be manual reset type.
4. Check to see if H. W. pump is operating. Sometimes boiler operation is interlocked with H. W. pump operation.
5. Check outdoor thermostat if used.
6. Check to be sure fuel is available.

(F) Chiller Will Not Operate

1. Check to be sure main power and control power is present.
2. Check to be sure it is indexed to operate from system controls, time clock, operating control, outside air thermostat, etc..
3. Check safety controls, especially the the flow switches.
(Chilled & condenser water)
4. Check chilled water and condenser pump operation. Sometimes chiller operation is interlocked with C. W. and/or condenser water pump operation.

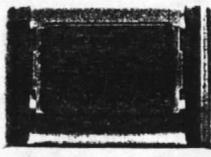


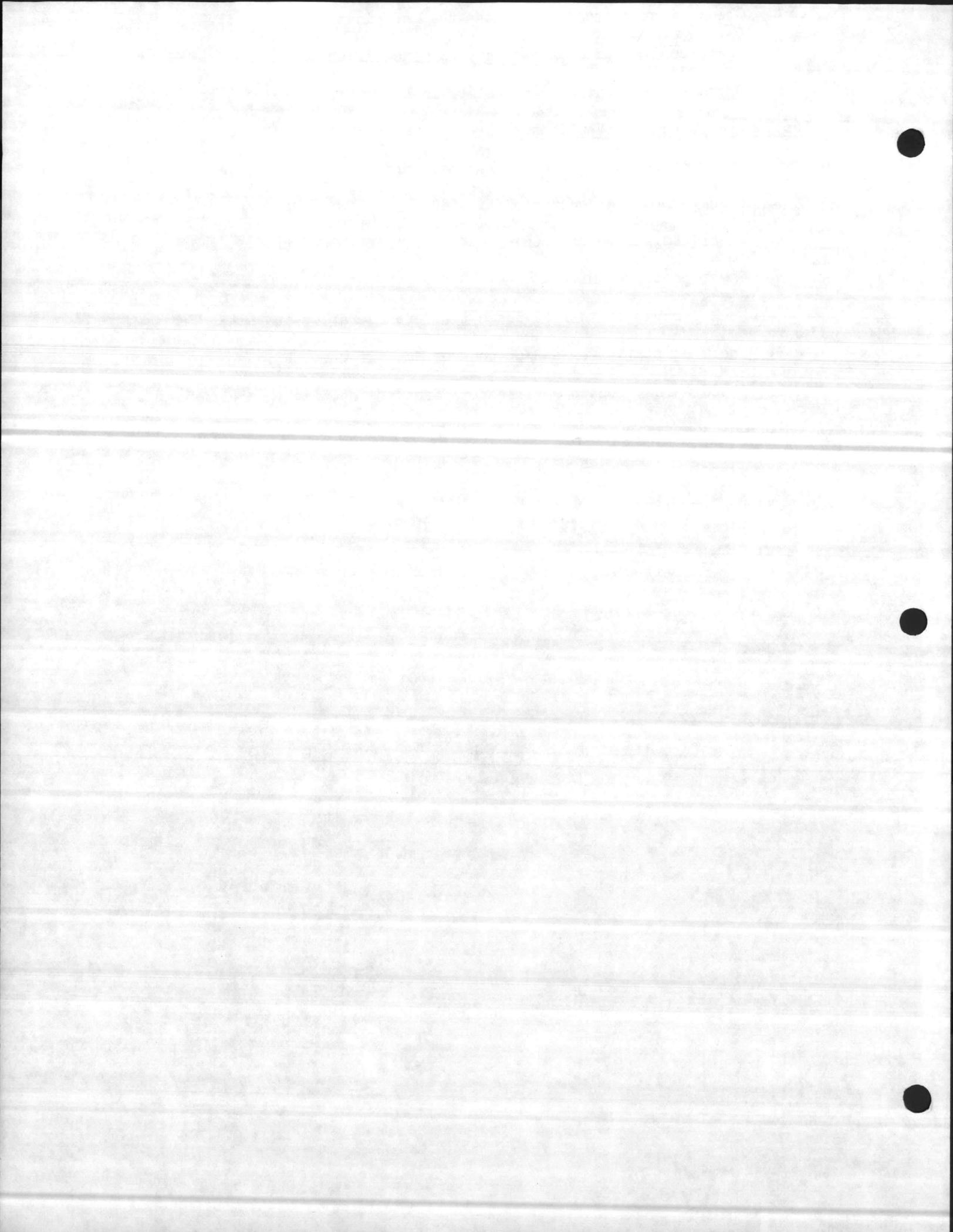
4. Check circuit breaker or fuses that are installed in unit.
5. Check control power and/or control fuse if used.
6. Check safety controls (firestat, freezerstat, smoke detector, etc.)

I - Fan Coil Unit or Unit Ventilator Will Not Operate

1. Check to be sure it is indexed to operate from respective time clock, or system controls, if used.
2. Check respective wall thermostat and subbase switch, if used.
3. Check power to unit.
4. Check circuit breaker or fuses that are installed in unit.
5. Check control power and/or control fuse if used.
6. Check safety controls (firestat, freezerstat, smoke detector, etc.)
7. Check position of fan speed switch if used.

1



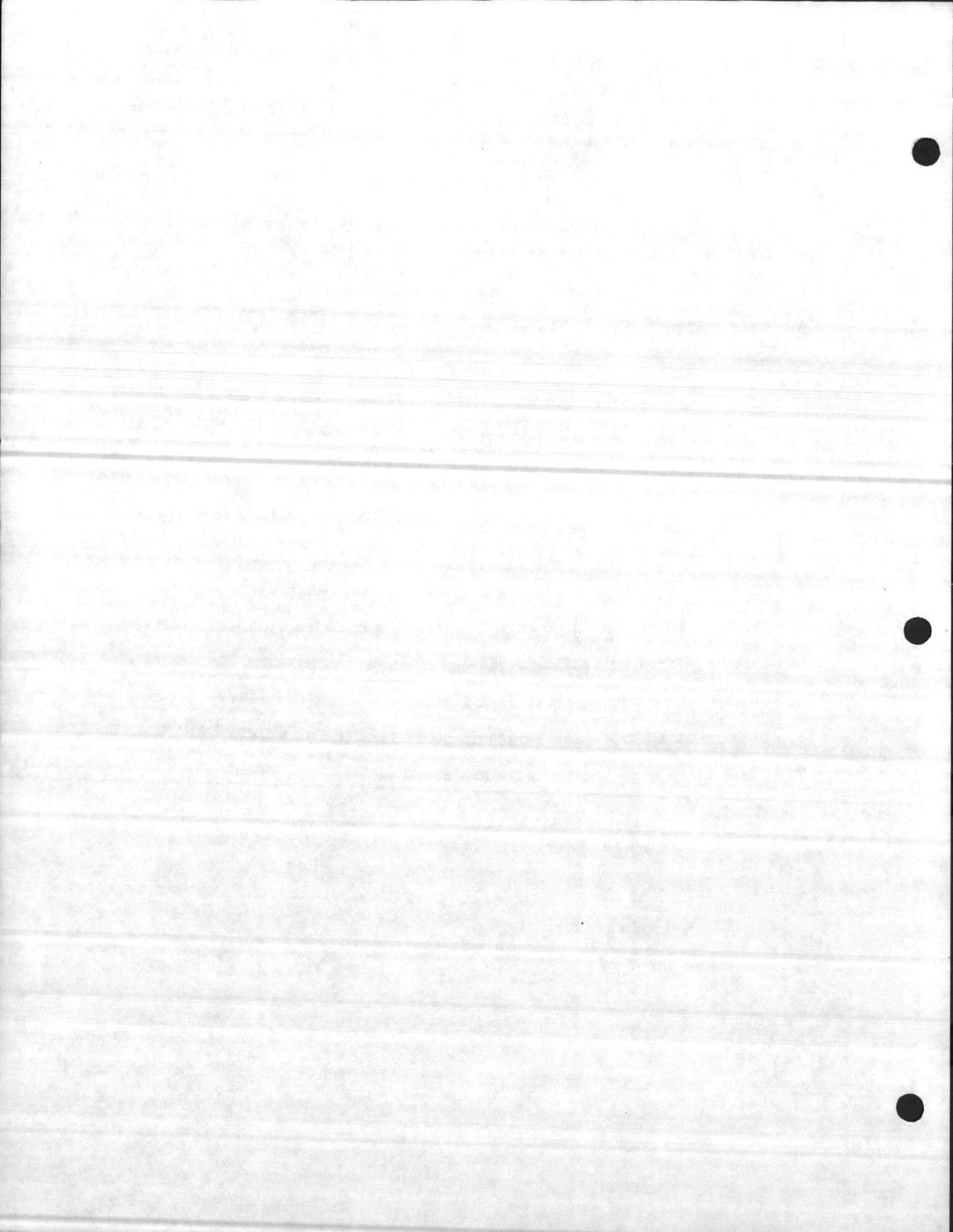


(F) Heat Pump or Condensing Unit

1. Check to be sure it is indexed to operate from respective time clock, or system controls if used.
2. Check respective wall thermostat and sub-base switches.
3. Check power to unit.
4. Check circuit breaker or fuses that are installed in unit.
5. Check control power and/or control fuse if used.
6. Check safety controls (Firestats, Freezerstats, smoke detectors, High & Low pressure switches, Timers, etc.).
7. If they are water cooled units, they may have a water flow switch and a low temperature switch.

(G) Electric Duct Heater

1. Check to be sure it is indexed to operate from respective controller and/or thermostat.
2. Check to be sure respective supply air fan is operating.
3. Check to be sure main power and control power is present.
4. Check air flow switch if provided.
5. Check auto and manual reset High Limits.
6. Check melting type High Limits in power legs inside heater.
7. Check to be sure heater coils are not open.



MAINTENANCE

Temperature Controls

The control system needs to be checked for complete and proper operation at least once each year. It is recommended that at least the following be done:

Daily- If the system is pneumatic, do the following: If no auto traps are used on the air compressor, the air tank and filter must be drained daily to prevent moisture from getting into the system.

Weekly- Check time clock operation and system indexing switches to be sure that they are set properly.

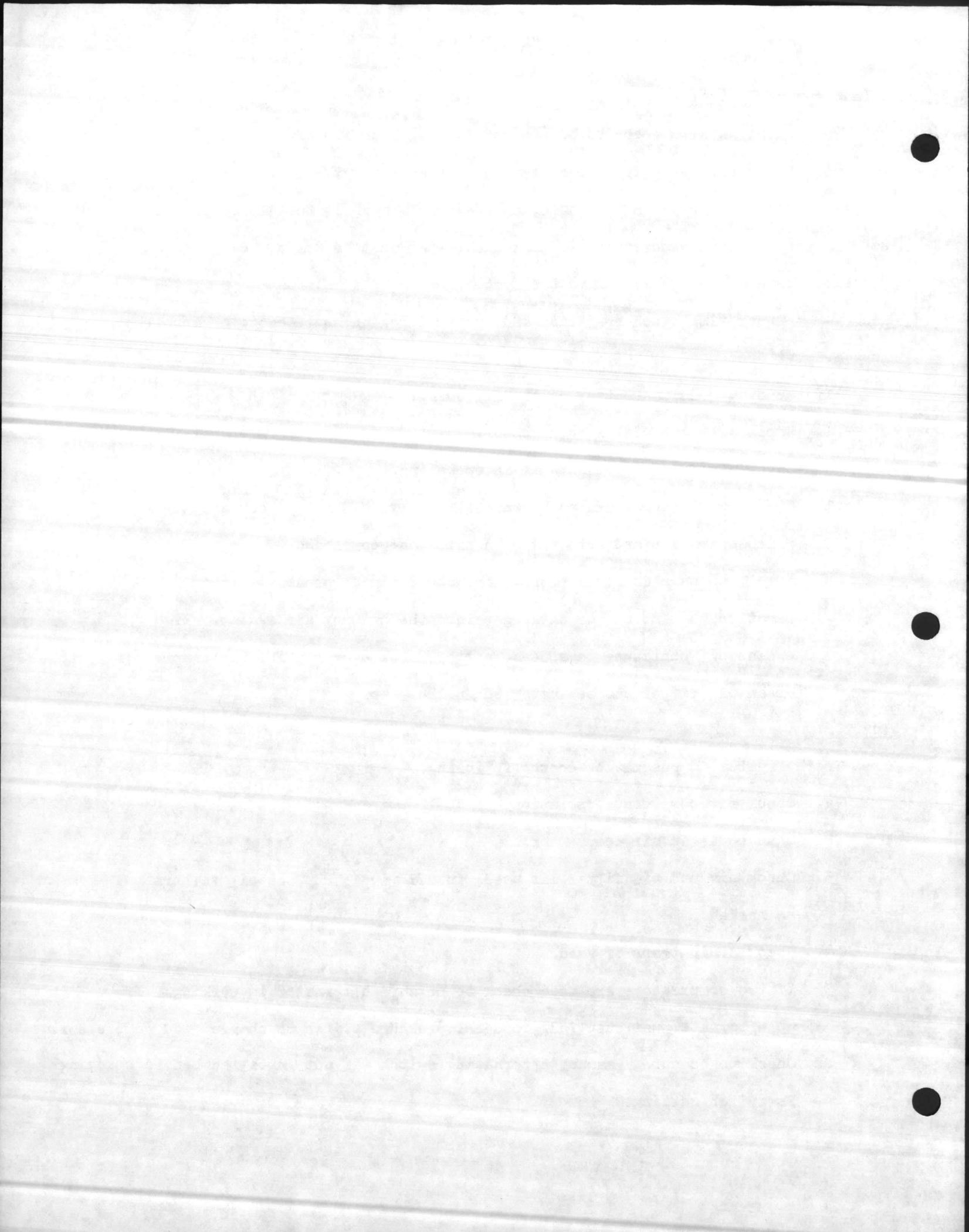
If the system is pneumatic, do the following:

1. Check oil level in air compressor.
2. Check air drier to be sure it is operating.
3. Check air filter glass to be sure it is dry. If not, check air drier operation and auto traps on drier and compressor.
4. If oil appears in air filter glass, check air compressor. It is imperative that no oil or water get into the control air system. If excess oil continues to appear, either rebuild or replace the compressor or an oil filter can be installed in the line.

Quarterly

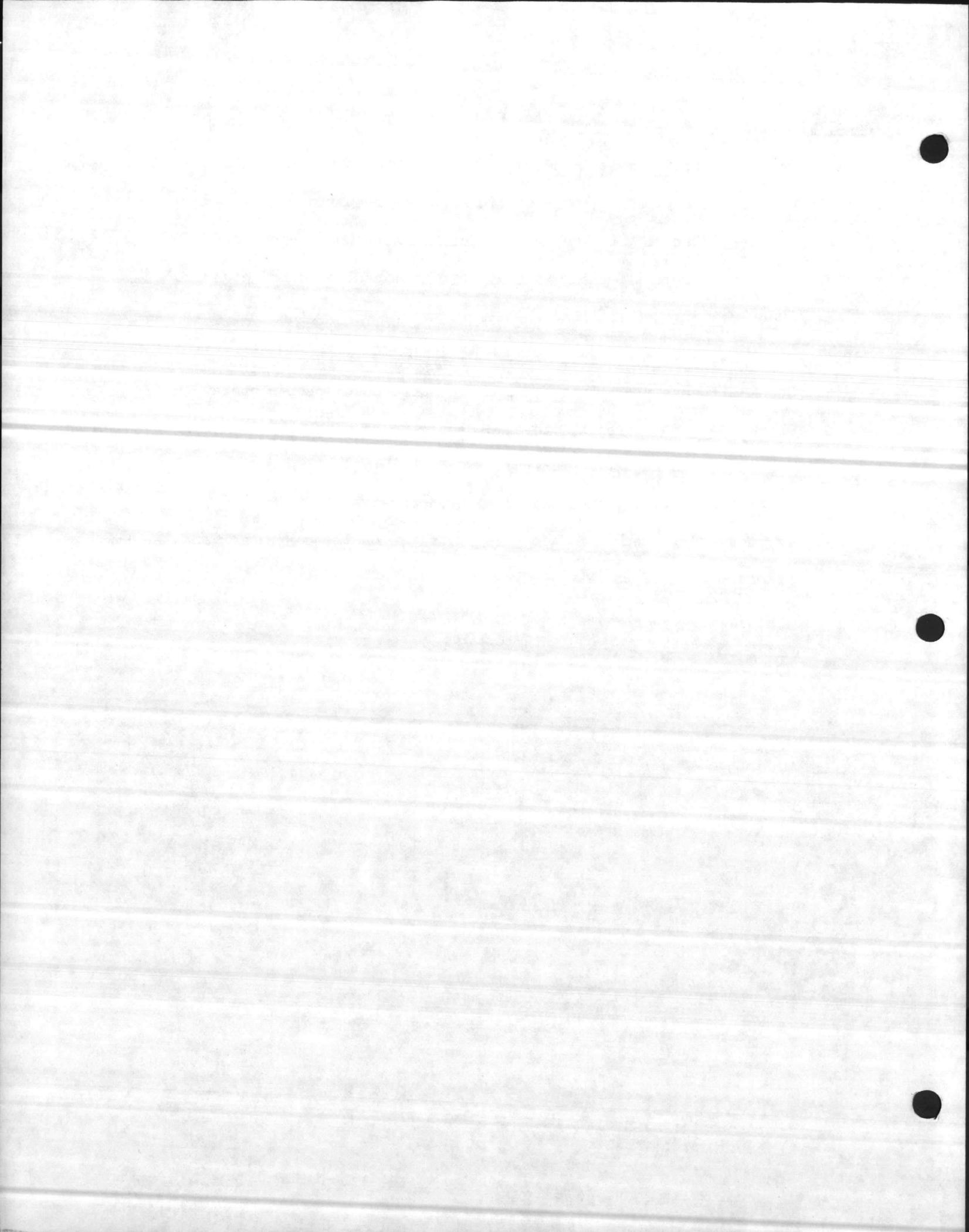
If the system is pneumatic, do the following:

1. Check air compressor operation.
2. Change oil in air compressor.
3. Check air and oil filter, if used, in air line. Replace oil filters as needed.
4. Check drain traps if used.
5. If two compressors are used check to be sure alternater is working. If no alternater was supplied, readjust pressure switch to change lead compressor. Check to be sure a manual alternating switch was not installed before changing PE switch setting.



Annually

1. Operate each thermostat and switch to be sure it operates its respective valve, damper motor, or electric motor as required.
2. Visually check all control valves for leaks around bonnet and packing nuts. Replacement packing is available from control manufacturers.
3. Check settings on all remote thermostats to be sure they are set properly.
4. Check all safety controls and smoke detectors for proper operation.
5. Check operation of each automatic damper to be sure it operates freely and that linkage is adjusted properly.
6. Lubricate control damper bearings as required.
7. If pneumatic, check the safety relief valve on the compressor and the low pressure side of the PRV.



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5214-15460-1.4.194b, 2.4.5 P.5

American Standard Inc.
United States
Plumbing Products Group
P.O. Box 8305
Trenton, NJ 08650
Telephone: 609 587-5100

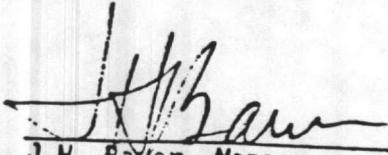
American
Standard
PURE LUXURY

September 23, 1987

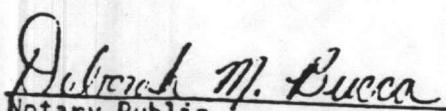
TO: WHOM IT MAY CONCERN
JOB: MEDICAL/DENTAL FACILITY

This is to certify that the following American-Standard products meet the requirements noted below:

- | | | |
|-------------------------|---|-------------------|
| 6561.017 - Urinal | - | 1½ gallon maximum |
| 2221.026 - Water Closet | - | 3½ gallon maximum |
| 2529.014 - Water Closet | - | 4 gallon maximum |
| 0373.050 - Lavatory | - | ANSI A112.19.2M |
| 9012.014 - Lavatory | - | ANSI A112.19.2M |
| 9047.093 - Service Sink | - | ANSI A112.19.2M |
| 9061.193 - Work Sink | - | ANSI A112.19.2M |
| 9512.013 - Clinic Sink | - | ANSI A112.19.2M |
| 4869.012 - Lavatory | - | ANSI A112.19.1M |


J.H. Bayer, Manager
Codes & Standards Dept.

Subscribed and sworn before me this 23rd day of September, 1987.


Notary Public

DEBORAH M. BUCCA
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires December 3, 1990



Model S1931 Combination Drench Shower/Eye Wash Unit

The combination of drench shower and eye wash fountain provides greater protection than either unit alone and greater space saving than separate units in one area.

Standard Equipment

Drench Shower

10" (254mm) diameter yellow Cyclocac plastic, Model S24-070.

Valve

Chrome plated brass 1" IPS stay-open ball valve operated by chrome plated steel pull rod with triangular handle. Pull open—push close.

Eye Wash

10" diameter yellow Cyclocac bowl, Model S90-097. Chrome plated brass yoke assembly with twin soft flow eye wash heads and protective sprayhead covers. Chrome plated 1/2" IPS stay-open ball valve, hand operated by stainless steel push flag handle. The integral flow control assures safe steady flow under varying water supply conditions.

Standard

1 1/4" galvanized steel pipe, polyurethane coated, with 9" diameter floor flange. Provisions for vertical or horizontal supply.

Water Supply

1 1/4" IPS

Identification Sign

14" x 3 1/2" sign designed for wall mounting. Reads: EMERGENCY SHOWER.

Specification Check List

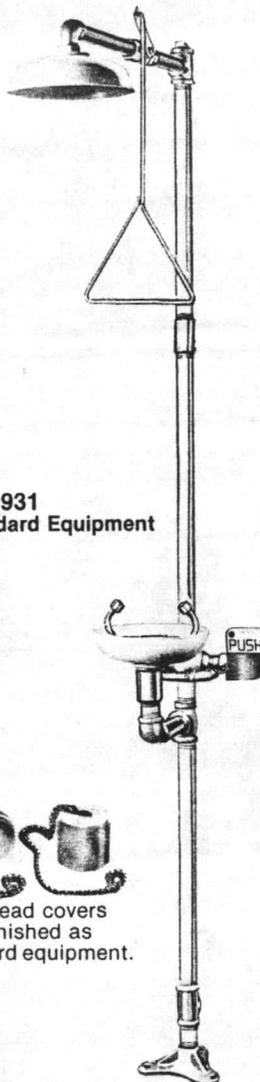
Bradley Model S1931 combination drench shower and eye wash fountain, with standard equipment, as described above.

Optional Equipment

(Check options desired)

NOTE: See Page 5/2 for complete information on Optional Equipment.

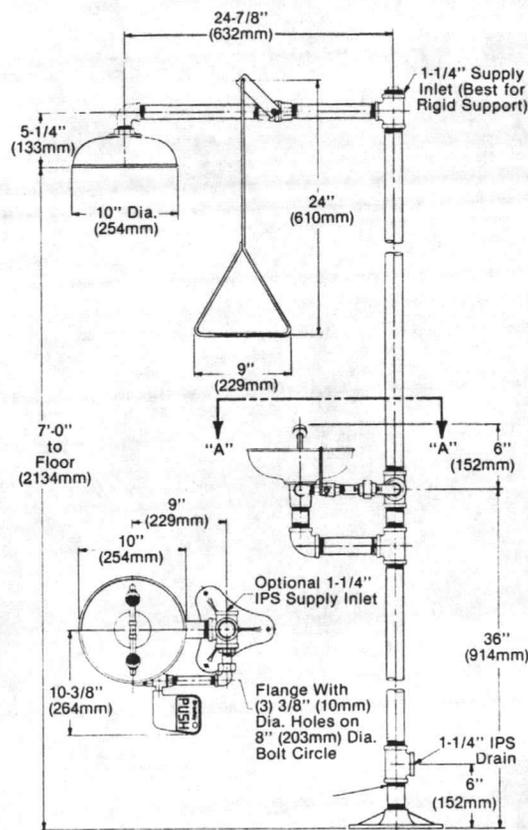
- Air Alarm Horn. **Suffix AL**
- Bradtect™ Finish. **Suffix BT**
- Double Chain Operated. **Suffix DCHO**
- Eye/Face Wash Option. **Suffix EFW**
- Face Spray Ring. **Suffix SR**
- Foot Treadle Operated. **Suffix FO** (See NOTE opposite)
- Frost-Proof — Independent Operation. SPECIFY DEPTH OF BURY REQUIRED. 18" (457mm), 36" (914mm), 48" (1219mm), 60" (1524mm), 72" (1829mm). **Suffix IOP**
- Frost-Proof Operation — Hand Operated. SPECIFY DEPTH OF BURY AS ABOVE. **Suffix HFP**
- Frost-Proof Operation — Treadle Operated. SPECIFY DEPTH OF BURY AS ABOVE. **Suffix FFP**
- Hand and Foot Operated. Self-Closing Valve. **Suffix HFO** (See NOTE opposite)
- Hand and Foot Operated with Stay-Open Valve. **Suffix HFSO**
- Self-Closing Eye Wash Valve. **Suffix SCE** (See NOTE opposite)



Model S1931
With Standard Equipment



Sprayhead covers are furnished as standard equipment.



NOTE: FIELD ASSEMBLY REQUIRED.

Model S1931
With Standard Equipment

Optional Equipment Continued

- Self-Closing Shower & Eye Wash Valves. **Suffix SCB** (See NOTE below)
 - Self-Closing Shower Valve. **Suffix SCS** (See NOTE below)
 - Single Valve Operation. **Suffix SV**
 - Stainless Steel Bowl. **Suffix SB**
 - Stainless Steel Showerhead. **Suffix SSH**
 - HOSE SPRAY (SUFFIX HS)
- NOTE: All self-closing shower and eye wash valves are hazardous for usage in emergency equipment and do not comply with ANSI Z358.1, 1981.

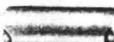
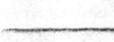
A constant water drenching to the affected body parts for a minimum of 15 minutes is required and both hands should be free to remove clothing and to hold eyelids open.

This information is subject to change without formal notice.

Emergency equipment should be tested weekly for proper operation.

WB - Wall Bracket for Hose Spray

Standard Models Available As Follows:

- | | |
|---|---|
|  | Galvanized Steel Pipes & Fittings
Specify S1931 |
|  | Chrome Plated Red Brass Pipes & Fittings
Specify S1931 CPRB |
|  | Stainless Steel Pipes & Fittings
Specify S1931 SS |

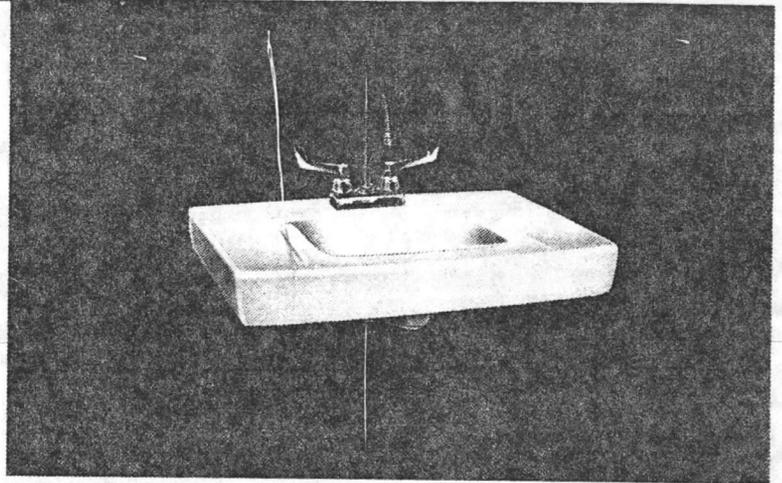
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American Standard

PURE LUXURY

15460 2.4.2 (P.2)

Surgeon's lavatory
Vitreous China

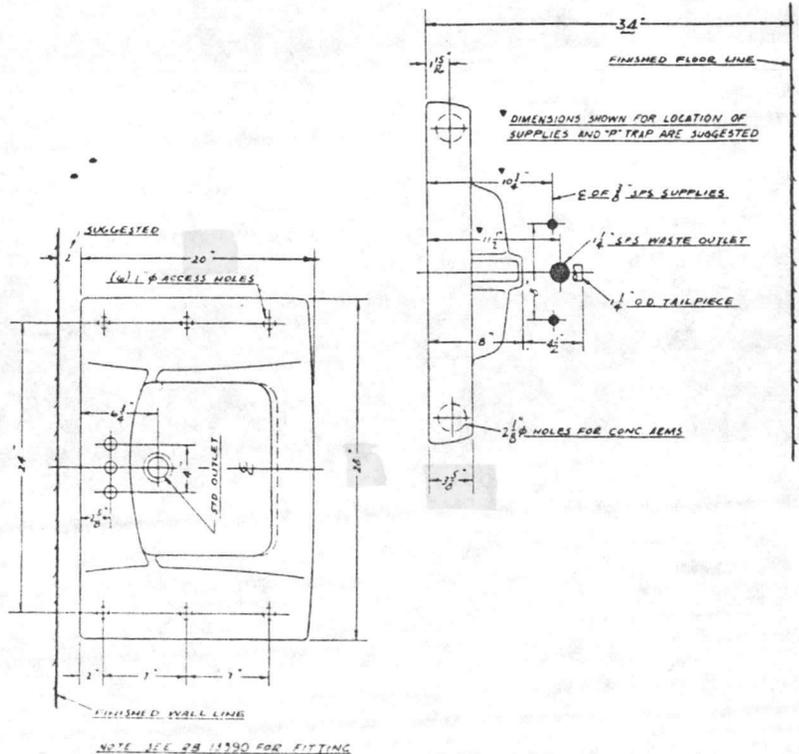


□ 9012.014

Surgeon's lavatory with front overflow for concealed arms, with faucet holes on 4" (102mm) centers. Shown with 7516.172 Heritage centerset faucet with 4" brass wrist handles and 2411.015 lavatory drain, 3/8 flex supplies and 1 1/4 O.D. x 1 1/4 SPS "P" trap. Fixture only.

bowl sizes:

12" x 14" (305mm x 356mm)



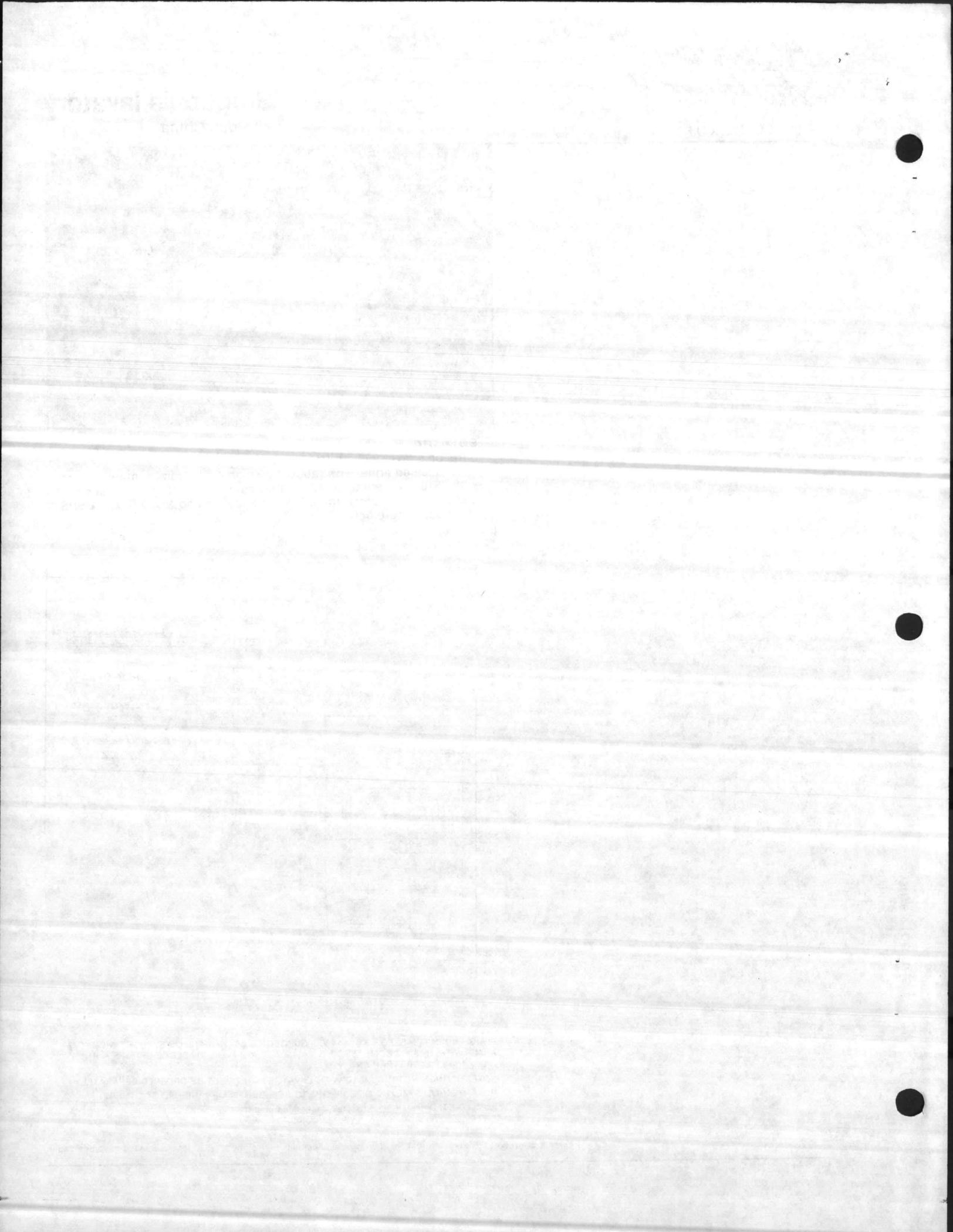
ROUGHING-IN MEAS. FOR 9012.014 V.C. SURGEON'S LAVATORY (FOR SUPPORT W/COMC. ARMS) WITH 7516.172 COMB. FITTING, 2411.015 DRAIN PLUG, 3/8 FLEX. SUPPLIES AND 1 1/4 O.D. x 1 1/4 S.P.S. "P" TRAP AND NIPPLE.

NOTE: FITTINGS NOT INCLUDED WITH LAVATORY AND MUST BE ORDERED SEPARATELY.

NOTE: METHOD & MEANS OF SUPPORT TO BE FIGURED & FURNISHED BY OTHERS.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standards A112.19.2.

These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.





THE SYMBOL OF QUALITY

2100 SOUTH NUCLEAR DRIVE • DES PLAINES, ILLINOIS 60018
312 694-4400

FILE
NUMBER

FITTING
NUMBER

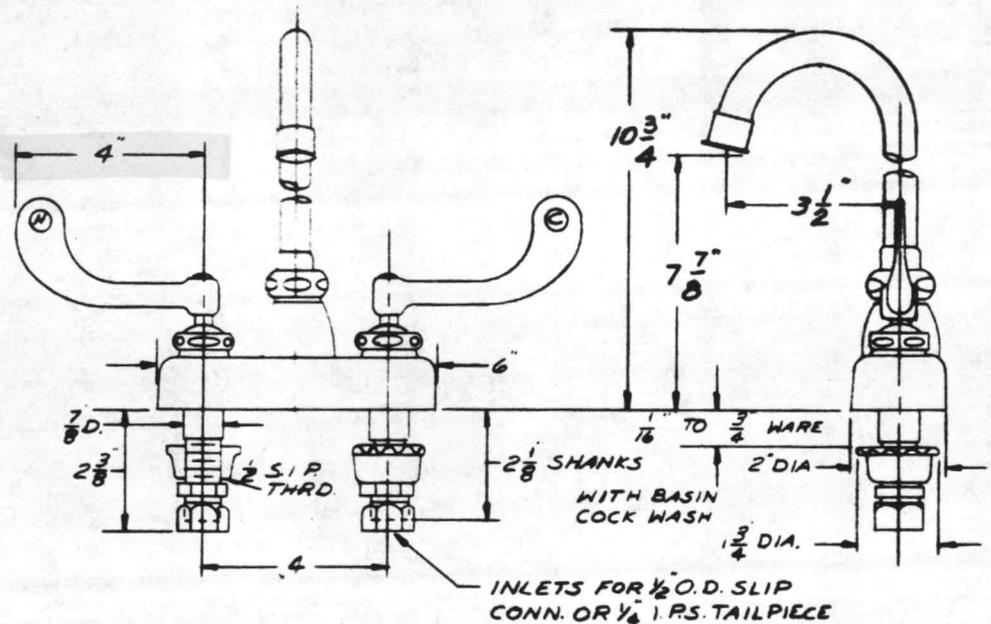
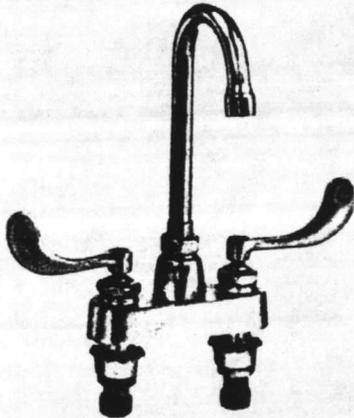
895-317

SECTION

PAGE

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Rough in dimensions may vary 1/4" plus or minus.

TECHNICAL DATA

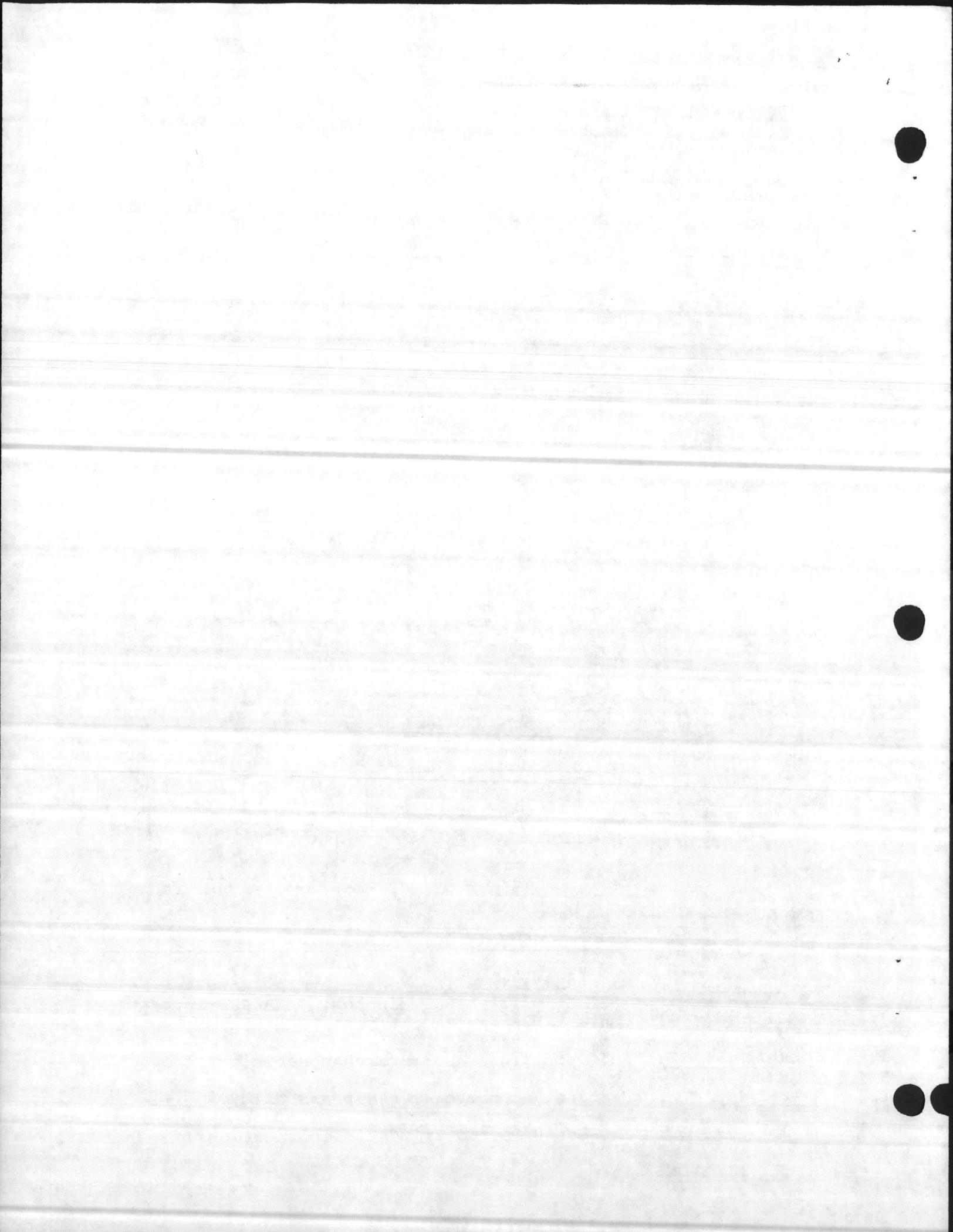
DESCRIPTION: No. 895-317 Hi-Lite centerset lavatory faucet with #317 4" wrist blade handles, GN1A-E3 rigid/swing convertible gooseneck spout with E3 Softflo outlet.

OPERATING UNIT: Self-contained and interchangeable.

MATERIAL: Casting - commercial red brass alloy.

CHROME PLATE: Exceeds U. S. Government specifications.

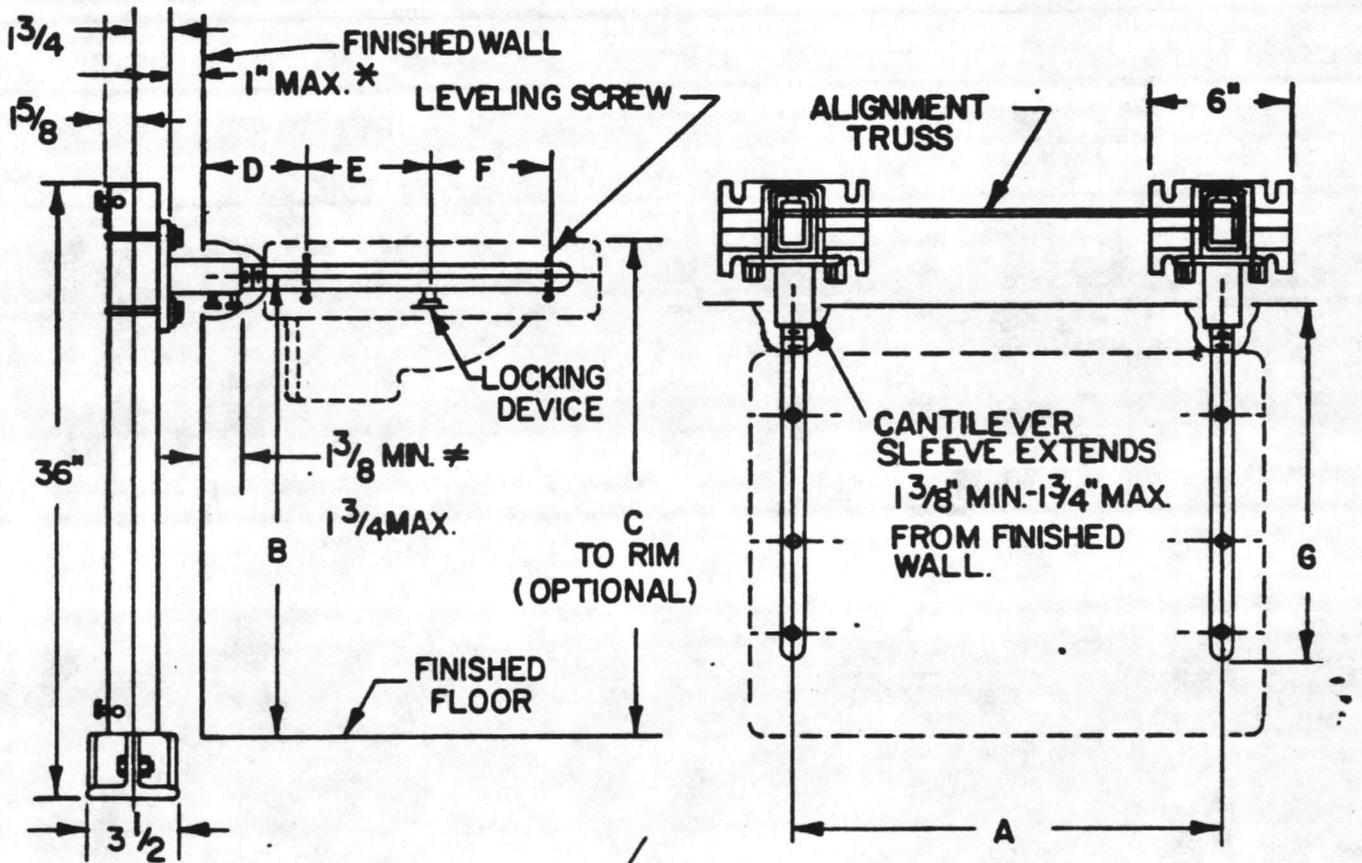
C.S.I. SECTION: 15



DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE

FOR: #9012.014

NOTE:
LETTERED DIMENSIONS TO MEET FIXTURE REQUIREMENTS.
FOR INSTALLATION-REQUEST ROUGHING-IN DRAWINGS.



REGULARLY FURNISHED

AS SHOWN, STEEL STANCHIONS, & SLEEVES.
"DURA-COATED" CAST IRON FEET, HEADERS, &
CONCEALED ARMS CAST CHROME PLATED 2"
LONG THREADED ESCUTCHEONS.

NOTE:

LAVATORY TO BE ORDERED WITH 2" MIN. OPENINGS IN REAR TO FIT CONCEALED ARMS.
≠ ADJ. SCREWS IN SLEEVE MUST BE LOCATED AT BOTTOM AS SHOWN.

FURNISHED WHEN SPECIFIED

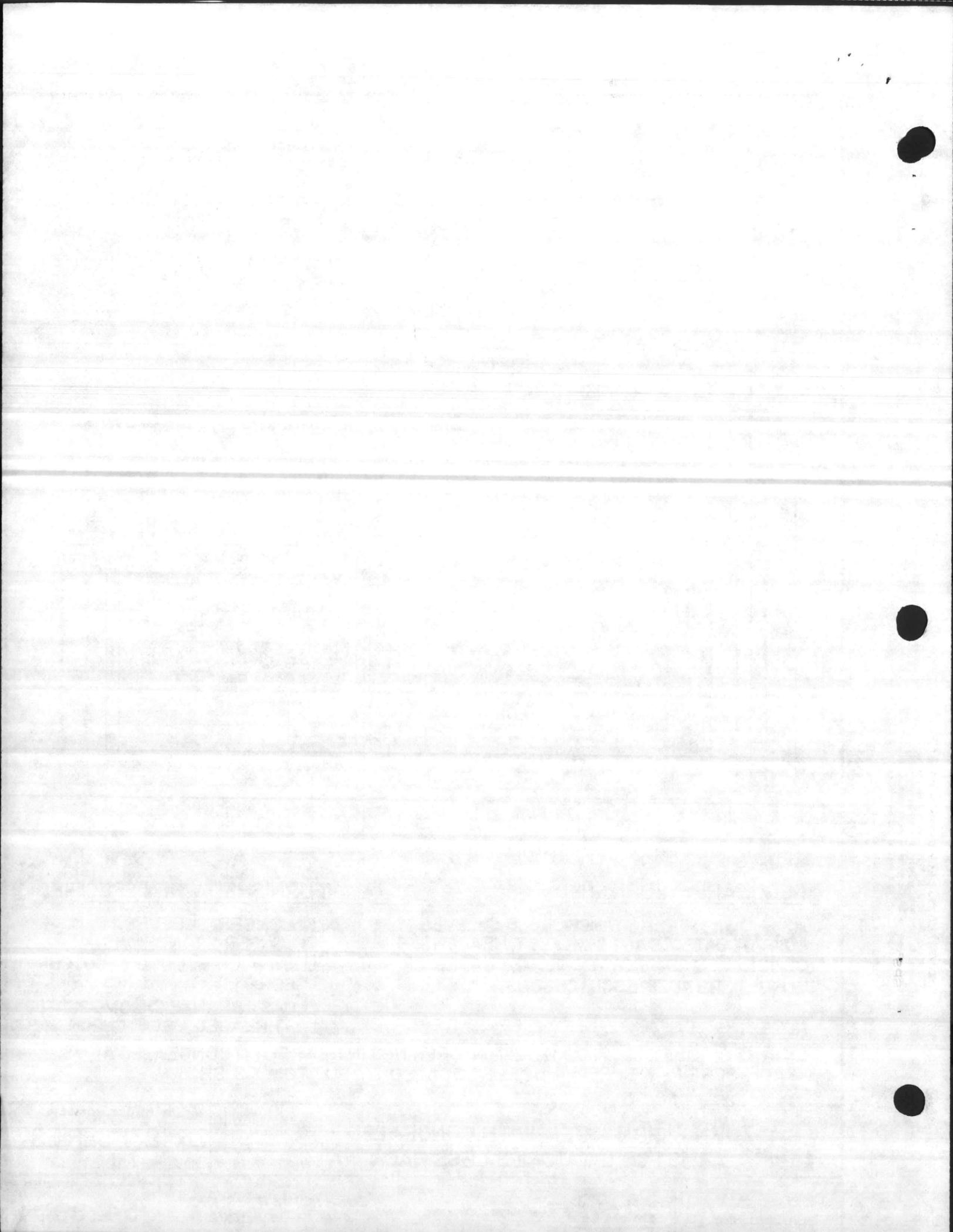
- * □ LONGER SLEEVES
- LONGER STANCHIONS
- 3"-4" OR 6" LONG ESCUTCHEONS
- CAST BRONZE CHROME PLATED THREADED ESCUTCHEONS.

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DRN 8-26-81 BY K.K. CKD LM APPD LM LAST REV. CNR. DATE BY CKD. APPD.

ZURN RIGID SYSTEM WITH CONCEALED ARMS FOR LAVATORIES LESS BACK	PRODUCT NUMBER ZR-1231 SERIES
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©1981 BY ZURN IND., INC.	a step ahead of tomorrow	ZURN INDUSTRIES, INC. ERIE, PA U.S.A. 16512	DRAWING NUMBER 54289
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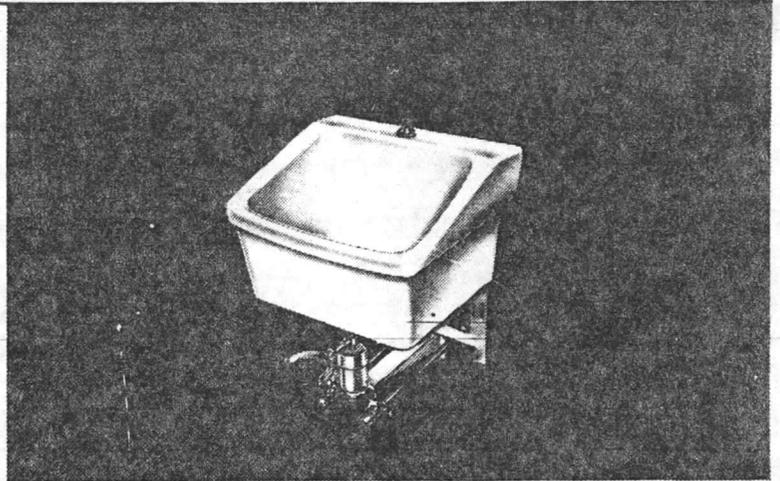


15460 2.4.3 (P.3)

American Standard

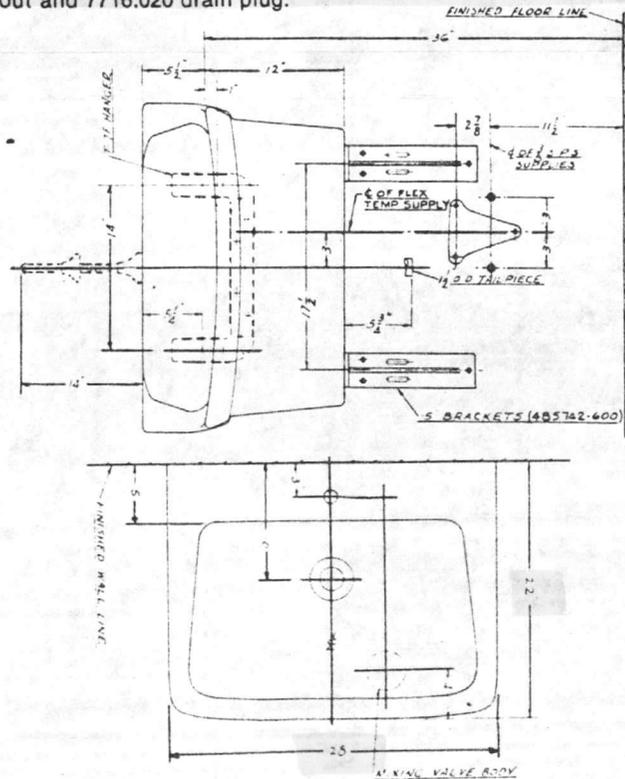
PURE LUXURY

surgeon's scrub sink
Vitreous China



- X **9047.093**
for exposed bracket support, with center faucet hole
 - **9047.044**
for exposed bracket support, with faucet holes on 8" (204mm) centers
- Surgeon's vitreous china scrub-up sink with low front rim, wall hanger. Bracket support 485742-600 to be specified separately when required. Fixture only.

Shown with 7676.029 knee action mixing valve, 7522.055 gooseneck spout and 7716.020 drain plug.

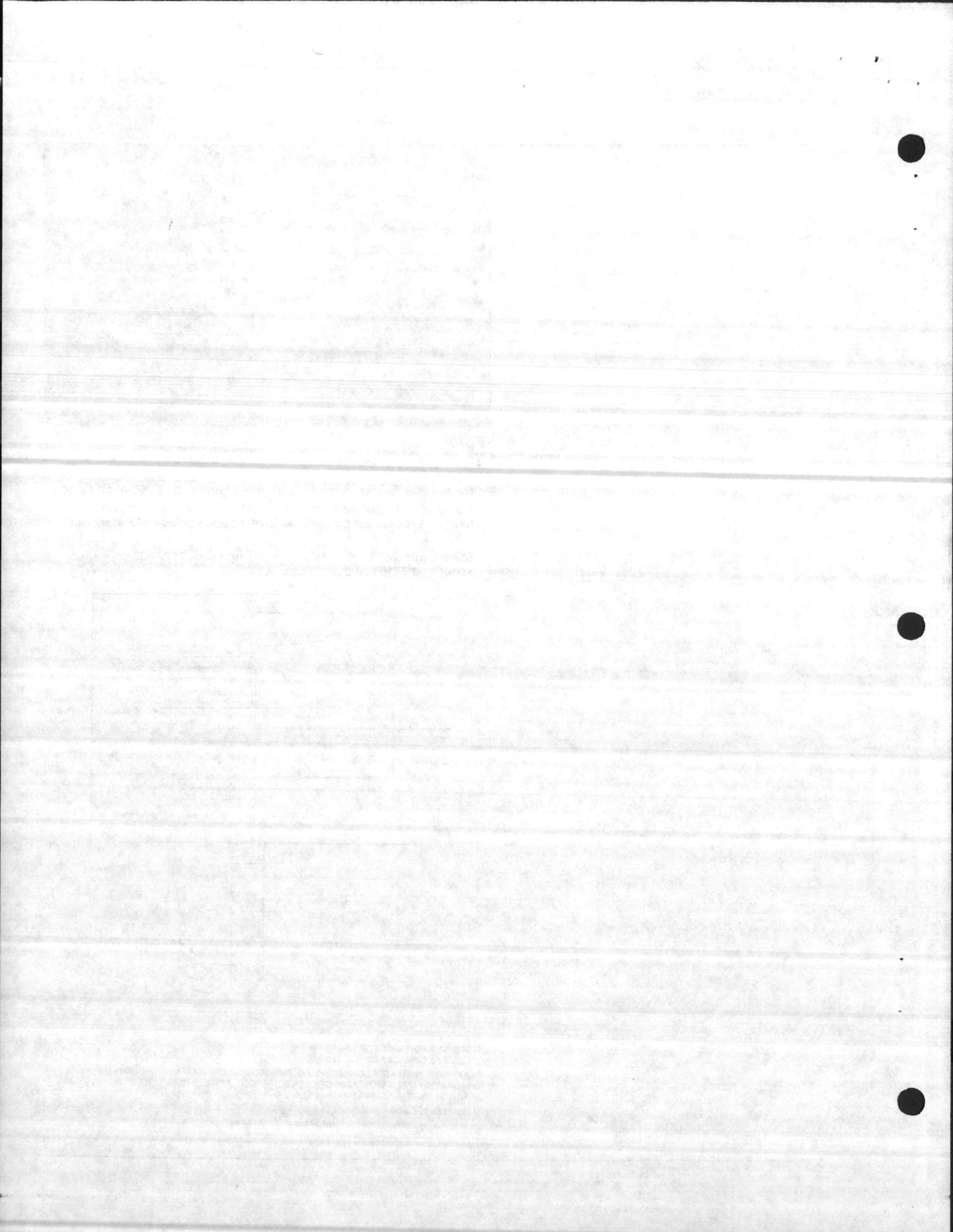


NOTE: SEE RB-132.85 FOR SPOUT
SEE RB-4184 FOR K.A. MIXER

ROUGHING-IN MEAS. FOR 9047.093 V.C. SURGEON'S SCRUB-UP SINK MOUNTED 15" BRACKETS, FITTED W/7522.055 GOOSENECK SPOUT, STRAIGHT TAILPIECE, 7676.029 K.A. MIXER, FLEX TEMP SUPPLY 7716.020 DRAIN PLUG.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standards A112.19.2.

These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.



P.O. PLUGS WITH OPEN GRID STRAINER

McGuire
Cat. Number
155A

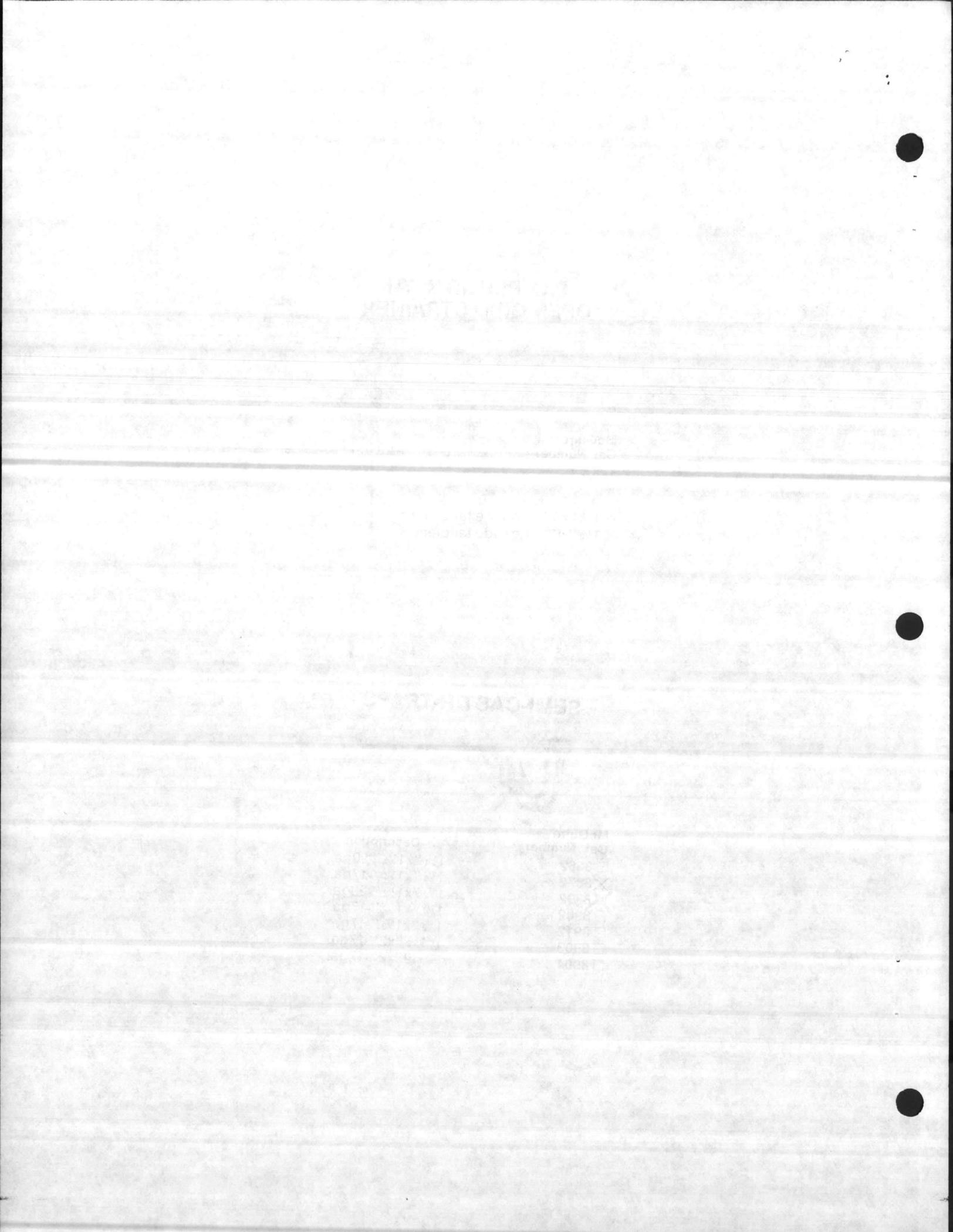
- 1 1/4" x 6" 17 gauge tailpiece
- 1 1/2" x 6" 17 gauge tailpiece



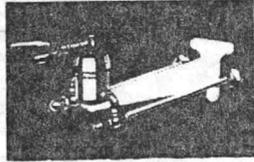
SEMI-CAST P-TRAPS



McGuire Cat. Number	Description
<input type="checkbox"/> 8862	1 1/4" x 1 1/4" -20ga.
<input checked="" type="checkbox"/> 8872	1 1/4" x 1 1/4" -17ga.
<input type="checkbox"/> 8892	1 1/2" x 1 1/2" -20ga.
<input type="checkbox"/> 8902	1 1/4" x 1 1/2" -17ga.
<input type="checkbox"/> 8912	1 1/2" x 1 1/2" -17ga.
<input type="checkbox"/> 8903	1 1/2" x 2" -17ga.
<input type="checkbox"/> 8904	2" x 2" -17ga.

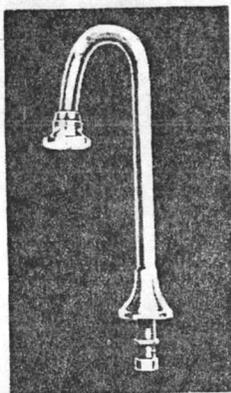


Knee action and pedal valves



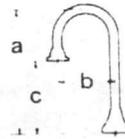
7676.029

Knee action mixing valve. Renewable seat. Screwdriver stops. $\frac{3}{8}$ " supplies-to-wall on 6" (152mm) centers. Wall escutcheons. Chrome finish. Wall support bracket.



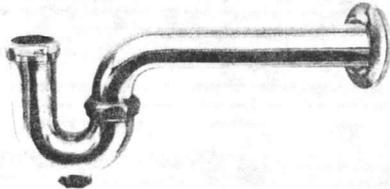
7522.055

$\frac{3}{8}$ " gooseneck spout — spray outlet $7\frac{5}{8}$ " (194 mm) above slab — height $13\frac{5}{8}$ " (270mm) — coupling nut for $\frac{1}{4}$ " tailpiece — chrome finish.



- a — $13\frac{5}{8}$ " (346mm)
- b — 7" (178mm)
- c — $7\frac{5}{8}$ " (194 mm)

SEMI-CAST P-TRAPS



McGuire
Cat. Number

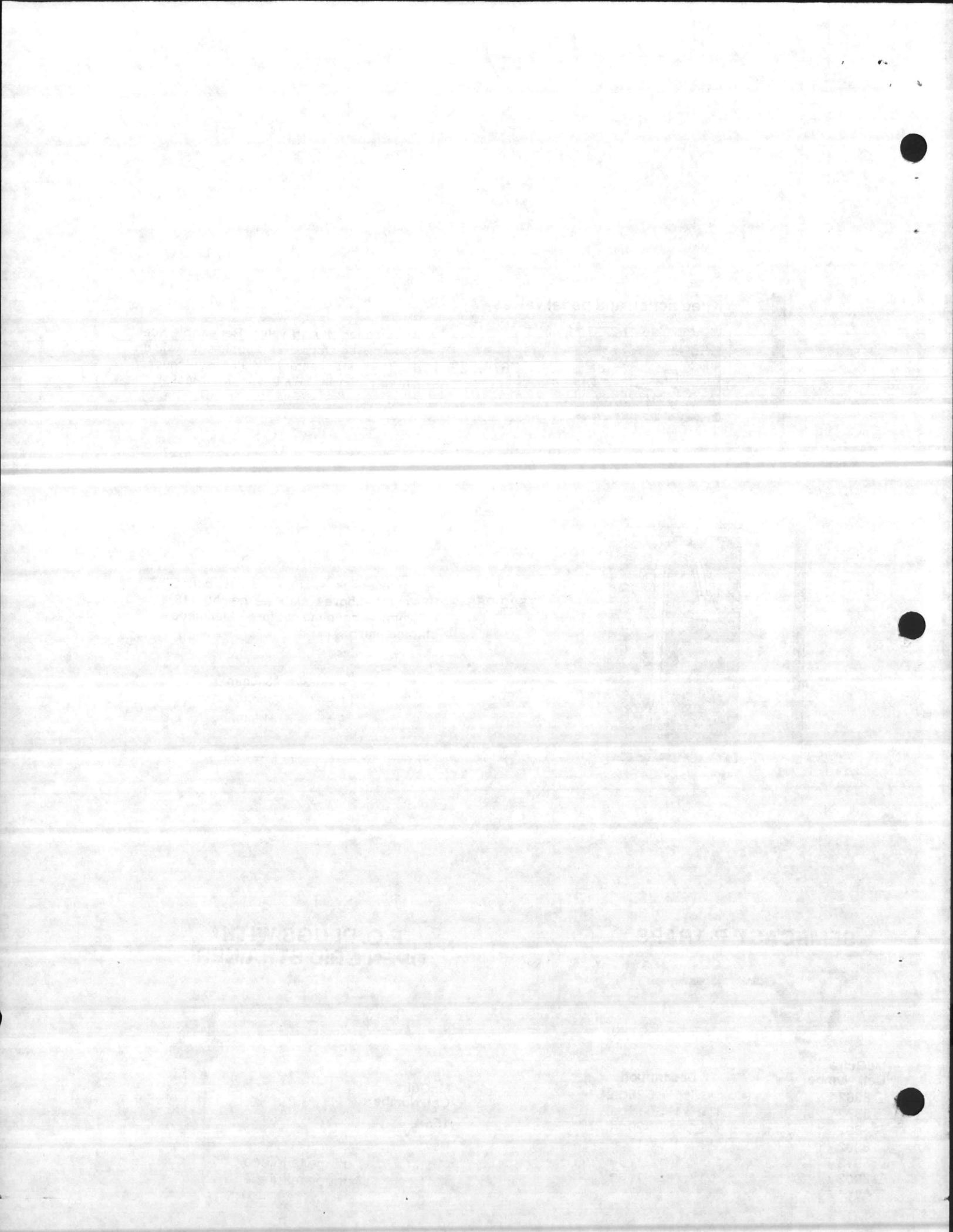
- | McGuire
Cat. Number | Description |
|--|---|
| <input type="checkbox"/> 8862 | 1 $\frac{1}{4}$ "x1 $\frac{1}{4}$ "-20ga. |
| <input type="checkbox"/> 8872 | 1 $\frac{1}{4}$ "x1 $\frac{1}{4}$ "-17ga. |
| <input checked="" type="checkbox"/> 8892 | 1 $\frac{1}{2}$ "x1 $\frac{1}{2}$ "-20ga. |
| <input type="checkbox"/> 8902 | 1 $\frac{1}{4}$ "x1 $\frac{1}{2}$ "-17ga. |
| <input type="checkbox"/> 8912 | 1 $\frac{1}{2}$ "x1 $\frac{1}{2}$ "-17ga. |
| <input type="checkbox"/> 8903 | 1 $\frac{1}{2}$ "x2"-17ga. |
| <input type="checkbox"/> 8904 | 2"x2"-17ga. |

P.O. PLUGS WITH OPEN GRID STRAINER



McGuire
Cat. Number
155A

- 1 $\frac{1}{4}$ "x6" 17 gauge tailpiece
- 1 $\frac{1}{2}$ "x6" 17 gauge tailpiece



DOUBLE COMPARTMENT SINKS

ELKAY

Lustertone SINK

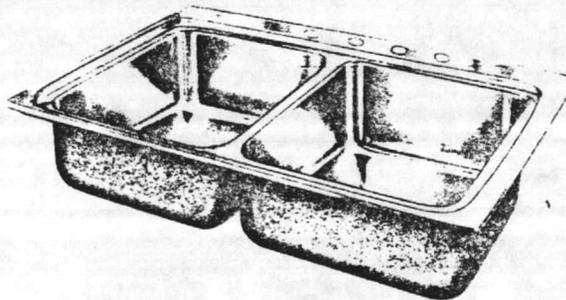
**LR-3322
DOUBLE COMPARTMENT
18 GAUGE-TYPE 302-SELF RIM**

Highest quality. Sink bowls seamlessly drawn of #18 gauge, type 302 (18-8) nickel bearing stainless steel provides convenient use from either side. Standard depth: 8-inches with 1 1/4-inch radius coved corners. Self rim. Exposed surfaces are hand blended to a highlighted LK-6K-H satin finish. Underside is fully undercoated.

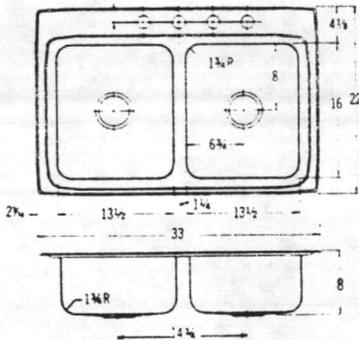
Model LR-3322 has a 7/16-inch drop ledge with a raised faucet deck.

Drain opening size is 3 1/2-inches.

NOTE: Where choice of three or four faucet holes are indicated, four holes furnished unless otherwise specified.



LR-3322 Illustrated

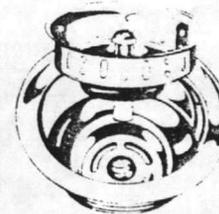


Model Number	DIMENSIONS IN INCHES Length is left to right. Width is front to back.					Cutout in Counter Top (1 1/2" Radius Corners)	No. of 1 1/2" Dia. Faucet Holes 4" Center	Ship. Wt. Lbs.
	Overall		Inside Each Compartment					
	L	W	L	W	D			
LR-3322	33	22	13 1/2	16	8	32 3/8 21 3/8	3 or 4	21

SEMI-CAST P-TRAPS

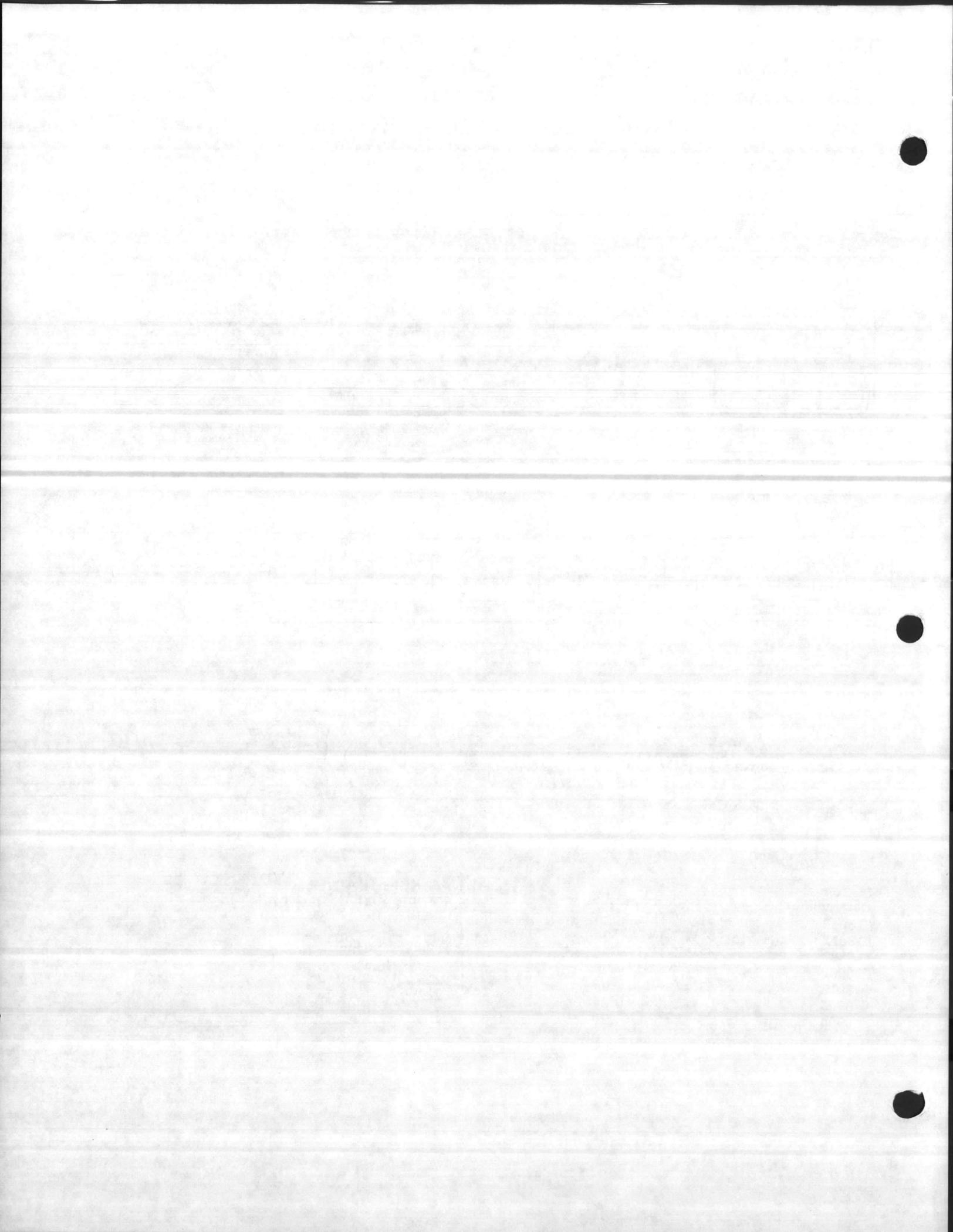


McGuire Cat. Number	Description
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<input type="checkbox"/> 8872	1 1/4" x 1 1/4" -17ga.
<input checked="" type="checkbox"/> 8892	1 1/2" x 1 1/2" -20ga.
<input type="checkbox"/> 8902	1 1/4" x 1 1/2" -17ga.
<input type="checkbox"/> 8912	1 1/2" x 1 1/2" -17ga.
<input type="checkbox"/> 8903	1 1/2" x 2" -17ga.
<input type="checkbox"/> 8904	2" x 2" -17ga.



SS250

BASKET STRAINER chrome plated brass body with the "IT CAN'T SKIP" lock nut Stick Type—Stainless Basket Neoprene Stopper		CIN. QTY.
SS250	Less TP	40
<input checked="" type="checkbox"/> SS250W	With (Satin 4") TP	40
SS25	Basket Assembly Only	48



CHICAGO FAUCETS

THE SYMBOL OF QUALITY

2100 SOUTH NUCLEAR DRIVE • DES PLAINES, ILLINOIS 60018
312 694-4400

FILE
NUMBER

FITTING
NUMBER

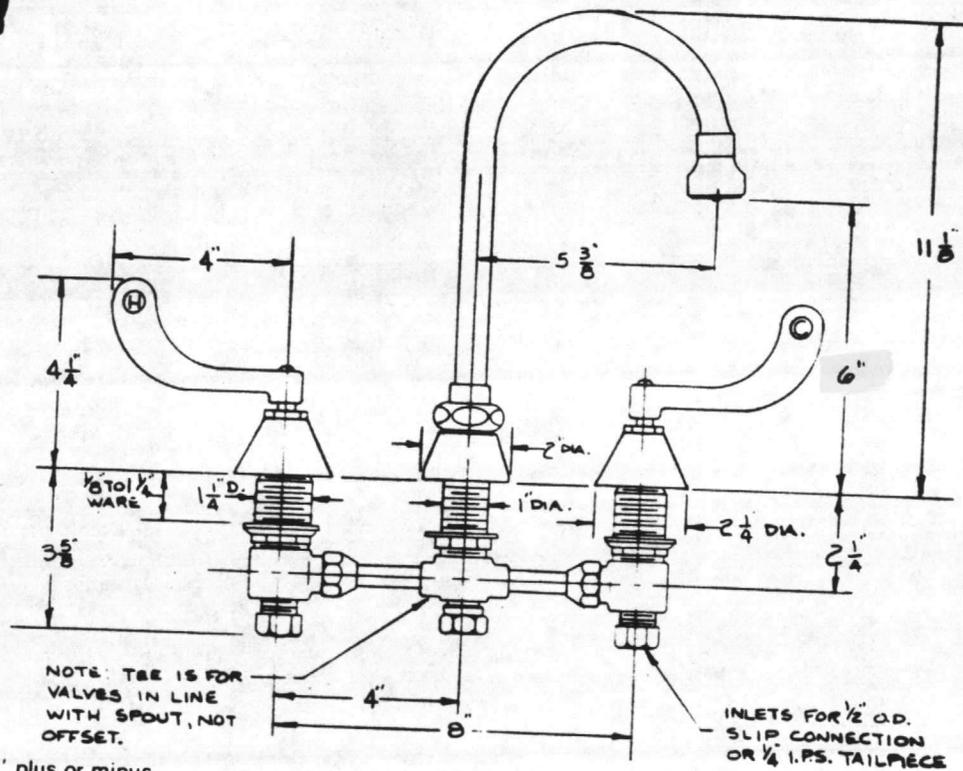
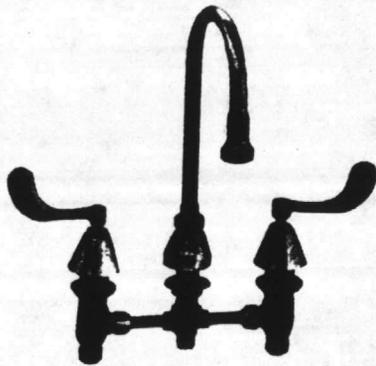
786

SECTION

PAGE

H

37



Rough in dimensions may vary 1/4" plus or minus.

TECHNICAL DATA

DESCRIPTION:

No. 786 Hi-Lite combination lavatory faucet with #317 4" wrist blade handles, GN2B-E4 rigid/swing convertible gooseneck spout with E4 rose spray outlet.

OPERATING UNIT:

Self-contained and interchangeable.

MATERIAL:

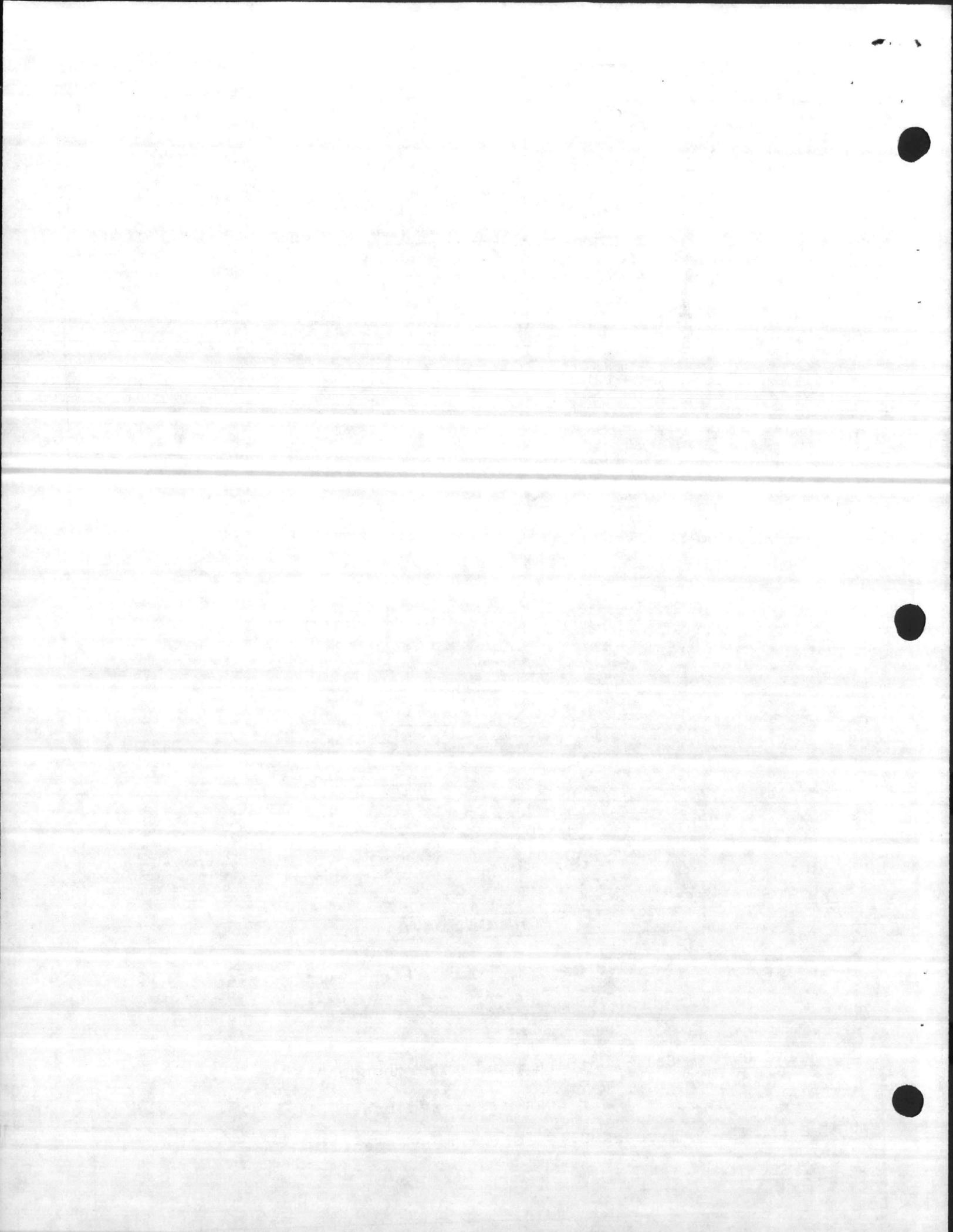
Casting - commercial red brass alloy.

CHROME PLATE:

Exceeds U. S. Government specifications.

C.S.I. SECTION:

15



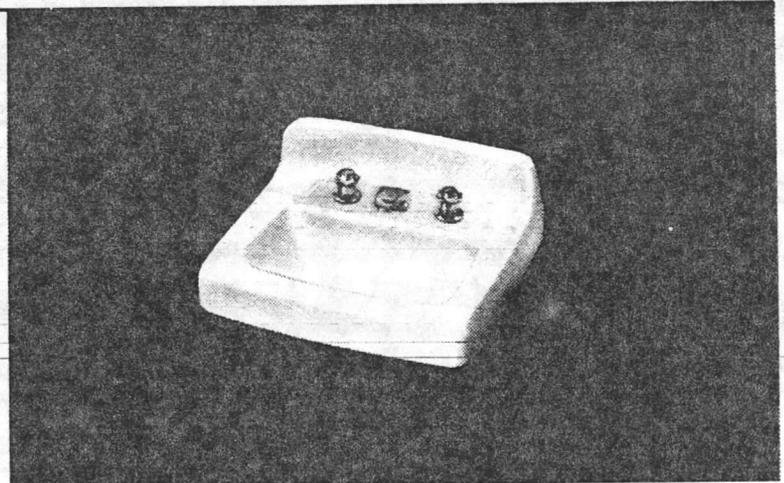
American Standard

PURE LUXURY

15460 2.4.5 (P-5)

Regalyn lavatory

Enameled Cast Iron



P.O. PLUGS WITH OPEN GRID STRAINER



McGuire
Cat. Number
155A

- 1 1/4" x 6" 17 gauge tailpiece
- 1 1/2" x 6" 17 gauge tailpiece

8" (204mm) centers

- 4867.016
19" x 17" (483mm x 432mm)
- 4867.024
20" x 18" (508mm x 457mm) (illustrated)

4" (102mm) centers

- 4869.012
19" x 17" (483mm x 432mm)
- 4869.020
20" x 18" (508mm x 457mm)

Regalyn enameled cast iron lavatory with soap depression, wall hanger. Fixture only. Shown with comb. or center-set fitting, 3/8 flex. supply, pop-up drain & 1 1/4 O.D. "P" trap.



P TRAP

Supplied with 1 1/2 x 1 1/4 Poly Inlet Washer

PVC

ABS

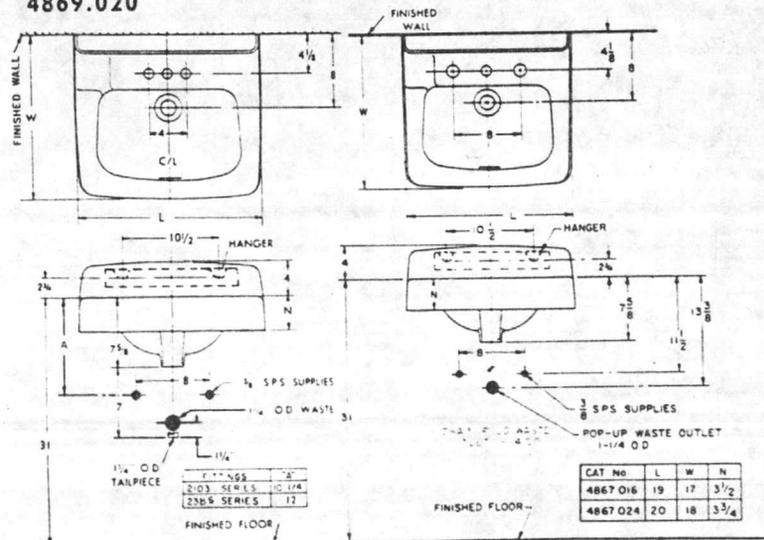
- 106-6 106-7 w/Schd. 40 Adapter
- 108-6 108-7 w/S.J. Adapter

- bowl sizes:

- 19" x 17"
14 1/2" wide (368mm), 87/8" front to back (222mm), 6" deep (153mm)
- 20" x 18"
15 1/2" wide (394mm), 97/8" front to back (249mm), 6" deep (153mm)

- 4869.012
- 4869.020

- 4867.016
- 4867.024



CAT. NO.	L	W	N
4869.012	19	17	3 1/2
4869.020	20	18	3 3/4

*DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND "P" TRAP ARE SUGGESTED

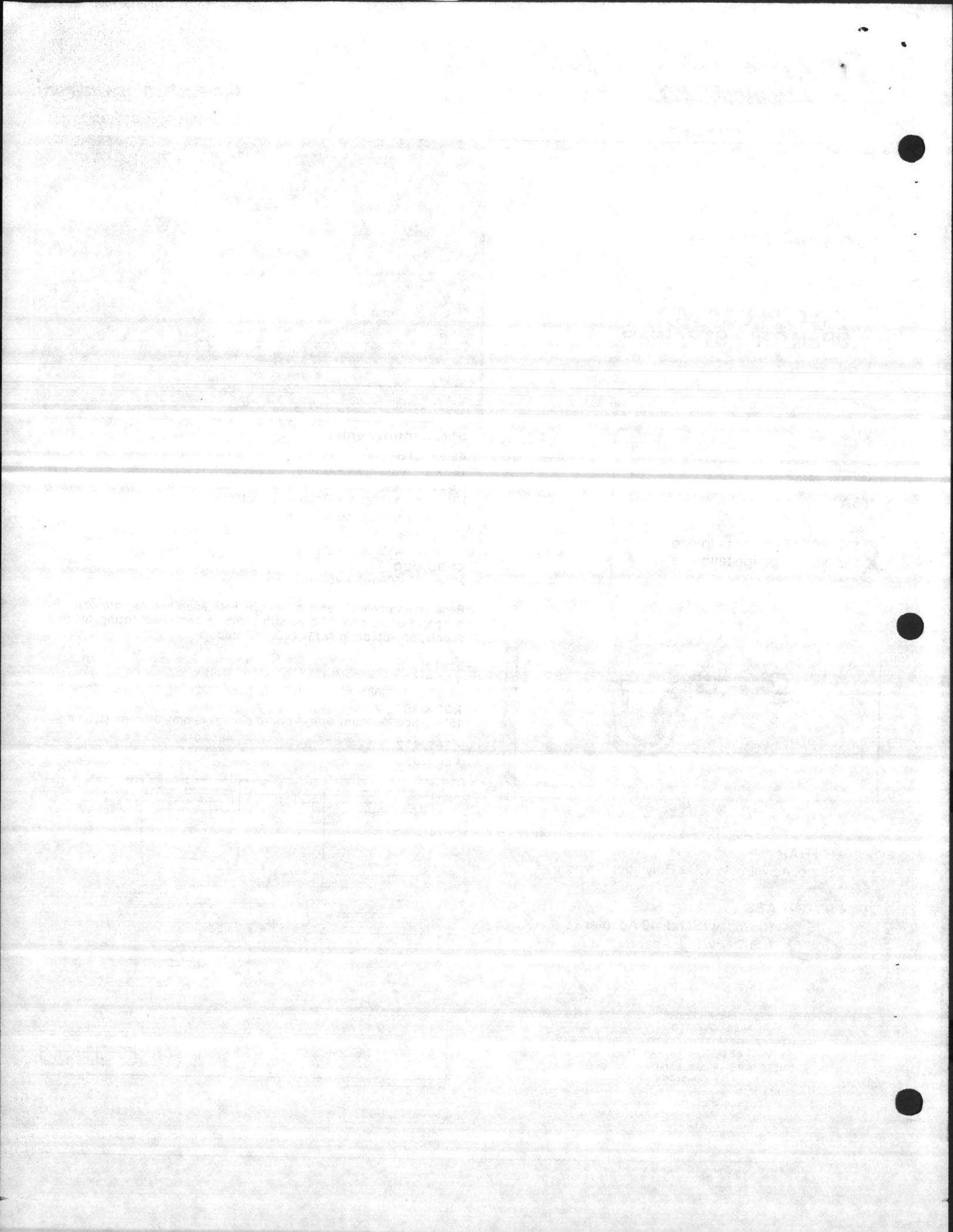
NOTE: FITTINGS NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY.

PLUMBER NOTE—Provide suitable reinforcement for all wall supports.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standards A112.19.1.M.

These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

SPS 4869



Dick Brothers INC.

P. O. BOX 381. READING. PA. 19603

PHONE 215 374-4917



FIRST NAME IN PLUMBERS BRASS GOODS SINCE 1896

Noland Company
P. O. Box 3069
Kinston, NC 28501

Attention: Larry Elmore

Gentlemen:

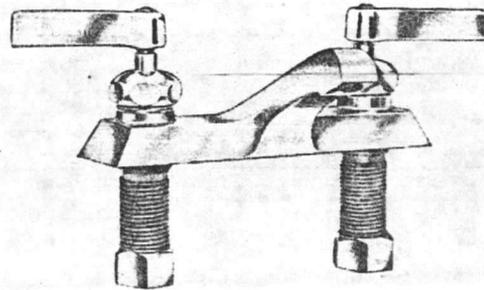
This is to certify that #6039 and #4058 faucets manufactured by Dick Brothers, Inc. are all brass and meet the ANSI code #A112.18.1M.

Very truly yours,

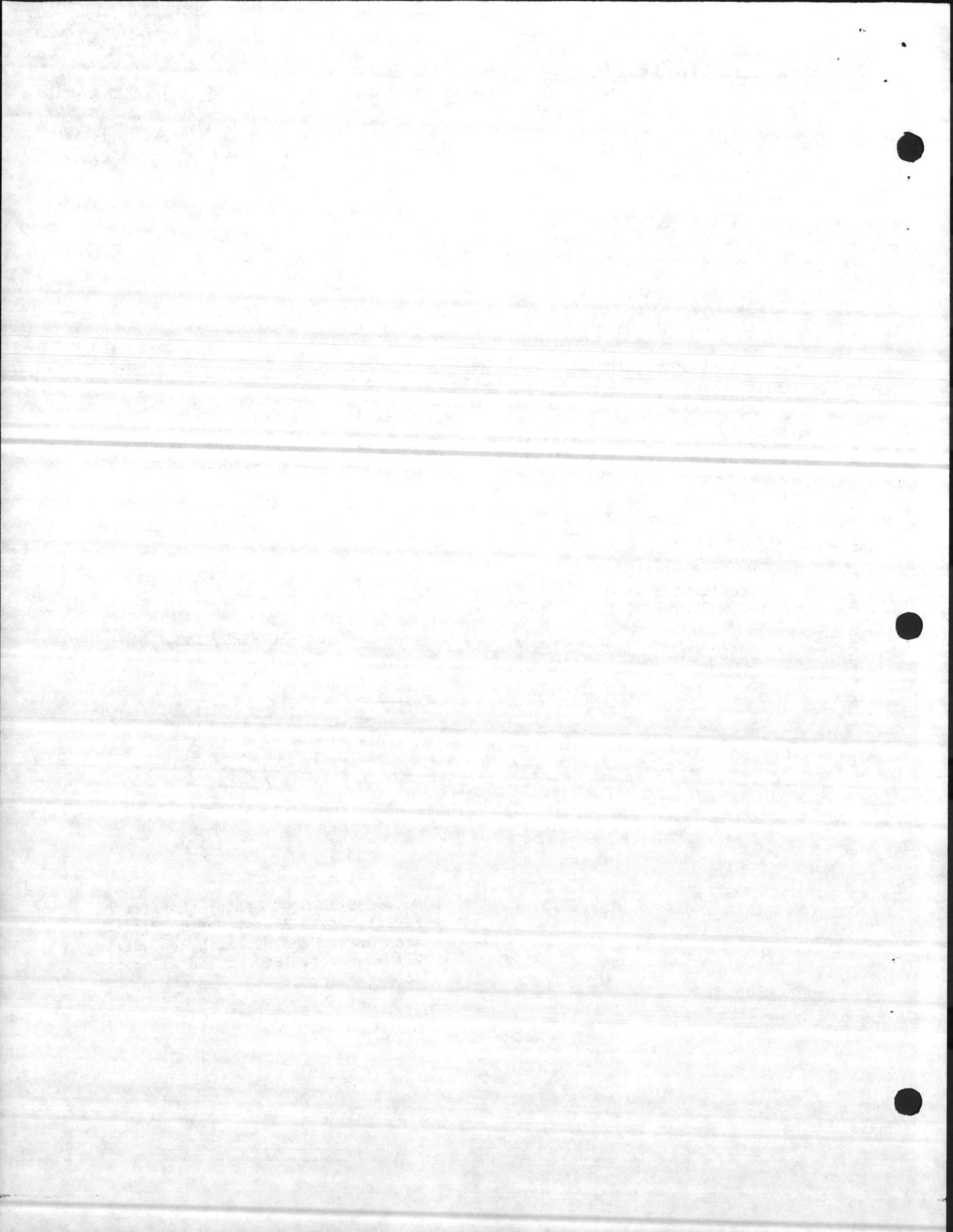
H. A. Perlmutter
President
DICK BROTHERS, INC.

HAP/s

DICK BROTHERS, INC.



No. 6039-ARRS 4" Centers Lavatory
Faucet, Solid Brass, Chrome Plated,
with Brass Handles, with Ren. Seats,
with Aerator. Faucet and all parts
copper alloy



5214-15460-1.4.1987, 2.4.5 P5



a step ahead of tomorrow

November 9, 1987

Sneeden Inc.
301 Eastwood Road
Wilmington, NC 28403

Reference: Job #1 Medical / Dental Clinic
Contract #N62470-85-C-5214
Subject: Certification of Material

Gentlemen:

This is to certify that the following Zurn Drains and Water Control products meet or exceeds ANSI Specifications below and are manufactured with our normal care and processes.

- Hydrants - ANSI A112.21.3
- Carriers - ANSI A112.61M
- Floor Drains - ANSI A112.211M
- Roof Drains - ANSI A112.21.2
- Metallic Cleanouts - ANSI A112.36.2

Very Truly Yours,

ZURN INDUSTRIES, INC.
Hydromechanics Division

John R. Rensel
Manager - Manufacturing

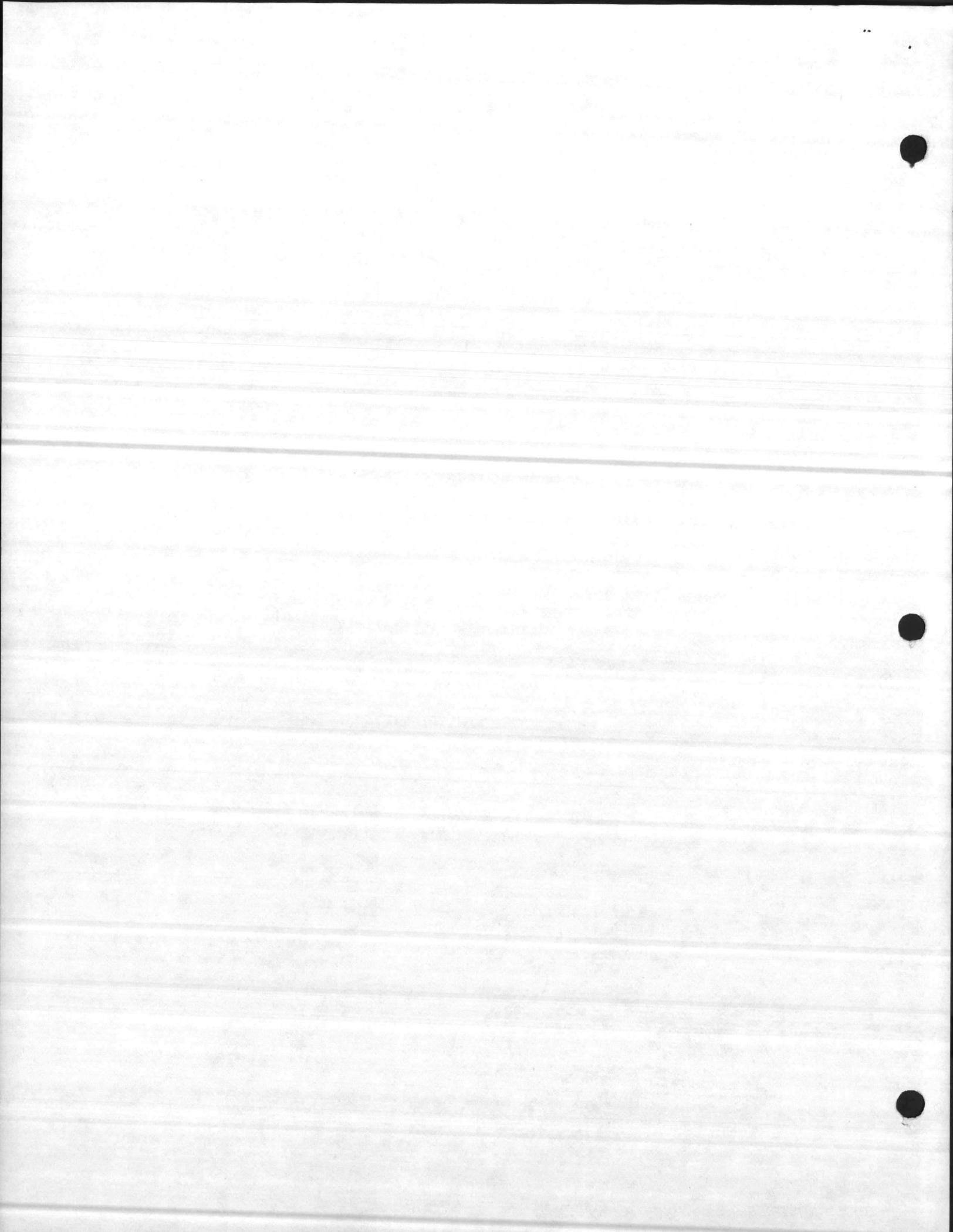
JRR/alb
CC: File

Forrest Pearce, Noland Co.

Sworn to and subscribed before me
this 9th day of November 19 87 .

Notary Public

JOSEPH T. LOREI, NOTARY PUBLIC
ERIE, ERIE COUNTY, PENNSYLVANIA
MY COMMISSION EXPIRES FEB. 3, 1988

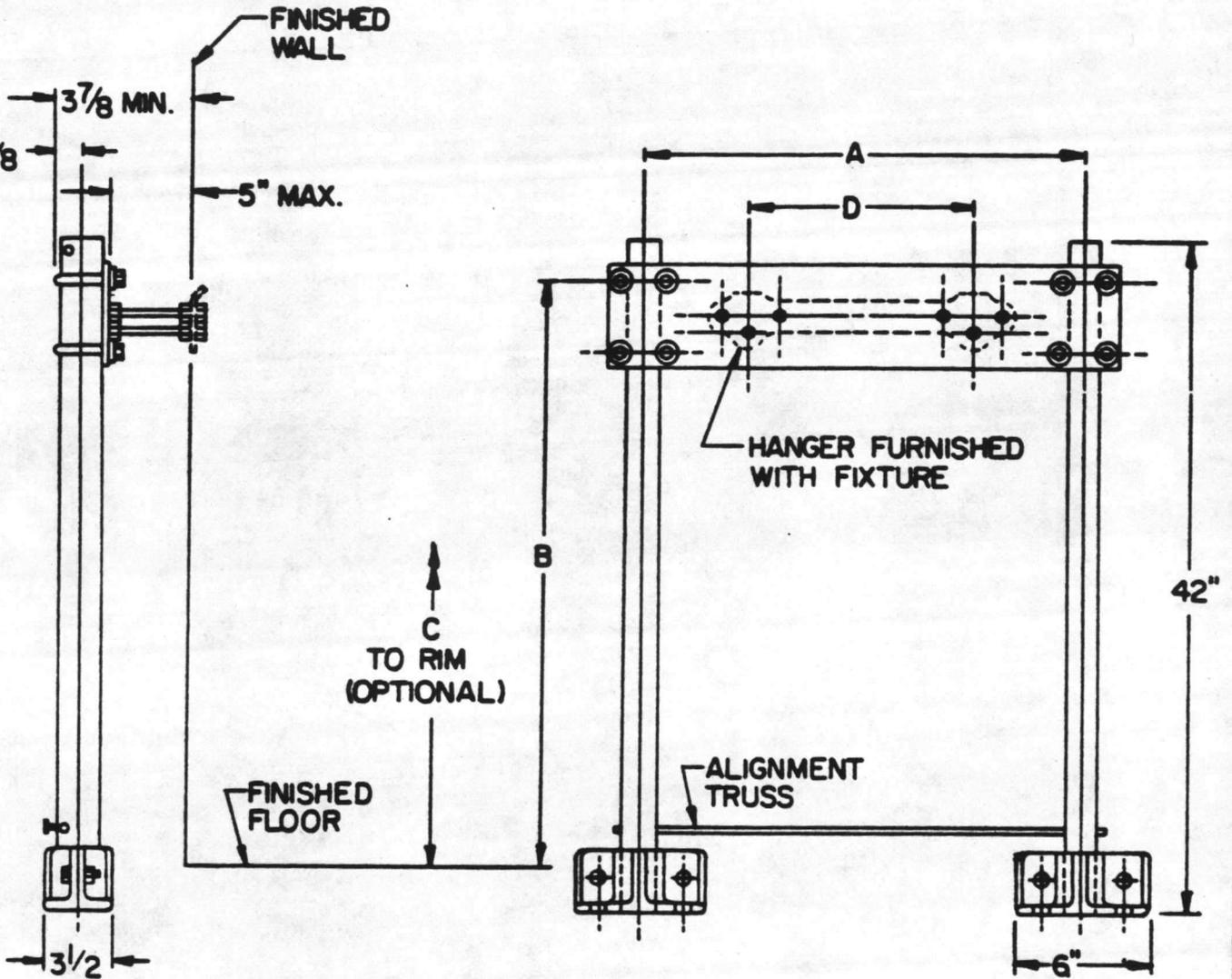


DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE

NOTE:
LETTERED DIMENSIONS TO MEET FIXTURE REQUIREMENTS
FOR INSTALLATION - REQUEST ROUGHING-IN DRAWINGS.

FOR: #4869.012

APPD. CKD. BY DATE CMN. LAST REV. L.M. APPD. L.M. CKD. L.M. BY R.G. DRN. 11-11-81



REGULARLY FURNISHED
 AS SHOWN, HEAVY STEEL STANCHIONS,
 & SUPPORTING PLATE "DURA-COATED"
 CAST IRON FEET.

FURNISHED WHEN SPECIFIED
 LONGER SUPPORTING BOLTS
 LONGER STANCHIONS

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 Property of Zurn Industries, Inc., Erie, Pa.

ZURN RIGID SYSTEM FOR LAVATORIES

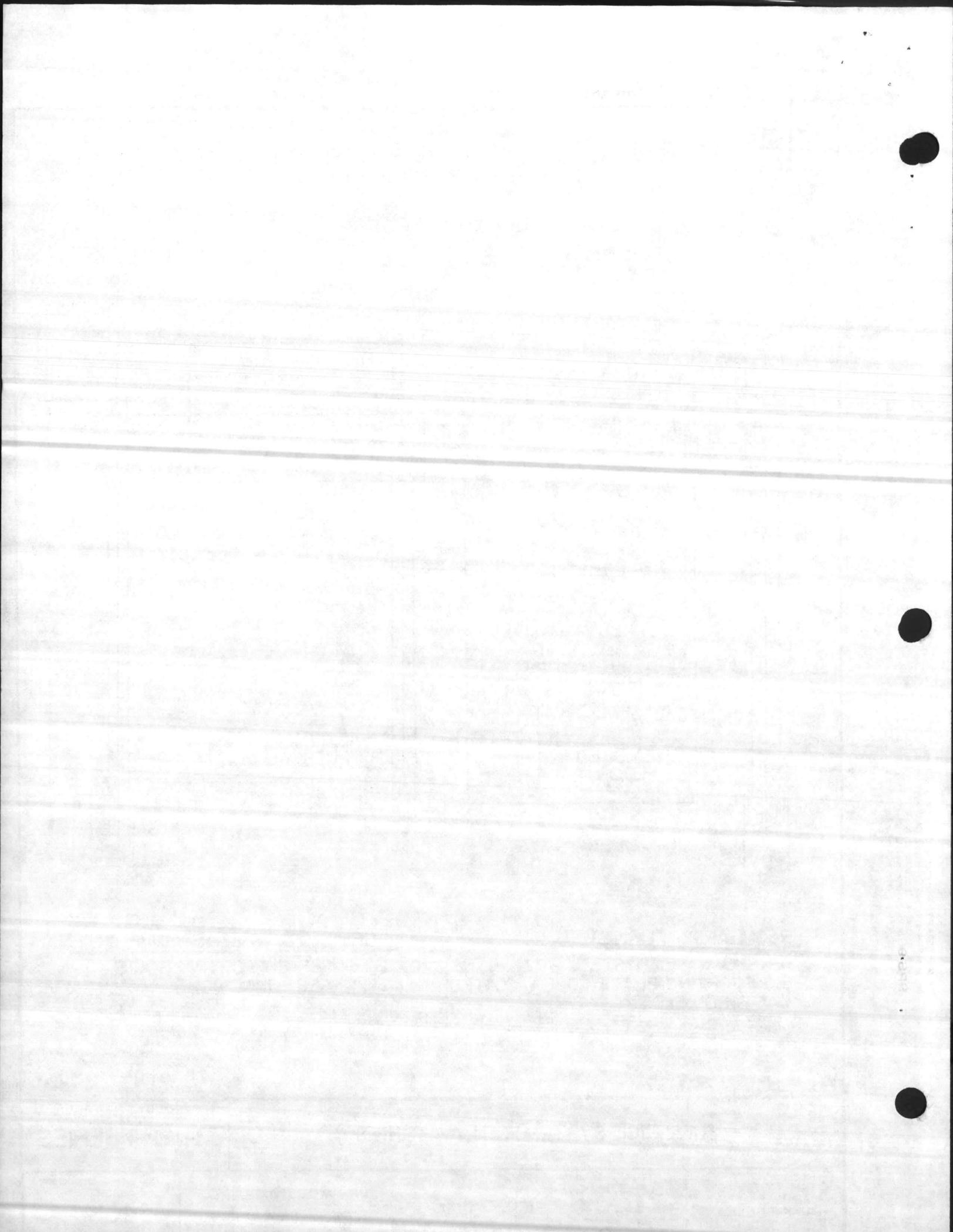
PRODUCT NUMBER
ZR-1224 SERIES

© 1981 BY
ZURN IND., INC.

ZURN a step ahead of tomorrow

ZURN INDUSTRIES, INC.
ERIE, PA. U.S.A. 16512

DRAWING NUMBER
54314



American Standard

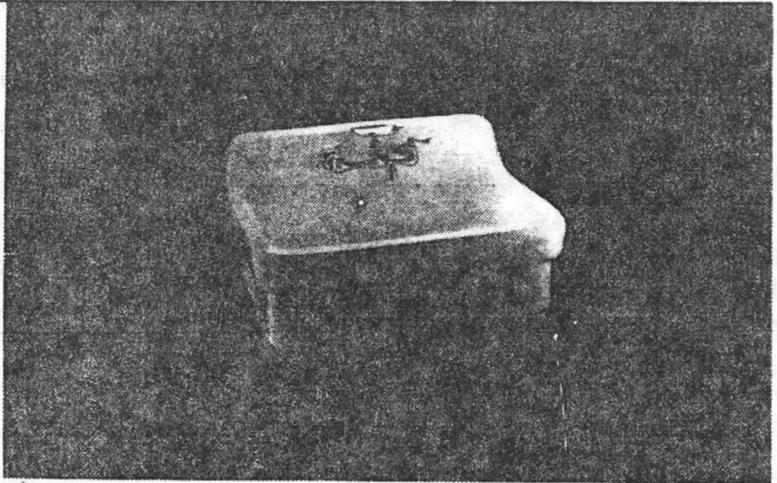
PURE LUXURY

15460 2.4.6

(P-6)

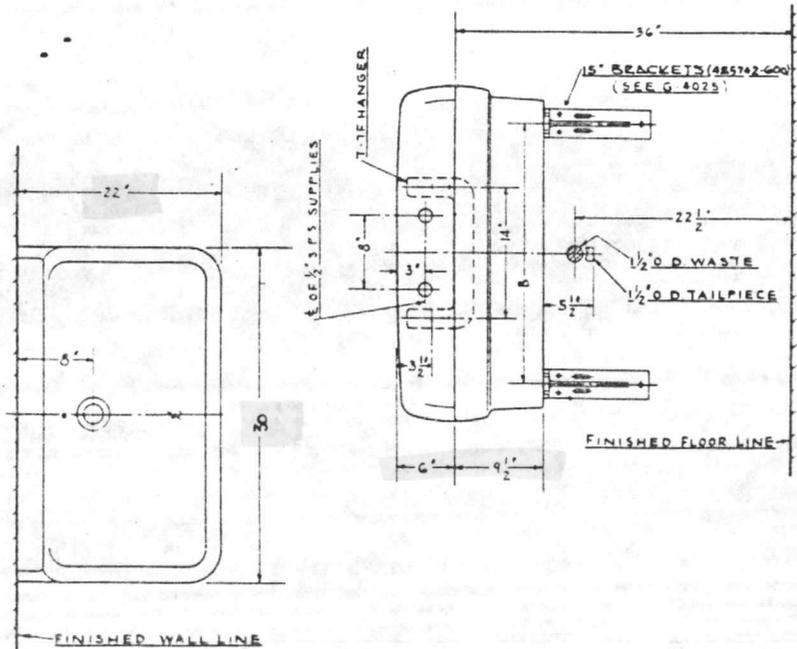
plaster work sink

Vitreous China



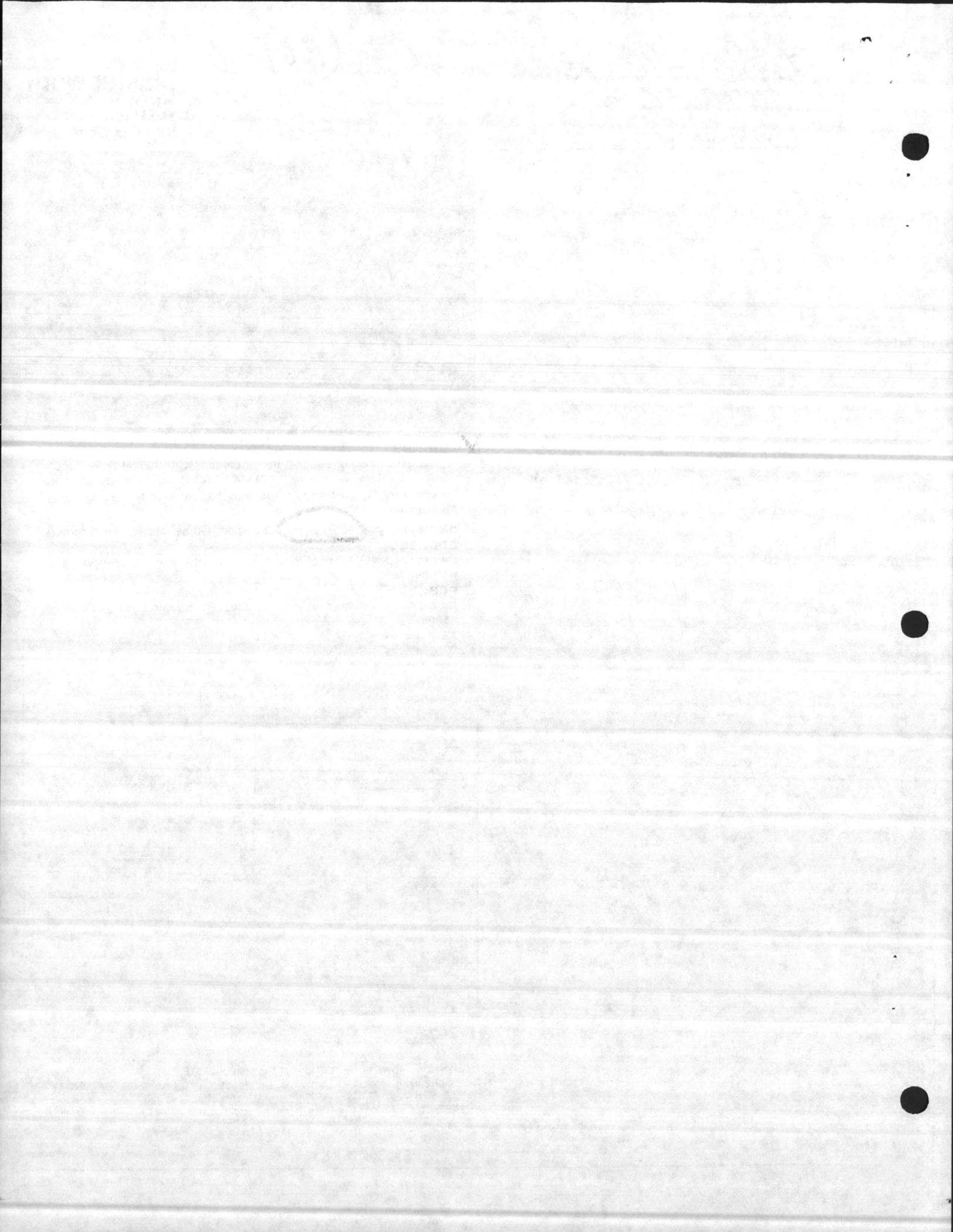
NOTE: Submitted as alternate for PAKK Sink - Discontinued item

- X **9061.193** for exposed bracket support (not included), with faucet holes on 8" (204mm) centers. Shown with 4141.085 faucet with integral soap dish. Plaster work sink, vitreous china, wall hanger with high splash-back. Fixture only.
Bracket Support 485742-600 to be specified separately when required.
- 9061.250** for exposed wall bracket (not included), with single faucet hole and wall hanger.
- 9061.292** for exposed wall bracket (not included), with plain back and wall hanger.



*DIMENSION SHOWN FOR LOCATION OF TRAP IS SUGGESTED.
 ROUGHING-IN MEAS. FOR 9061.193 V.C. ALL-PURPOSE SINK ON 485742-600 BRACKETS AND FITTED WITH COMB FTG., 7716.020 DRAIN PLUG, AND 1 1/2" O.D. "P" TRAP.
 IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standards A112.19.2.

These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.





THE SYMBOL OF QUALITY

2100 SOUTH NUCLEAR DRIVE • DES PLAINES, ILLINOIS 60018
312 694-4400

FILE
NUMBER

FITTING
NUMBER

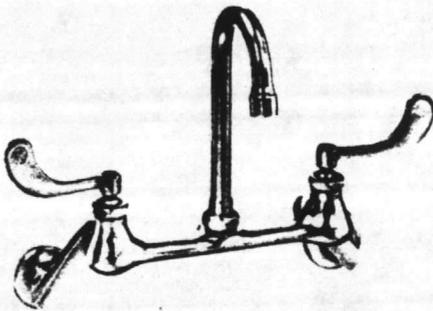
631-R-319

SECTION

PAGE

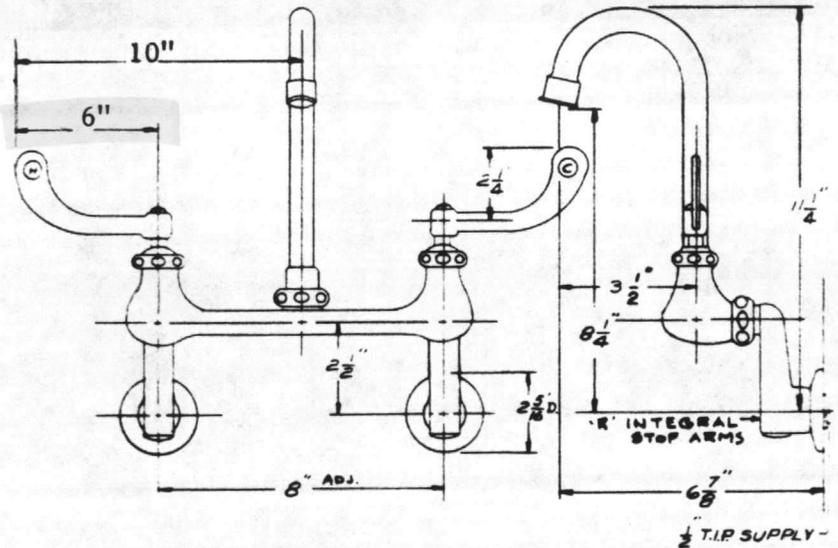
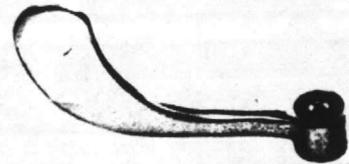
H

14



with ↘

No. 319. 6" Wrist blade handle.
Polished chromium plated.
Furnished with blue & red
index tabs for user safety.



Rough in dimensions may vary 1/4" plus or minus.

TECHNICAL DATA

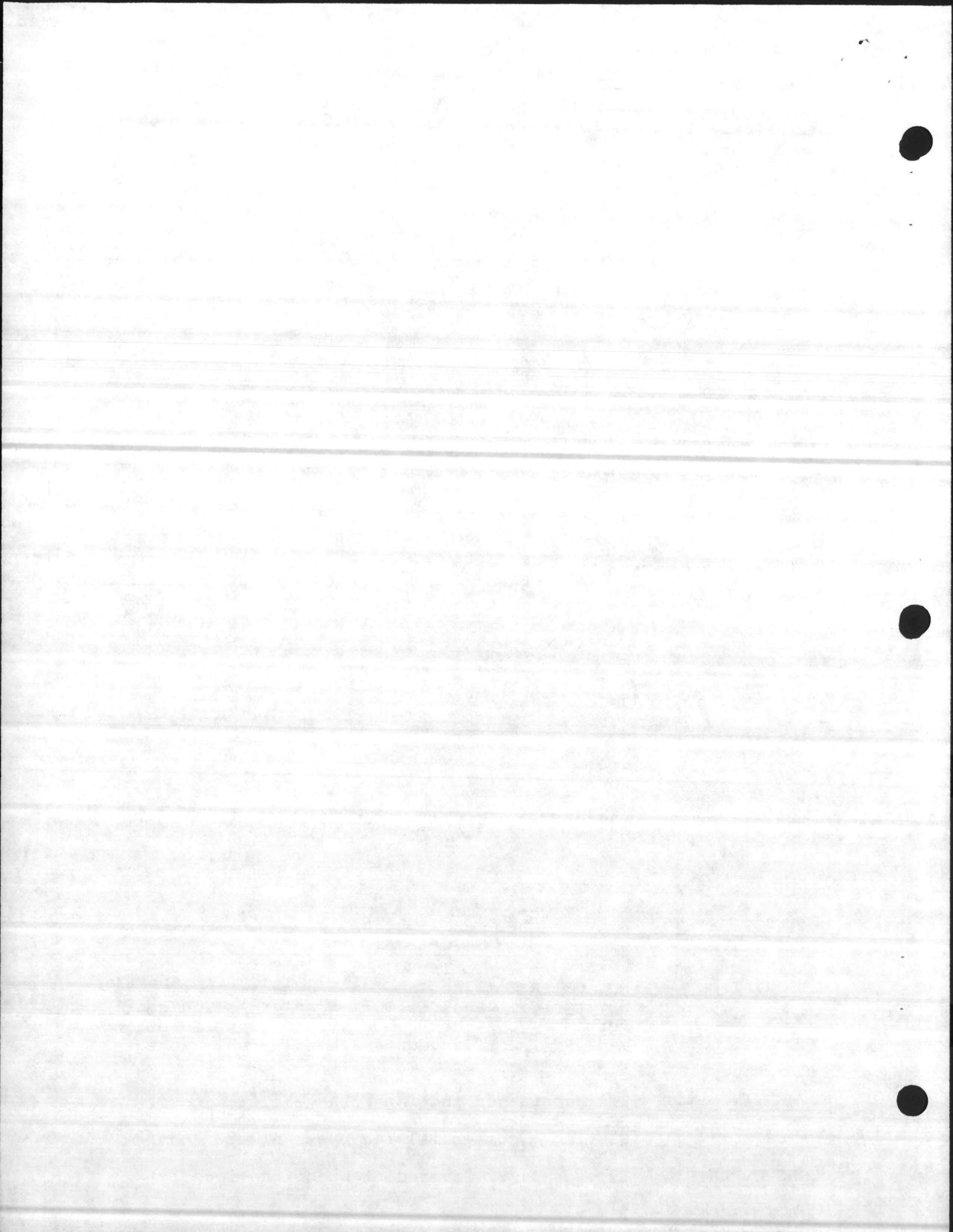
DESCRIPTION: No. 631-R Combination sink faucet with #319 6" wrist blade handles, GN1A-E3 rigid/swing convertible gooseneck spout with E3 Softflo outlet and "R" 1/2" flanged female adjustable integral stop arms.

OPERATING UNIT: Self-contained and interchangeable.

MATERIAL: Casting - commercial red brass alloy.

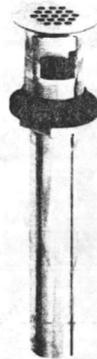
CHROME PLATE: Exceeds U. S. Government specifications.

C.S.I. SECTION: 15



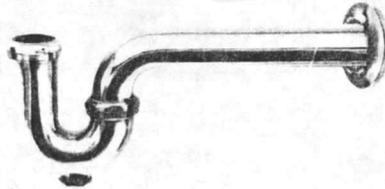
P.O. PLUGS WITH OPEN GRID STRAINER

McGuire
Cat. Number
155A

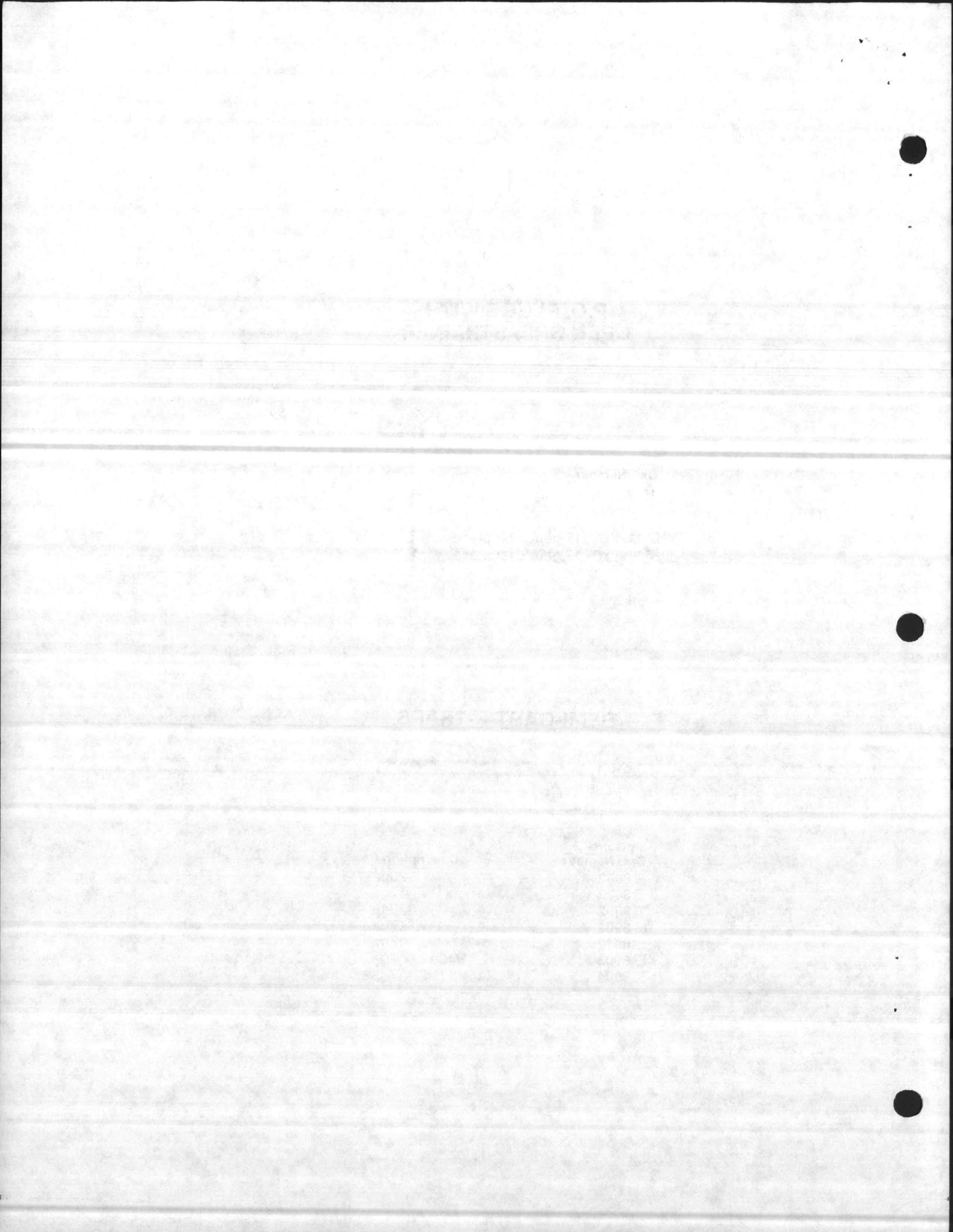


- 1 1/4" x 6" 17 gauge tailpiece
- 1 1/2" x 6" 17 gauge tailpiece

SEMI-CAST P-TRAPS



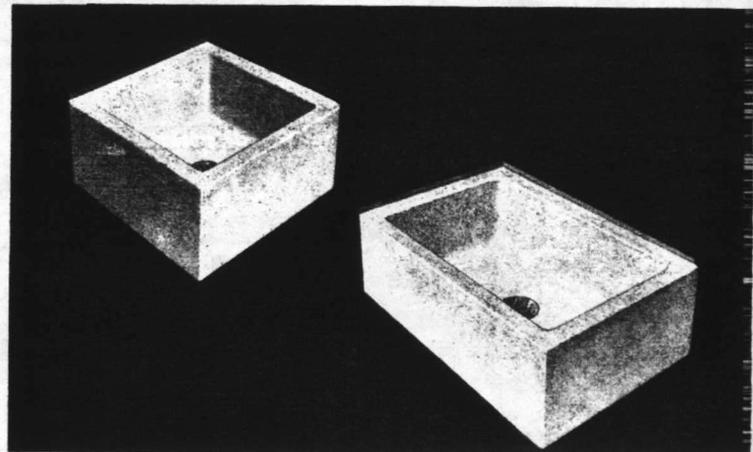
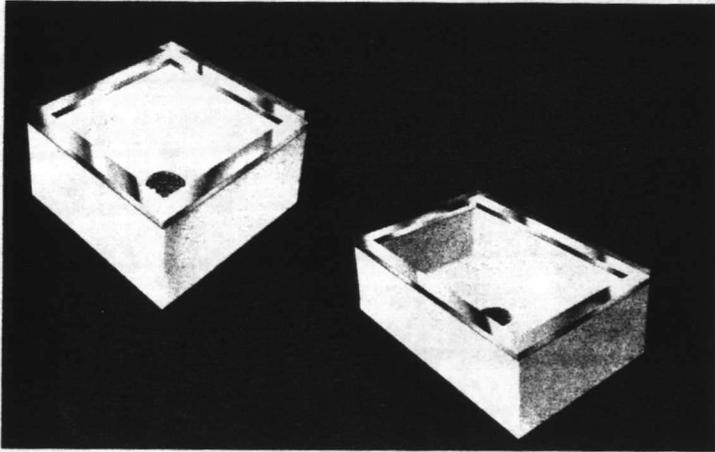
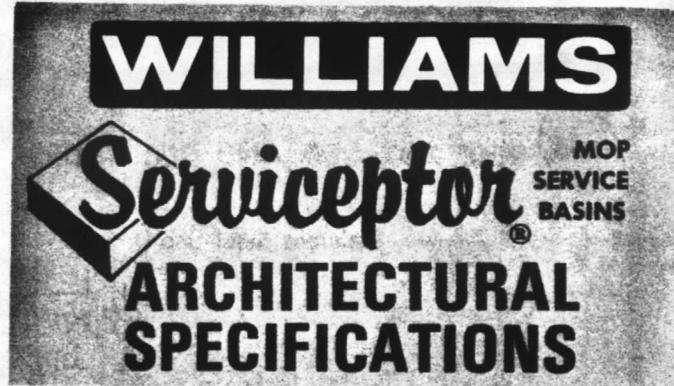
McGuire Cat. Number	Description
<input type="checkbox"/> 8862	1 1/4" x 1 1/4" -20ga.
<input type="checkbox"/> 8872	1 1/4" x 1 1/4" -17ga.
<input checked="" type="checkbox"/> 8892	1 1/2" x 1 1/2" -20ga.
<input type="checkbox"/> 8902	1 1/4" x 1 1/2" -17ga.
<input type="checkbox"/> 8912	1 1/2" x 1 1/2" -17ga.
<input type="checkbox"/> 8903	1 1/2" x 2" -17ga.
<input type="checkbox"/> 8904	2" x 2" -17ga.



15460 2-4-7

P-7 TERRAZZO MOP SINK

24"x24"
 Model No. (SB-850) Size (24"x12") as manufactured by Stern-Williams Co., Inc. Shoulders shall not be less than 9³/₄" high inside measurement, and not less than 1¹/₄" wide. Tiling flange, cast integral, shall extend 1" above shoulder on 1, 2 or 3 sides (as job required). Drain shall be cast brass with stainless steel strainer, cast integral and shall provide for a caulked lead connection not less than 1" deep to a 3" pipe. Receptor composed of pearl grey marble chips and white Portland cement ground smooth, grouted and sealed to resist stains. Stainless steel cap of one piece 20 ga. 302 stainless steel cast integral on all four sides.



WITH STAINLESS STEEL CAP

MODEL	FLANGES	MODEL	FLANGES
24"x24"x12"		36"x36"x12"	
SB-900	without tiling flange	SB-500	without tiling flange
SB-901	w/tiling flange—1 sd.	SB-501	w/tiling flange—1 sd.
SB-902	w/tiling flange—2 sds.	SB-502	w/tiling flange—2 sds.
SB-903	w/tiling flange—3 sds.	SB-503	w/tiling flange—3 sds.
32"x32"x12"		36"x24"x12"	
SB-700	without tiling flange	SB-300	without tiling flange
SB-701	w/tiling flange—1 sd.	SB-301	w/tiling flange—1 sd.
SB-702	w/tiling flange—2 sds.	SB-302-L	w/tiling flange—2 sds.
SB-703	w/tiling flange—3 sds.	SB-302-R	w/tiling flange—2 sds.
		SB-303	w/tiling flange—3 sds.

* Flange is across back and on LEFT side on model numbers ending in "L".

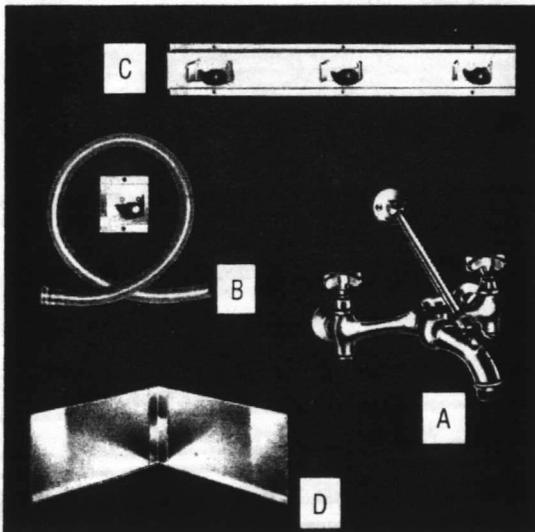
WITHOUT STAINLESS STEEL CAP

MODEL	FLANGES	MODEL	FLANGES
24"x24"x12"		36"x36"x12"	
SB-800	without tiling flange	SB-400	without tiling flange
SB-801	w/tiling flange—1 sd.	SB-401	w/tiling flange—1 sd.
SB-802	w/tiling flange—2 sds.	SB-402	w/tiling flange—2 sds.
SB-803	w/tiling flange—3 sds.	SB-403	w/tiling flange—3 sds.
32"x32"x12"		36"x24"x12"	
SB-600	without tiling flange	SB-200	without tiling flange
SB-601	w/tiling flange—1 sd.	SB-201	w/tiling flange—1 sd.
SB-602	w/tiling flange—2 sds.	SB-202-L	w/tiling flange—2 sds.
SB-603	w/tiling flange—3 sds.	SB-202-R	w/tiling flange—2 sds.
		SB-203	w/tiling flange—3 sds.

* Flange is across back and on RIGHT side on model numbers ending in "R".

SB-850 24" x 24" x 12" with 4 S.S. caps without tiling flange

QUALITY OPTIONAL FITTINGS



- ☑ A T-10-VB Mop-Service sink fitting with vacuum breaker, adjustable top brace, 3/4" hose thread on spout with bucket hook inlets 8" on center, chrome finish.
- T-15-VB same as above with polished chrome finish.
- ☑ B T-35 Hose and wall hook. Hose 36" long, with 3/4" chrome couplings. Wall bracket of stainless steel.
- ☑ C T-40 Stainless Steel Mop Hanger of stainless steel with #4 finish . . . 24" long, with 3 rubber spring loaded grips.
- ☑ D BP Splash Catcher Panels of 20 ga. type 304 stainless steel.

JOB

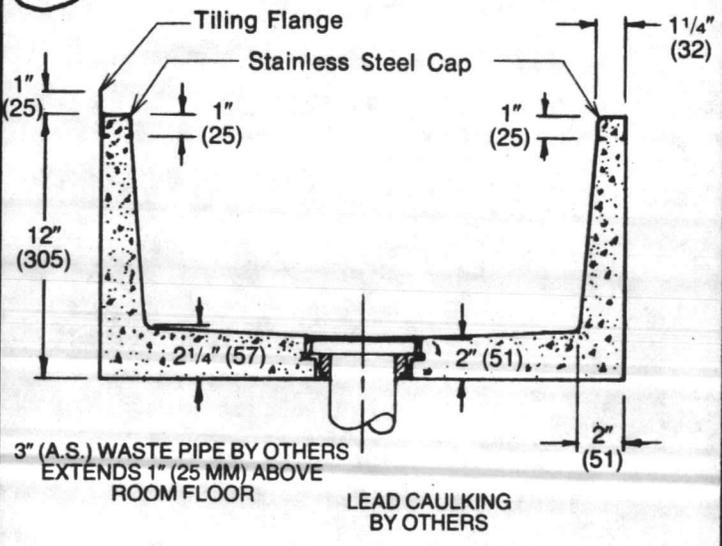
ARCHITECT

ENGINEER

1240 2-41

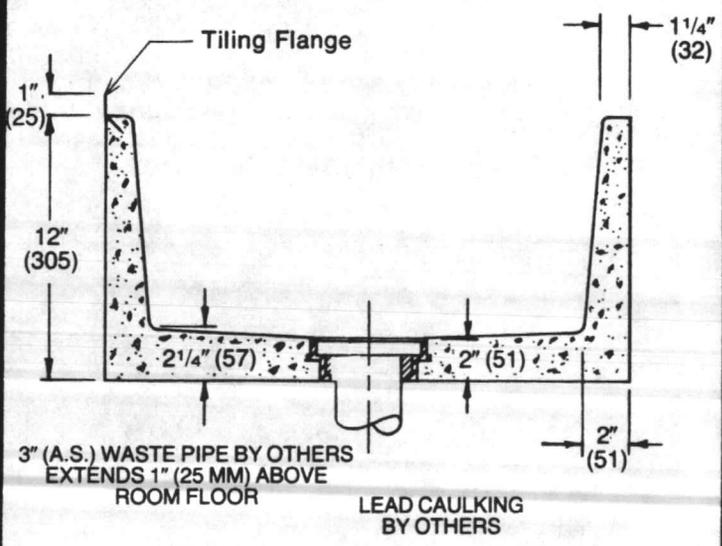
CROSS SECTION

900, 700, 500 AND 300 SERIES

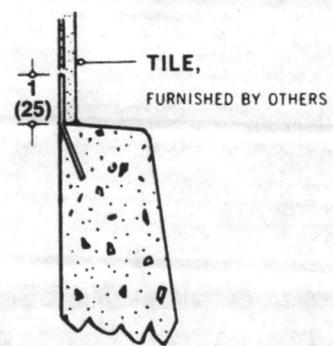
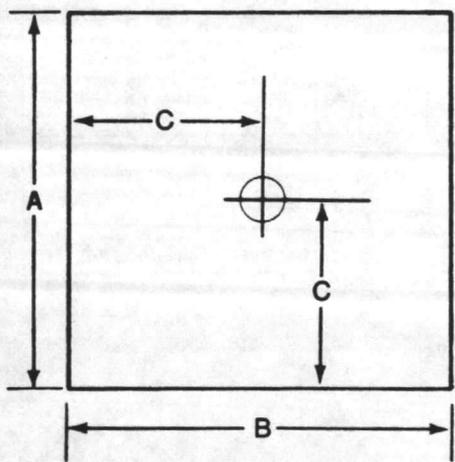


CROSS SECTION

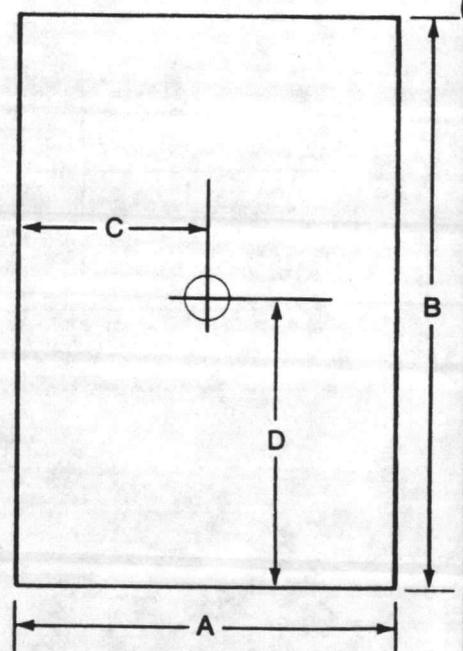
800, 600, 400 AND 200 SERIES



ROUGH-IN



CAST INTEGRAL TILING FLANGE



SERIES	A		B		C	
	Inches	MM	Inches	MM	Inches	MM
850	24	610	24	610	12	305
800	24	610	24	610	12	305
700	32	813	32	813	16	406
600	32	813	32	813	16	406
500	36	914	36	914	18	457
400	36	914	36	914	18	457

Height all models 12", 305 MM

SERIES	A		B		C		D	
	Inches	MM	Inches	MM	Inches	MM	Inches	MM
300	24	610	36	914	12	305	18	457
200	24	610	36	914	12	305	18	457

Height all models 12", 305 MM

STERN - WILLIAMS CO., INC. ★ P. O. BOX 8004 ★ SHAWNEE MISSION, KANSAS 66208

Note: All dimensions subject to manufacturing variance of plus or minus 1/4" (6 MM).

(No. S 5-85)



STERN-WILLIAMS CO., Inc.
P.O. BOX 8004 • SHAWNEE MISSION, KANSAS 66208
913-362-5635

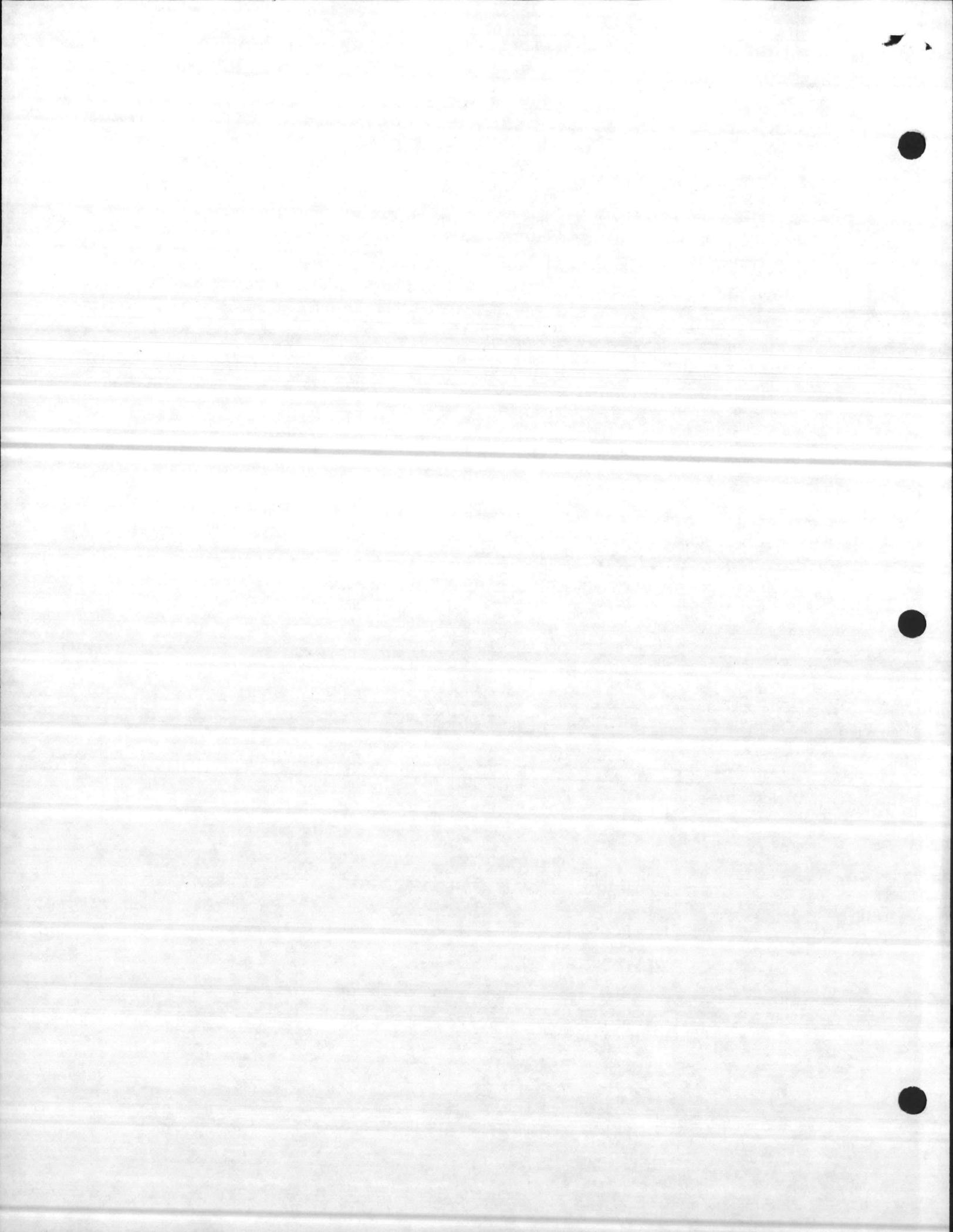
TO WHOM IT MAY CONCERN:

THE T-10-VB SERVICE SINK FITTING AND THE T-15-VB
SERVICE SINK FITTING COMPLY WITH ANSI STANDARD
A112.18.1M.

STERN-WILLIAMS CO., INC.

B. A. Briggs
B. A. BRIGGS
OFFICE MANAGER

11-18-87



15460 2.4.8

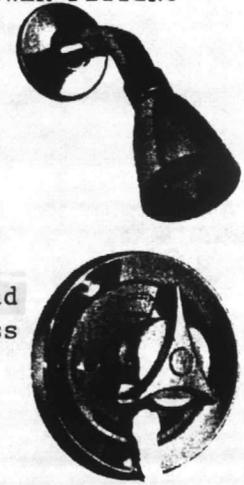
96-1

P-8 SHOWER FITTING

Temptrol Shower Unit

#96-1-X-L(B)-B-BDC

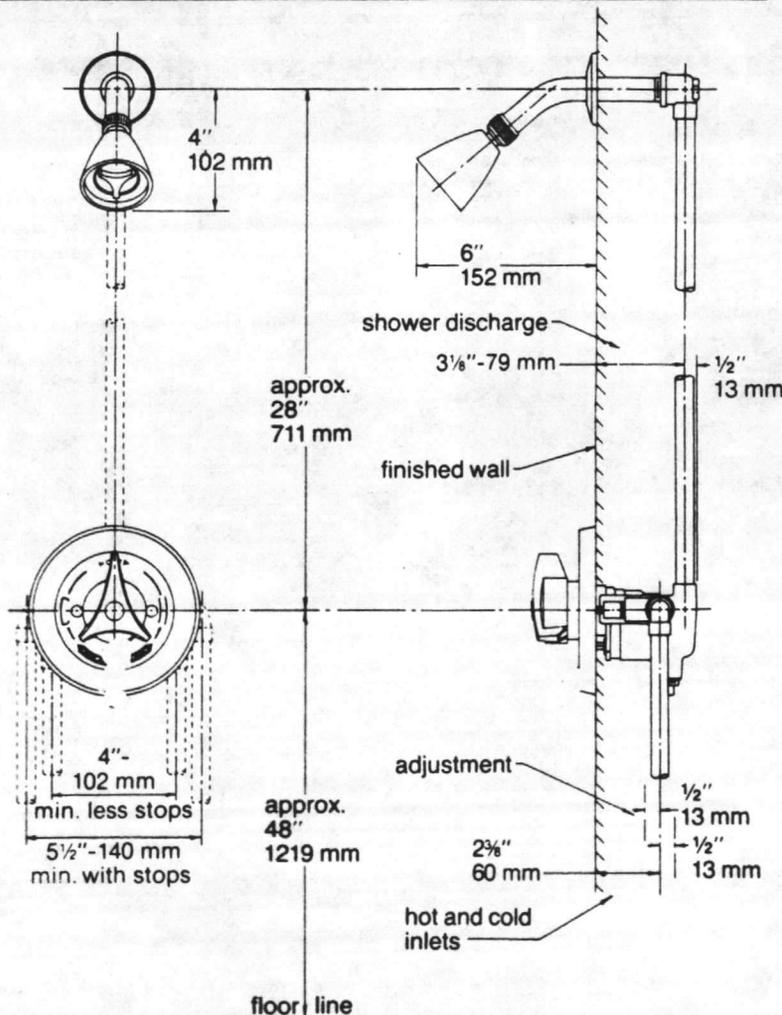
SYMMONS pressure balancing built-in shower valve with maximum temperature limit stop, front access service stops, CP brass single lever handle, CP brass escutcheon and CP brass dome cover & locknut. Valve body constructed of brass with internal parts of brass & S.S. To include a CP plastic adj. spray pattern shower head w/brass ball joint connection & 2-3/4 GPM flow restrictor, CP brass



- Suffix X** Service stops shower arm & flange.
- Suffix L (B)** Lever Hdles. of brass
- Suffix BDC** brass dome cover
- Suffix B** brass escutcheon
- Suffix WHS** Wall and hand shower with shower head diverter valve
- Suffix NU** NU-Arm head bracket in place of arm and flange

ALL SHOWER HEADS AND HAND SPRAYS ARE EQUIPPED WITH A 2.75 (±.25) GPM FLOW CONTROL DEVICE IN ACCORDANCE WITH ASHRAE 90-75 AND 90-A-1980 STANDARDS

Modifications



Job

.....

.....

.....

.....

.....

All floor to center dimensions optional. Concealed pipe and fittings not furnished by manufacturer.

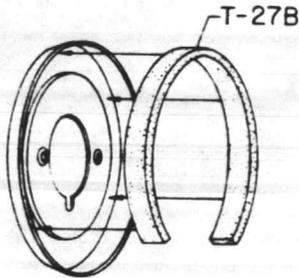
Symmons INDUSTRIES INC.

31 BROOKS DRIVE, BRAINTREE, MASSACHUSETTS 02184

When installing Temptrol in fiberglass or panel walls and it is desired to sandwich wall between valve body and escutcheon, follow instructions below. Note: It is also recommended to secure valve with rough construction and not on fiberglass wall for valve mounting security.

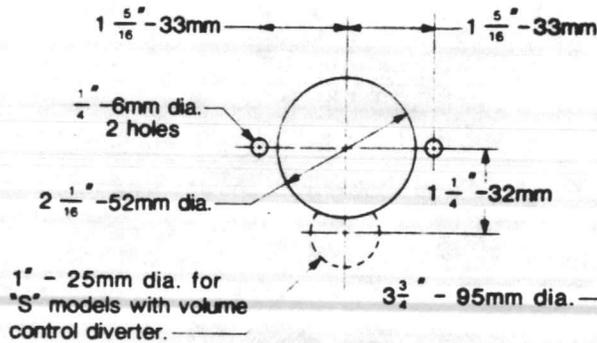
ESCUTCHEON GASKET: Position gasket in back side of escutcheon with open end at bottom as shown.

The use of this gasket should not preclude sealing valve body in wall as directed in installation instructions step 2.



BOTTOM

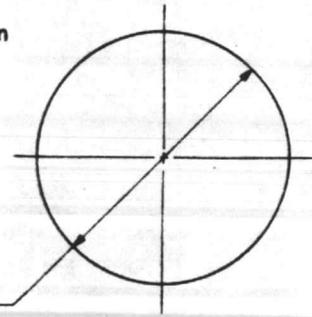
VALVE (less stops)



CUT WALL AS SHOWN AND MOUNT VALVE FROM REAR

VALVE (with stops)

Order Part No. FG-1
Wall Mounting Flange



CUT WALL AS SHOWN AND MOUNT VALVE WITH WALL MOUNTING FLANGE FROM REAR

INDIVIDUAL PARTS

(For Parts Not Shown See Composite Parts List)

Part No. Description

- T-1 HOT RENEWABLE SEAT
- T-2 COLD SEAT O-RING
- T-3 COLD RENEWABLE SEAT
- T-5 HOT WASHER SCREW
- T-6 HOT WASHER
- T-7 COLD WASHER RETAINER
- T-8 COLD WASHER

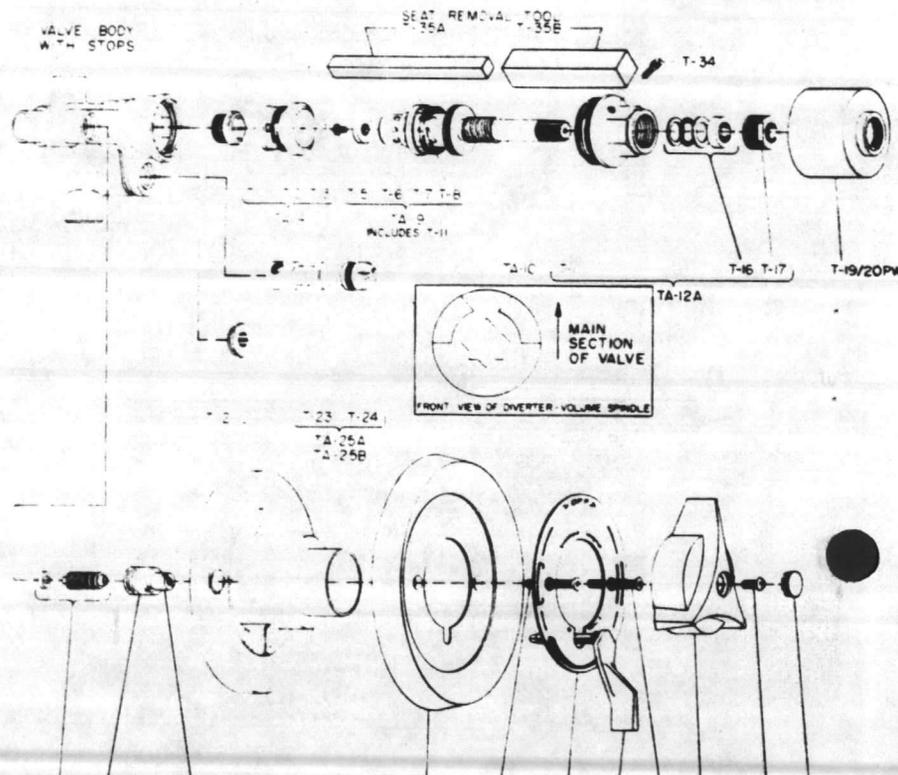
- TA-10 FLOW CONTROL SPINDLE
- T-11 CAP GASKET
- T-12A CAP ASSEMBLY
- T-16 PACKING O-RING & WASHER
- T-17 PACKING NUT
- T-19 20PW DOME COVER & LOCK NUT
- T-21C DIVERTER RETAINER
- T-23 DIVERTER SPINDLE (MODEL A)
- T-23 DIVERTER SPINDLE (MODEL B)
- T-24 SPINDLE O-RING
- T-27PW ESCUTCHEON
- T-28 ESCUTCHEON SCREWS (TWO)

- T-29A DIAL (MODEL A)
- T-29B DIAL (MODEL B)
- T-29C DIAL (MODEL C)
- T-30 DIVERTER - VOLUME HANDLE
- T-31 TEMPERATURE CONTROL HANDLE
- T-32 HANDLE SCREW
- T-33 PLUG BUTTON
- T-34 LIMIT STOP WITH O-RING
- T-35A HOT SEAT REMOVAL TOOL
- T-35B COLD SEAT REMOVAL TOOL
- T-52 SPINDLE ASSEMBLY
- T-53 PLASTER SHIELD
- T-54 ESCUTCHEON SCREW RETAINER

COMPOSITE PARTS

- | PART NO. | DESCRIPTION |
|----------|---|
| TA-4 | HOT SEAT (T-1), COLD SEAT (T-3), COLD SEAT O-RING (T-2) |
| TA-9 | HOT WASHER SCREW (T-5), HOT WASHER (T-6), COLD WATER RETAINER (T-7), COLD WASHER (T-8), CAP GASKET (T-11) |
| TA-10 | SPINDLE ASSEMBLY |
| TA-25-A | DIVERTER-VOLUME SPINDLE (T-23), O-RING (T-24) - FOR MODEL A VALVE - COLOR BEIGE OR GREY |
| TA-25-B | VOLUME SPINDLE (T-23), O-RING (T-24) - FOR MODEL B VALVE - COLOR BLACK |

REMOVE ESCUTCHEON SCREW RETAINERS FOR ACCESS TO STOPS WITH 3/16\"/>



IMPORTANT

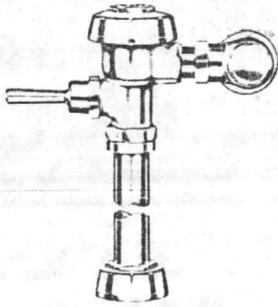
Escutcheon Assembly

American Standard

PURE LUXURY

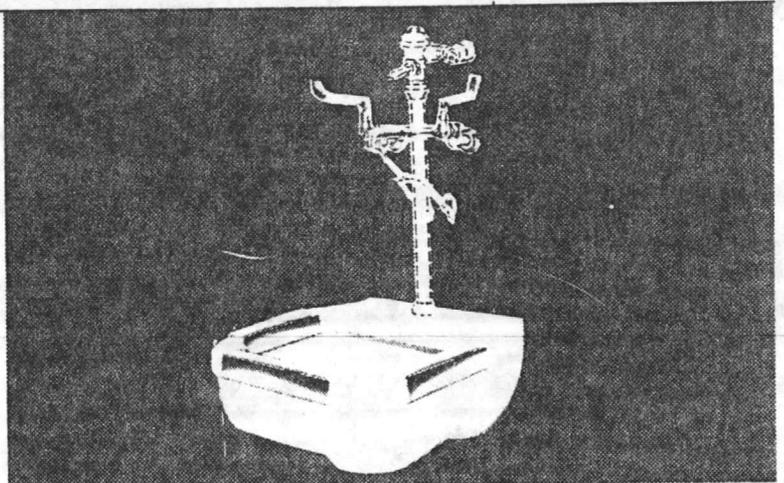
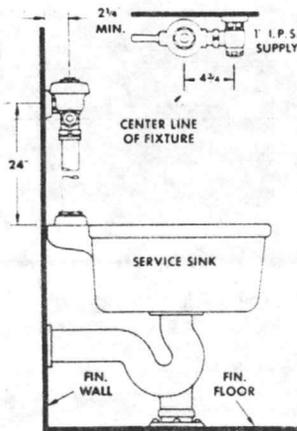
15460 2.4.9 (P.9)

clinic service sink
Vitreous China



ROYAL 117
Code No. 3010500

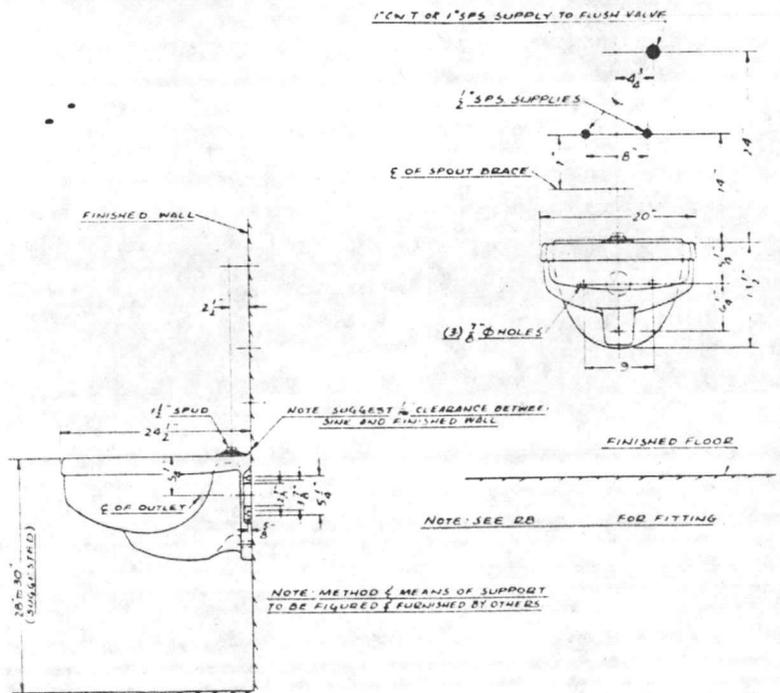
Quiet Exposed Service Sink Flush Valve, Chrome Plated, metal oscillating non-hold-open handle, 1-inch I.P.S. screw driver Bak-Chek angle stop with protective cap, adjustable tailpiece, vacuum breaker flush connection and spud coupling for 1½-inch top spud, wall and spud flanges. See page 52 for ordering procedure.



X 9512.013
Clinic service sink with blow-out flushing action, flushing rim, and 1½" (38mm) brass top spud. Wall hung. Fixture only.

7832.017
Rim Guard - Not included. Specify 3 if required.

Suggested flush valve: Sloan Royal 117H.
Shown with 8345.100 wall mounted sink faucet with 6" brass wrist handles.
minimum pressure—25 psi at valve while flushing.

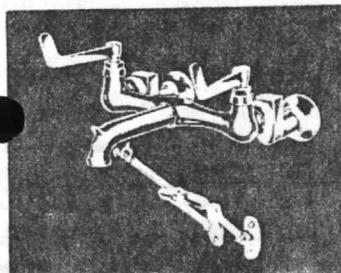


WALL HUNG CLINIC SERVICE
DN # 117 NYV, 115 TV
15H VALVE

TO BE FIGURED & FURNISHED BY OTHERS

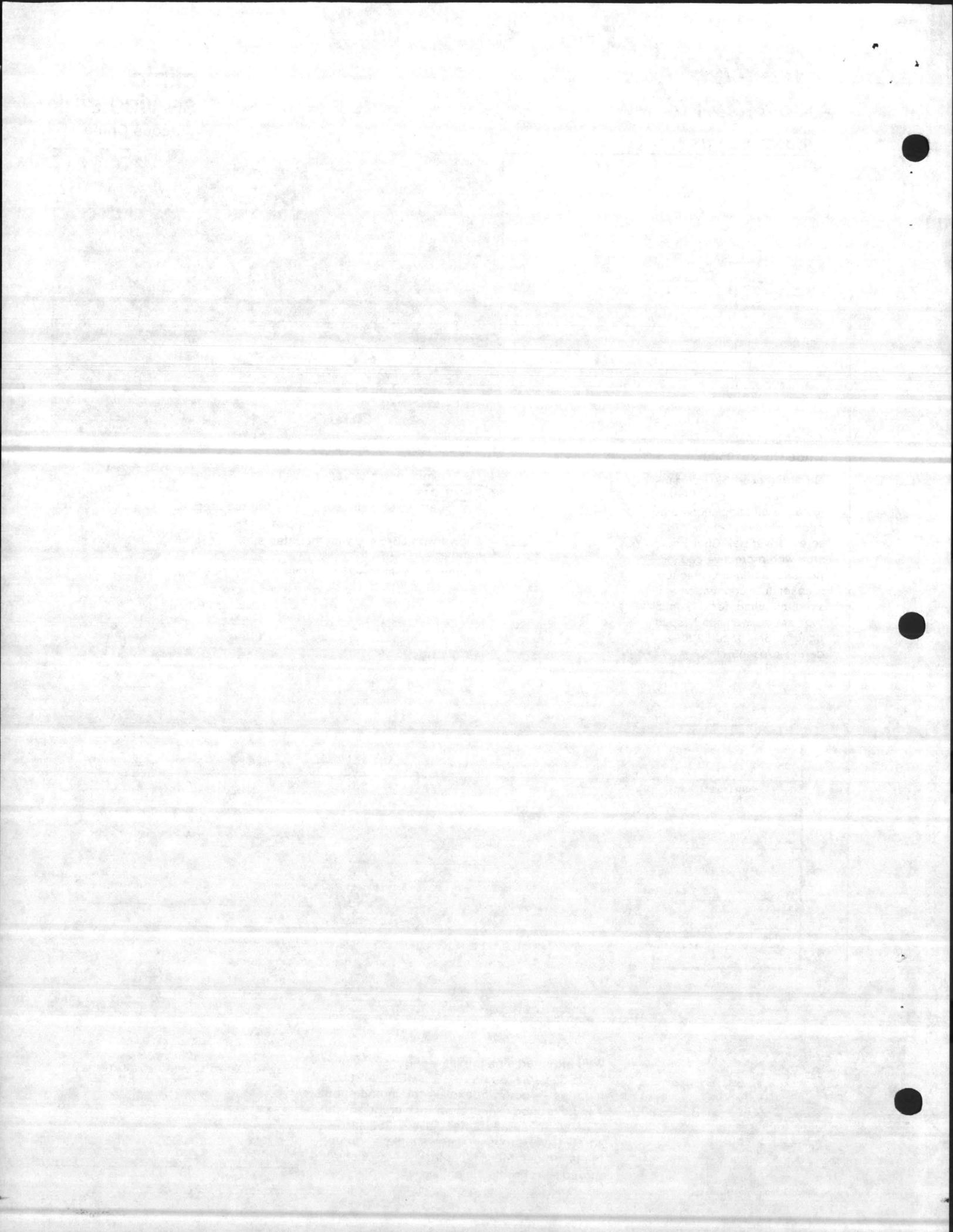
ominal and may vary within the range of tolerances
rds A112.19.2.

bility is assumed for use of superseded or voided pages.



8345.100

Wall mounted sink faucet — Aquaseal valves — renewable seats — 6" (152mm) brass handles — color indexes — plain end spout — bucket hook — bottom fork brace to wall — wall to spout outlet 10¼" (260mm) — screwdriver stops in inlet shanks — union inlets adjustable 8" centers — ½" female thread — chrome finish.



DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE

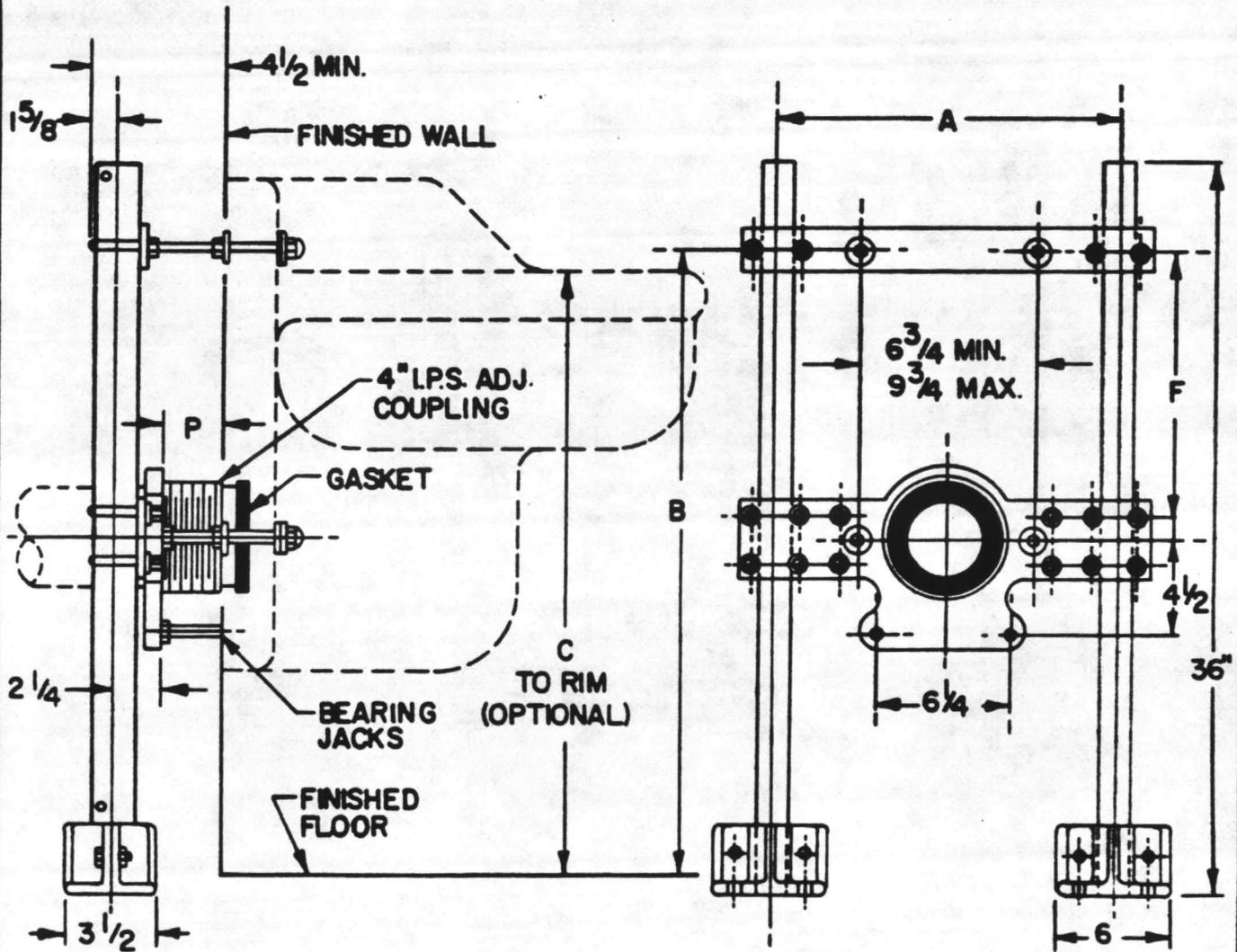
FOR: #9512.013

NOTE:
LETTERED DIMENSIONS TO MEET FIXTURE REQUIREMENTS FOR INSTALLATION-
REQUEST ROUGHING-IN DRAWINGS.

LOCATE 4" I.P.S. ADJ. COUPLING IN FRONT OF WALL (USUALLY $\frac{7}{16}$ " LESS THAN
DEPTH GASKET RECESS.)

DRN. 11-11-81 BY K.S.K. CKD. L.M. APPD. L.M. LAST REV. CMN. DATE BY CKD. APPD.

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REGULARLY FURNISHED

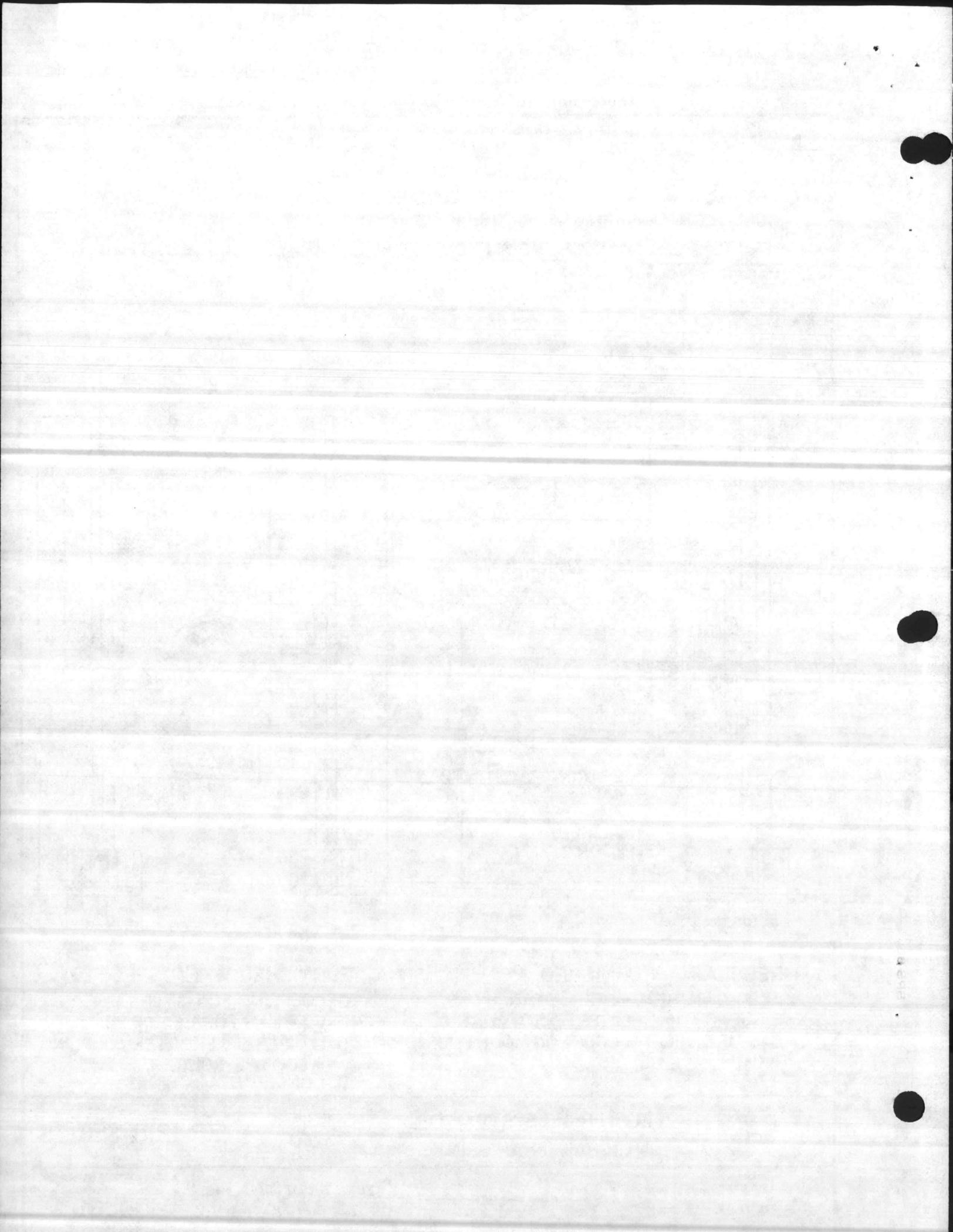
AS SHOWN, HEAVY STEEL STANCHIONS,
& SUPPORTING PLATES. "DURA-COATED"
CAST IRON FEET & COUPLING MOUNTING
TRIM.

FURNISHED WHEN SPECIFIED

- COUPLING FOR 3" I.P.S.
- COUPLING FOR LEAD PIPE
- LONGER OR SHORTER COUPLING
& FIXTURE BOLTS.
- LONGER STANCHIONS

ZURN RIGID SYSTEM FOR
INTEGRAL TRAP SINKS

PRODUCT NUMBER
ZR-1218 SERIES



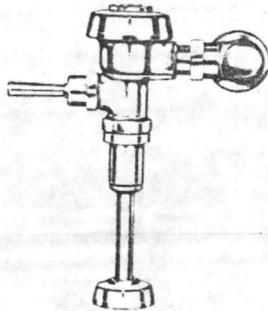
American Standard

PURE LUXURY

15460 2.4.10

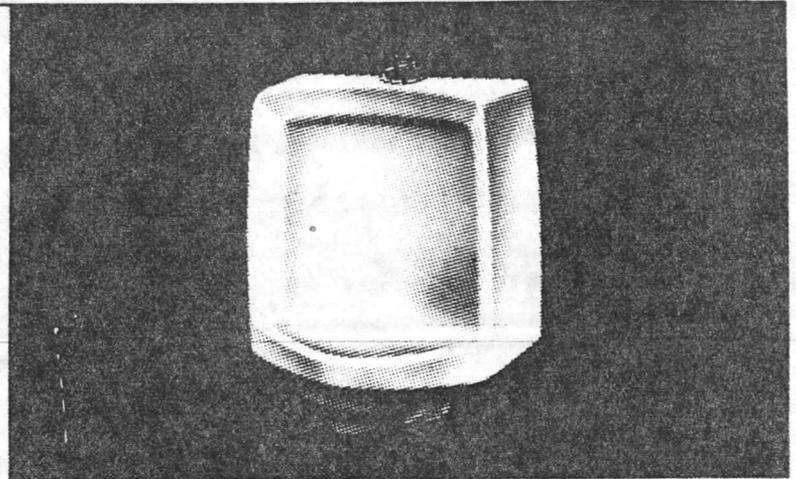
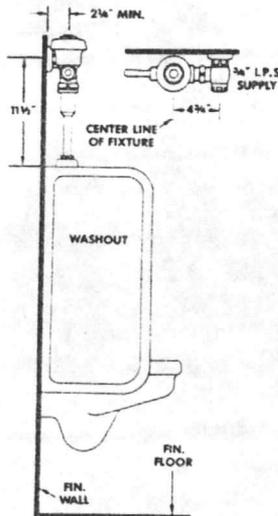
(P-10)

**water-saver
Trimbrook urinal**



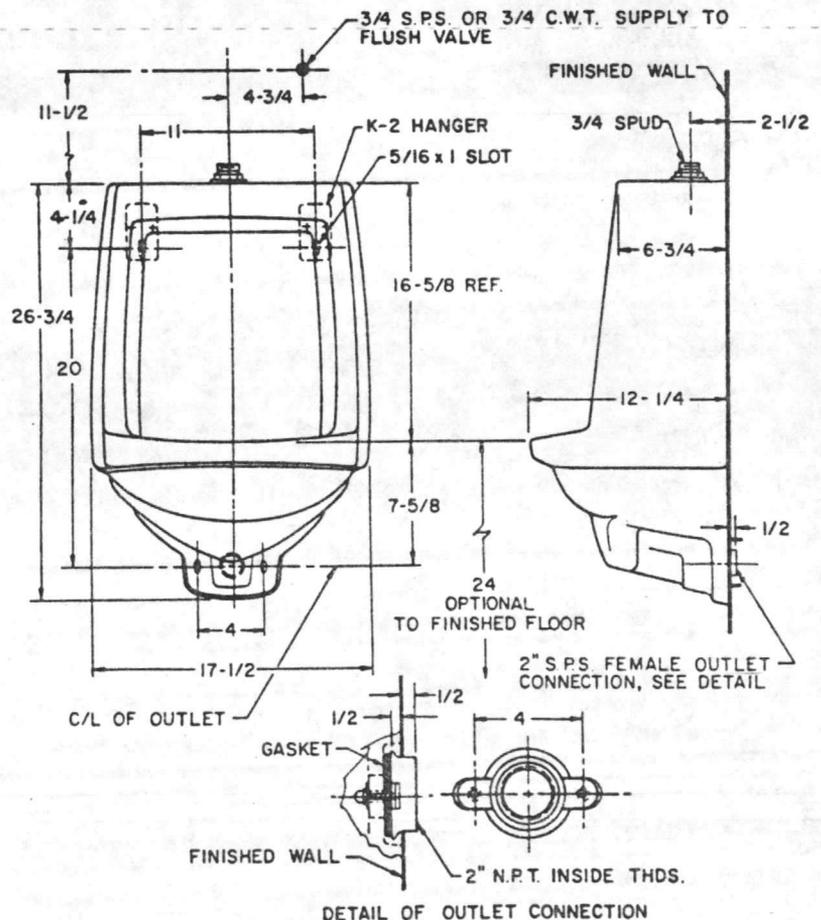
ROYAL 186
Code No. 3012600

Quiet Exposed Urinal Flush Valve, Chrome Plated, metal oscillating non-hold-open handle, 3/4-inch I.P.S. screw driver Bak-Chek angle stop with protective cap, adjustable tailpiece, vacuum breaker flush connection and spud coupling for 3/4-inch top spud, wall and spud flanges. See page 57 for ordering procedure.



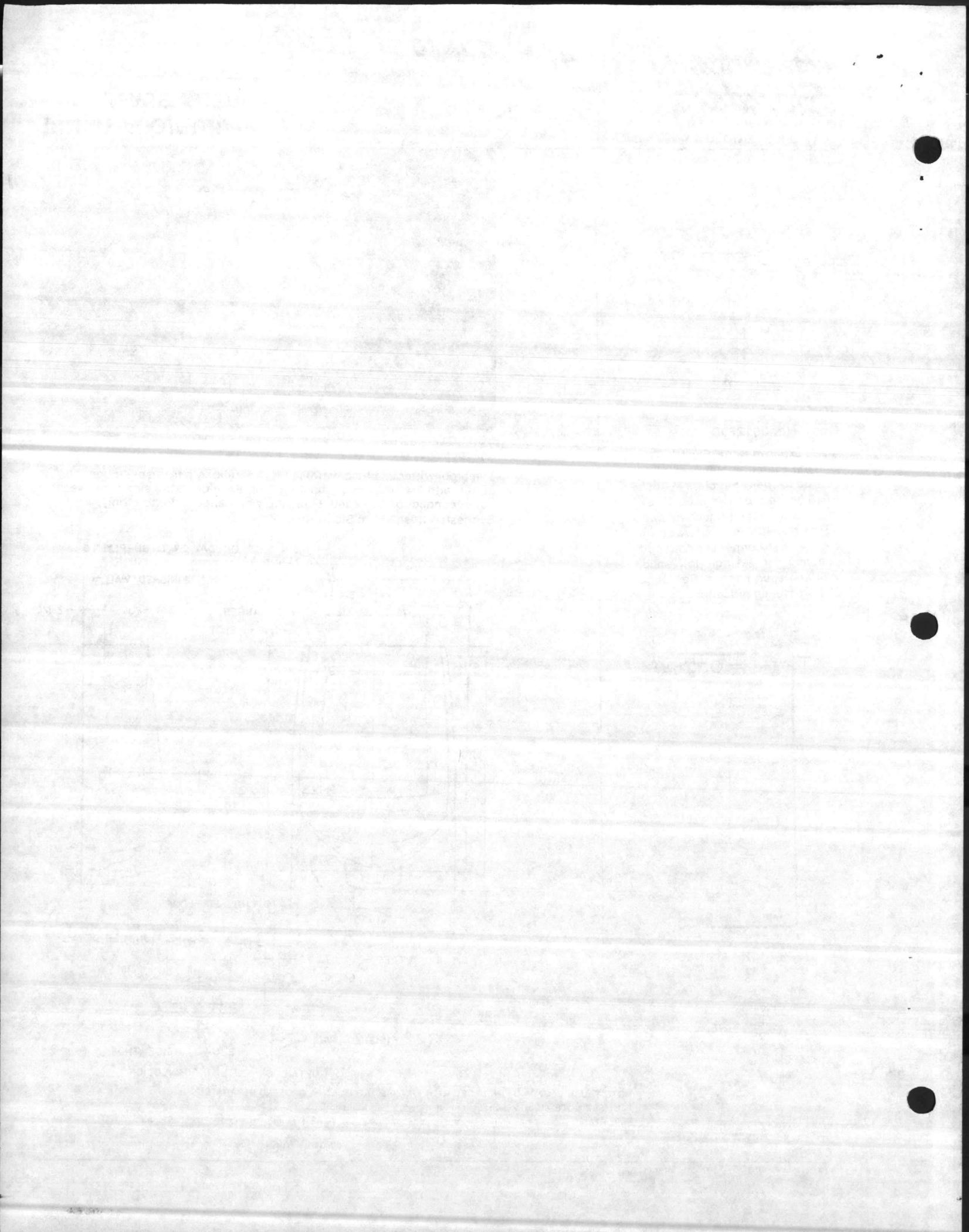
6561.017
top spud

Trimbrook vitreous china watersaver (1.5 gallons per flush) siphon jet urinal, with 3/4" inlet spud, flushing rim, extended stall side for privacy, outlet connection threaded 2" inside, wall hangers. Fixture only. Suggested flush valve: Sloan Royal 186.

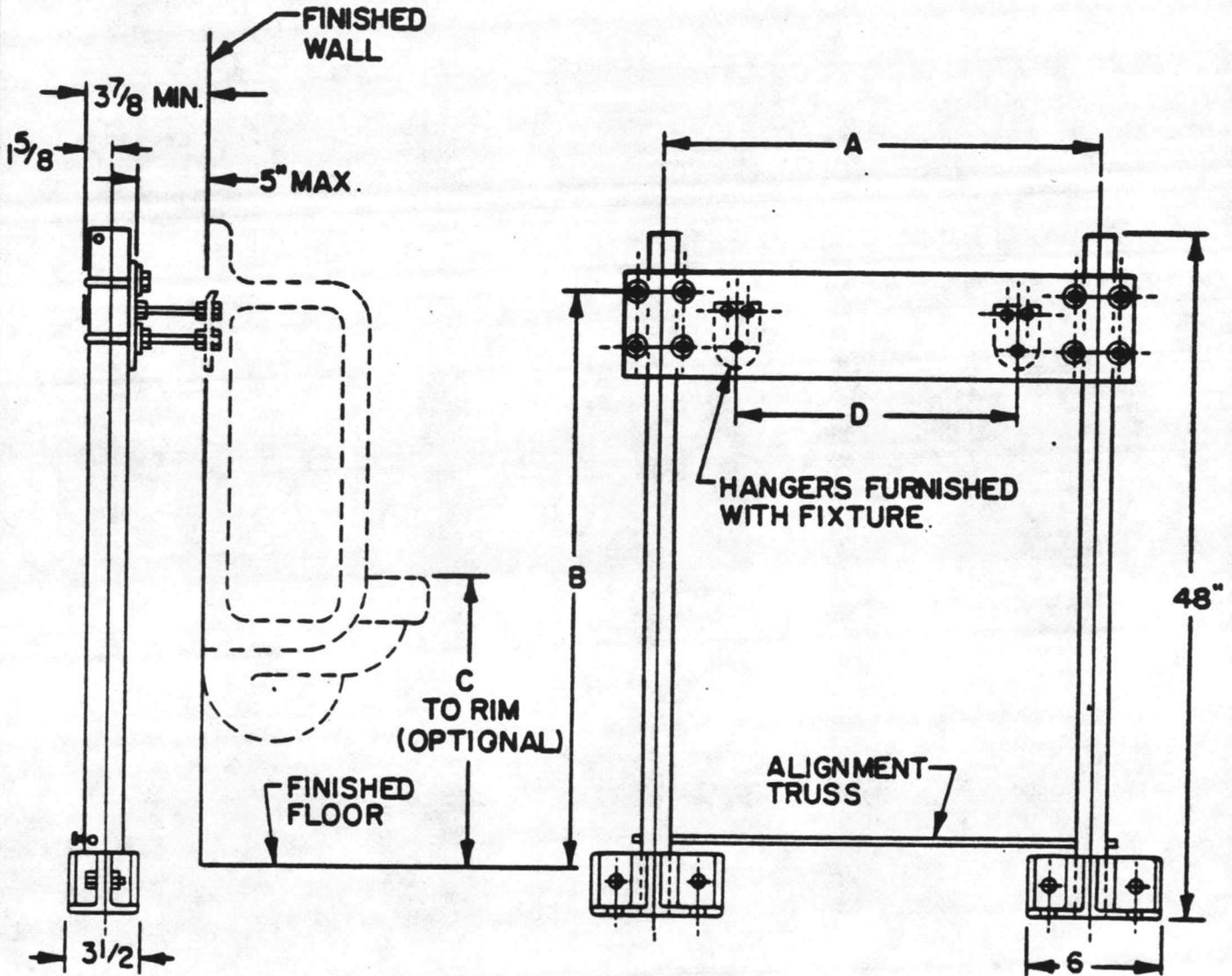


NOTE: FLUSH VALVE NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY.
 PLUMBER NOTE—Provide suitable reinforcement for all wall supports.
 IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standards A112.19.2
 These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

SPS 6561



NOTE:
LETTERED DIMENSIONS TO MEET FIXTURE REQUIREMENTS
FOR INSTALLATION - REQUEST ROUGHING-IN DRAWINGS.



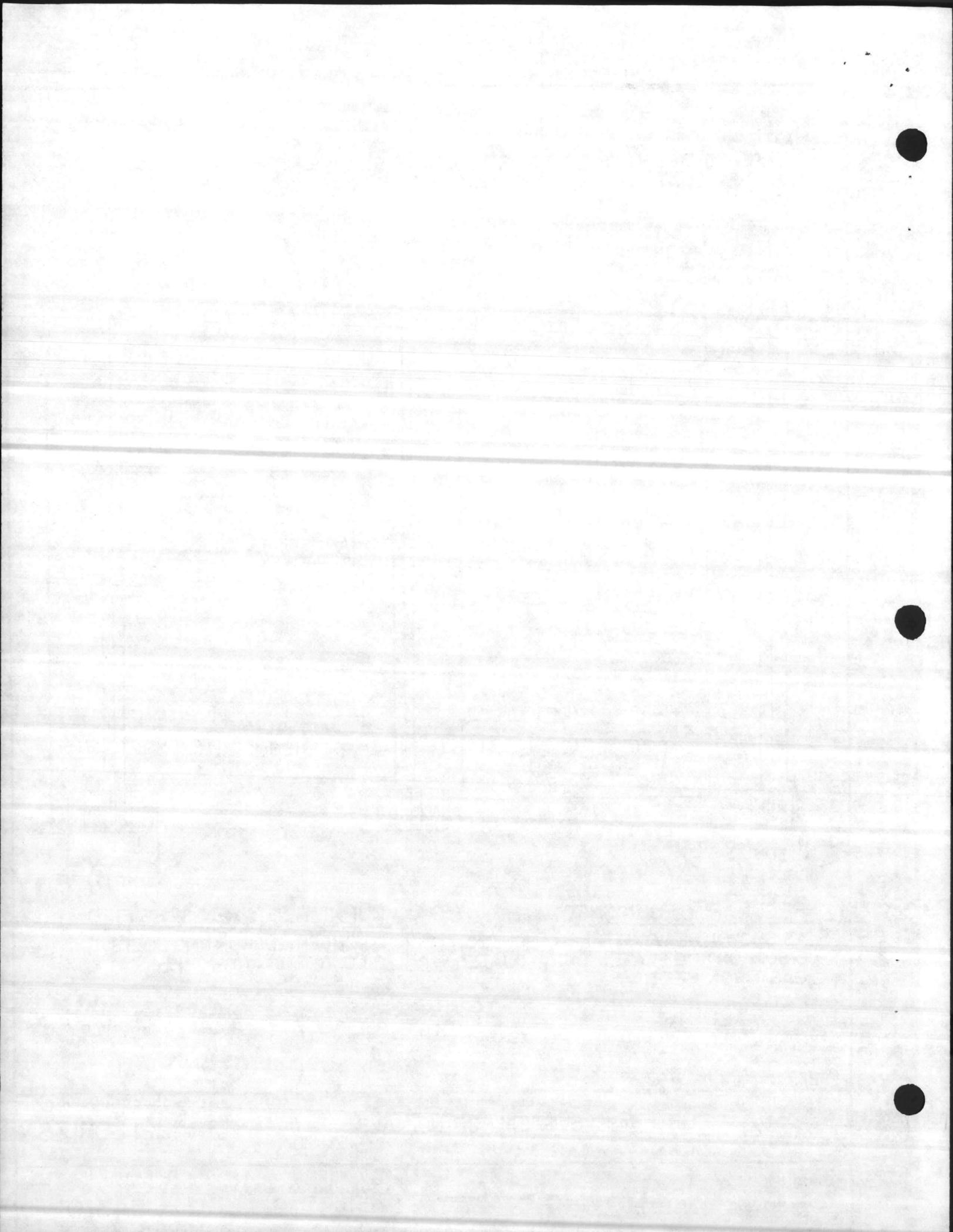
REGULARLY FURNISHED
AS SHOWN, HEAVY STEEL STANCHIONS,
& SUPPORTING PLATE "DURA-COATED"
CAST IRON FEET.

FURNISHED WHEN SPECIFIED
□ LONGER SUPPORTING BOLTS
□ LONGER STANCHIONS

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DRN 11181 BY KSK CKD L M APPD L M LAB...EV CNM DATE BY CKD APPD

ZURN RIGID SYSTEM FOR URINALS	PRODUCT NUMBER ZR-1221 SERIES
--------------------------------------	---



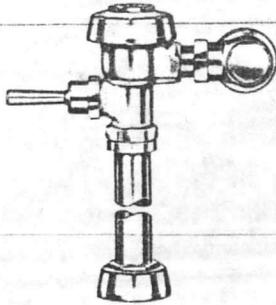
American Standard

PURE LUXURY

15460 2.4.11

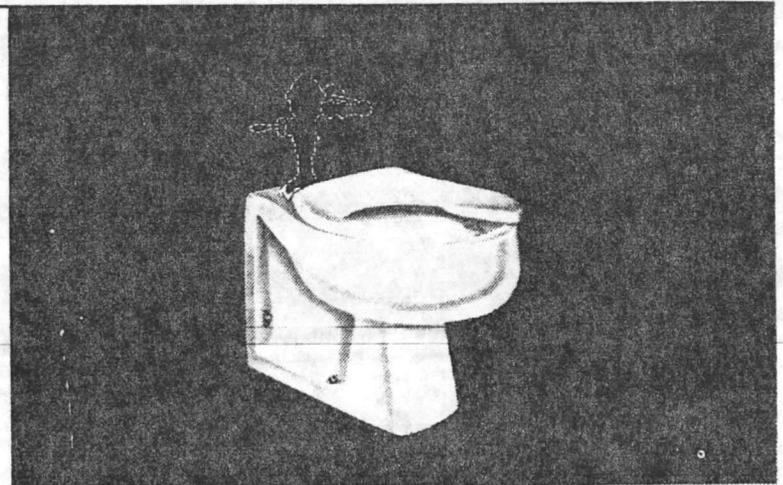
(P.11)

Neolo toilet
Vitreous China



ROYAL 115
Code No. 3010300

Quiet Exposed Closet Flush Valve, Chrome Plated, metal oscillating non-hold-open handle, 1-inch I.P.S. screw driver Bak-Chek angle stop with protective cap, adjustable tailpiece, vacuum breaker flush connection and spud coupling for 1½-inch top spud, wall and spud flanges. See page 28 for ordering procedure.

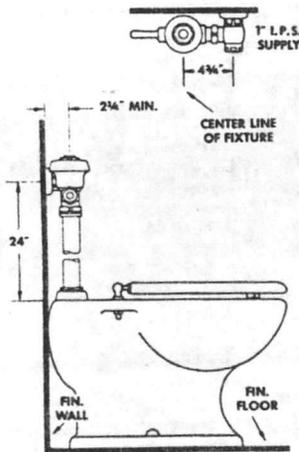


- 2529.014** top spud (illustrated)
- 2530.012** back spud

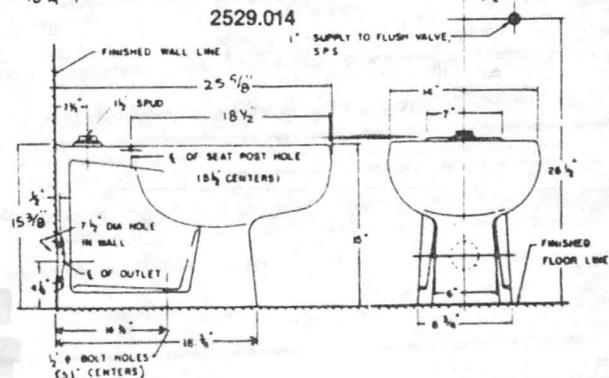
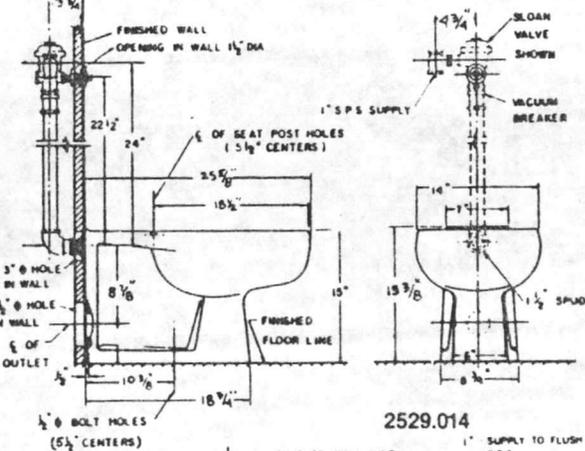
Neolo toilet with wall outlet siphon jet action, elongated bowl, angle back and base, 1½" inlet spud, vitreous china. Fixture only, less seat and floor screws.

Suggested flush valve:
Sloan Royal 110 (top spud). Sloan Royal 152 (back spud)
Seat shown: Olsonite #95

water surface, seal, ballpass and operation meets or exceeds ANSI A112.19.2M code requirements.
minimum working pressure—30 psi valve while flushing.



2530.012
FOR WALLS UP TO 1" IN THICKNESS. FOR EACH INCH ADDITIONAL THICKNESS OF WALL ADD 1" TO THIS DIMENSION.



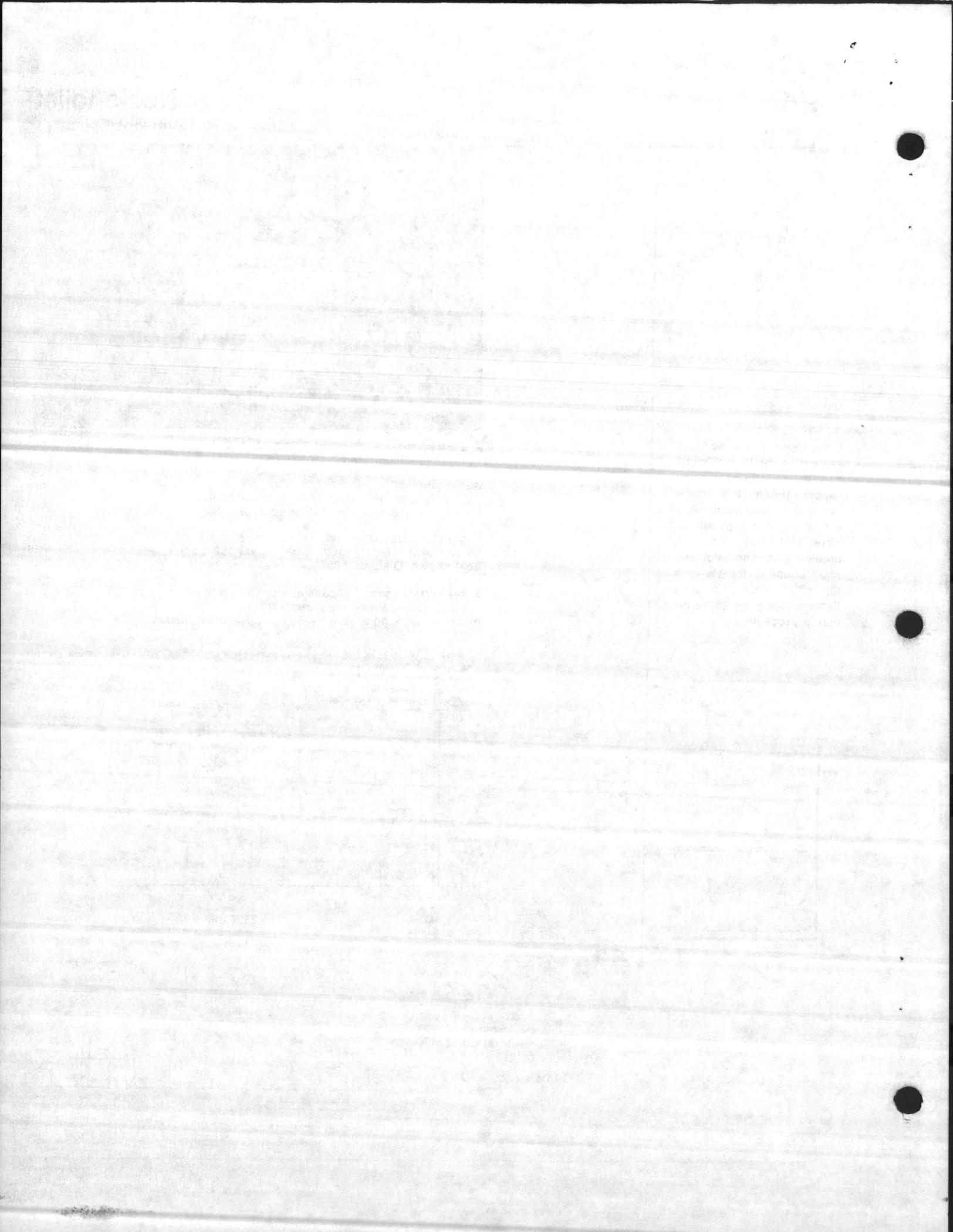
NOTE: TO COMPLY WITH AREA CODE GOVERNING THE HEIGHT OF VACUUM BREAKER ON FLUSH VALVE, THE PLUMBER MUST VERIFY DIMENSIONS SHOWN FOR SUPPLY ROUGHING.

NOTE: FLUSH VALVE NOT INCLUDED WITH TOILET AND MUST BE ORDERED SEPARATELY.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standards A112.19.2

These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

SPS 2529

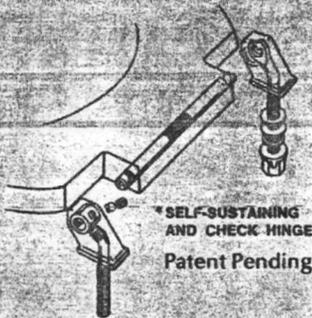
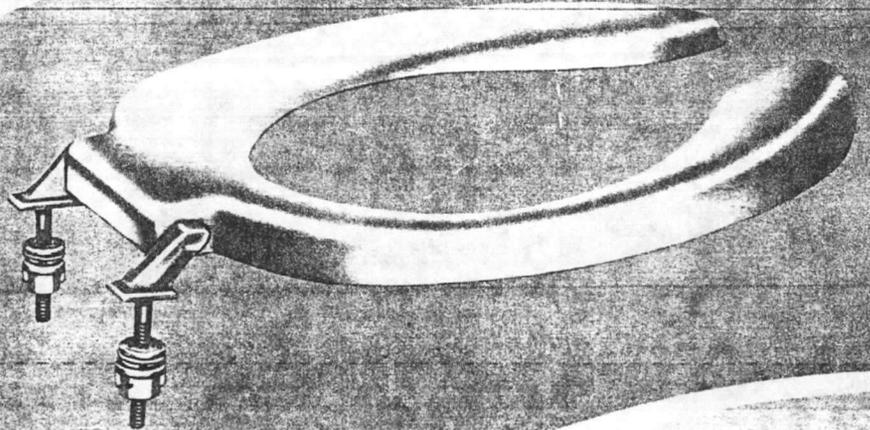


CHURCH

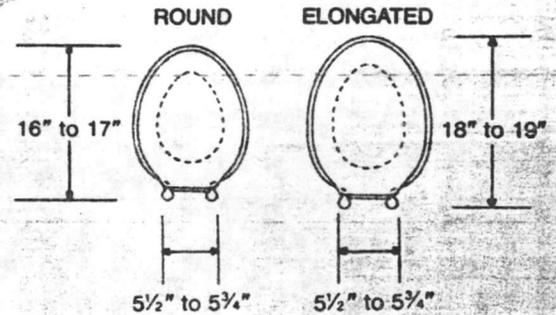
THE BEST SEAT IN THE HOUSE

SOLID PLASTIC HIGH-IMPACT POLYSTYRENE COMMERCIAL WEIGHT

295/397
Elongated Round



*SELF-SUSTAINING
AND CHECK HINGE
Patent Pending



295
(5334.016)

Commercial weight, solid plastic elongated, open front toilet seat; 310B anodized aluminum hinge posts, no check.

White Black

295C
(5334.024)

Commercial weight, solid plastic elongated, open front toilet seat; 3150 stainless steel hinge posts with check.

White Black
 Code 1 Colors *See Color Chart*

295NSSC*
(5334.107)

Commercial weight, solid plastic elongated, open front toilet seat; 3150/3155 stainless steel hinge posts with combination self-sustaining and check.

White Black

397
(5330.147)

Commercial weight, solid plastic round, open front toilet seat; 310B anodized aluminum hinge posts, no check.

White Black

397C
(5333.356)

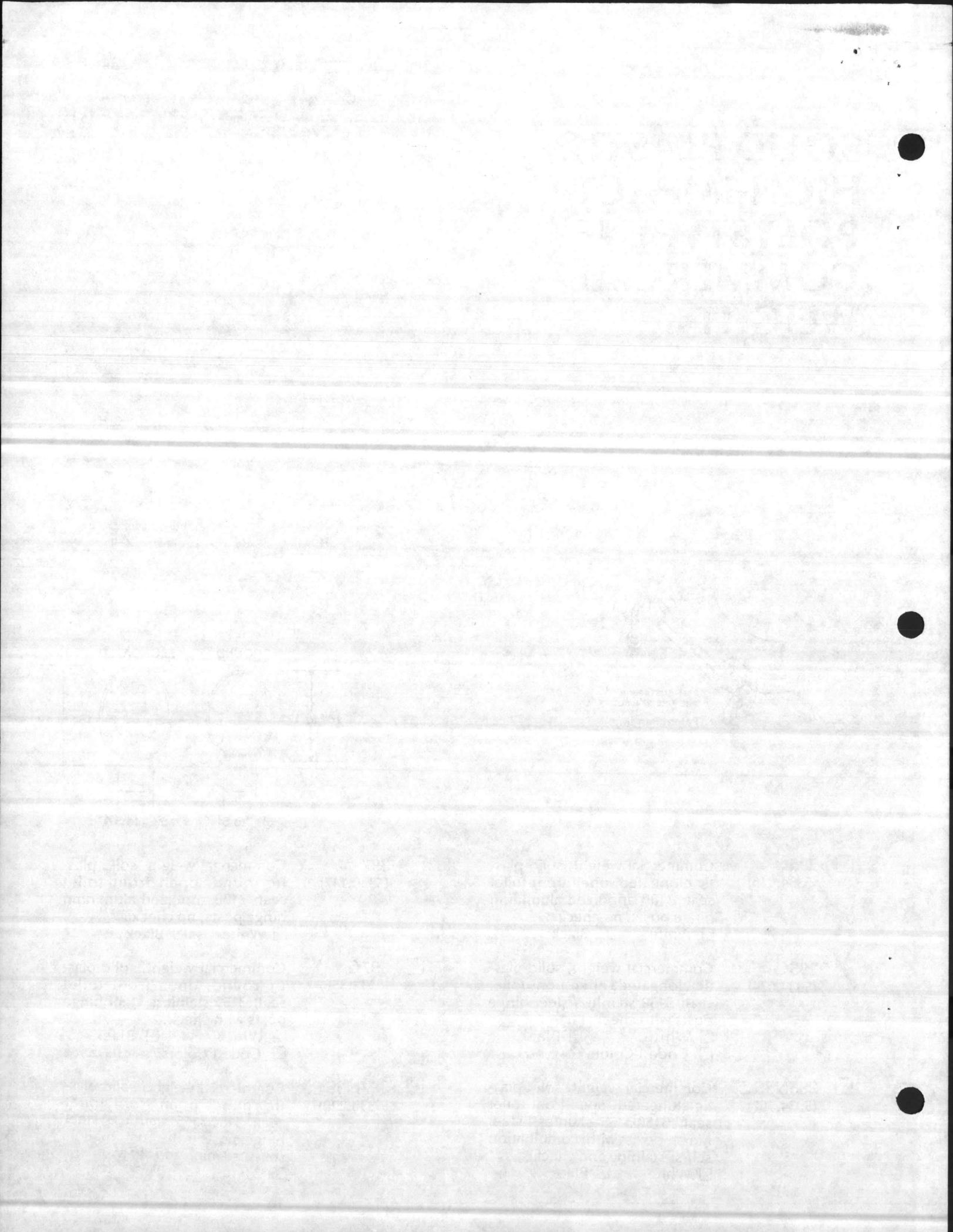
Commercial weight, solid plastic round, open front toilet seat; 3150 stainless steel hinge posts with check.

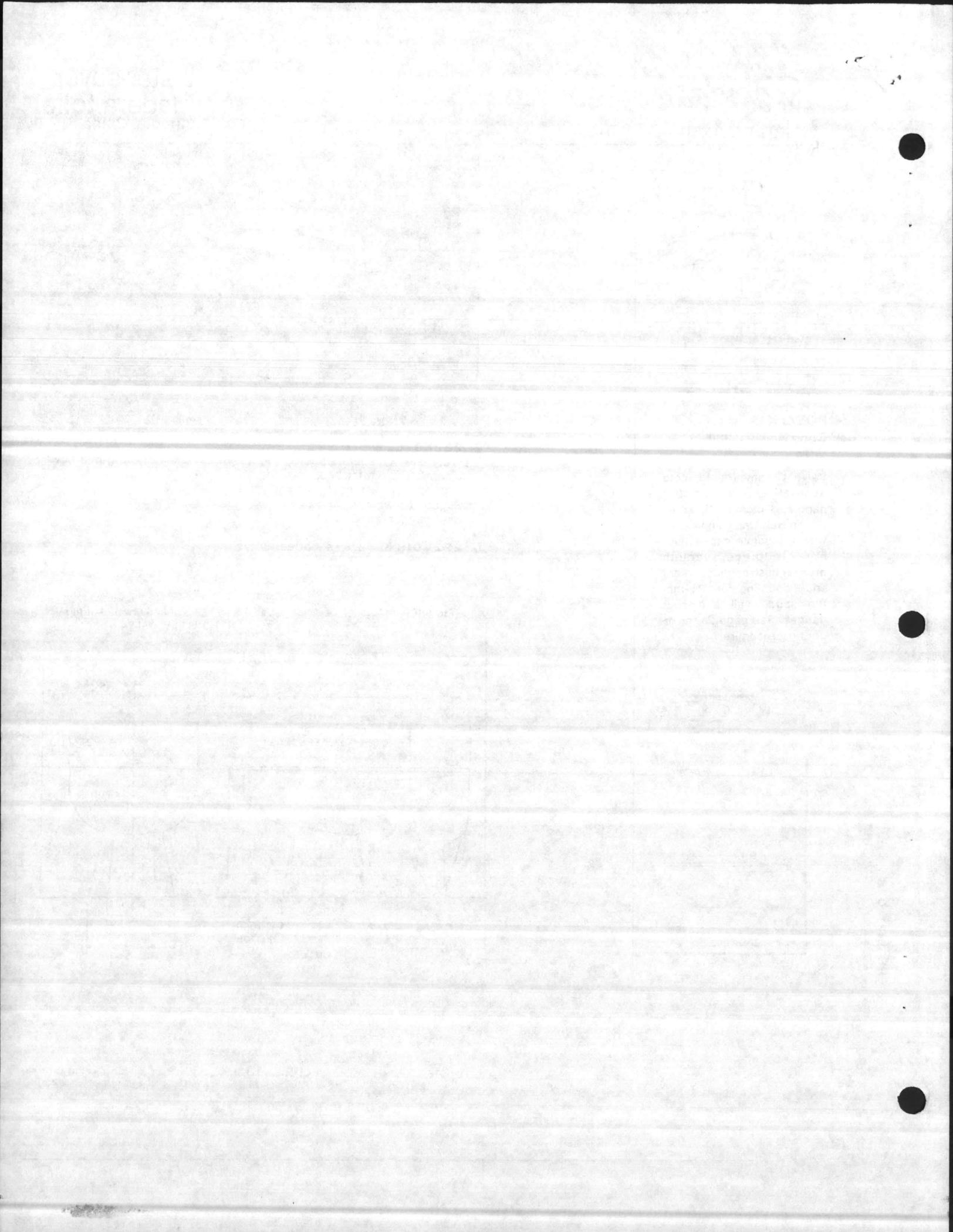
White Black
 Code 1 Colors *See Color Chart*

397NSSC*
(5330.220)

Commercial weight, solid plastic round, open front toilet seat; 3150/3155 stainless steel hinge posts with combination self-sustaining and check.

White Black





The ORIGINAL

YES YOU CAN
 LEAKPROOF WASHER CONNECTIONS

WASHER - CONNECTOR BOX

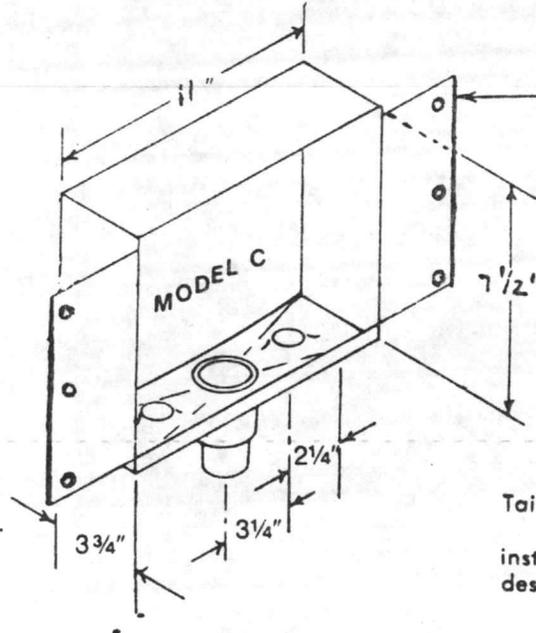
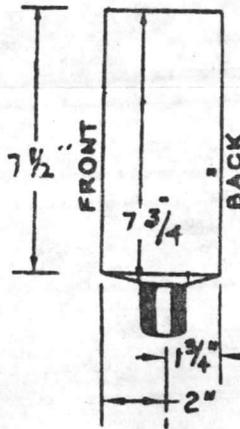
Manufacturers of LEAKPROOF facilities

SINCE 1955

FULL SIZE

SPACE SAVER

LEAKPROOF ALL WASHER CONNECTIONS



Overlaps
 16" Center Studs
 Easy Installation
 In New or
 Existing Walls

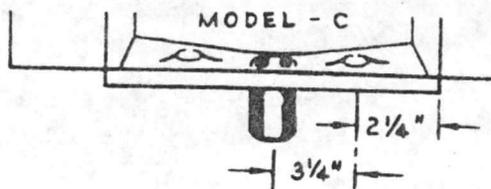
Tail piece slips into place.
 (slip nut
 installation may be used if
 desired).

DRAIN SIZES

High Impact ABS Fits 1 1/2", 1 3/4", or 2" DWV Pipe.

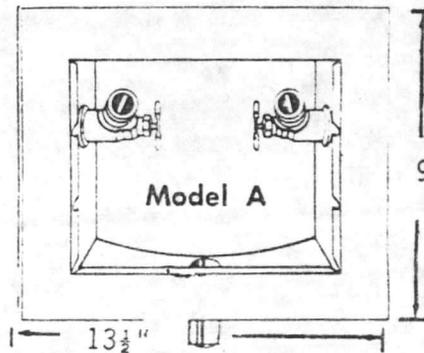
All drains are attached at
 factory- **WATER-TIGHT,**
PERMANENTLY SEALED

Also available with brass
 1 1/2", 1-3/4" & 2" OD
 drain attachments



MODEL-C

Supply pipes are brought
 up THRU raised bottom knock-
 outs & grommets to 4 1/2"
 inches where faucets attach
 to provide ample clearance
 of bottom of box for supply
 hoses. Supply pipes are **NOT**
CUT below bottom of box.



Per Max Reynolds- Dallas, Tx. Fire Dept.:

NORMAL HOUSE FIRE IS 1000°

ALUMINUM melts @ 1217° approx.

METALS: 22 gauge steel @ 2600° to 2800° approx.

24 gauge steel @ 2400° to 2600° approx.

STEEL with BAKED ON ENAMEL

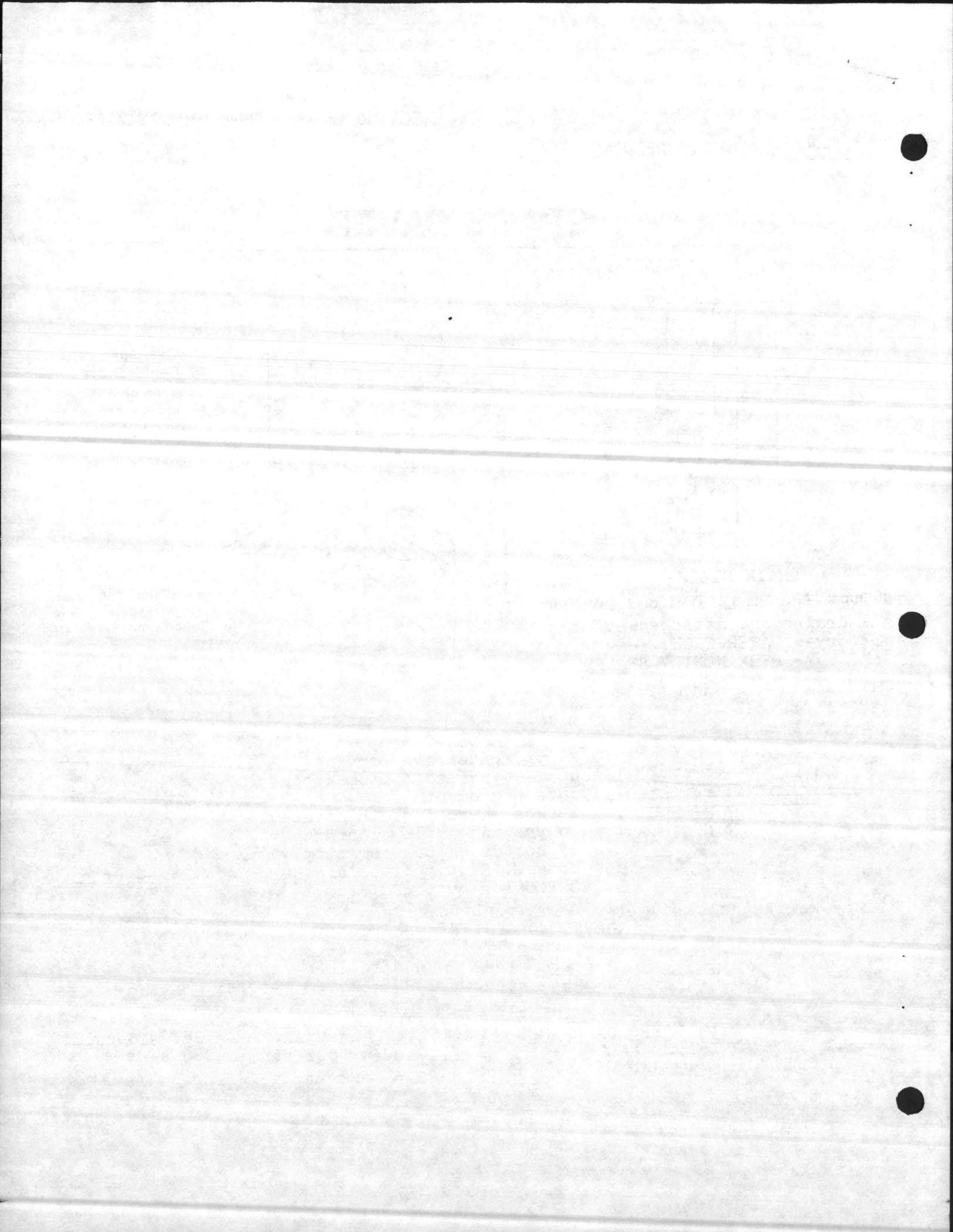
RUST FREE ALUMINUM

GALVANIZED (unpainted)

- 22 gauge pan, 24 gauge sidewalls
- ~~24~~ .032 pan - .025 sidewalls
- ~~22~~ 26 gauge pan, 24 gauge sidewalls

Manufactured & warehoused in Ennis, Texas by **CARUTH MANUFACTURING CO.**

FOR INFORMATION PLEASE CONTACT
 GENERAL SALES OFFICE



OASIS®

Compact On-A-Wall
Water Coolers

- OCP1M
- OCP3M
- OCP5M
- CFM (Fountain only)

These durable, attractively styled coolers occupy very little space. Ideal for use in stores, shops, schools, offices, etc.

Steel panels have standard finish of cathodically electrocoated acrylic enamel in Mocha Tan. Optional colors are available in enamel, vinyl laminated to steel and stainless steel.

Model CFM is a non-refrigerated drinking fountain designed for use with packaged water chillers or for direct connection to cold water supply. This fountain has a limited one-year warranty, parts only for one year from date of installation.



Mounting at any height (above) makes the Compact On-A-Wall ideal for primary schools, children's hospital wards.

SUGGESTED SPECIFICATIONS

Cooler(s) shall deliver at least _____ gph of 50°F. water at 80°F. inlet water and 90°F. room temperature.

Bubbler shall have lever handle and built-in pressure regulator to deliver smooth, steady flow at supply pressures from 20 to 125 psi.

Cooling tank shall be red brass with copper refrigerant coils. Refrigerant flow controlled by capillary tube. Temperature controlled by adjustable thermostat.

All water carrying lines shall be copper.

Water cooler(s) shall have limited five-year warranty on the sealed refrigeration system and most component parts.

Cooler(s) shall meet specifications of U.S. Department of Commerce Bureau of Standards; Public Health, Sanitary and Plumbing Codes; and be Certified to ARI, Listed by Underwriters' Laboratories, and Certified by CSA. Water cooler(s) shall be OASIS Compact On-A-Wall Model(s) _____.



OASIS Compact On-A-Wall Water Cooler Specifications

Model	Capacity in GPH of 50°F.* Drinking Water				Base Rate GPH	Pre- Cooler	115 Volts, 60 Hz.		Net Weight, Approx.
	Ambient Air Temperature						Compr. HP	Full Load Amps	
	70°F.	80°F.	90°F.*	100°F.					
OCP1M	1.4	1.2	1.0	0.9	1.0	No	1/20	1.6	42 Lbs.
OCP3M	3.1	2.9	2.7	2.5	2.7	No	1/8	3.2	49 Lbs.
OCP5M	5.1	4.9	4.7	4.3	2.4	Yes	1/8	3.2	49 Lbs.
CFM	FOUNTAIN ONLY								24 Lbs.

Number of People Served (Bubbler) Per One Gallon of Capacity At ARI Standard Rating Condition	
Offices, Hospitals, Schools, Stores, and Lobbies	25
Light Manufacturing	15
Heavy Manufacturing	12
Hot, Heavy Manufacturing	10

Note: The table above is in accordance with ARI
Drinking Water Cooler Application Standard 1020.

*Air Conditioning and Refrigeration Institute Standard Rating Condition 80°F. inlet water temperature.

Dial-A-Drink® Bubbler: Built-in pressure regulator assures a smooth, steady flow at line pressures from 20 to 125 psi. All metal parts are either stainless steel or brass.

Stainless Steel Top: One-piece type 304 polished stainless steel with effective anti-splash ridge. Easy-to-clean integral strainer grid.

Cabinet: The separate unitized (welded) framework of heavy gauge steel that provides rigidity is enamel coated for corrosion protection. Steel panels have standard finish of cathodically electrocoated acrylic enamel in Mocha Tan. Also available in optional colors of baked enamel and vinyl laminates (see Color Selector Guide), no extra charge. Satin finish stainless steel cabinets available at slight extra cost. For easy installation, units feature removable front and side panels, are shipped with mounting bracket.

Pre-Cooler: Cools incoming water with cold waste water. Double wall construction meets codes. All copper construction. Hot-tin bonded.

Tank and Cooling Coil: High efficiency tank-type cold water storage system reduces starts

and operating time of compressor. Two metal walls between drinking water and refrigerant. All water carrying lines are constructed of copper tubing. Connection provided for remote fountain.

Cooling Tank Insulation: Removable, molded, expanded bead polystyrene.

Cold Water Thermostat: Adjustable thermostat controls cold water temperature.

Refrigeration Unit: Fan cooled condenser. Internally spring mounted, hermetically sealed compressor with automatic overload protector. No lubrication needed. Refrigerant is controlled by accurately calibrated capillary tube.

Electrical: Furnished with 3-wire service cord and polarized plug.

Limited 5-Year Warranty (Continental limits of the United States and Canada): Five years on the sealed refrigeration system and most component parts. Detailed warranty certificate enclosed with each water cooler; sample copy available upon request.



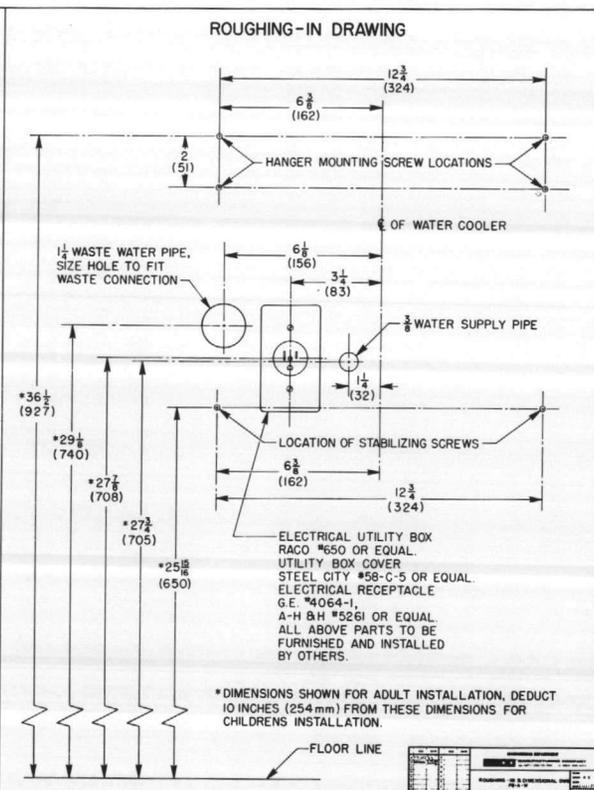
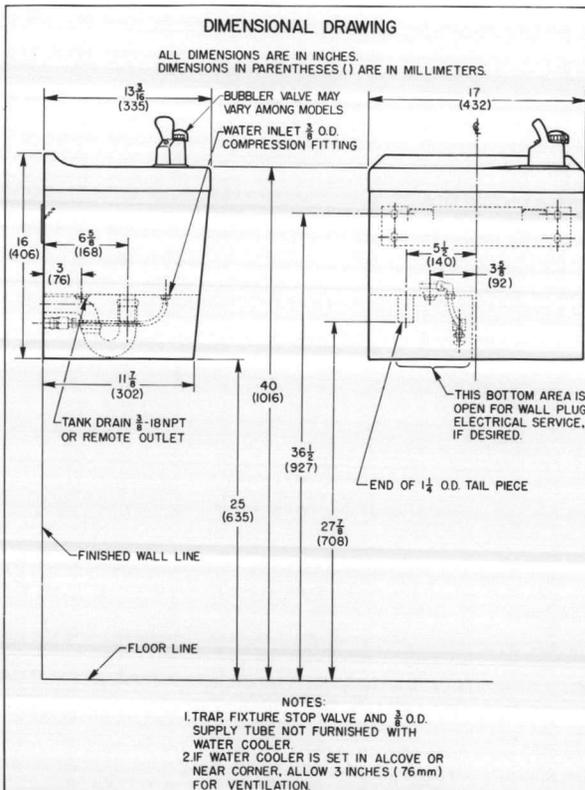
Models covered by these specifications comply with all known Plumbing Codes. Listed by

Underwriters' Laboratories, Certified by Canadian Standards Association, and Certified to Air Conditioning and Refrigeration Institute.

EXPORT

Special Export Models: Model OCP1M-50/60 is operable on 220-240 volts, 50/60 Hertz without transformer; Models OCP3M-50 and OCP5M-50 on 220-240 volts, 50 Hertz without transformers. UL, CSA and ARI not applicable.

Warranty: One year on the sealed refrigeration system and most component parts. Four-year replacement contract on sealed refrigeration system. Detailed warranty certificate enclosed with each water cooler; sample copy available upon request.



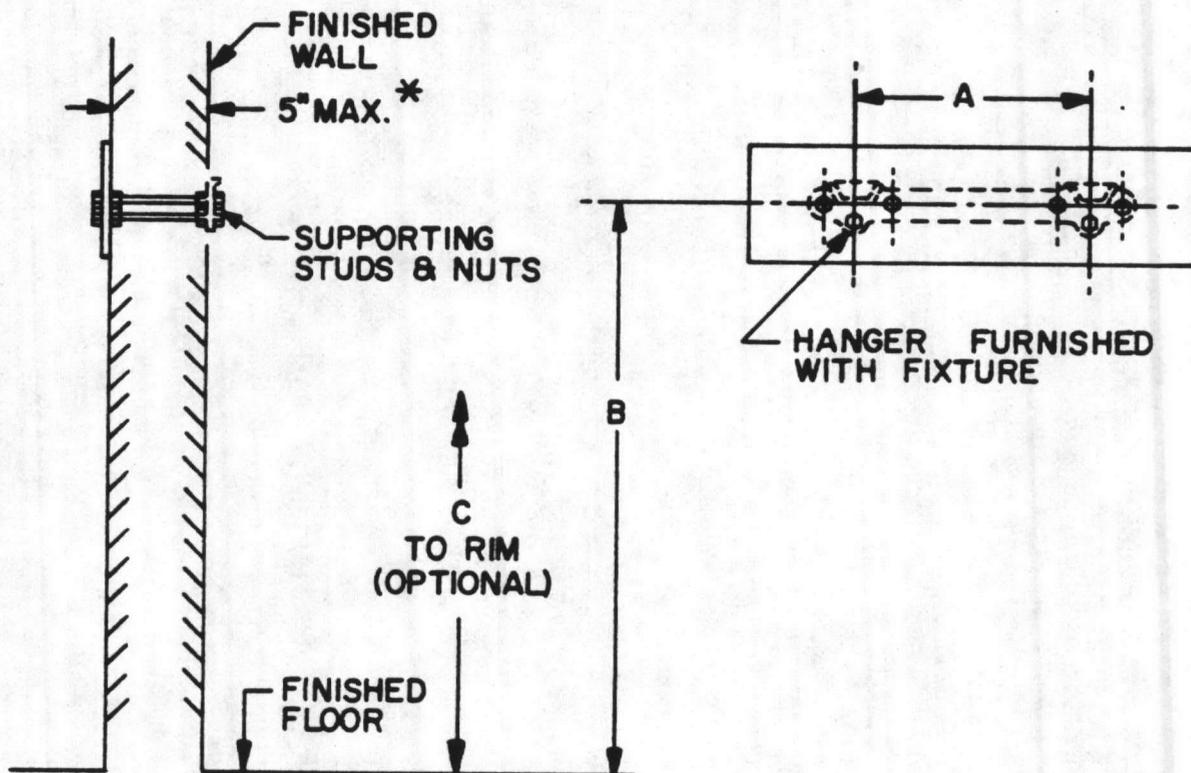
EBCO® MANUFACTURING COMPANY
265 N. HAMILTON RD. • COLUMBUS, OHIO 43213-1383

Specifications are subject to change without notice.

DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE

FOR: OCP-5M

NOTE:
LETTERED DIMENSIONS TO MEET FIXTURE REQUIREMENTS
FOR INSTALLATION-REQUEST ROUGHING-IN DRAWINGS.



REGULARLY FURNISHED
AS SHOWN, "DURA-COATED"
STEEL PLATE, STUDS & NUTS.

FURNISHED WHEN SPECIFIED
* □ LONGER SUPPORTING STUDS

APPD. BY DATE BY CKD. BY DATE BY CKN. BY DATE BY LAST REV. BY DATE BY MS

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ZURN SYSTEM FOR LAVATORIES
& DRINKING FOUNTAINS

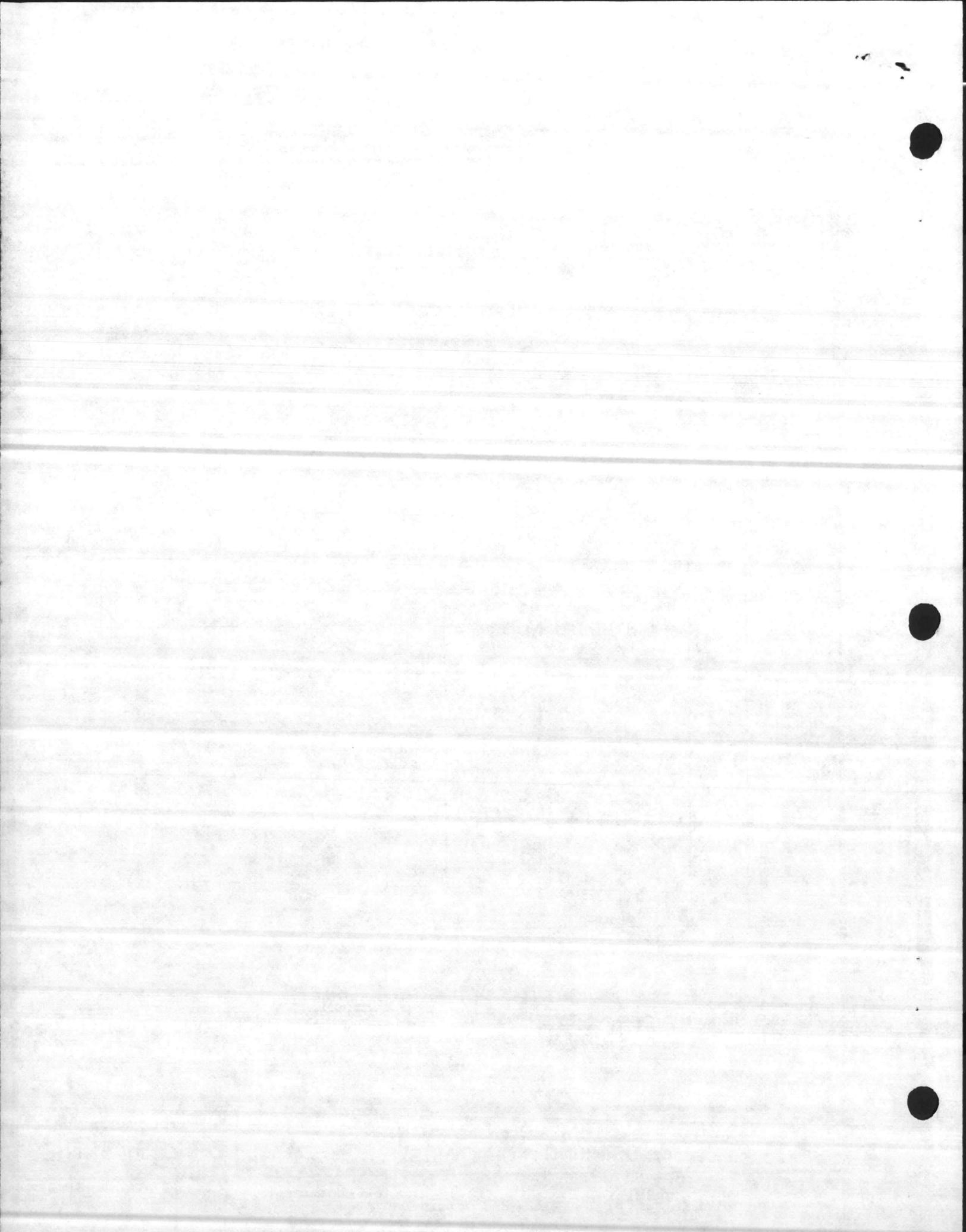
PRODUCT NUMBER
Z-1259-4SERIES

© 1969 BY
ZURN INDUSTRIES, INC.



A Step Ahead of Tomorrow
ZURN INDUSTRIES, INC.
ERIE, PA. 16512 U S A

DRAWING NUMBER
51000



American Standard

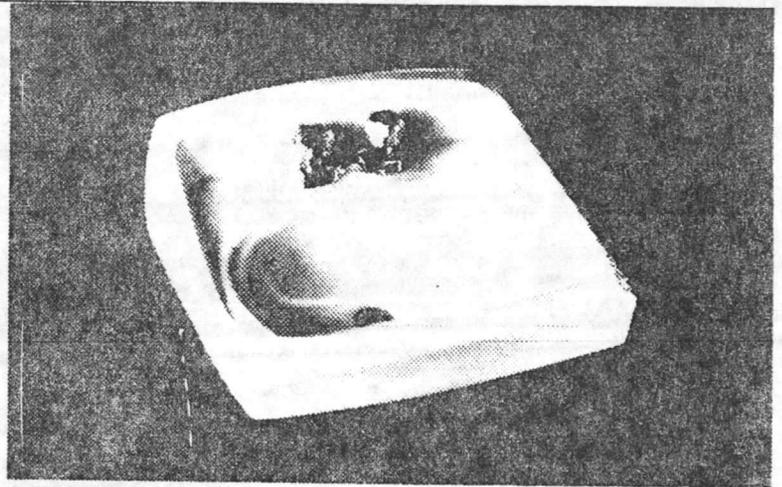
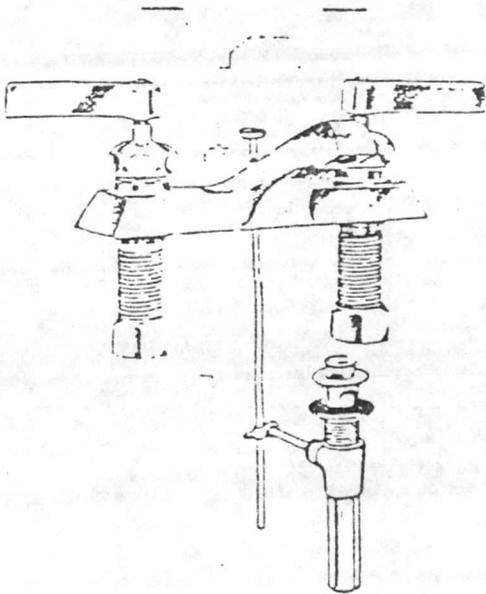
PURE LUXURY

15460 2.4.15

(P. 15)

new Lucerne lavatory
Vitreous China

DICK BROTHERS, INC.



4" (102mm) centers

0355.012 for wall hanger or concealed arms

0355.027 for exposed bracket support

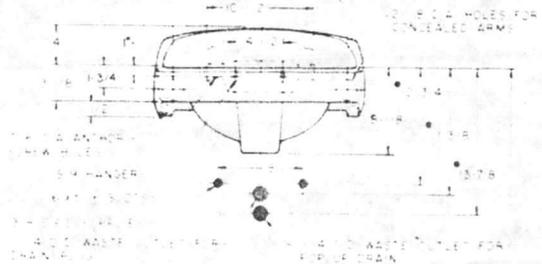
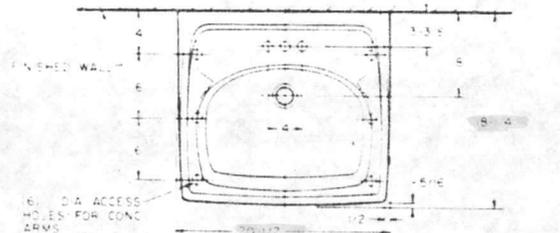
new Lucerne vitreous china lavatory with dual front overflows. "D" shaped bowl, self-draining deck area with contoured back and side splash shields. Fixture only. Shown with 2103.703 Heritage fitting.

bowl sizes:

15" (381mm) wide, 10" (254mm) front to back, 6 3/4" (172mm) deep

SHOWN WITH CENTER-SET FTTG. 3/8" FLEX SUPPLIES. POP-UP OR GRID DRAIN & 1 1/4" O.D. "P" TRAP

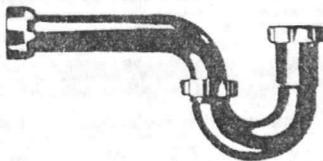
No. 6030-AR-RS 4" Centerset Fixture with Pop-up Drain, ALL BRASS, with brass lever handles, Polished and C. P.



P TRAP

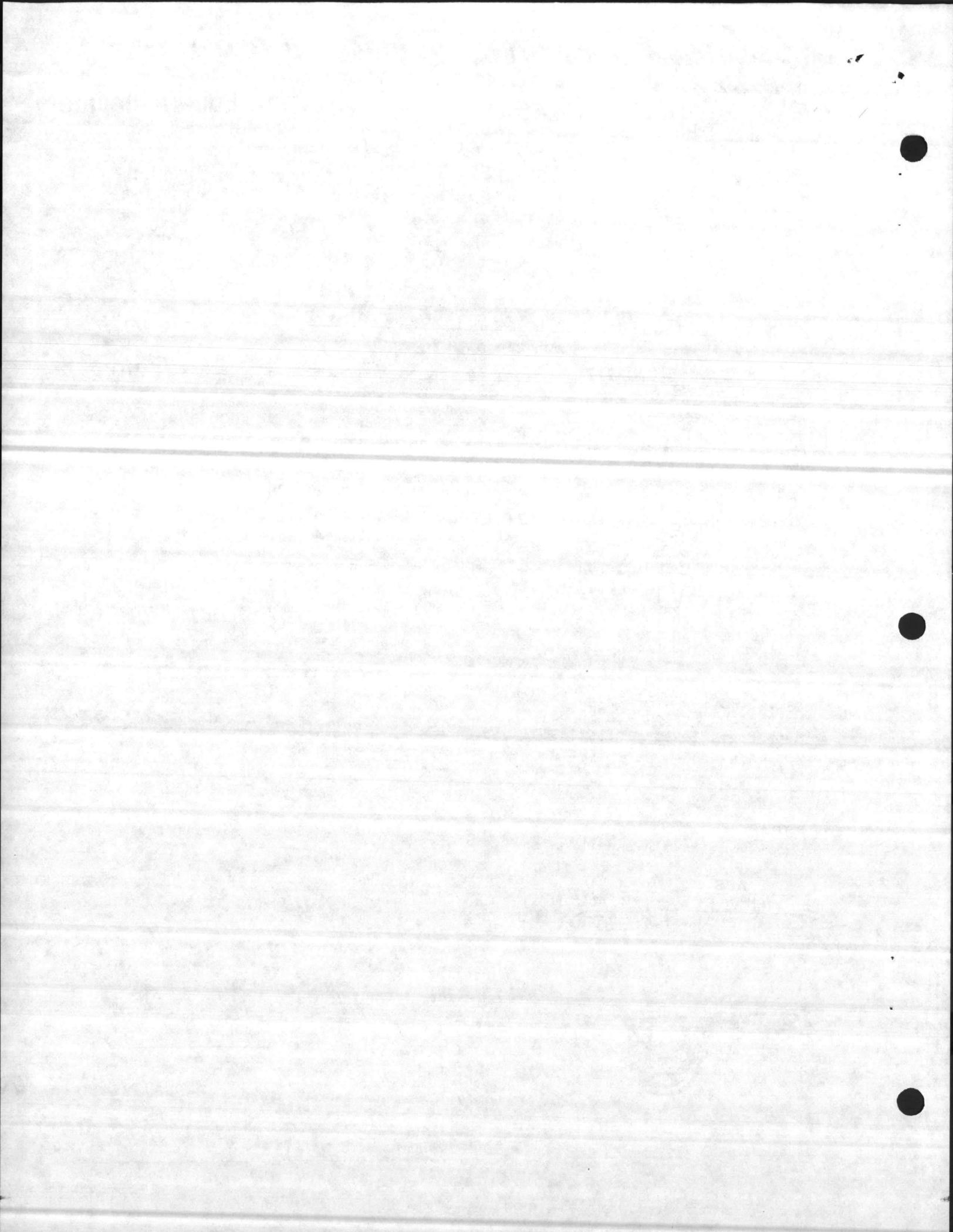
Supplied with 1 1/2 x 1 1/4 Poly Inlet Washer

PVC	ABS	
105-6	106-7	w/Schd. 40 Adapter
106-6	108-7	w/S.J. Adapter



*DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND "P" TRAP ARE SUGGESTED
NOTE: FITTINGS NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY
PLUMBER NOTE—Provide suitable reinforcement for all wall supports
IMPORTANT: Dimensions of fixtures may vary within the range of tolerances established by ANSI Standards A112.19.2

These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages



5214-15460-1.4.1987, 2.4.15



a step ahead of tomorrow

November 9, 1987

Sneedan Inc.
301 Eastwood Road
Wilmington, NC 28403

Reference: Job #1 Medical / Dental Clinic
Contract #N62470-85-C-5214
Subject: Certification of Material

Gentlemen:

This is to certify that the following Zurn Drains and Water Control products meet or exceeds ANSI Specifications below and are manufactured with our normal care and processes.

- Hydrants - ANSI A112.21.3
- Carriers - ANSI A112.61M
- Floor Drains - ANSI A112.211M
- Roof Drains - ANSI A112.21.2
- Metallic Cleanouts - ANSI A112.36.2

Very Truly Yours,

ZURN INDUSTRIES, INC.
Hydromechanics Division

John R. Rensel
Manager - Manufacturing

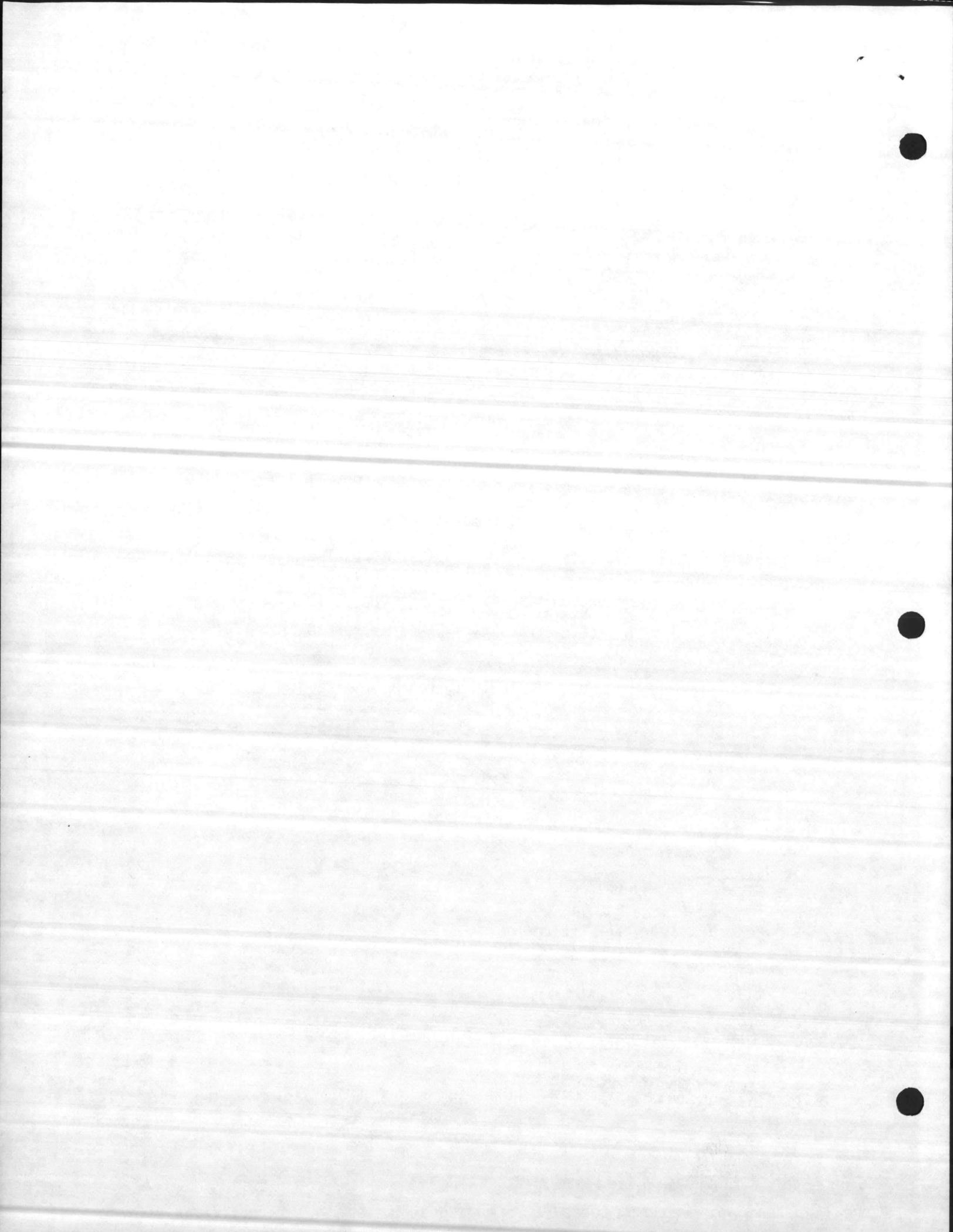
JRR/alb
CC: File

Forrest Pearce, Noland Co.

Sworn to and subscribed before me
this 9th day of November 19 87 .

Notary Public

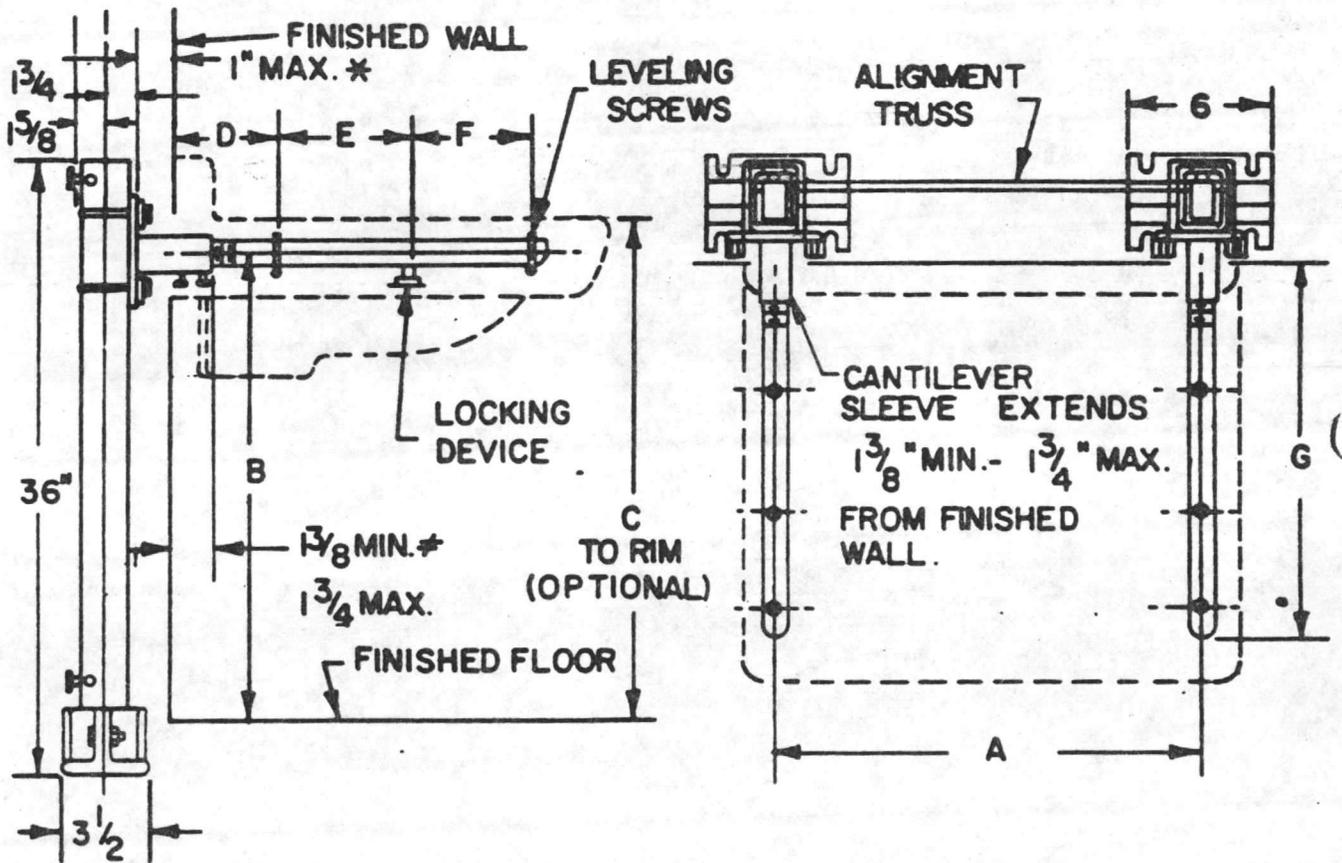
JOSEPH T. LOREI, NOTARY PUBLIC
ERIE, ERIE COUNTY, PENNSYLVANIA
MY COMMISSION EXPIRES FEB. 3, 1988



DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE

FOR: ~~XXXXXXXXXX~~
0355.012

NOTE:
LETTERED DIMENSIONS TO MEET FIXTURE REQUIREMENTS
FOR INSTALLATION-REQUEST ROUGHING-IN DRAWINGS.



REGULARLY FURNISHED

AS SHOWN, HEAVY STEEL STANCHIONS, & SLEEVES. "DURA-COATED" CAST IRON FEET, HEADERS, & CONCEALED ARMS.

FURNISHED WHEN SPECIFIED

- * □ LONGER SLEEVES
- LONGER STANCHIONS

NOTE:

LAVATORY TO BE ORDERED WITH 2" MIN. OPENINGS IN REAR TO FIT CONCEALED ARMS.
* ADJ. SCREWS IN SLEEVES MUST BE LOCATED AT BOTTOM AS SHOWN.

ZURN RIGID SYSTEM WITH CONCEALED
ARMS FOR LAVATORIES WITH BACK

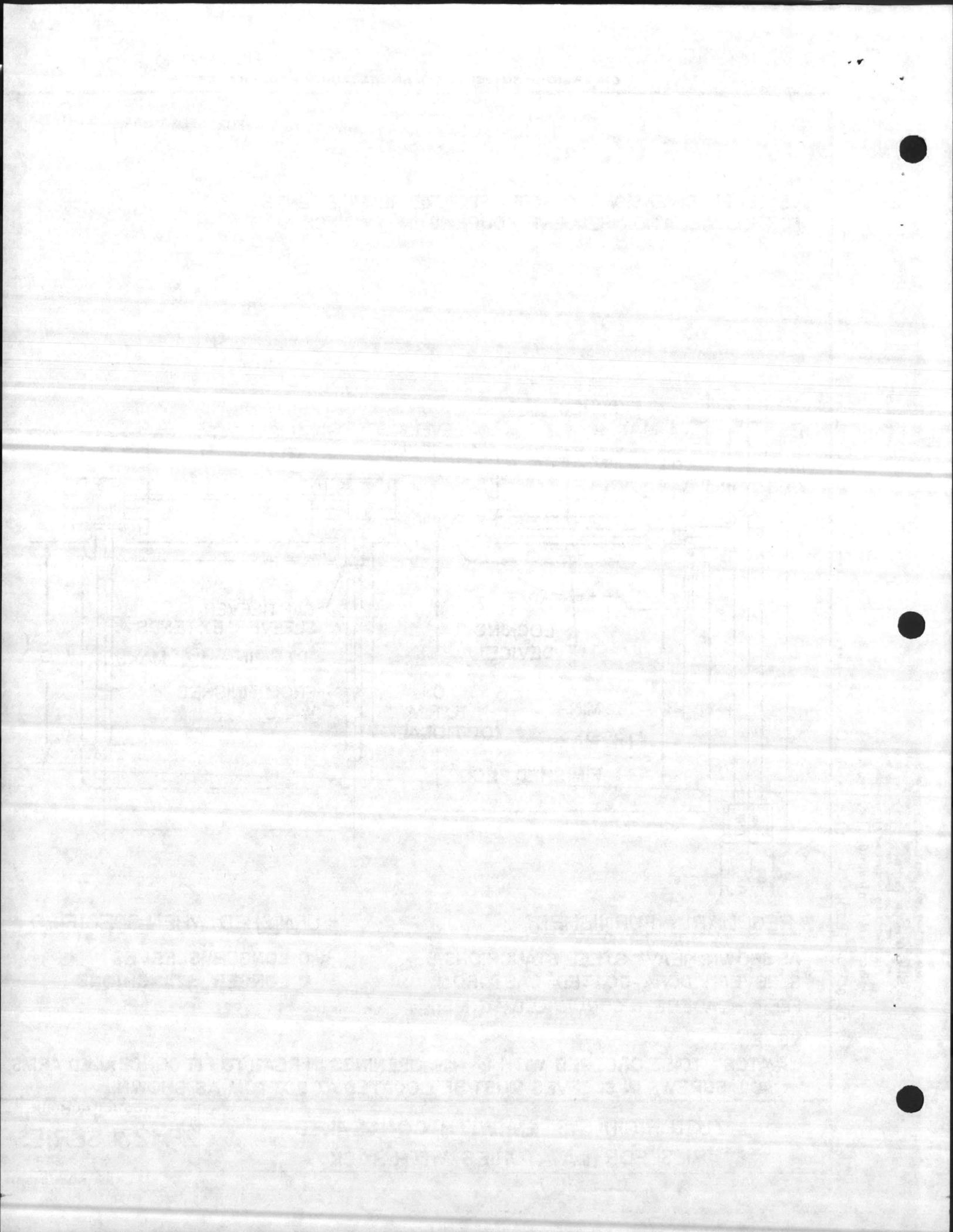
PRODUCT NUMBER
ZR-1231 SERIES

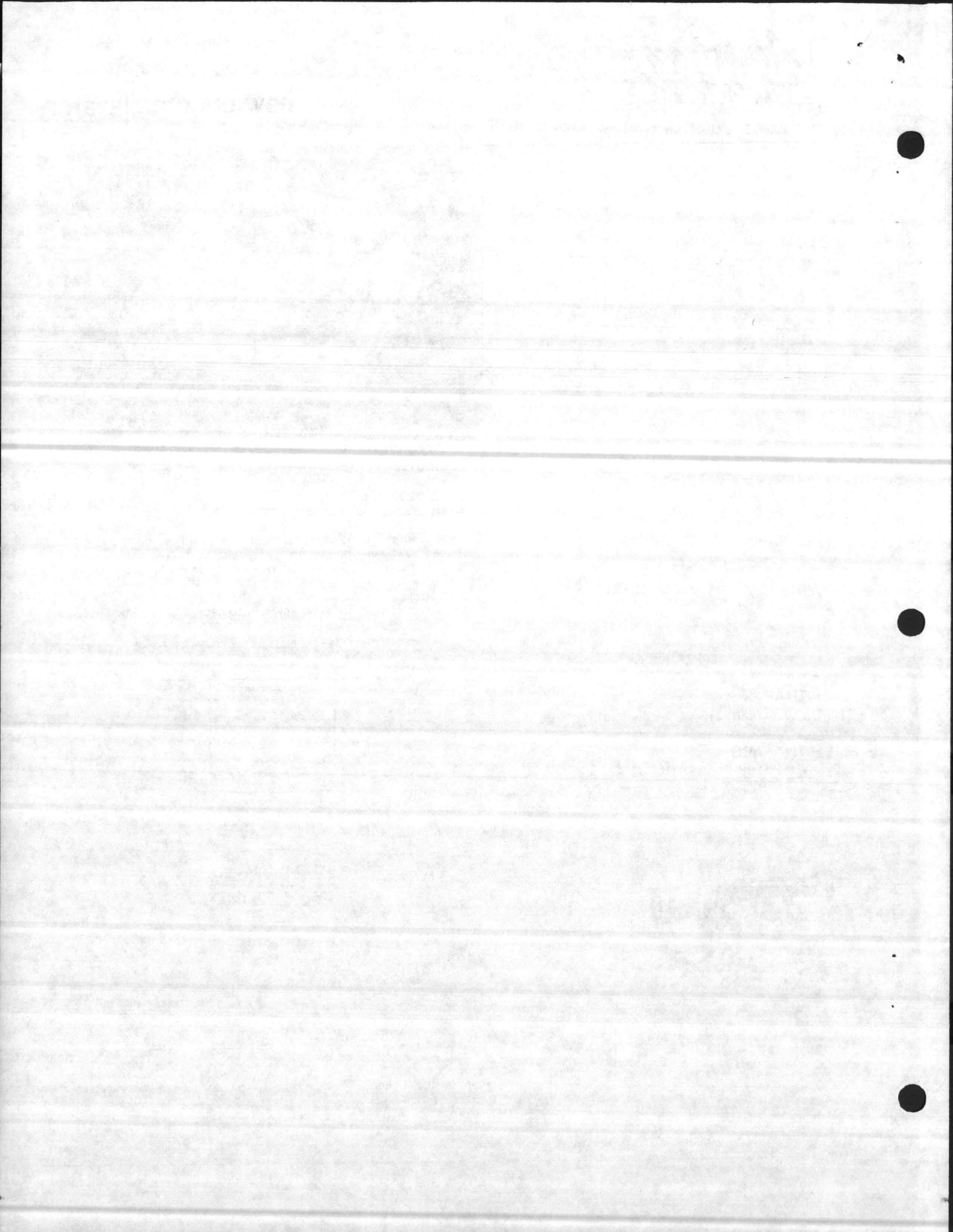
DRAWING NUMBER

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APPD. BY DATE CKD. BY DATE LM APPD. LM LAST REV. CMM

DN 8-26-81 BY K.S.K.







THE SYMBOL OF QUALITY

2100 SOUTH NUCLEAR DRIVE • DES PLAINES, ILLINOIS 60018
312 694-4400

FILE
NUMBER

FITTING
NUMBER

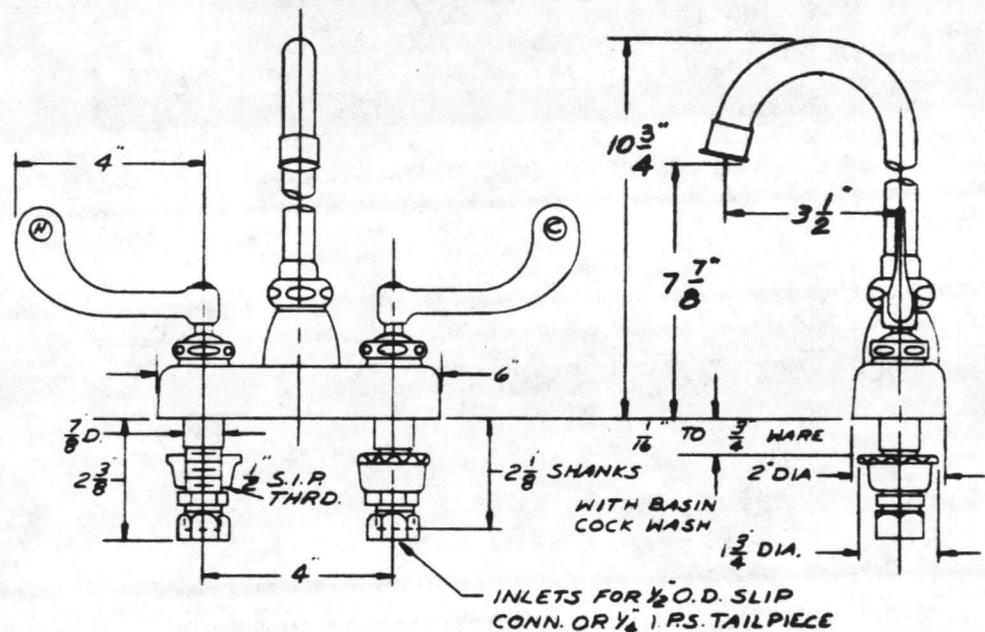
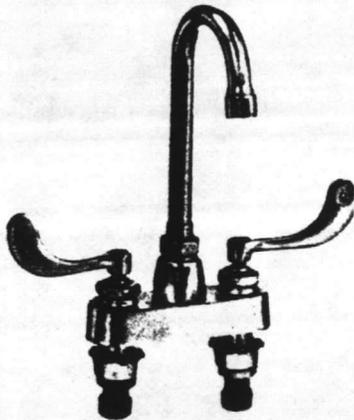
895-317

SECTION

PAGE

H

54



Rough in dimensions may vary 1/4" plus or minus.

TECHNICAL DATA

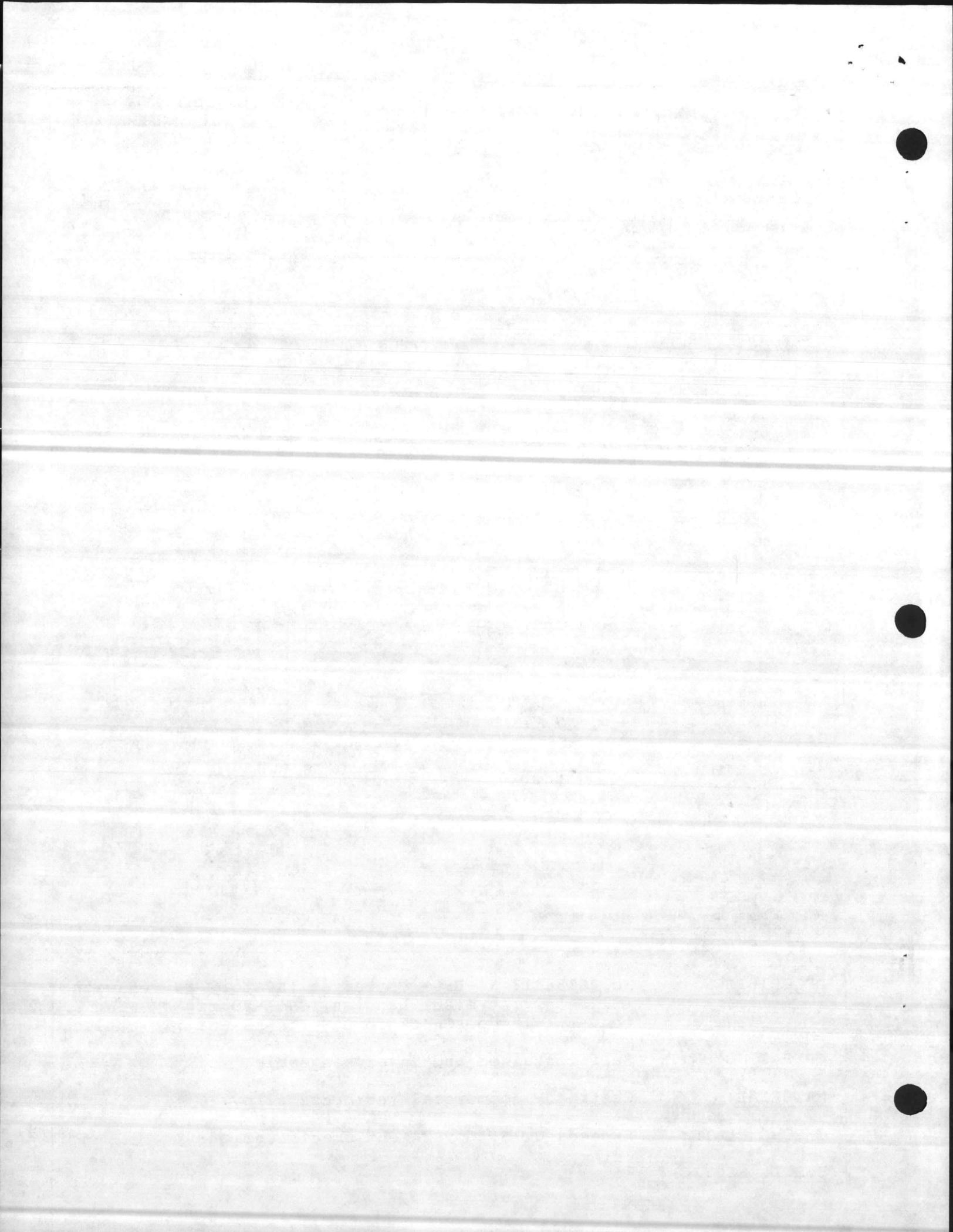
DESCRIPTION: No. 895-317 Hi-Lite centerset lavatory faucet with #317 4" wrist blade handles, GN1A-E3 rigid/swing convertible gooseneck spout with E3 Softflo outlet.

OPERATING UNIT: Self-contained and interchangeable.

MATERIAL: Casting - commercial red brass alloy.

CHROME PLATE: Exceeds U. S. Government specifications.

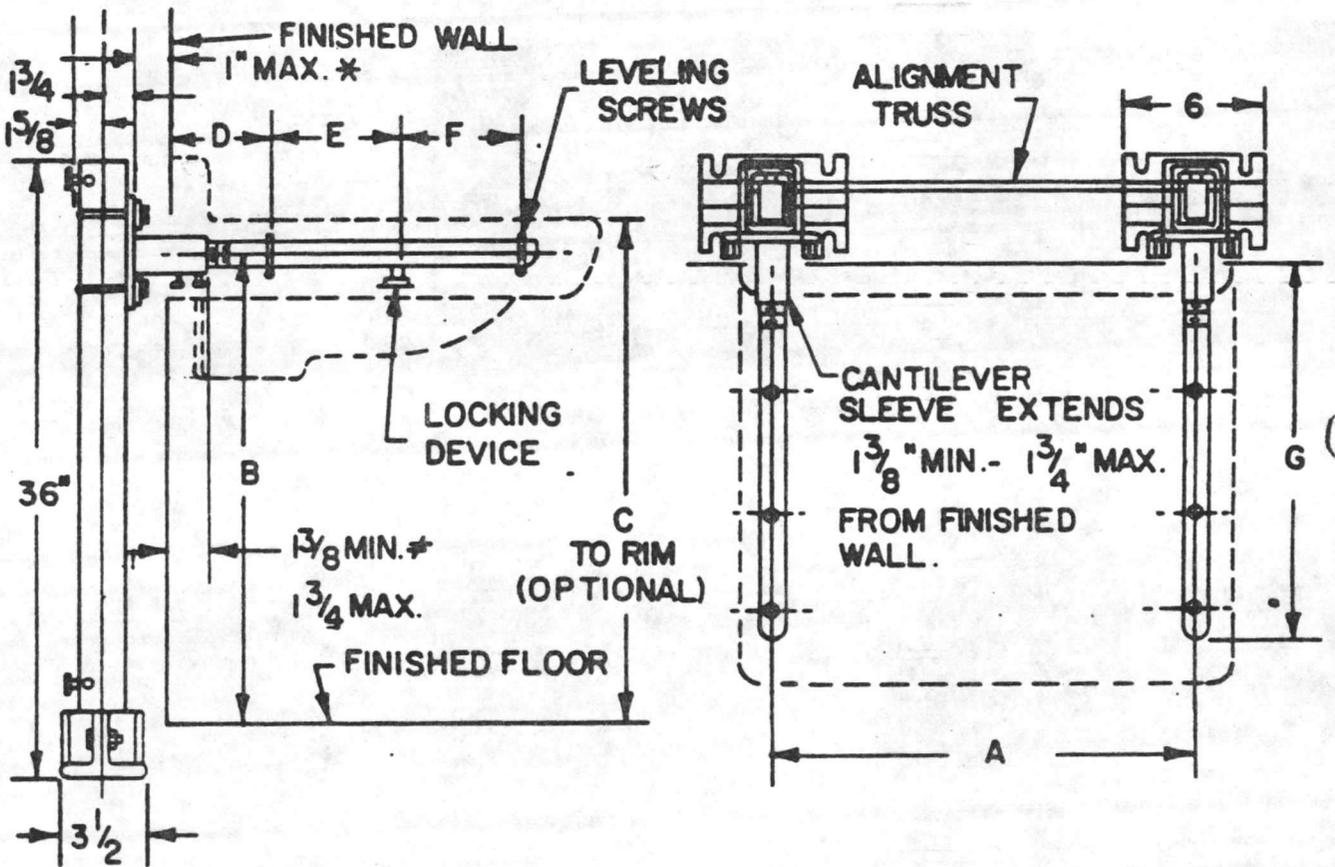
C.S.I. SECTION: 15



FOR: #123456789
0355.012

NOTE:
LETTERED DIMENSIONS TO MEET FIXTURE REQUIREMENTS
FOR INSTALLATION-REQUEST ROUGHING-IN DRAWINGS.

APPD. BY DATE CMD. LAST REV. LM APPD. LM DRN 8-26-81 BY K.S.K.



REGULARLY FURNISHED

AS SHOWN, HEAVY STEEL STANCHIONS, & SLEEVES. "DURA-COATED" CAST IRON FEET, HEADERS, & CONCEALED ARMS.

FURNISHED WHEN SPECIFIED

- * □ LONGER SLEEVES
- LONGER STANCHIONS

NOTE:

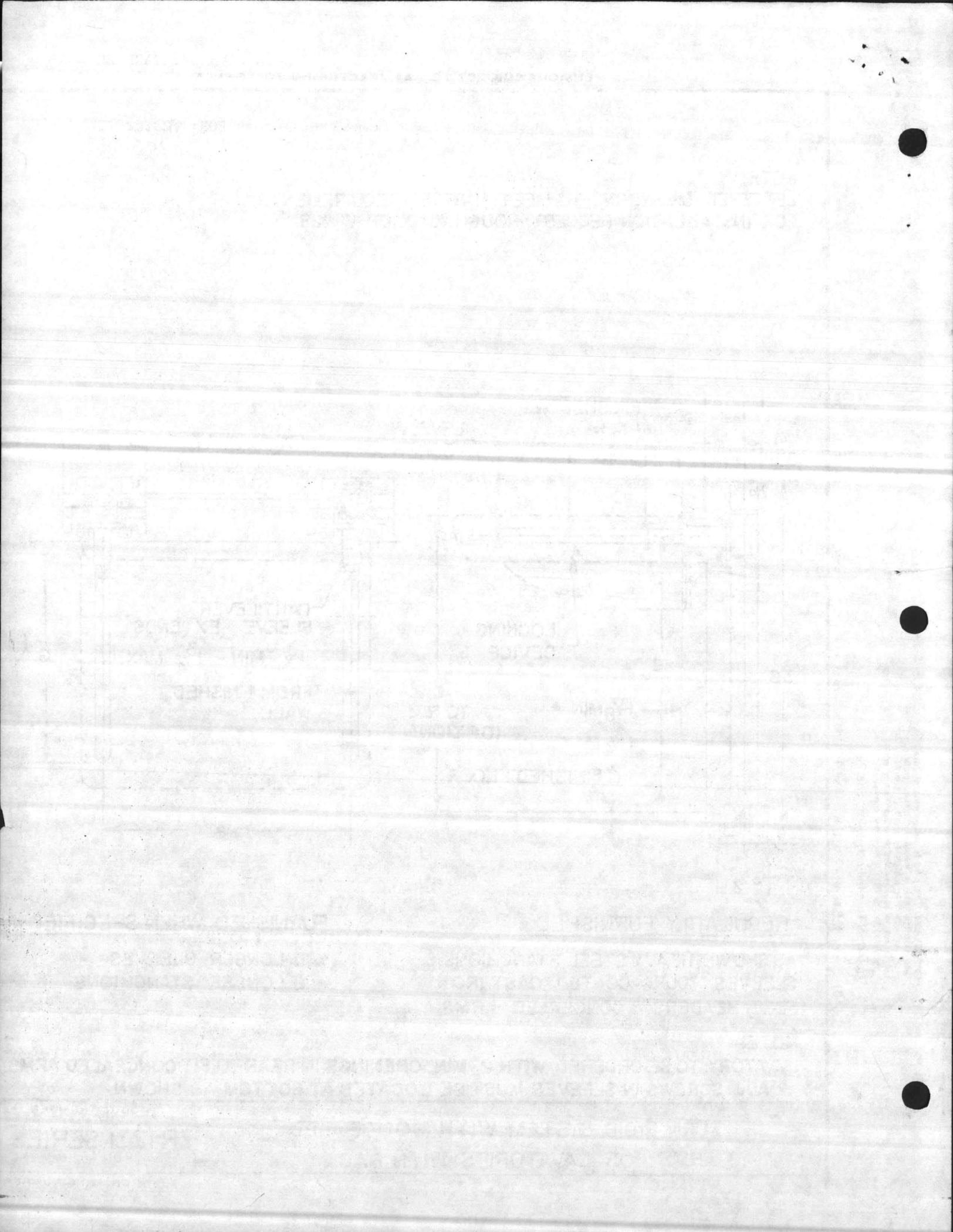
LAVATORY TO BE ORDERED WITH 2" MIN. OPENINGS IN REAR TO FIT CONCEALED ARMS.
* ADJ. SCREWS IN SLEEVES MUST BE LOCATED AT BOTTOM AS SHOWN.

ZURN RIGID SYSTEM WITH CONCEALED ARMS FOR LAVATORIES WITH BACK

PRODUCT NUMBER
ZR1231 SERIES

DRAWING NUMBER

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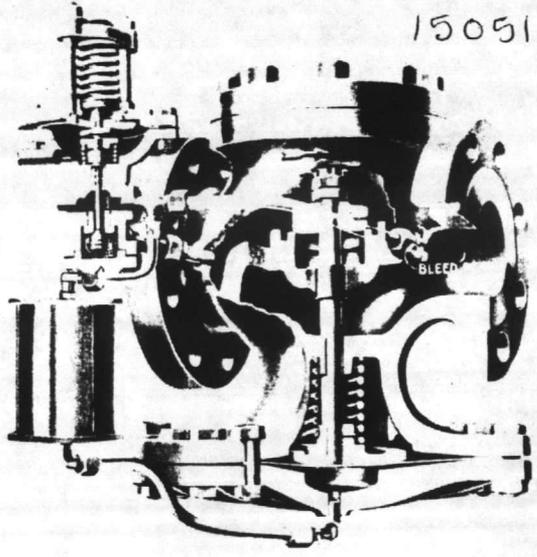
15091-2.2.1K, 6.2.6



SPENCE ENGINEERING COMPANY, INC.
Walden, New York 12586

TYPE ED AND ED2 PRESSURE REGULATOR

FOR SERVICE TO 600 PSIG (750° F)

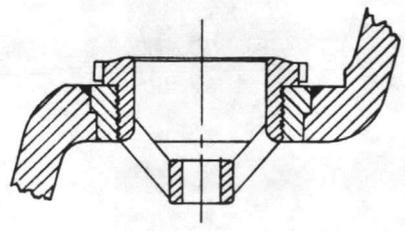


Type ED Pressure Regulator

The SPENCE Type ED and ED2 Pressure Regulators are designed to reduce a steady or varying initial pressure to a constant delivery pressure. The Cast Steel Valves are especially constructed for superheated steam service up to a temperature of 750° F., as shown below.

Delivery pressure ranges, determined by a choice of Pilot and Control Spring, are as follows:

- | | | |
|----------------|---|---|
| Type ED | } | 3 to 20 psi <input checked="" type="checkbox"/> |
| | | 5 to 50 psi <input type="checkbox"/> |
| | | 10 to 100 psi <input type="checkbox"/> |
| | | 20 to 150 psi <input type="checkbox"/> |
| | | Type ED2 120 to 300 psi <input type="checkbox"/> |



SECOWELD

A patented high pressure valve seat construction which prevents steam from cutting away the valve body if a leak develops at the threaded seat ring joint. A SECO Metal bushing is seal welded into the body and threaded to take a renewable seat ring of the same material. As SECO Metal resists wiredrawing, if a slight leak should occur, no damage can be done to the body or seat ring.

Cast Steel Main Valve and Pilot Bodies are suitable for maximum inlet conditions as follows:

	<u>Below 600° F</u>	<u>600 to 750° F</u>
Screwed Ends	<input checked="" type="checkbox"/> 300 psi	<input type="checkbox"/> 300 psi
Flanged ANSI 150 lb.	<input type="checkbox"/> 150 psi	
Flanged ANSI 300 lb.	<input type="checkbox"/> 300 psi	<input type="checkbox"/> 300 psi
Flanged ANSI 400 lb.	<input type="checkbox"/> 400 psi	<input type="checkbox"/> 400 psi
Flanged ANSI 600 lb.	<input type="checkbox"/> 600 psi	<input type="checkbox"/> 600 psi

Other Materials:

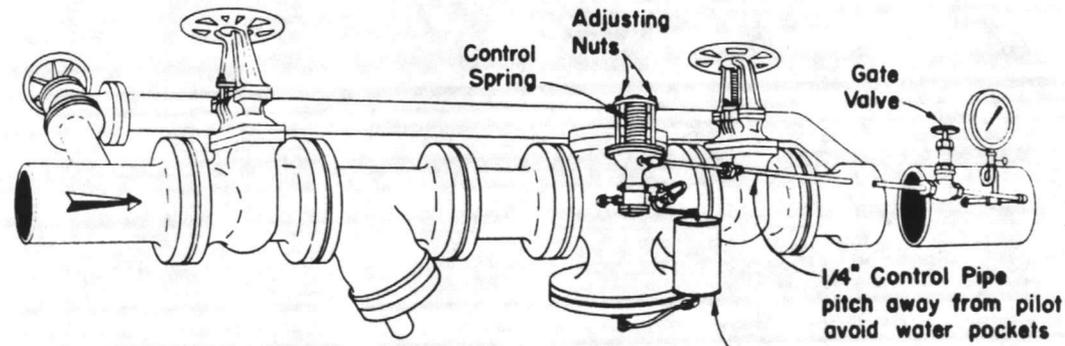
- | | | |
|---------------------------|--|--|
| Seats and Discs | <input type="checkbox"/> SECO Metal | <input type="checkbox"/> SECO Metal |
| Stems | <input type="checkbox"/> Stainless Steel | <input type="checkbox"/> Hardened St. Stl. |
| Diaphragms | <input type="checkbox"/> Stainless Steel | <input type="checkbox"/> Stainless Steel |
| Springs | <input type="checkbox"/> Tempered Steel* | <input type="checkbox"/> A-286 Alloy Stl. |

* A-286 for pressures 400 psi and higher.

Main Valve Accessories:

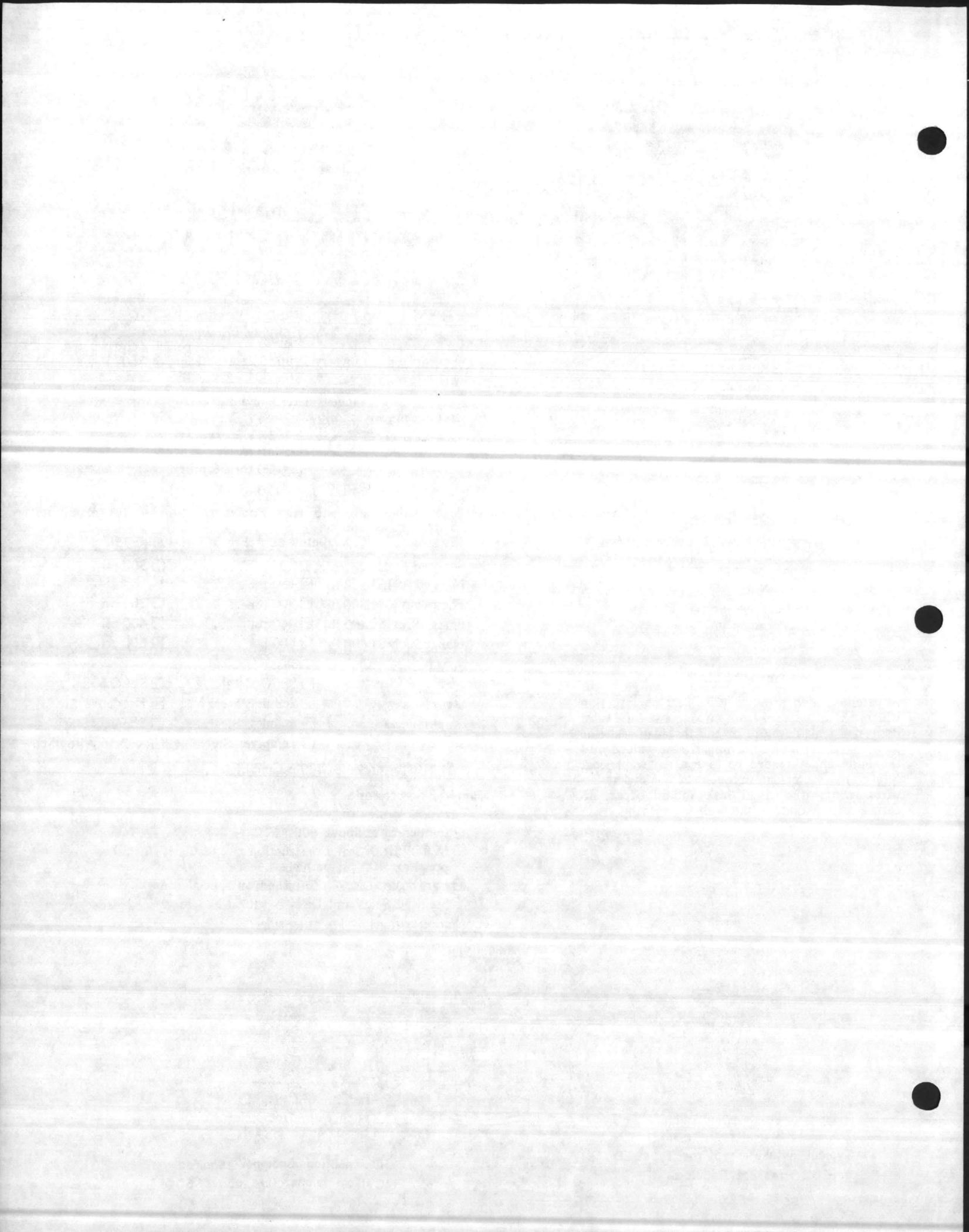
- Condensation Chamber — regularly furnished for steam temperatures above 600° F.
- SECOWELD Seat Construction — regularly furnished for pressures 400 psi or higher.
- Parabolic Disc — furnished on special order.
- Stellite Seats and Discs — furnished on special order.

Pilot modifications — see other side



Typical installation of the Type ED or ED2 Pressure Regulator

Condensation Chamber required for steam temperature above 600° F



RATED STEAM CAPACITY TABLE TYPE E MAIN VALVE—FULL PORT

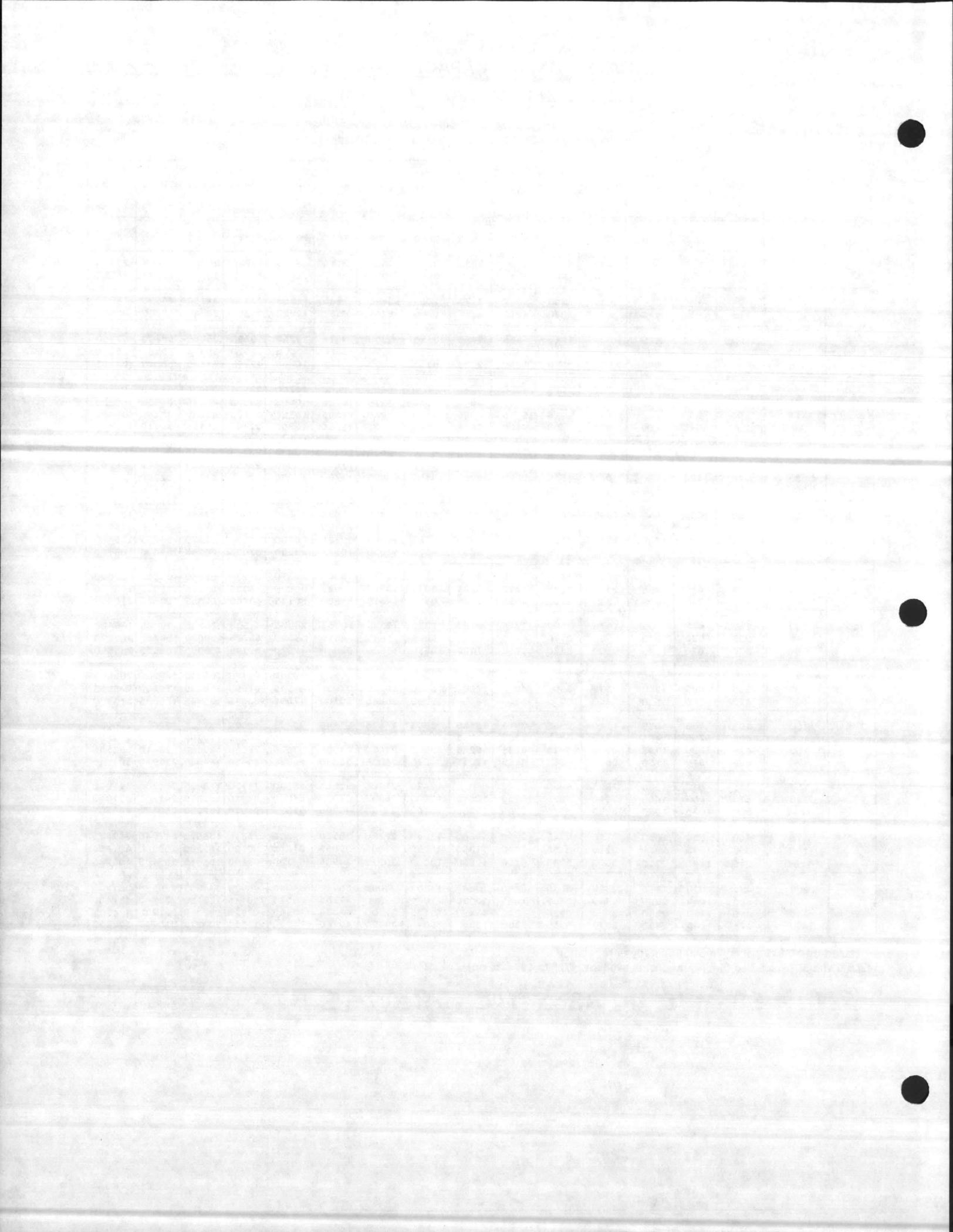
Pounds of Saturated Steam Per Hour

PRESSURE-psi _g		PRV-1 VALVE SIZE														
INLET	REDUCED	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
20	5-0	90	165	370	520	835	1175	1840	2610	4390	6470	10030	14715	26345	41890	66040
25	10	100	185	350	575	920	1290	2025	2870	4830	7115	11030	16185	28980	46080	72645
	5-0	100	190	365	595	955	1345	2105	2985	5025	7400	11475	16835	30140	47930	75560
30	15	105	195	380	615	990	1390	2175	3085	5190	7645	11855	17400	31150	49530	78080
	10-0	115	215	415	675	1080	1515	2370	3365	5655	8330	12920	18955	33940	53965	85075
40	25	120	220	425	695	1115	1565	2450	3475	5850	8615	13355	19600	35085	55790	87950
	20	135	250	480	780	1250	1760	2755	3905	6570	9680	15005	22020	39425	62690	98830
	15-0	140	260	505	825	1320	1850	2900	4115	6920	10195	15805	23195	41530	66035	104105
50	35	130	245	470	765	1225	1720	2695	3830	6435	9480	14700	21575	38825	61415	96820
	30	150	275	530	865	1385	1945	3045	4320	7270	10705	16600	24360	43615	69350	109330
	25	160	300	580	945	1515	2125	3325	4720	7940	11695	18130	26605	47635	75745	119410
	20-0	165	310	600	975	1560	2190	3430	4870	8185	12060	18700	27440	49125	78110	123140
60	45	140	265	510	830	1330	1865	2925	4150	6975	10280	15935	23385	41865	66570	104945
	40	160	300	575	940	1505	2115	3310	4700	7905	11645	18055	26495	47435	75425	118905
	35	175	330	630	1030	1650	2320	3630	5155	8665	12705	19790	29045	51905	82600	130345
	30-0	190	350	680	1105	1770	2490	3895	5530	9300	13700	21240	31170	55805	88735	139885
75	55	180	330	640	1045	1670	2350	3675	5215	8775	12925	20040	29405	52845	83710	131970
	50	195	365	705	1150	1840	2585	4045	5740	9655	14220	22050	32355	57930	92110	145215
	45	210	395	760	1235	1980	2785	4360	6185	10405	15325	23760	34865	62420	99255	156475
	40-0	225	420	805	1315	2105	2955	4630	6570	11050	16275	25230	37025	66285	105400	166160
100	75	225	420	810	1320	2115	2970	4655	6605	11110	16365	25370	37230	66650	105985	167080
	60	275	510	985	1610	2575	3620	5865	8045	13525	19925	30890	45330	81155	129045	203440
	50-0	295	550	1060	1725	2765	3885	6080	8630	14515	21380	33145	48640	87085	138475	218300
125	100	250	470	905	1475	2360	3315	5190	7370	12395	18255	28305	41535	74360	118235	186400
	75	335	630	1215	1980	3170	4455	6970	9895	16645	24515	38010	55775	98860	158785	250320
	65-0	360	670	1290	2100	3370	4730	7405	10510	17680	26040	40370	59245	106065	168655	265860
150	125	275	515	990	1610	2585	3625	5680	8060	13555	19970	30960	45430	81340	129335	203895
	100	370	695	1340	2185	3500	4915	7695	10920	18370	27055	41945	61555	110205	175235	276255
	80-0	425	790	1520	2480	3970	5575	8730	12390	20840	30700	47595	69845	125045	188835	313460
175	150	295	555	1065	1740	2785	3915	6130	8695	14625	21545	33405	49020	87765	139555	220005
	125	405	755	1455	2370	3800	5335	8355	11860	19945	29375	45545	68835	119660	180270	299960
	100	475	890	1715	2790	4475	6285	9835	13960	23480	34585	53825	78690	140880	224015	353155
	95-0	485	910	1750	2855	4575	6425	10055	14275	24005	35360	54820	80450	144030	229015	361045
200	150	435	810	1560	2545	4080	5725	8965	12725	21405	31525	48880	71730	128420	204200	321920
	125	515	960	1850	3015	4825	6780	10615	15065	25335	37320	57860	84910	152015	241715	381060
	110-0	550	1030	1980	3230	5175	7265	11380	16150	27160	40005	62025	91020	162960	259120	408500
225	175	460	860	1660	2710	4340	6095	9540	13540	22770	33540	52000	78310	136620	217240	342475
	150	550	1025	1975	3220	5155	7240	11335	16090	27065	39865	61810	90700	162380	258200	407055
	125-0	615	1145	2210	3600	5765	8100	12680	18000	30270	44585	69130	101440	181615	288785	455265
250	200	490	910	1755	2880	4585	6440	10080	14305	24080	35440	54045	80830	144355	229540	361865
	175	580	1085	2095	3410	5465	7675	12020	17060	28690	42255	65515	96145	172130	273700	431485
	150	655	1220	2350	3830	6135	8615	13490	19145	32200	47435	73540	107920	193210	307225	484355
	140-0	675	1265	2435	3970	6360	8930	13985	19845	33380	49165	76230	111860	200270	318445	502025

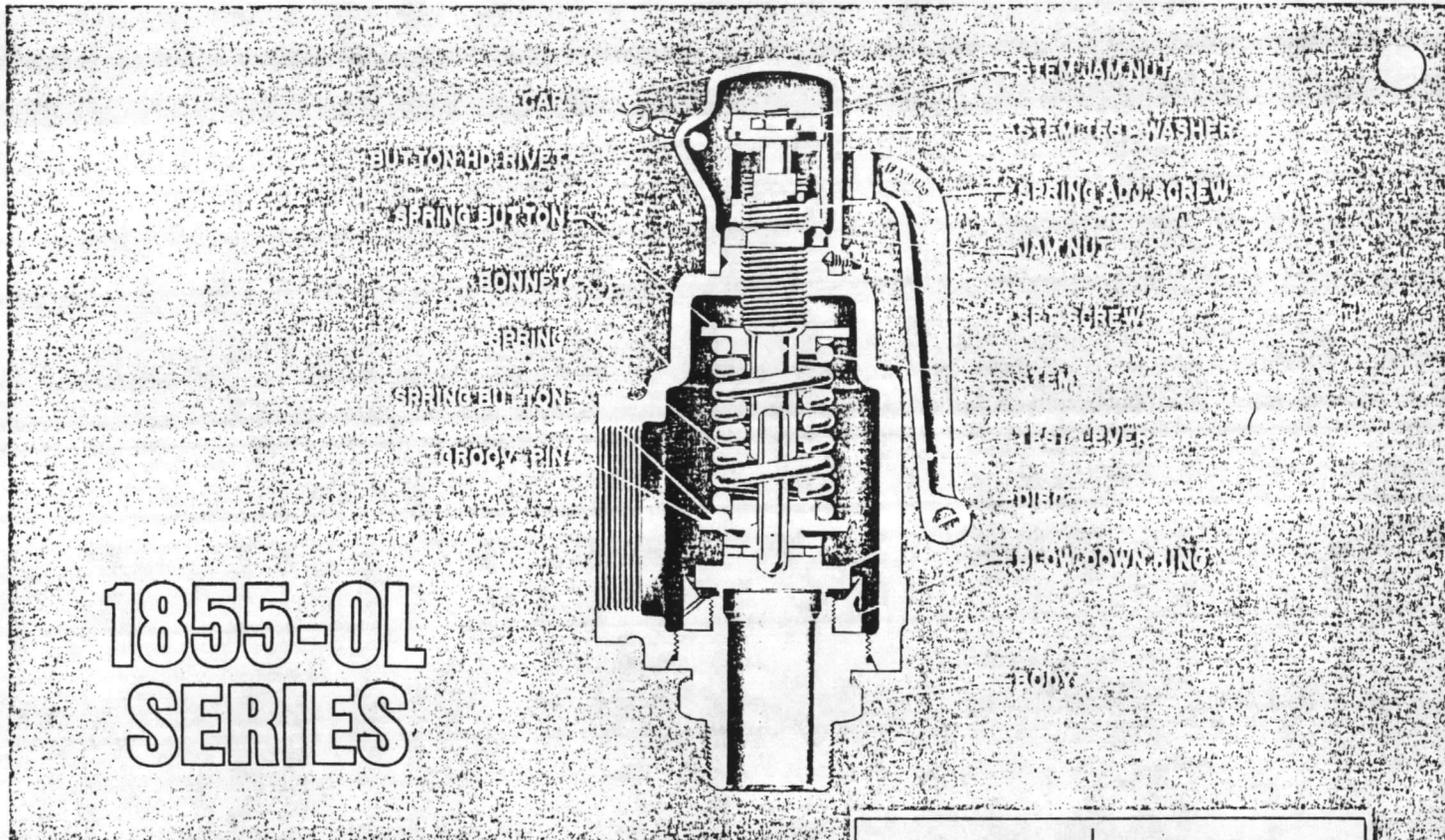
Based on 10% (2 psi minimum) accuracy of regulation.

* 75% and 50% reduced trim (Parabolic) is available 1/2" to 12" size only.

PRV-1 - ED - 1 1/2" , 2800 #/HR , 90 #/15 #



Teledyne Farris Safety Valves/High Capacity/Screwed Connections



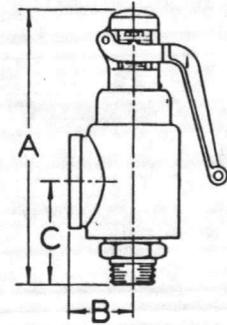
TYPE 1855-OL Male Inlet, Female Outlet, Open Lever

The Teledyne Farris 1855-OL Series embodies the most progressive engineering design features for three-way High Capacity operation—High Capacity with minimum inlet pipe size; High Capacity with ASME-NB certification; High Capacity with the greatest economy to you. Temp. Range - 20°F to + 450°F.

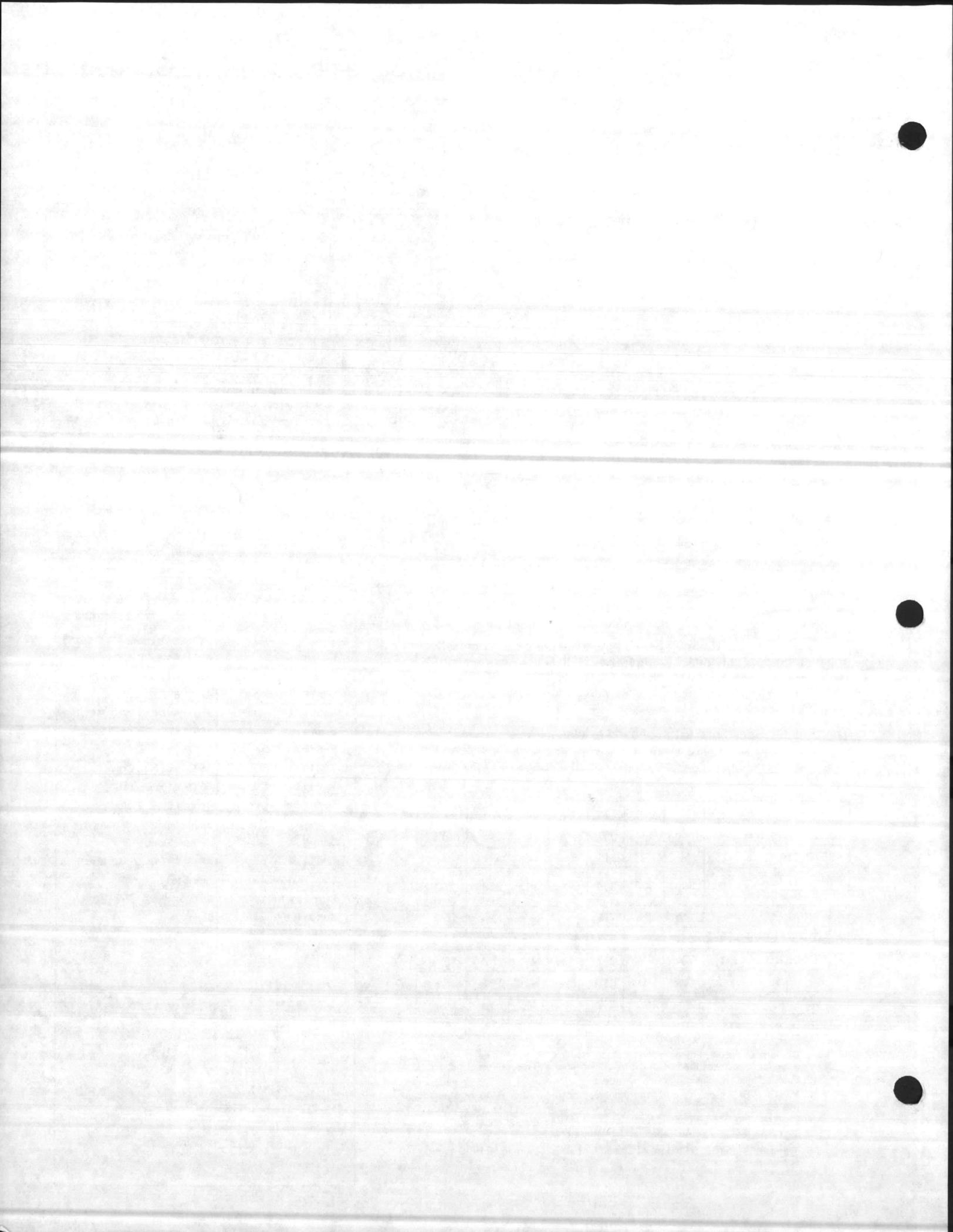
The 1855-OL Series has extra-long top guiding for safe, positive protection. This valve also features optically machined and lapped flat seat and SELF-ALIGNING disc for maximum tightness and positive shut-off.

VALVE SIZE	INLET	1/2	3/4	1	1 1/2	2	2 1/2	3
	OUTLET	3/4	1 1/4	1 1/2	2 1/2	3	4	4
SEAT DIA.		1/2	3/4	1	1 1/2	2	2 1/2	3
MAX. SET PRESS. PSIG		300	300	300	300	300	250	250
A	PLAIN CAP	6 1/4	6 5/8	7 1/8	9	11 1/2	13 1/4	15 1/4
	OPEN LEVER	6 5/8	7 1/8	7 5/8	9 3/4	12 1/2	14 1/4	16 5/8
	PACKED LEVER	7 3/4	8 1/4	8 3/4	11 1/8	14 1/8	16	18 1/4
B		1 1/16	1 1/16	1 15/16	2 5/16	3 1/16	3 11/16	4 1/16
C		2 7/16	2 13/16	3 1/8	4	4 5/8	5 11/16	6 5/16
APPROX. WEIGHT		3	3 1/2	5	11	20	30	40

PART NAME	MATERIAL
Body	ASTM B16 H.H. Brass or ASTM B62, Bronze
Bonnet	ASTM A126 CL B, Cast Iron
Disc	ASTM B16 H.H. Brass
Blow Down Ring	ASTM B16 H.H. Brass
Cap	ASTM A47 Gr. 32510, Mall. Iron
Stem	ASTM A581 Type 303 St. St.
Spring Adj. Screw	ASTM B16 H.H. Brass
Jam Nut	ASTM B16 H.H. Brass
Spring Button, Upper	ASTM A108 Gr. 1117
Spring Button, Lower	Carbon Steel, Plated
Groov-Pin	Stainless Steel, Hardened
Spring	Carbon Steel, Rust Proofed
Test Lever	ASTM A47 Gr. 32510, Mall. Iron
Stem Test Washer	AISI C1117
Stem Jam Nut	Steel, Plated
Button H'd Rivet	Steel
Set Screw	Steel, Plated



- NOTES: 1. Conforms to ASME Pressure Vessel Code, Section VIII and has been tested and rated for capacity by the National Board of Boiler and Pressure Vessel Inspectors.
 2. Flanged inlets available on quantity orders.
 3. "O" Ring Seat Seal for additional tightness optional. Add "R" to type number (example: 1855R-OL).
 4. Plain cap (no lever) & packed lever designs available on application.
 5. Test lever required for Air, Steam & Hot Water Service.
 6. Types 1855 and 1855-PKD may be used for back pressure to 50 PSIG when specified.



Saturated steam in pounds per hour at 10% overpressure
ASME Pressure Vessel Code (UV) Section VIII

90% RATING

SET PRESS. PSIG	VALVE TYPE AND SIZE							
	1855 1056M(C)	1/2x3/4 3/4x3/4	3/4x1 1/4 1x1 1/4	1x1 1/2 —	1 1/2x2 2x2 1/2	2x3 2 1/2x3	2 1/2x4 3x4	3x4 —
1# INCR	4	9	15	25	35	57	98	142
5# INCR	20	45	76	123	175	285	492	710
10	92	207	355	575	827	1332	2299	3311
20	131	296	507	821	1182	1902	3284	4728
30	171	384	659	1067	1536	2472	4268	6145
40	210	473	811	1313	1890	3042	5252	7563
50	249	561	963	1559	2245	3612	6236	8981
60	289	650	1115	1805	2599	4182	7220	10400
70	328	738	1267	2051	2953	4752	8204	11820
80	368	827	1418	2297	3307	5322	9189	13230
90	407	916	1570	2543	3661	5892	10170	14650
100	446	1004	1722	2789	4015	6462	11160	16070
110	486	1093	1874	3035	4370	7032	12140	17490
120	525	1181	2026	3281	4724	7602	13130	18900
130	564	1270	2178	3527	5078	8172	14110	20320
140	604	1358	2330	3774	5433	8742	15090	21730
150	643	1447	2482	4020	5787	9312	16080	23150
160	683	1536	2634	4266	6141	9882	17060	24570
170	722	1624	2786	4512	6495	10450	18050	25990
180	761	1713	2938	4758	6850	11020	19030	27400
190	801	1801	3090	5004	7204	11590	20010	28820
200	840	1890	3241	5250	7558	12160	21000	30240
210	879	1978	3393	—	7912	12730	21980	31660
220	919	2067	3545	—	8267	13300	22970	33070
230	958	2156	3697	—	8621	13870	23950	34490
240	998	2244	3849	—	8976	14440	24940	35910
250	1037	2333	4001	—	9331	15010	25920	37320
260	1076	2421	4153	—	9685	15580	—	—
270	1116	2510	4305	—	10040	16150	—	—
280	1155	2598	4457	—	10393	16720	—	—
290	1194	2687	4609	—	10745	17290	—	—
300	1234	2776	4761	—	11097	17860	—	—

NOTE: Heavy black line indicates pressure limits of 1856M(C)

Air in standard cubic foot per minute at 10% overpressure and 60°F.
ASME Pressure Vessel Code (UV) Section VIII
For other gases correct for specific gravity and temperature then multiply by 0.885.

90% RATING

SET PRESS. PSIG	VALVE TYPE AND SIZE							
	1855 1056M(C)	1/2x3/4 3/4x3/4	3/4x1 1/4 1x1 1/4	1x1 1/2 —	1 1/2x2 2x2 1/2	2x3 2 1/2x3	2 1/2x4 3x4	3x4 —
1# INCR	1.4	3.1	5	9	12	20	35	50
5# INCR	7.0	16	27	44	62	101	175	252
10	33	74	126	204	294	473	816	1175
20	67	105	180	291	420	675	1166	1678
30	61	136	234	379	546	877	1515	2181
40	75	168	288	466	671	1079	1864	2684
50	89	199	342	553	796	1282	2214	3187
60	102	231	395	641	922	1484	2563	3690
70	117	262	449	728	1048	1686	2912	4193
80	130	294	503	815	1174	1889	3262	4696
90	144	325	557	903	1300	2091	3611	5200
100	158	357	611	990	1426	2293	3960	5703
110	172	388	665	1078	1551	2496	4310	6206
120	186	420	719	1165	1677	2698	4659	6709
130	200	451	773	1252	1803	2900	5009	7212
140	214	483	827	1340	1928	3102	5358	7715
150	228	514	881	1427	2054	3305	5707	8218
160	242	545	934	1514	2180	3507	6057	8721
170	256	577	988	1602	2306	3709	6406	9224
180	270	608	1042	1689	2431	3912	6755	9727
190	284	640	1096	1776	2557	4114	7105	10230
200	298	671	1150	1864	2683	4316	7454	10730
210	312	703	1204	1951	2809	4518	7805	11236
220	326	734	1258	2047	2935	4721	8153	11739
230	340	766	1312	2118	3060	4923	8502	12242
240	354	797	1366	2213	3186	5125	8852	12745
250	368	829	1420	2301	3311	5328	9201	13250
260	382	860	1473	2388	3437	5530	—	—
270	396	892	1527	2476	3563	5732	—	—
280	410	923	1581	2563	3689	5935	—	—
290	424	954	1635	2650	3815	6137	—	—
300	438	986	1689	2761	3941	6339	—	—

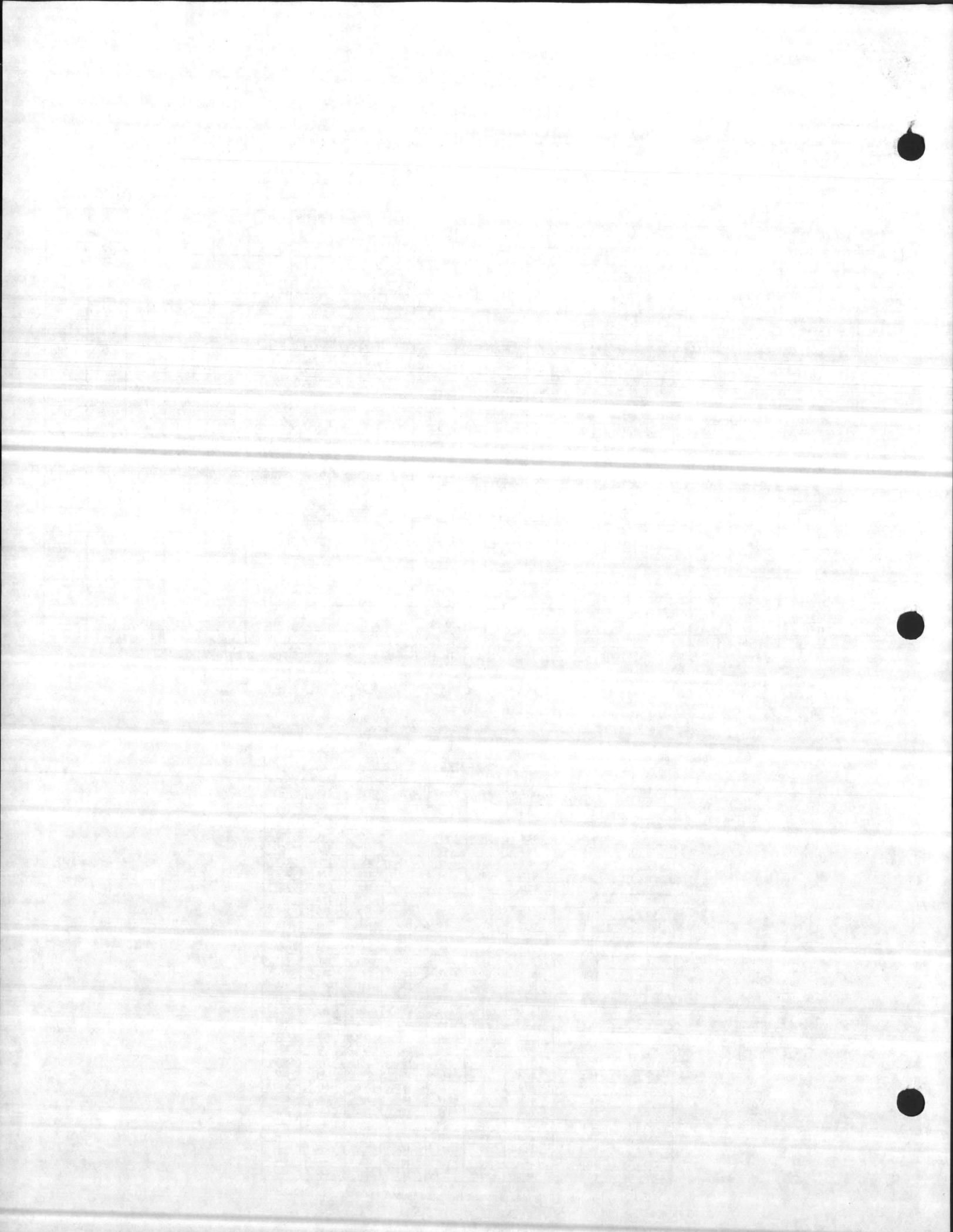
NOTE: Heavy black line indicates pressure limits of 1856M(C)

SV-1 - FAREIS 1855-OL, 2800 #/hr, SET @ 35 #

Water in gallons per minute at 25% overpressure.
For capacities at 10% overpressure, multiply values in table by 0.6

SET PRESS. PSIG	VALVE TYPE AND SIZE							
	1855 1056M(C)	1/2x3/4 3/4x3/4	3/4x1 1/4 1x1 1/4	1x1 1/2 —	1 1/2x2 2x2 1/2	2x3 2 1/2x3	2 1/2x4 3x4	3x4 —
10	3.7	8.4	15	23	34	60	95	133
20	5.3	11.9	21	33	48	85	132	188
30	6.5	14.5	26	41	58	103	161	230
40	7.5	18.8	30	47	67	119	187	266
50	8.3	18.8	33	52	75	133	209	297
60	9.1	20.6	36	57	82	146	228	326
70	9.9	22.3	39	62	89	158	246	352
80	10.5	23.8	42	66	95	168	263	376
90	11.2	25.2	45	70	101	179	280	398
100	11.8	26.6	47	74	106	189	295	421
110	12.3	28	49	77	111	198	309	442
120	12.9	29.2	52	81	116	207	324	461
130	13.4	30.3	54	84	121	215	336	480
140	14.0	31.5	56	87	126	223	350	498
150	14.4	32.6	58	91	130	231	361	516
160	14.9	33.6	60	94	134	239	373	533
170	15.3	34.7	61	96	138	246	384	548
180	15.8	35.7	63	99	143	254	396	564
190	16.2	36.6	65	102	146	260	408	579
200	16.5	37.6	67	105	150	267	417	594
210	17.1	38.5	68	107	154	273	426	608
220	17.5	39.4	70	110	157	280	436	622
230	17.7	40.4	71	112	161	286	447	637
240	18.2	41.2	73	114	164	292	456	651
250	18.6	42	75	117	168	298	466	665
260	19.0	43	76	119	171	304	—	—
270	19.4	43.7	78	121	174	310	—	—
280	19.7	44.5	79	124	178	316	—	—
290	20.0	45.4	80	126	181	322	—	—
300	20.4	46.2	82	128	184	327	—	—

NOTE: Heavy black line indicates pressure limits of 1056M(C)



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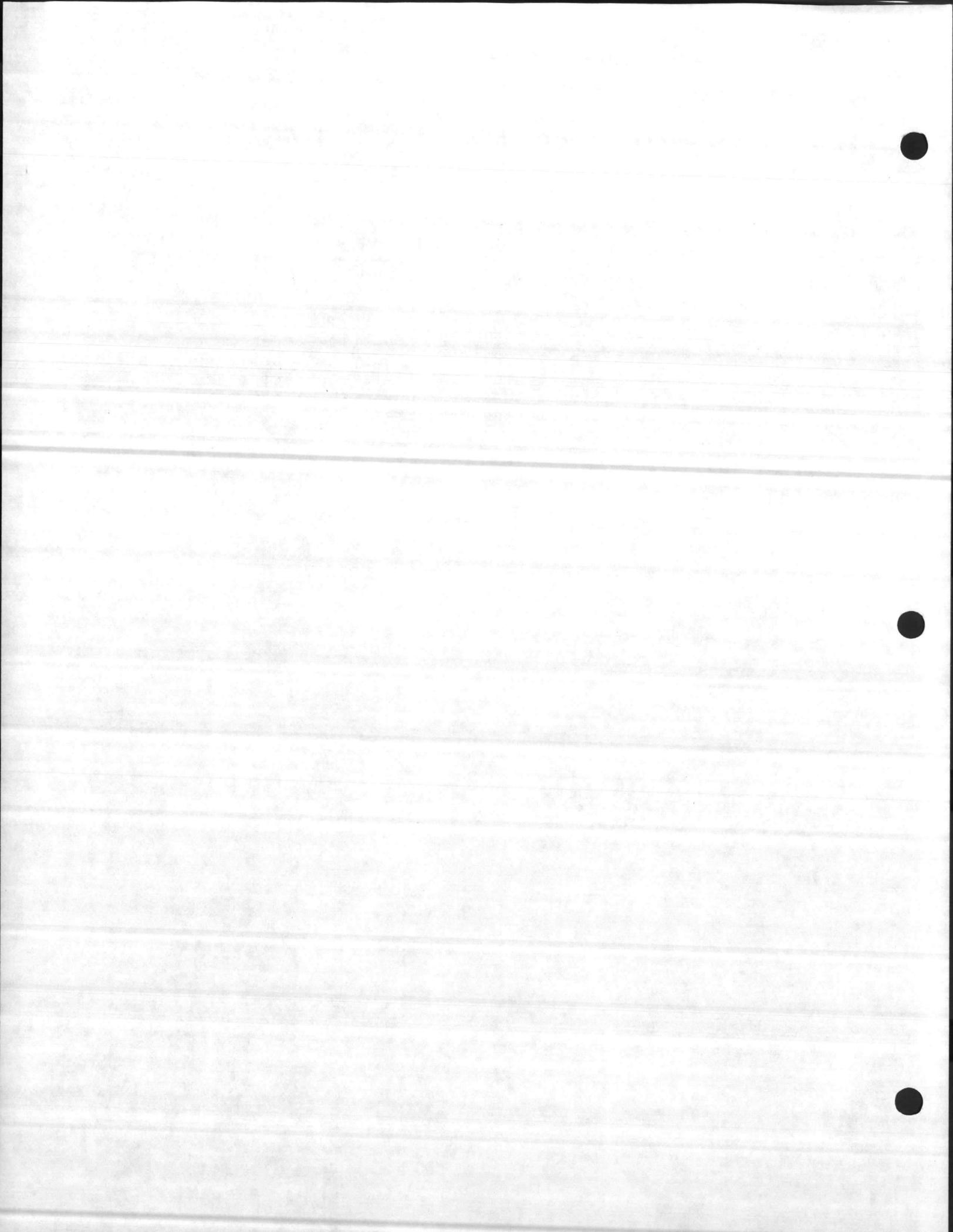
5214 - 02695 - 1.4.1f - Drawing M-4 Detail 2/M3/M4

Item No.

MEDICAL/DENTAL CLINIC

STEAM METER AS PER DETAIL
NO.2 DWG M-4

(1) BIF Model 0402 2" Shuntflow Steam meter complete with 250# C.I. Body-Self contained counter, remote counter with contactor and capacity to measure 2800 lbs/HR, Steam at 125 PSI entering pressure.



Basic Description

BIF's axial-turbine type Shuntflo meter, Series 402, is a totalizing meter designed to measure the flow of steam, air, or gas. Self-contained and self-operating, it requires no mercury, pressure piping or compressed air. No external power is required except for operation of accessory contacts to remote receivers or for digital output.

This compact meter is easily installed, being mounted directly in and supported by the pipe line. Ruggedly constructed, all parts subject to pressure are of high tensile gray iron, bronze or cast steel.

As the steam, air or gas flows through the meter body, a portion of the flow is diverted to drive the fan shaft assembly, rotating on a jewel bearing. A second set of blades on the fan shaft, rotating in damping fluid, acts as a damper or governor. Rotational speed of the shaft is proportional to the rate of flow at all rates within the normal range of the meter. Therefore, the number of turns made by the shaft is a measure of the total flow.

Suitable gearing reduces the rotational speed to a driving magnet in the damping chamber.

A counter box, located below the damping chamber contains a following magnet, a six-

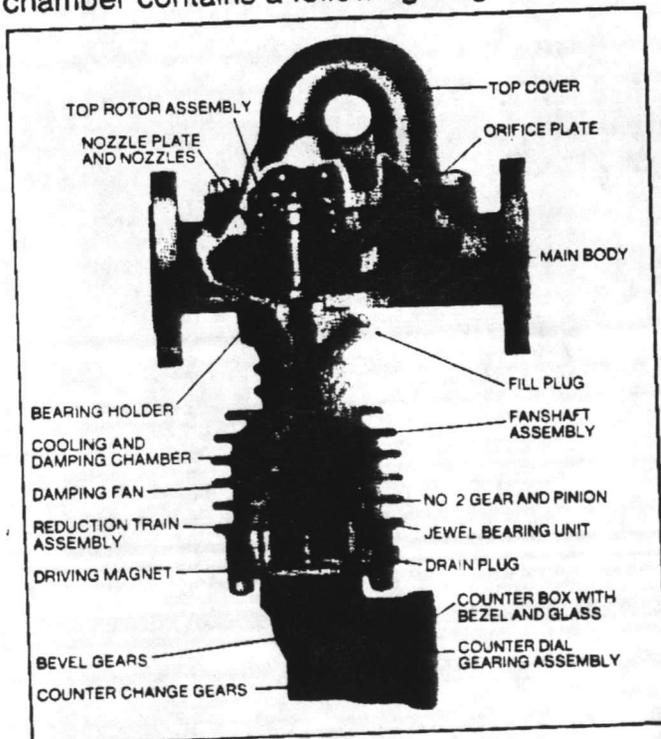


Fig. 1 - Cross section of Shuntflo Meter

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1/85 Supersedes 9/83

digit counter and dial, plus necessary gearing to cause the counter to register the desired units of flow.

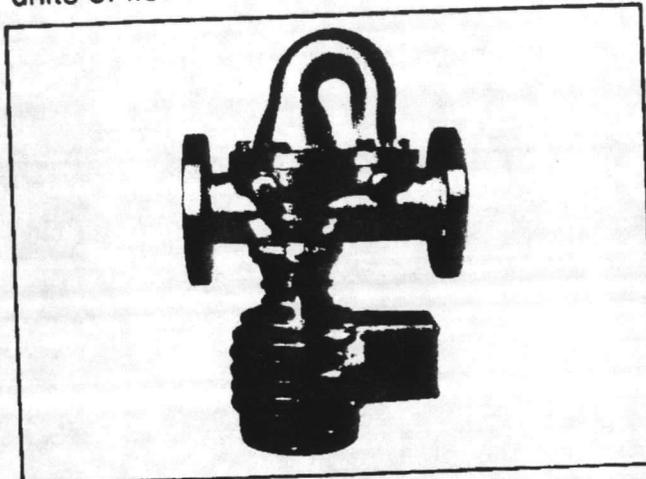


Fig. 2 - Basic meter showing conduit box for optional electronic output

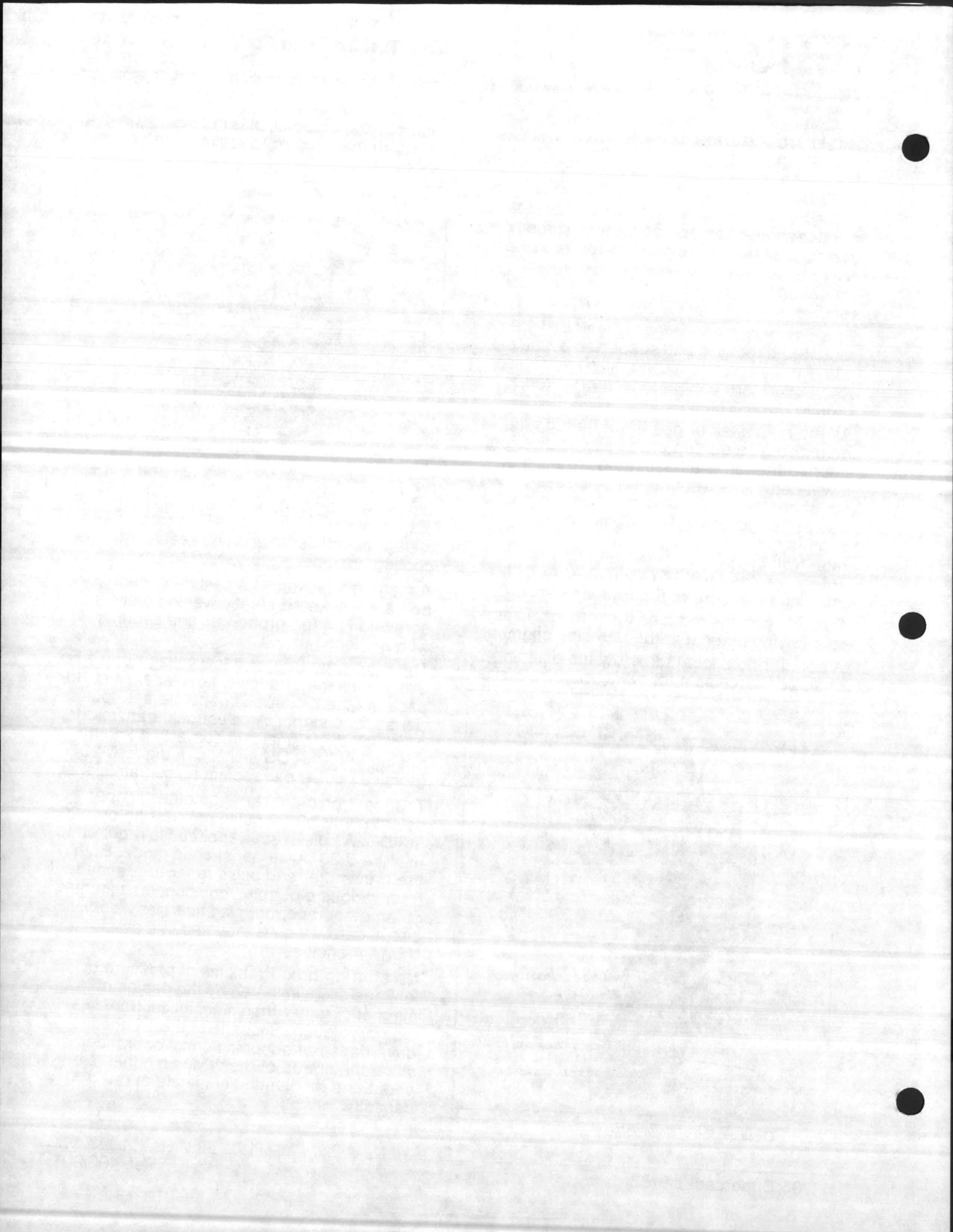
Digital/Analog Output: When a Digital/Analog output signal is required, a bronze probe-well is permanently screwed and sealed into the cooling chamber.

A magnetic pickup, in a cast iron conduit box and gasketed steel cover is tightly screwed into the probe-well and secured with a check nut.

The pickup generates a low voltage pulse for every passage of a lower fan blade. At rated capacity the pickup will generate a 20 pulse per second signal. An electronic transmitter amplifies this signal and converts it into an analog 4-20 mA DC signal or a digital 0-20 (nominal) pulse per second pulse train signal.

The electronic converter output is jumper selectable for 0-20 pulse per second or 4-20 mA DC. A pulse receiver circuit is required to use the 0-20 pulse per second mode. Both the transmitter and pulse receiver are made from various electronic components mounted on an etched copper clad fiberglass/epoxy circuit card which is mounted in a steel NEMA 4 enclosure.

No stuffing box: Problems of pressure or leakage are eliminated by the design of magnetic, rather than mechanical transmission of rotation. Slippage of the magnetic drive does not occur in normal operation, since the speed of the driving magnet is only about one revolution per minute at rated capacity.



Open upper limit, or temporary overload range, means that the mechanical totalizer will continue to register accurately at rates up to 200% of rated capacity on steam service.

Overloads of more than 150% of capacity should not exceed 10 minutes duration or once in 12 hours frequency.

Direct reading: Meter is calibrated and counter geared to read directly in pounds of steam, or cu ft of air or gas.

Low maintenance: Meter has a minimum number of moving parts. Disassembly and replacement is easy. In most cases, modification of capacity is affected by removal and replacement of the orifice plate assembly. Counter can be removed or replaced without shutting off the flow. Means for sealing the counter to prevent unauthorized tampering can be provided.

Engineering Specifications

Service: Steam, Air or Gas up to 300 psig or 750°F.

Operating temperature for Digital/Analog Model:

Sensor: -20°F to 450°F

Electronics: -20°F to 200°F

Some of the gases that can readily be metered by the Model 402 Shuntflo:

argon	
boron flouride	methane
butadiene	natural gas
carbon dioxide	nitrogen
carbon monoxide	oxygen
coke oven gas	petroleum gas
ethyl chloride	propane
helium	sewage digester gas
hydrogen	sulphur dioxide
manufactured gas	vent gas

Size: The 1 in. cast steel unit is available with threaded ends only.

The 1, 2, 3 and 4 in. sizes have flanged ends (250 lb cast iron ASA Std., 300 lb steel ASA Std. except in one inch size) for horizontal installation.

For line sizes 5 in. and over, a by-pass assembly is used. The assembly includes a 2 in. meter, high tensile iron (or steel) flanged elbows, a main line orifice plate, and 2 in. fittings, but not the companion flanges. Shut-off valves are required. These valves can be furnished by BIF or the customer, but meter must be calibrated at BIF with the valves in place.

Meter body construction for pressures and temperatures in excess of 250 psig or 450°F is cast steel.

Space requirements: For accurate metering, it is necessary to provide straight sections of pipe upstream and downstream from the meter, in addition to the clearance required. The straight sections must be of the same nominal size as the meter, and at least as long as specified in the following table:

METER TYPE AND SIZE	FITTINGS UPSTREAM	PIPE DIAMETERS UPSTREAM	PIPE DIAMETERS DOWNSTREAM
IN-LINE (1, 2, 3, 4 inch)	any	12	6
BY-PASS (5 inch and larger)	one elbow	10	5
	two elbows in same plane	15	5
	two elbows not in same plane	25	5
	three elbows not in same plane	50	5
	gate valve (if not kept wide open)	50	5

Differential: For meters where line pressure is 50 psig or less, differential of standard meters at rated capacity is approximately 20 in. of water.

For line pressure in excess of 50 psig, differential of standard meters at rated capacity is approximately 80 in. of water.

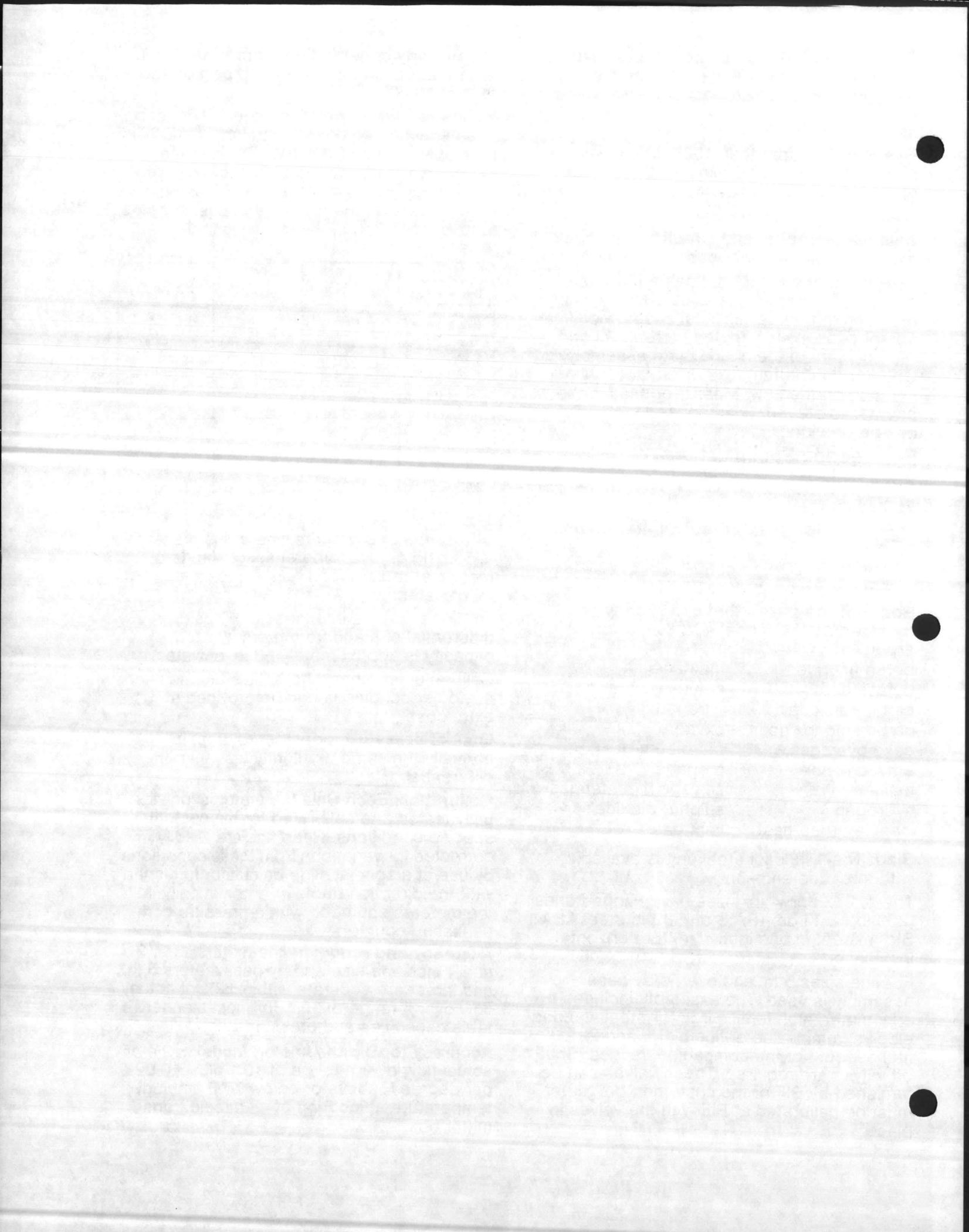
Calibration at other differentials for specific customer conditions can be provided at extra cost.

Loss of pressure, or pressure drop, is normally the same or slightly less than the differential.

Calibration: Each Shuntflo meter is individually tested and calibrated for the customer's specific conditions. Readings are readily corrected for variations from these conditions by use of a special slide calculator furnished with the direction book, or automatically if the meter is equipped with a pressure compensating counter.

Accuracy and range: In-line meters, 1, 2, 3 and 4 inch line size and by-pass meters 5 in. and larger are accurate within $\pm 2\%$ of actual flow over a range of 10:1 for most standard table capacities and pressures.

Accuracy for Digital/Analog Model: $\pm 2\%$ of actual flow over a range of 10:1 plus $\pm 0.02\%$ per degree F above or below 70°F ambient temperature at location of electronic transmitter box.



Counter: Direct reading in pounds of steam or cubic feet of air or gas. Readout is on 6-digit dial and pointer type, or cyclometer type counter as specified.

Capacity: Model 402 Shuntflo meters are available in eight standard orifice sizes. The rated capacities at pressures from 1 to 300 psig are shown in Capacity Table, Ref. No. 400.21-3.

Capacities and ranges: In the 4-20 mA DC mode, 4 mA corresponds to no flow and 20 mA corresponds to 150% of capacity. The 20 mA value may be altered to meet special customer requirements as determined by the product engineer.

In the 0-20 pulse per second mode, 0 pulse per second corresponds to no flow and 20 pulse per second corresponds to about 100% of capacity. The specific pulse rate for 100% capacity is determined by flow calibration and appears on the nameplate as the totalized flow value for 100 pulses.

Damping liquid: For steam, the damping liquid is water, replenished and maintained by condensation during operation.

For air or gas, the damping liquid may be kerosene, water, anti-freeze solution, or other liquid depending upon the nature of the gas. For visual check of the liquid, a gauge glass should be specified.

Meters are calibrated using the same damping fluid to be used in field installation.

Electrical requirements for Digital/ Analog Model

Transmitter power: 4-20 mA DC loop power, 12 to 45 VDC. The power is supplied by receiving equipment such as the BIF "B" case recorder or a similar device that supplies current loop power.

Pulse receiver power: 117 VAC, 50/60 Hz, 2 Watt.

Maximum loop impedance: 1,000 ohm includes wire and receiving equipment.

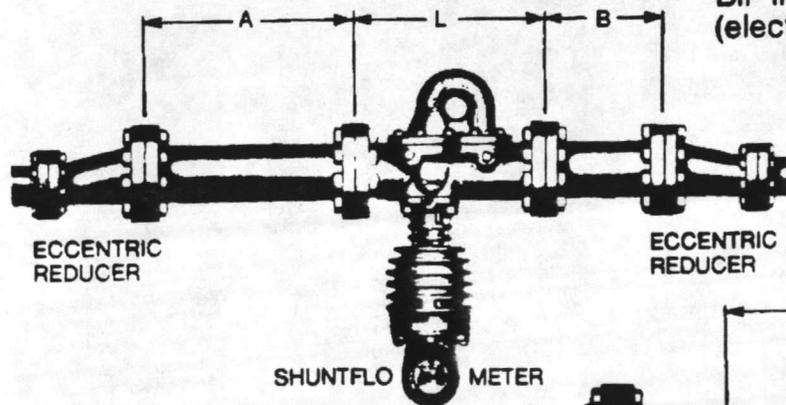
Signal transmission: Up to 1,000 ft. by twisted pair #22 AWG (or larger) wire. Shielded twisted pair such as Belden #8451 #22 AWG or Belden #8760 #18 AWG is preferred - especially in areas with power equipment or other electrical noise sources. Cable must not run in conduit with power wiring.

Maximum distance between Shuntflo meter and transmitter is 25 ft. (as supplied). This cable may be run in conduit. Both Shuntflo meter and transmitter will accept 1/2 inch conduit connections.

Pulse receiver output: Optically isolated, open collector transistor switch.

Optional Accessories

- Gauge glass
- Pressure compensated counter
- Combined counter and contactor
- Remote totalizer, electrically operated
- Mechanical totalizer (optional on electronic units)
- BIF instrumentation such as "B" case, etc. (electronic units only)



METER SIZE	A MINIMUM	L ACTUAL	B MINIMUM
2"	24"	12"	12"
3"	36"	12"	18"
4"	42"	14"	24"

Note Eccentric fittings may be either threaded or flanged.

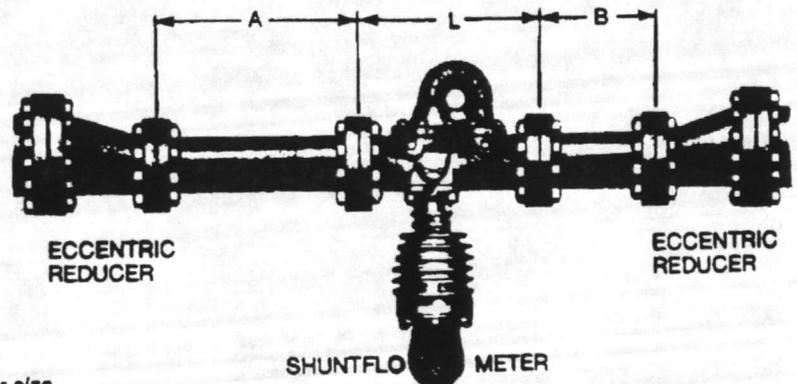
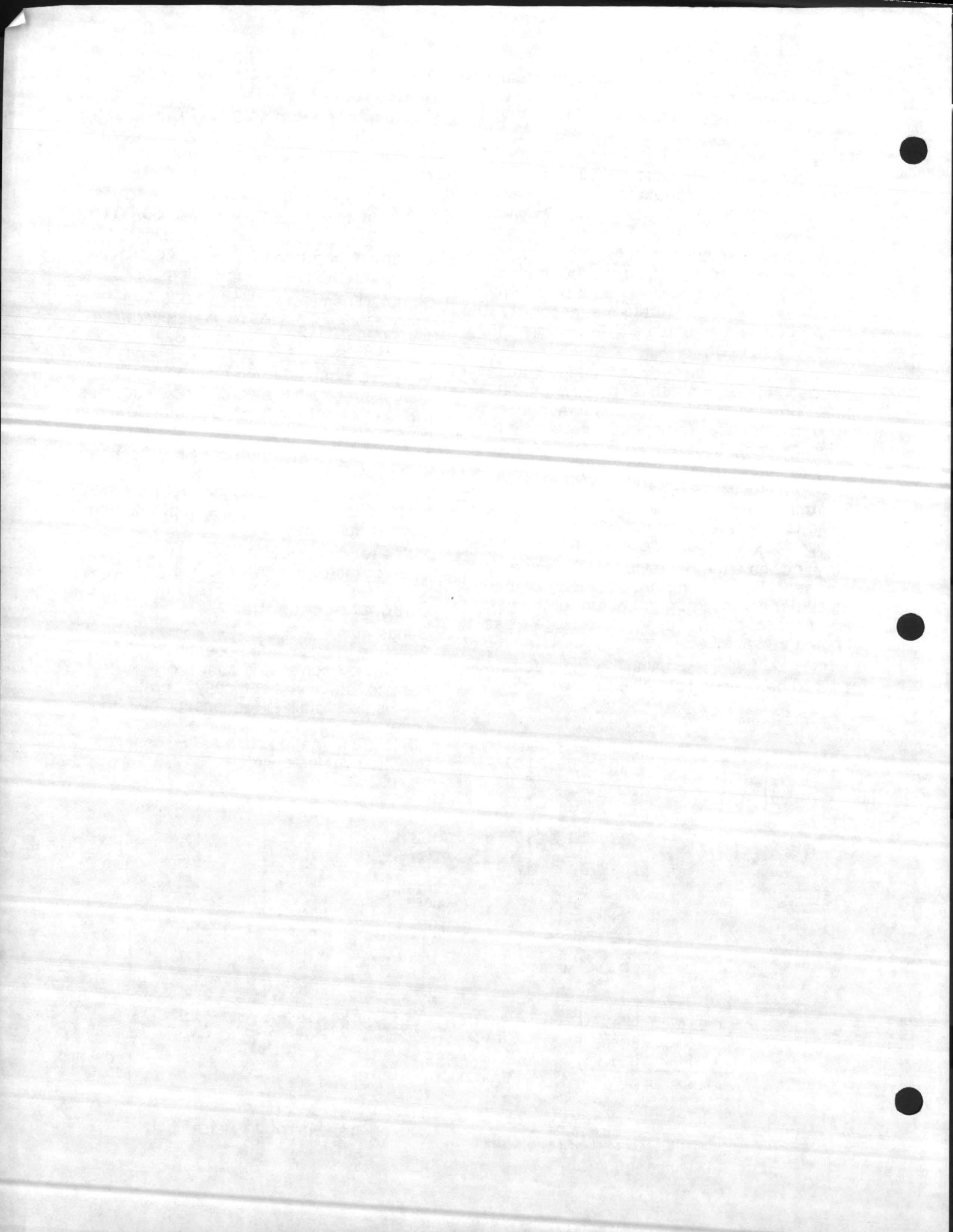
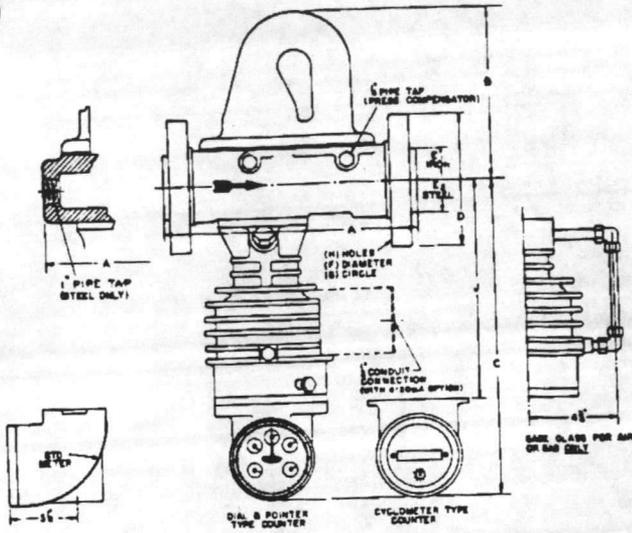


Fig. 3 - Installation in lines larger or smaller than meter size



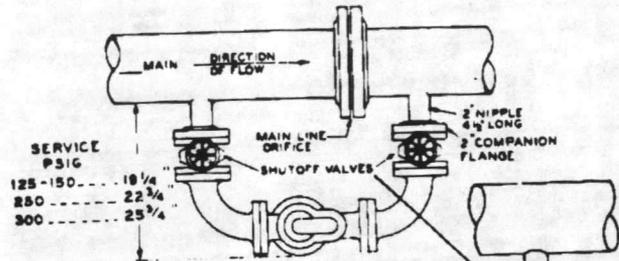


SIZE & TYPE	A	B	C	D	E	E1	F	G	H	J	WT LB
1" TND	8.25	7.88	14.25	3.25	0	0	0	0	0	10.13	68
1" FLG	12.00	7.88	14.25	4.88	3.88	-	75	3.30	4	10.13	70
2" FLG	12.00	7.88	14.62	6.50	4.8	3.82	75	5.00	8	10.80	75
3" FLG	12.00	8.00	15.38	8.25	5.88	5.00	88	6.82	8	11.25	100
4" FLG	14.00	8.50	16.00	10.00	6.84	6.18	88	7.88	8	11.87	180

FOR OPTIONAL VARIABLES SPECIFIC TO CUSTOMER ORDER REFER TO ORDER DATA SHEET

*Dimension includes optional mechanical counter

Fig. 4 - Dimensions of standard in-line meters for steam service

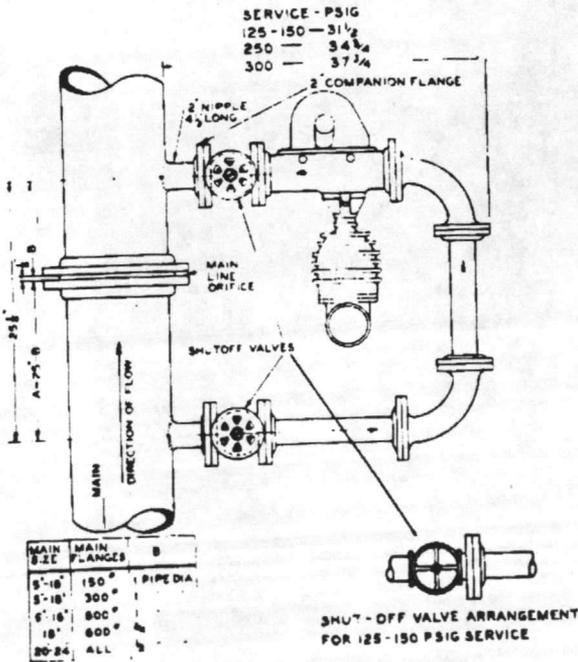


SERVICE PSIG	Dimension
125-150	18 1/4"
250	22 3/4"
300	25 3/4"

MAIN SIZE	MAIN FLANGES	B
5'-18"	150°	1 PIPE DIA.
5'-18"	300°	"
5'-18"	600°	"
18"	600°	"
20-24"	ALL	"

NOTES - METER IS CALIBRATED AND MUST BE USED WITH PARTS FURNISHED ALL 2" FLANGES 250° FURNISHED 2" METER BY-PASS PIPING AND MAIN LINE ORIFICE SHUTOFF VALVES EXTRA

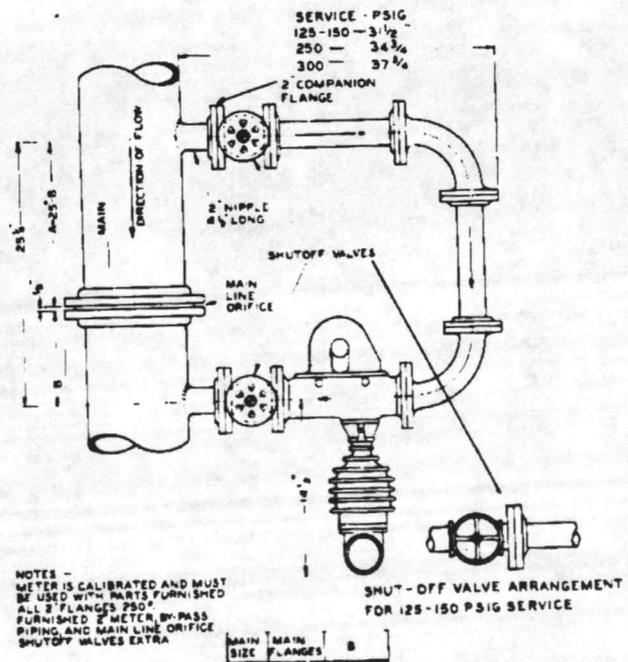
Fig. 5 - By-pass Shuntflo Meter for metering flow in horizontal main



MAIN SIZE	MAIN FLANGES	B
5'-18"	150°	1 PIPE DIA.
5'-18"	300°	"
5'-18"	600°	"
18"	600°	"
20-24"	ALL	"

NOTES - METER IS CALIBRATED AND MUST BE USED WITH PARTS FURNISHED ALL 2" FLANGES 250° FURNISHED 2" METER BY-PASS PIPING AND MAIN LINE ORIFICE SHUTOFF VALVES EXTRA

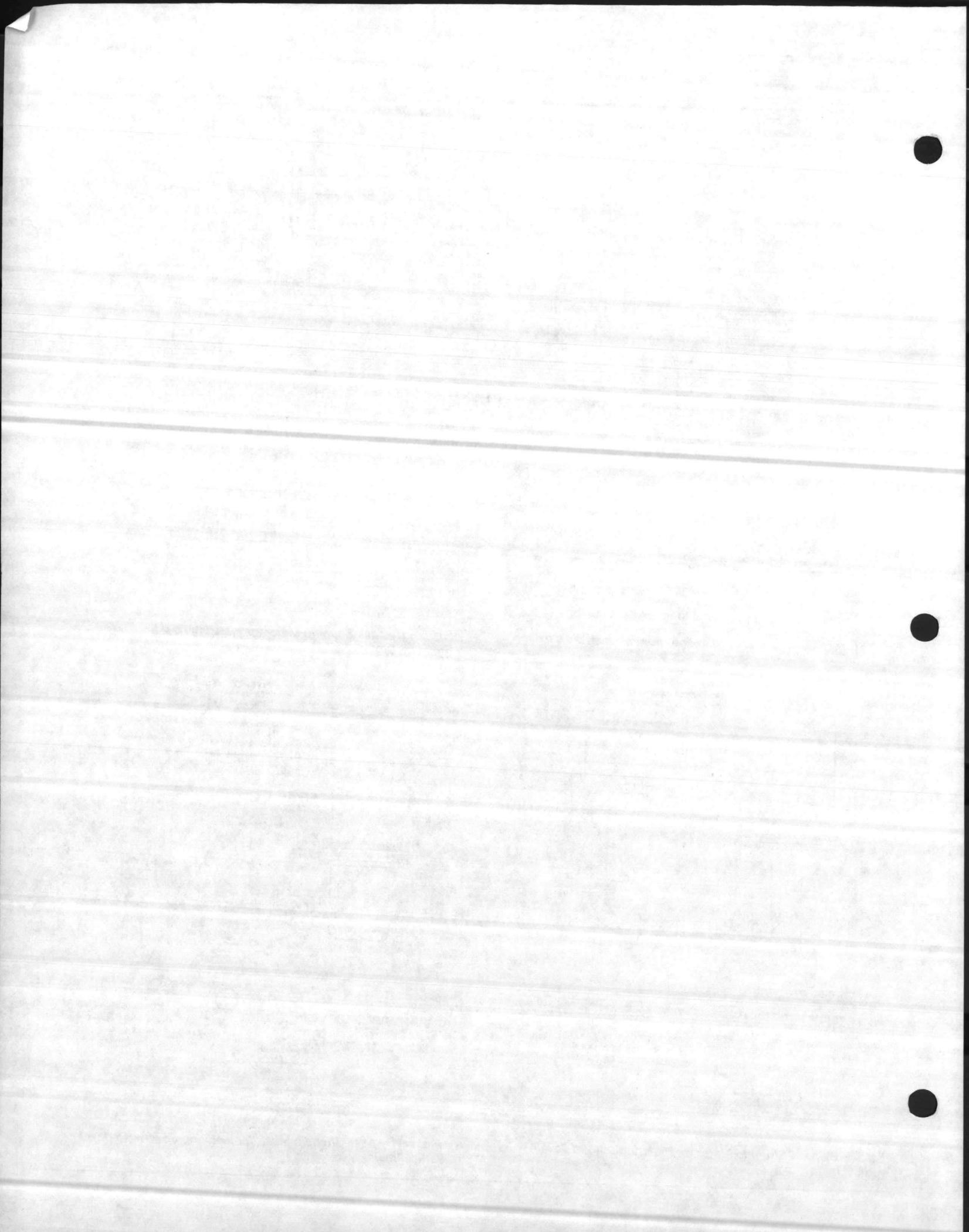
Fig. 6 - By-pass Shuntflo Meter for metering upward flow in vertical main



MAIN SIZE	MAIN FLANGES	B
5'-18"	150°	1 PIPE DIA.
5'-18"	300°	"
5'-18"	600°	"
18"	600°	"
20-24"	ALL	"

NOTES - METER IS CALIBRATED AND MUST BE USED WITH PARTS FURNISHED ALL 2" FLANGES 250° FURNISHED 2" METER BY-PASS PIPING AND MAIN LINE ORIFICE SHUTOFF VALVES EXTRA

Fig. 7 - By-pass Shuntflo Meter for metering downward flow in vertical main



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MAINT. & OPERATION

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MEDICAL/DENTAL CLINIC

CAMP LEJEUNE, N. C.

MECHANICAL CONTRACTOR-----SNEEDEN, INC.
301 EASTWOOD ROAD
WILMINGTON, N. C. 28406

INDEX

1. INSTALLATION, START-UP AND SERVICE INSTRUCTIONS ON CARRIER MODEL 50MED40 PACKAGE MULTI-ZONE COOLING/HEATING UNIT.
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MAINT. & OPERATION

Installation and Start-Up Instructions

SAFETY CONSIDERATIONS

Installing and servicing air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install or service air conditioning equipment.

Untrained personnel can perform basic maintenance, such as cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on air conditioning equipment, observe precautions in literature and on tags and labels attached to unit.

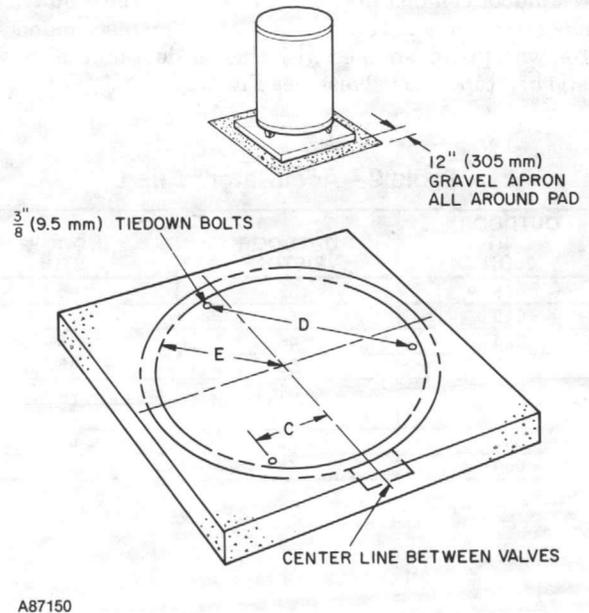
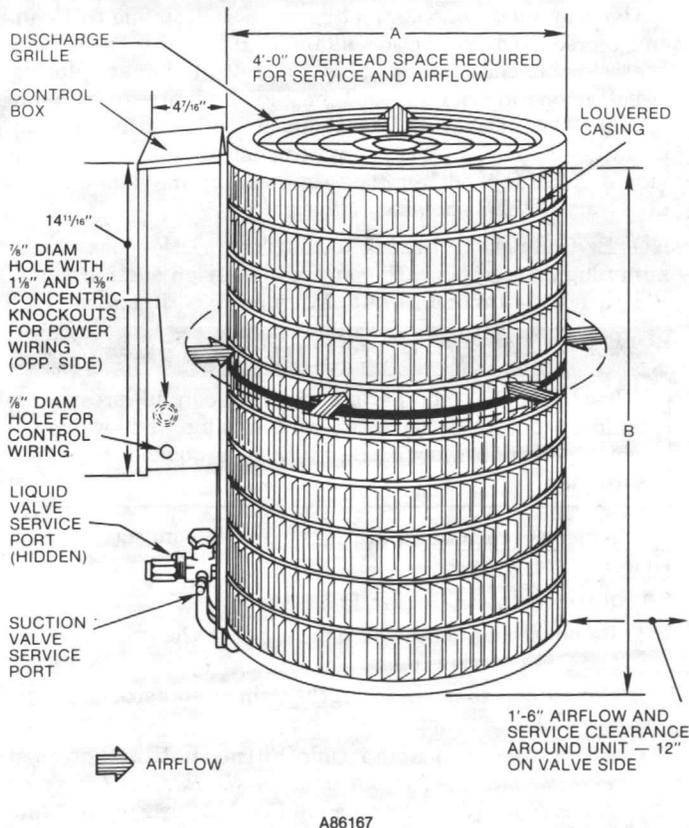
Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions *thoroughly*. Consult local building codes and National Electrical Code (NEC) for special installation requirements.

⚠ WARNING

Before installing or servicing unit, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power if applicable. Electrical shock can cause personal injury.

INSTALLATION

Step 1—Check Equipment and Jobsite—Install on a solid, level mounting pad. It is recommended that unit be attached to pad using tiedown bolts. Fasten unit to pad using holes provided in unit mounting feet. See Fig. 1.



Dimensions (ft.-in.)

Model 38QN	015-030	036-048	060
Diameters	1-9 ¹ / ₂	2-5 ¹ / ₄	3-3
Squares (minimum)	1-11	2-6	3-4
Tiedown Bolt Locations	C	0-6 ³ / ₄	1-1 ¹⁵ / ₁₆
	D	1-4	1-10 ¹ / ₂
	E	0-9 ¹ / ₄	1-1

Fig. 1—Dimensions, Connections and Mounting Pad (Refer to Table 1)

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

Table 1—Physical Data

MODEL 38QN	015	018	024	030	036	042	048	060
OPER WT (lb)*	132	151	155	180	195	189	235	270
REFRIGERANT Control	22 AccuRater™ (Bypass Type)							
COND FAN	Propeller Type, Direct Drive							
Air Discharge	Vertical							
Air Qty (Cfm)	1850	2400	3100	3800	4000	5000		
Mtr Rpm (60 Hz)	830	1075	850	1075	840			
COND COIL (fins/in.)	16							
Tube Diam	1/2-in. E-Coil							
Rows	1							
Refrig Ckts	2	2	2	3	2	4		
Face Area (sq ft)	12.77		17.33			21.88		
DIMENSIONS (ft.-in.)								
Diameter	A		B					
Height	1-9/16		2-5/16			3-2/16		
CONNECT. (in. ODF)	Compatible Fitting (Suction) & Flare (Liquid)							
Suction	3/8		3/8			3/8		
Liquid	3/8		3/8			3/8		
REFRIG LINES (in. ODF)								
Suction	3/8		3/8			1/2		
Liquid	3/8		3/8			1/2		

*Weight increases slightly with addition of any accessories.
 †38QN048-060 require 1 1/8-in. suction line for optimum performance. A 3/4- x 1 1/8-in. connection adapter accessory (Carrier Part No. 28AU900061) is available. If a 7/8-in. accessory tubing package is used, expect a slight capacity loss.

When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping and servicing. Maintain a minimum of 4 ft clearance from obstructions above and 18 in. around unit (12 in. on valve side). Maintain a distance of 24 in. between heat pumps. Position so water or ice from roof or eaves cannot fall directly on unit.

Step 2—Replace Indoor AccuRater™ Piston, if Required— Check indoor coil piston to see if it matches the required piston listed in Table 2. If it does not match, replace indoor coil piston with piston shipped with this outdoor unit (located in plastic bag taped to valves). See Fig. 2.

Table 2—AccuRater™ Chart

OUTDOOR UNIT 38QN	OUTDOOR PISTON	INDOOR PISTON
015	35	46
018	40	49
024	46	59
030	55	65
036	61	73
042	67	73
048	73	82
060	78	101

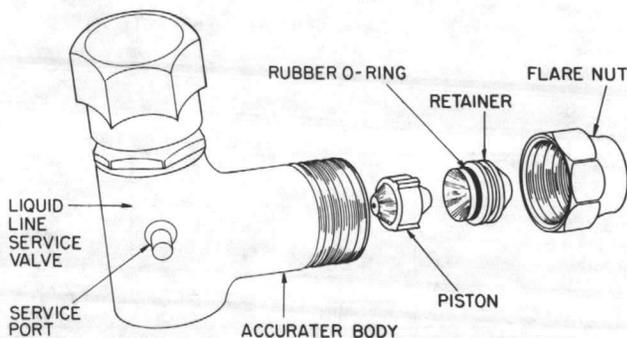


Fig. 2—AccuRater (Bypass Type) Components

Step 3—Make Piping Connections—Outdoor units may be connected to indoor sections using Carrier accessory tubing package or field-supplied tubing of refrigerant grade, correct size and condition (Table 1). For tubing requirements beyond 50 ft, obtain information from local Carrier distributor.

Outdoor Units Connected to Carrier-Approved Indoor Units—Outdoor units contain correct system refrigerant charge for operation with indoor unit of the same size when connected by 25 ft of field-supplied or Carrier accessory tubing. Check refrigerant charge for maximum efficiency.

CAUTION

DO NOT BURY MORE THAN 3 FT OF REFRIGERANT TUBING IN GROUND. If any section of tubing is buried, there must be a 6-in. vertical rise to valve connections on outdoor unit. If more than the recommended length is buried, refrigerant may migrate to cooler buried section during extended periods of unit shutdown. This causes refrigerant slugging and possible compressor damage at start-up.

CONNECT REFRIGERANT LINES to fittings on unit suction and liquid service valves (Fig. 1). *Liquid service valve has flare fitting; suction service valve has Compatible Fitting.* Make suction line connection first. Slide flare nut on liquid line, then flare and connect liquid line. Use a maximum torque of 15 ft-lb to tighten flare nut. (Do not disassemble AccuRater.) Unit Compatible Fitting permits mechanical or sweat connection as described below.

Models 38QN048,060—When using 1 1/8 in. field-supplied refrigerant suction line, sweat-connect suction line to 1 1/8 in. end of required connection adapter. Be sure to provide a heat sink at the service valve to prevent damage during sweating operation. Connect 3/4-in. end of adapter to unit suction line Compatible Fitting. Connect liquid refrigerant line to unit. When a 7/8-in. field-supplied suction line is used, provide a field-supplied 3/4-in. to 7/8-in. suction line adapter (not necessary if 38LS accessory tube is used).

NOTE: Compatible Fitting on outdoor section has aluminum plug located beneath compatible nut on suction valve. Plug keeps contaminants out of Compatible Fitting.

CAUTION

When removing compatible nut, be careful pressure build-up does not cause aluminum plug to blow and cause personal injury. After tubing is hooked up, discard plug.

Mechanical Connection—Mate one set of connections at a time.

1. Remove nut on Compatible Fitting.
2. Remove plug and be sure O-ring is in the groove inside the Compatible Fitting.
3. Cut tubing to correct length. Deburr and size as necessary. Slide nut onto tube.
4. Insert tube into Compatible Fitting until it bottoms. Tighten nut until it bottoms on shoulder of fitting or valve. Keep tube bottomed in Compatible Fitting while tightening nut.

CAUTION

If undersized, damaged or elliptically-shaped tubing is used when making Compatible Fitting, leaks may result.

Sweat Connection—Use refrigerant grade tubing.

1. Remove locking nut, plug, rubber O-ring and Schrader core and cap from valve service port.
2. Cut tubing to correct length. Deburr and size as necessary.
3. Insert tube in Compatible Fitting until it bottoms.

NOTE: Wrap top and bottom of service valves in wet cloth to prevent damage by heat. Solder with low-temperature (430 F) silver alloy solder.

4. Replace Schrader core and cap.
5. Evacuate or purge system with field-supplied refrigerant.

Compatible Fitting Repair

MECHANICAL CONNECTION—Frontseat unit service valves. Relieve refrigerant pressure from tubing. Back off locknut from Compatible Fitting onto tube. Cut fitting between threads and O-ring. See Fig. 3. Remove tubing section remaining in threaded portion of fitting. Discard locknut.

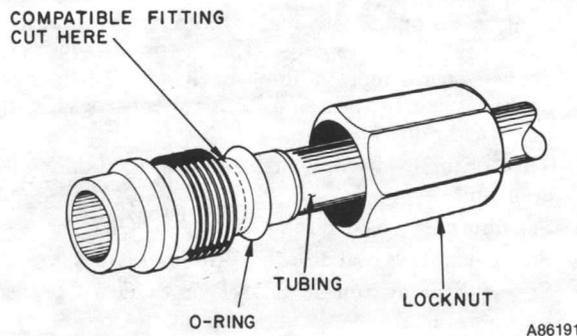


Fig. 3—Repair of Mechanical Connection

Clean, flux and insert new tube end into remaining portion of Compatible Fitting. *Wrap valve in wet rag to prevent damaging factory-made joints.* Heat and apply low-temperature (430 F) solder.

SWEAT CONNECTION—Frontseat unit service valves. Relieve refrigerant pressure from tubing. Clean and flux around leak. Repair, using low-temperature (430 F) solder. Evacuate or purge evaporator coil and tubing system. Add refrigerant charge. See Refrigerant Charging.

Step 4—Make Electrical Connections—Be sure field wiring complies with local and national fire, safety and electrical codes, and voltage to system is within limits shown in Table 3. Contact local power company for correction of improper line voltage.

NOTE: Operation of unit on improper line voltage constitutes abuse and could affect Carrier warranty. See Table 3. Do not install unit in system where voltage may fluctuate above or below permissible limits.

See Table 3 for recommended fuse sizes. When making electrical connections, provide clearance at unit for refrigerant piping connections.

INSTALL BRANCH CIRCUIT DISCONNECT PER NEC of adequate size to handle unit starting current. Locate disconnect within sight from and readily accessible from unit, per Section 440-14 of National Electrical Code (NEC).

ROUTE LINE POWER LEADS—Extend leads from disconnect through power wiring hole provided (see Fig. 1) and into unit splice area. Remove control box cover to gain access to unit wiring.

Table 3—Electrical Data (60 Hz)
Three-phase available with 036-060 sizes

OUTDOOR UNIT 38QN	V/PH	OPER VOLTS*		COMPR		FAN FLA	MCA	MAX FUSE† OR HACR TYPE CKT BKR AMPS
		Max	Min	LRA	RLA			
015-32	208-230/1	253	197	35.0	7.2	0.7	9.7	15
018-33				49.0	10.5	0.7	13.8	20
024-32				53.0	13.2	2.1	18.6	30
030-34				70.0	17.6	1.9	24.1	40
036-31				86.7	18.9	0.9	24.5	40
042-31				108.0	21.8	2.6	29.9	50
048-31				110.0	27.3	1.9	36.0	60
060-31				142.0	33.0	2.1	43.4	60
036-51	208/230/3	254	187	65.0	11.5	0.9	15.3	25
042-51				80.0	13.3	2.5	19.1	30
048-51				92.0	14.7	1.9	20.2	30
060-51				130.0	21.4	2.1	28.9	45
036-61	460/3	506	414	32.8	5.1	1.6	8.0	15
042-61				35.0	7.2	1.6	10.6	15
048-61				46.0	7.0	1.6	10.4	15
060-61				65.0	9.6	1.6	13.9	20

FLA — Full Load Amps
HACR—Heating, Air Conditioning, Refrigeration
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
RLA — Rated Load Amps

*Permissible limits of the voltage range at which unit will operate satisfactorily.
†Time-delay fuse.

NOTE: Control circuit is 24 v on all units and requires external power source.

CONNECT GROUND LEAD AND POWER WIRING—Connect ground lead to ground connection in control box for safety. Then connect power wiring. See Fig. 4. Splice line power leads to yellow and black pigtails. Use wire nuts and tape at each connection. Connect unit wiring to copper power wiring only.

CONNECT CONTROL POWER WIRING—Route 24-v control wires through control wiring hole and channel and connect leads to control wiring terminal board. See Fig. 1 and 6.

Use furnace or fan coil transformer as 24-v (40-va minimum) supply for system as shown in Fig. 6, or use accessory transformer.

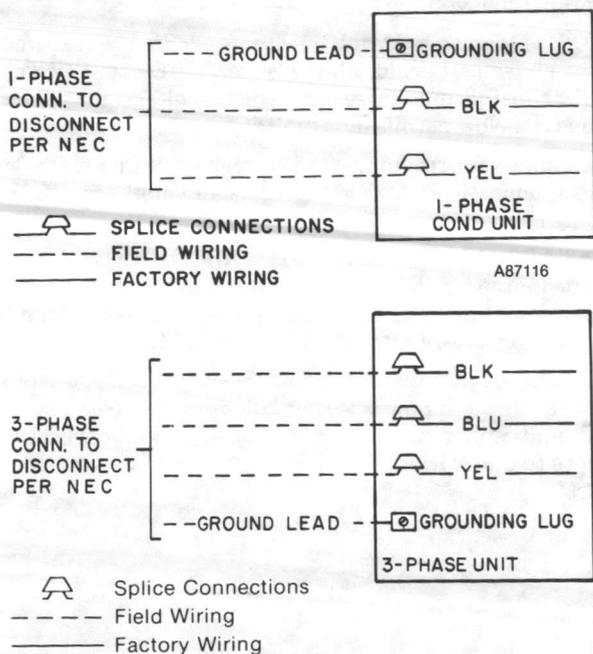


Fig. 4—Line Power Connections

Step 5—Start-Up—Heat Anticipator Settings for Room Thermostat. To set the heat anticipator, move the heat anticipator to the maximum setting. Determine which terminal powers the electric heater controls. With the heaters energized, measure the amperage between the appropriate W terminal and R and set the anticipator to the same value. Fig. 5 illustrates an easy method of obtaining the actual amp draw.

Accessory Outdoor Thermostat provides adjustable outdoor control of accessory electric heater. This thermostat makes contact when a drop in outdoor temperature occurs. It energizes a stage of electric heat when the outdoor temperature setting is reached, provided the room thermostat is on the second stage of heating. One outdoor thermostat is recommended for each stage of electric heat after the first stage. Set the outdoor thermostat(s) progressively lower for each stage. Refer to heat load of building and unit capacity to determine the correct outdoor thermostat settings.

The accessory supplemental heat relay is required when 2 outdoor thermostats are used. It is automatically energized by the manually operated supplemental heat switch in the indoor thermostat subbase. The thermostat locks out compressor and the relay bypasses the outdoor thermostats for electric heater operation during heat pump shutdown. When one outdoor thermostat is used, a supplemental heat relay is not required. The supplemental heat switch in the indoor thermostat subbase bypasses outdoor thermostat, locks out compressor and activates electric heater.

MOUNT OUTDOOR THERMOSTAT in control box. Attach brackets with short sheet metal screws to avoid contact with coil. Leave capillary tube coiled in control compartment making sure it is clear of all electrical connections and sharp metal edges.

MOUNT SUPPLEMENTAL HEAT RELAY in convenient location on indoor unit. Attach with sheet metal screw.

To Start Unit

1. Energize crankcase heater a minimum of 24 hours before starting unit. To energize heater only, set thermostat at OFF position and close electrical disconnect to outdoor unit.
2. Backseat (open) liquid and suction line service valves.



3. Unit is shipped with valve stem(s) frontseated, and caps installed. Replace stem caps after system is opened to refrigerant flow (backseated). Replace caps finger tight and tighten additional 1/6 turn with wrench. See sticker on valve cap.
4. Turn on main disconnect switch(es) to indoor and outdoor units.
5. Set fan switch as desired (ON or AUTO).
6. Set thermostat dial at desired temperature.
7. Set selector switch at HEAT or COOL. Operate unit for 15 minutes.
8. Check system refrigerant charge. See Refrigerant Charging.

Motors and controls are designed to operate satisfactorily in the voltage range shown in Table 3. If necessary to use manifold gages for servicing, refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, Pages 1-5, Fig. 8 for bypass method of returning charge to system. Removal of liquid line charging hose without following these precautions could result in some loss of charge.

Refrigerant Charging (Fig. 7 through 14)

CAUTION
To prevent personal injury, wear safety glasses and gloves when handling refrigerant. Do not overcharge system. This can cause compressor failure.

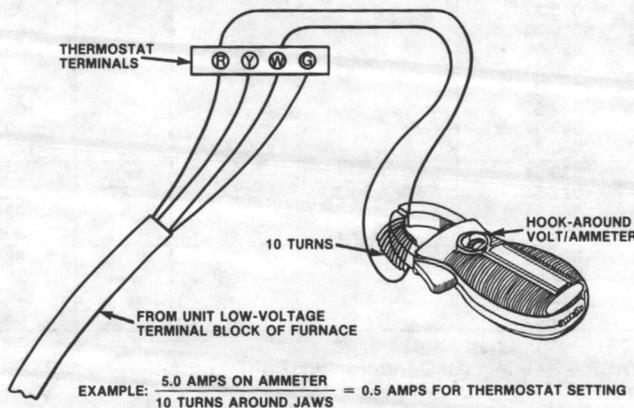
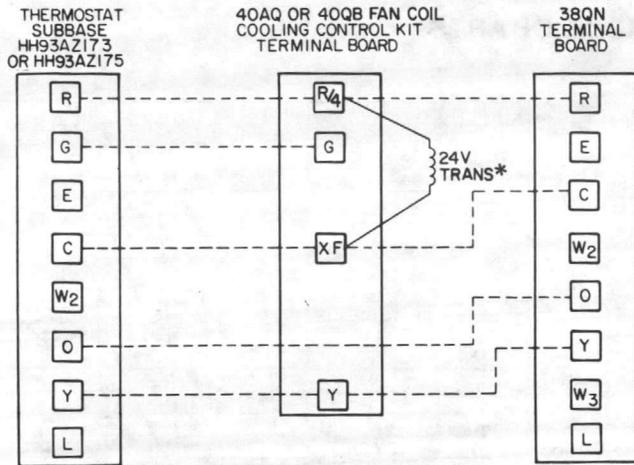


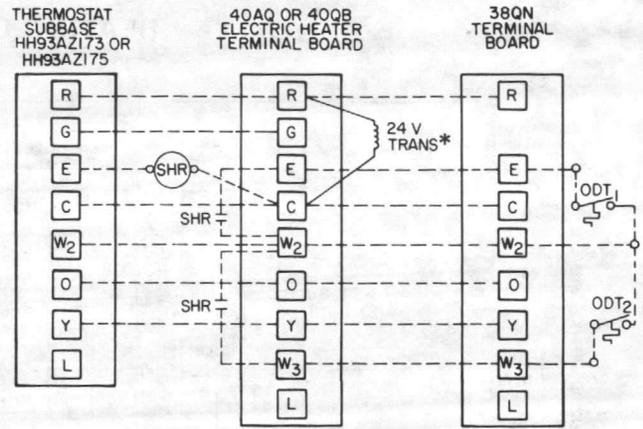
Fig. 5—Determining Amp Draw



COOLING AND ONE-STAGE HEATING
(38QN/40AQ OR 40QB WITHOUT ELECTRIC HEATER)

A

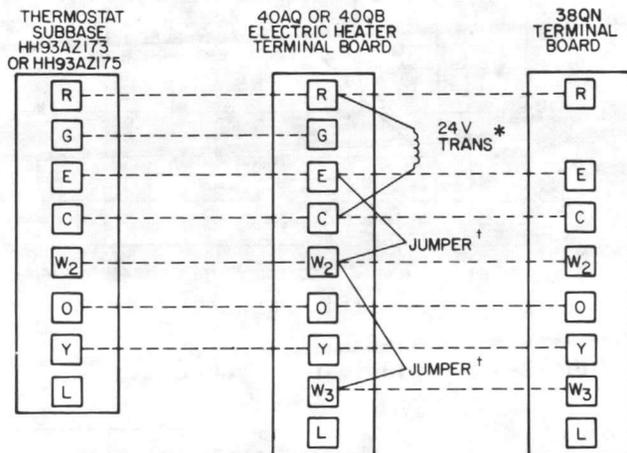
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COOLING AND TWO-STAGE HEATING
(38QN WITH 40FS/28HQ, VQ
EQUIPPED WITH ELECTRIC HEATER;
SUPPLEMENTAL HEAT, TWO OUTDOOR THERMOSTATS)

D

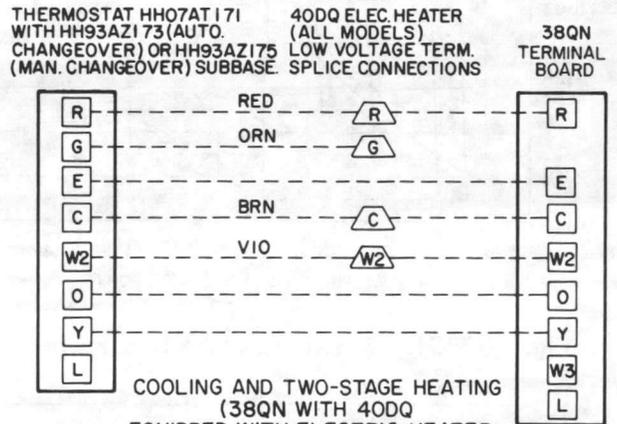
A87154



COOLING AND TWO-STAGE HEATING
(38QN WITH 40AQ, 40QB OR 40FS/28HQ, VQ
EQUIPPED WITH ELECTRIC HEATER;
SUPPLEMENTAL HEAT, NO OUTDOOR THERMOSTATS)

B

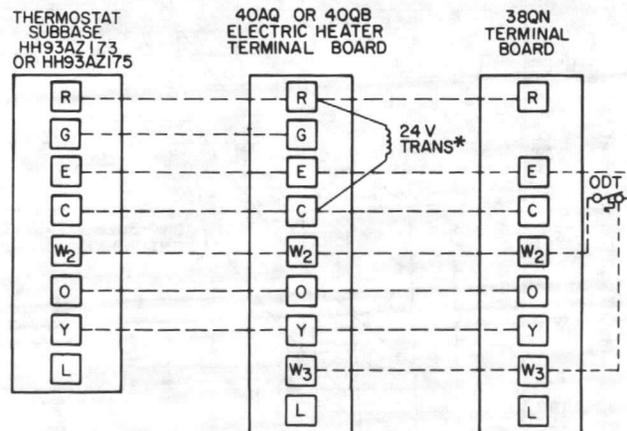
A87152



COOLING AND TWO-STAGE HEATING
(38QN WITH 40DQ
EQUIPPED WITH ELECTRIC HEATER;
SUPPLEMENTAL HEAT, NO OUTDOOR THERMOSTATS)

E

A87156



COOLING AND TWO-STAGE HEATING
(38QN WITH 40AQ, 40QB OR 40FS/28HQ, VQ
EQUIPPED WITH ELECTRIC HEATER;
SUPPLEMENTAL HEAT, ONE OUTDOOR THERMOSTAT)

C

A87155

- ODT — Outdoor Thermostat
- SHR — Supplemental Heat Relay
- Factory Wiring
- - - - - Field Wiring

*Transformer (60 va) located in cooling control kit or electric heater.

†Remove factory-installed jumper (Connection B) when installing outdoor thermostats (ODT).

Fig. 6—Control Circuit Connections

HEATING CYCLE CHECK CHARTS

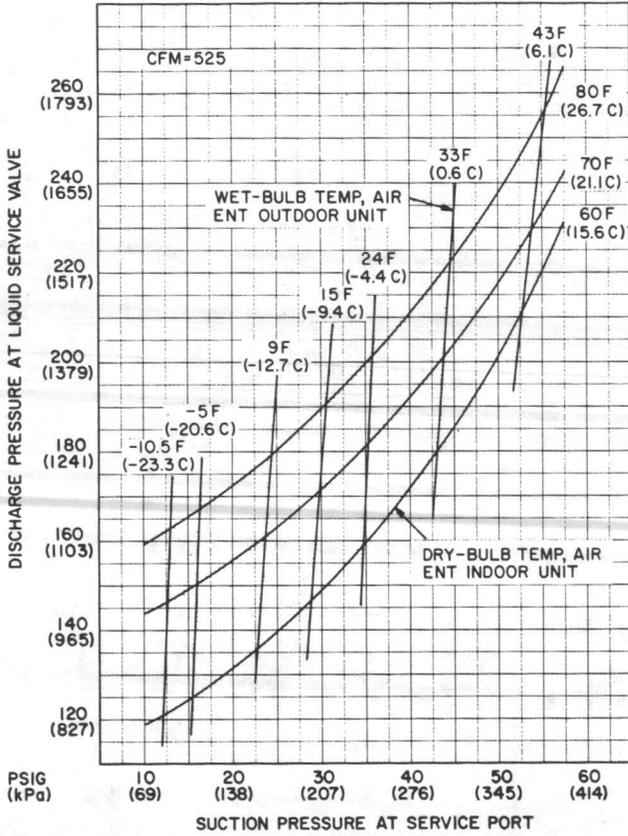


Fig. 7—38QN015 Heating Cycle Check Chart

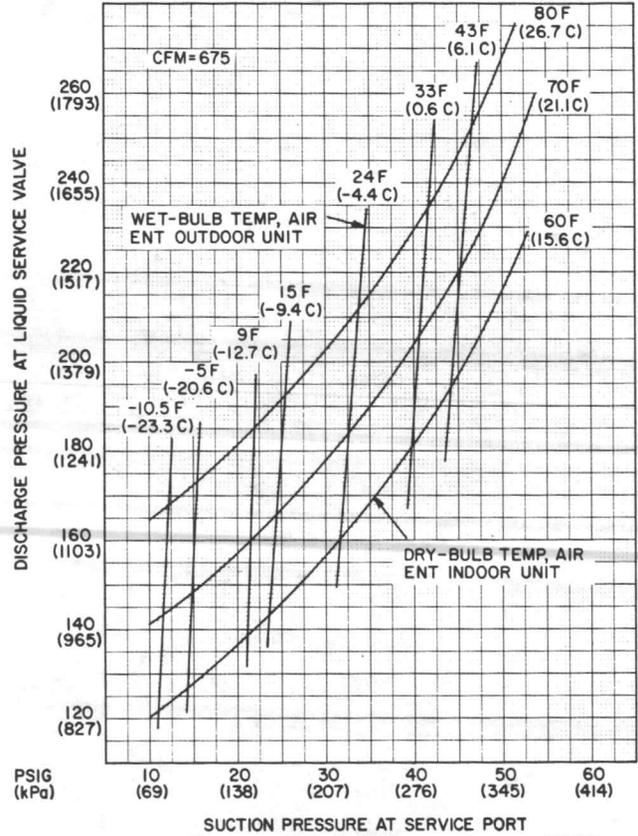


Fig. 8—38QN018 Heating Cycle Check Chart

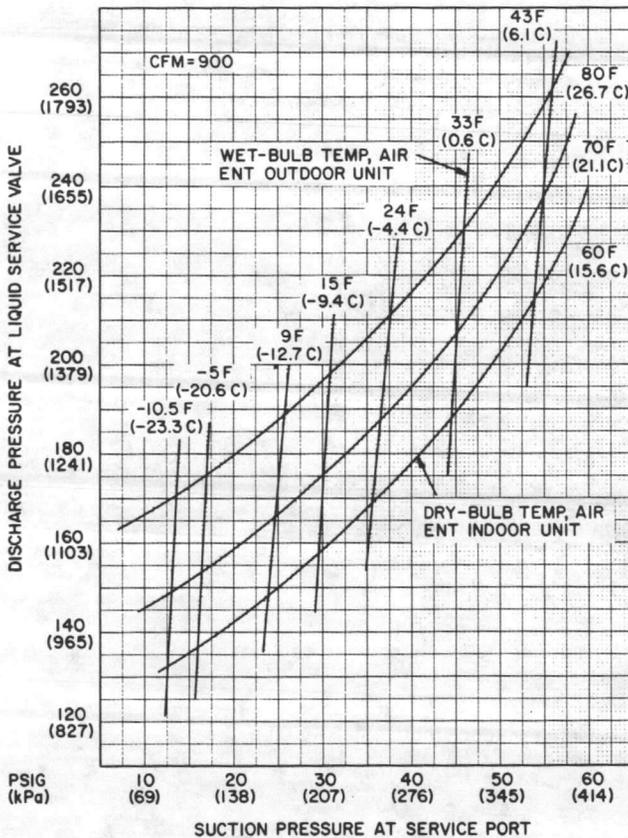


Fig. 9—38QN024 Heating Cycle Check Chart

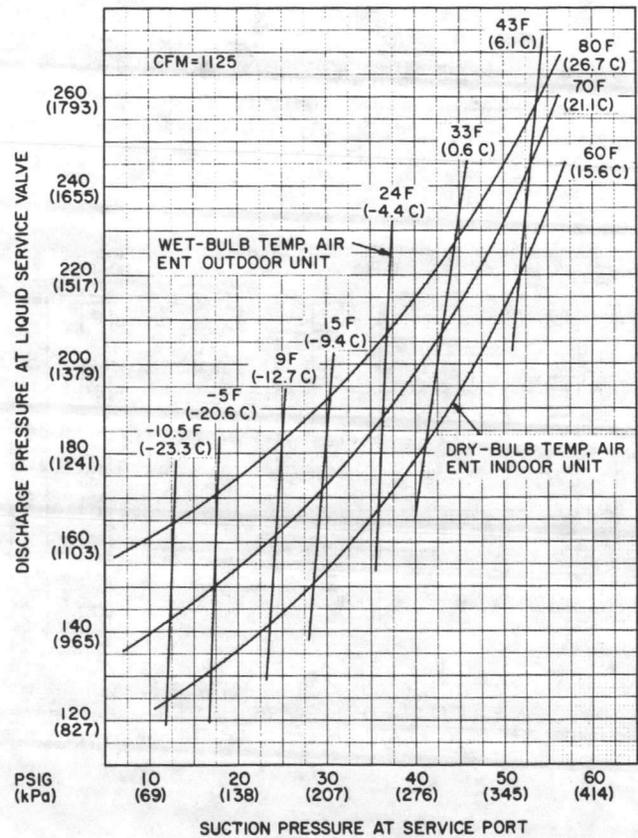


Fig. 10—38QN030 Heating Cycle Check Chart

HEATING CYCLE CHECK CHARTS (cont)

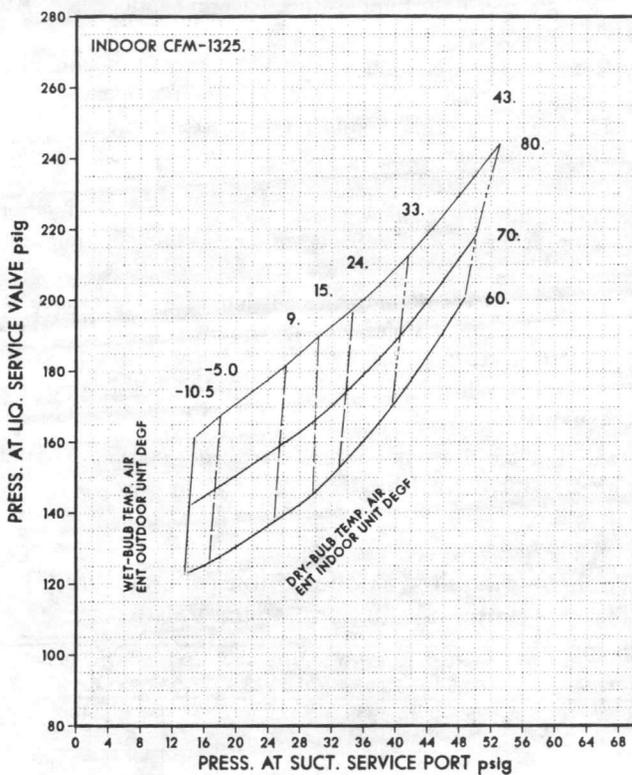


Fig. 11—38QN036 Heating Cycle Check Chart

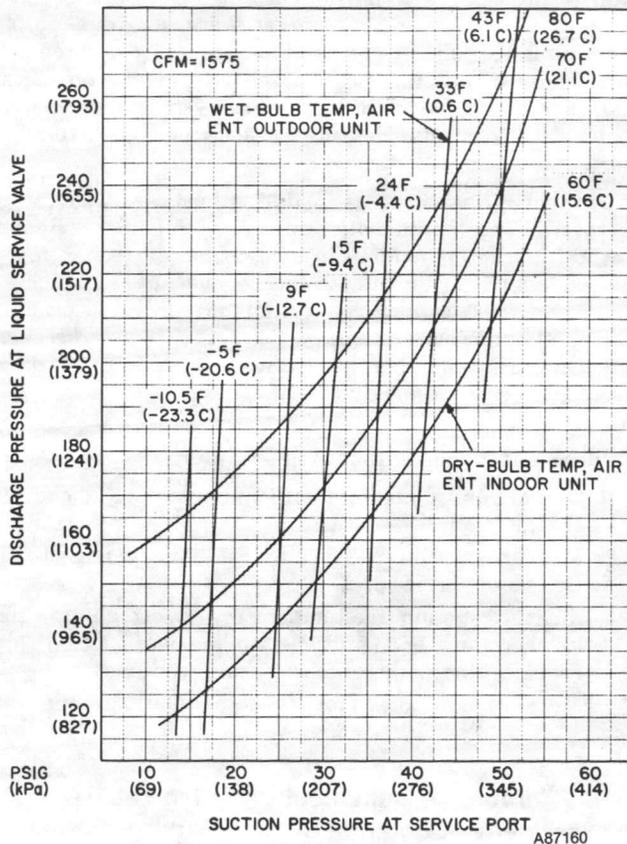


Fig. 12—38QN042 Heating Cycle Check Chart

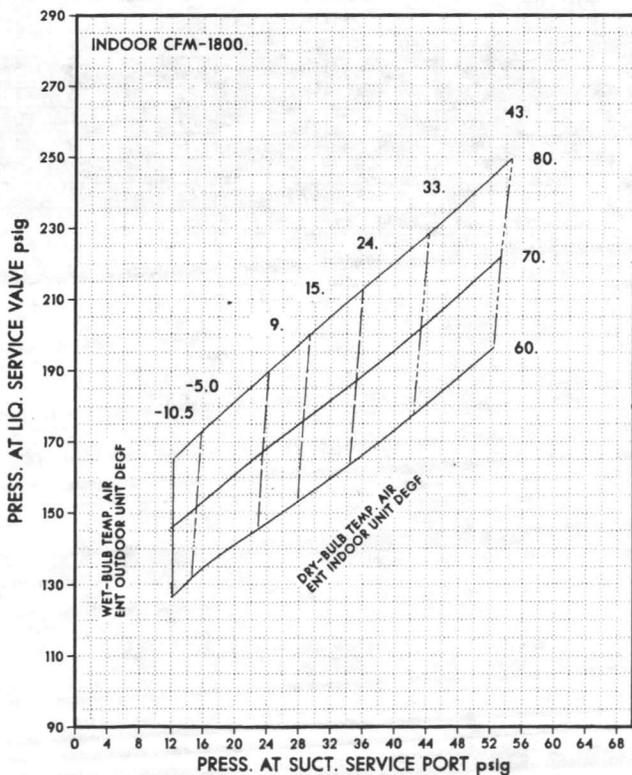


Fig. 13—38QN048 Heating Cycle Check Chart

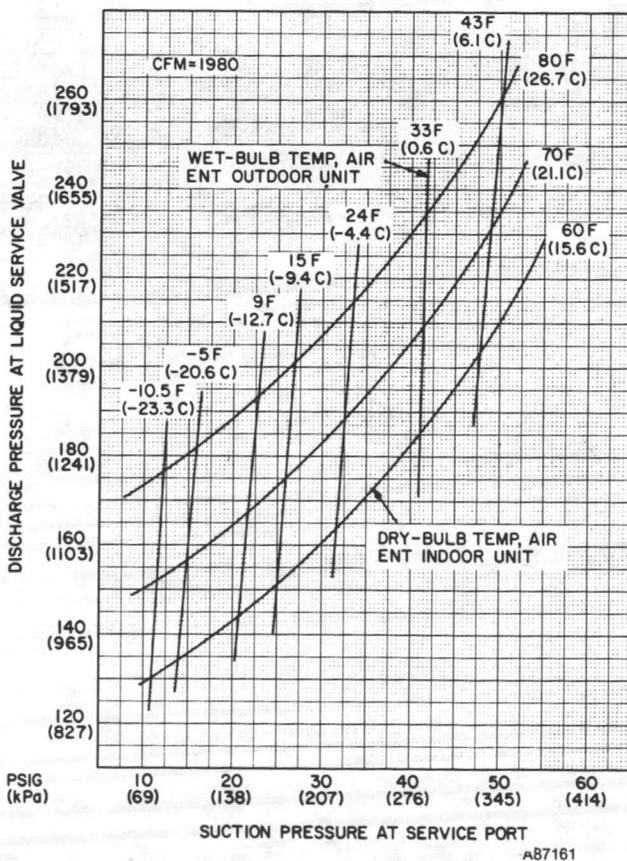


Fig. 14—38QN060 Heating Cycle Check Chart

To check system operation during heating cycle, use correct Heating Cycle Check Chart (Fig. 7 through 14). These charts indicate whether a correct relationship exists between system operating pressure and air temperatures entering indoor and outdoor units. If pressure and temperature lines do not intersect on chart, system refrigerant charge may not be correct or other system abnormalities may exist. Do not use Heating Cycle Check Charts to adjust refrigerant charge.

When recharging is necessary during heating season, weigh in total charge as indicated on unit rating plate. Remove any refrigerant remaining in system before recharging. If the system has lost complete charge, evacuate and recharge by weight. Service port connections are provided on liquid and suction line service valves. For evacuation and recharging, Dial-A-Charge charging cylinder is an accurate device for recharging systems by weight.

To check and adjust charge during cooling season, use Tables 4 and 5 and the following procedure:

1. Operate unit a minimum of 15 minutes before checking charge.
2. Measure suction pressure by attaching a gage to suction valve service port.
3. Measure suction line temperature by attaching a service thermometer to unit suction line near suction valve. Insulate thermometer for accurate readings.
4. Measure outdoor coil inlet air dry-bulb temperature

**Table 4—Superheat Charging Table
(Superheat Entering Suction Service Valve)**

OUTDOOR TEMP (F)	INDOOR COIL ENTERING AIR (F) WB													
	50	52	54	56	58	60	62	64	66	68	70	72	74	76
55	9	12	14	17	20	23	26	29	32	35	37	40	42	45
60	7	10	12	15	18	21	24	27	30	33	35	38	40	43
65	—	6	10	13	16	19	21	24	27	30	33	36	38	41
70	—	—	7	10	13	16	19	21	24	27	30	33	36	39
75	—	—	—	6	9	12	15	18	21	24	28	31	34	37
80	—	—	—	—	5	8	12	15	18	21	25	28	31	35
85	—	—	—	—	—	—	8	11	15	19	22	26	30	33
90	—	—	—	—	—	—	—	5	9	13	16	20	24	27
95	—	—	—	—	—	—	—	—	6	10	14	18	22	25
100	—	—	—	—	—	—	—	—	—	8	12	15	20	23
105	—	—	—	—	—	—	—	—	—	—	5	9	13	17
110	—	—	—	—	—	—	—	—	—	—	—	6	11	15
115	—	—	—	—	—	—	—	—	—	—	—	—	8	14

—Do not attempt to charge system under these conditions or refrigerant slugging may occur.

with a second thermometer.

5. Measure indoor coil inlet air wet-bulb temperature with a sling psychrometer.
6. Refer to Table 4. Find air temperature entering outdoor coil and wet-bulb temperature entering indoor coil. At this intersection, note the superheat.
7. Refer to Table 5. Find superheat temperature and suction pressure, and note suction line temperature.
8. If unit has higher suction line temperature than charted temperature, add refrigerant until charted temperature is reached.
9. If unit has lower suction line temperature than charted temperature, bleed refrigerant until charted temperature is reached.
10. If air temperature entering outdoor coil or pressure at suction valve changes, charge to new suction line temperature indicated on chart.
11. This procedure is valid, independent of indoor air quantity.

NOTE: For service data, refer to separate service manual for Models 38EH, EN, ES, QH, QN, QS.

**Table 5—Required Suction-Tube Temperature (F)
(Entering Suction Service Valve)**

SUPERHEAT TEMP (F)	SUCTION PRESSURE AT SERVICE PORT (psig)									
	61.5	64.2	67.1	70.0	73.0	76.0	79.2	82.4	85.7	
0	35	37	39	41	43	45	47	49	51	
2	37	39	41	43	45	47	49	51	53	
4	39	41	43	45	47	49	51	53	55	
6	41	43	45	47	49	51	53	55	57	
8	43	45	47	49	51	53	55	57	59	
10	45	47	49	51	53	55	57	59	61	
12	47	49	51	53	55	57	59	61	63	
14	49	51	53	55	57	59	61	63	65	
16	51	53	55	57	59	61	63	65	67	
18	53	55	57	59	61	63	65	67	69	
20	55	57	59	61	63	65	67	69	71	
22	57	59	61	63	65	67	69	71	73	
24	59	61	63	65	67	69	71	73	75	
26	61	63	65	67	69	71	73	75	77	
28	63	65	67	69	71	73	75	77	79	
30	65	67	69	71	73	75	77	79	81	
32	67	69	71	73	75	77	79	81	83	
34	69	71	73	75	77	79	81	83	85	
36	71	73	75	77	79	81	83	85	87	
38	73	75	77	79	81	83	85	87	89	
40	75	77	79	81	83	85	87	89	91	

Service Manual

38EH,EN,ES,QH,QN,QS

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INTRODUCTION

This Service Manual enables a service technician to service and repair a family of similar condensing units and heat pumps. Outwardly, many models appear

similar, however, there are distinct differences. Tables 1 and 2 help to differentiate these differences.

Models and SEER Ranges

Table 1 — Condensing Units

MODEL	DIAMETERS (in.)	SEER* (Nominal)
38EH015	22	9.0
38EH018	22	9.0
38EH024	22	9.0
38EH030	30	9.0
38EH036	30	9.0
38EH042	30	9.0
38EH048	30	9.0
38EH060	30	9.0
<hr/>		
38EN015	17	8.0
38EN018	17	8.0
38EN024	17	8.0
38EN030	22	8.0
38EN036	22	8.0
38EN042	30	8.0
38EN048	30	8.0
38EN060	30	8.0
<hr/>		
38ES018	30	10.0
38ES024	30	10.0
38ES030	30	10.0
38ES036	30	10.0
38ES042	30	10.0
38ES048	30	10.0
38ES060	39	10.0

*SEER — Seasonal Energy Efficiency Ratio. The higher the number, the less electrical power required to reach a given capacity. SEER is derived by dividing output energy by input energy.

Table 2 — Heat Pumps

MODEL	DIAMETERS (in.)	SEER* (Nominal)	C.O.P.† (Minimum)
38QH015	22	9.0	2.85
38QH018	22	9.0	2.85
38QH024	30	9.0	2.85
38QH030	30	9.0	2.85
38QH036	30	9.0	2.85
38QH042	30	9.0	2.85
38QH048	30	9.0	2.85
38QH060	39	9.0	2.85
<hr/>			
38QN015	17	8.0	2.55
38QN018	17	8.0	2.55
38QN024	22	8.0	2.55
38QN030	22	8.0	2.55
38QN036	30	8.0	2.55
38QN042	30	8.0	2.55
38QN048	30	8.0	2.55
38QN060	30	8.0	2.55
<hr/>			
38QS018	30	10.0	2.85
38QS024	30	10.0	2.85
38QS030	30	10.0	2.85
38QS036	30	10.0	2.85
38QS042	30	10.0	2.85
38QS048	30	10.0	2.85
38QS060	39	10.0	2.85

†C.O.P. — Coefficient of Performance (heating), determined by dividing Btu output by power input required to produce this Btu output.

Factory-Installed Options — Any condensing unit or heat pump listed in Tables 1 and 2 may be ordered as Basic or in one of 3 factory-option packages. Package designations are included in model number (excluding

Basic). Example: 38EN024301SM. SM designates this unit as sheet metal option package. Option package designations are shown in Table 3.

Table 3 — Option Packages

Basic	38EH.ES Standard unit with no added options.
Sheet Metal Option (SM)	Same unit as Basic except with addition of louvered inlet casing.
Deluxe Option (DL)	Same unit as (SM) except for addition of start assist components on single-phase units, crankcase heater, high- and low-pressure switches, and accumulator.
Custom Deluxe Option (CD)	Same unit as (DL) except for addition of sound shield around compressor, and Time Guard II device.
Basic	38EN Standard unit with no added options.
Sheet Metal Option (SM)	Same unit as Basic except for addition of louvered inlet casing.

Basic	38QH.QS Standard unit with no added options.
Sheet Metal Option (SM)	Same unit as Basic except for addition of louvered inlet casing.
Deluxe Option (DL)	Same unit as (SM) except for addition of start assist components on single-phase units, high-pressure switch, and Service Sentry device.
Custom Deluxe Option (CD)	Same unit as (DL) except for addition of sound shield around compressor and Time Guard II device.
Basic	38QN Standard unit with no added options.
Sheet Metal Option (SM)	Same unit as Basic, except for addition of louvered inlet casing.

Table 4 — Condensing Unit Specifications

OUTDOOR UNIT MODEL NO. 38-	ORIGINAL COMPRESSOR MODEL	REPLACEMENT COMPRESSOR MODEL	OIL CHARGE		REFRIG CHARGE* (R-22)
			Initial	Recharge	
EH-					
015301	REZ3-0125	50QT662300	24	20	6.2
018301	AB5515H	50SR661301	32	30	6.3
024301	MD2315GG	MD2364GE	46	44	5.6
030301	MD3215GG	MD3264GE	46	44	7.3
036301	AV5535E	50SR661336	54	50	7.4
042301	AV5542E	50SR661300	54	50	7.1
048321	AV5546H	50SR661331	54	50	8.9
060301	PC6016BD	PC6066ED	76	72	12.7
EN-					
015310	AK8515E	51DZ661300	17	15	3.2
018310	RES3-0175-PFV	38EA662301	24	20	3.7
024310	H21R243ABC	38EN663307	40	37	3.8
030300	H21A313ABCA	38EN663302	40	37	5.6
030320	MD3215GG	MD3264GE	46	44	6.7
036320	H21A363ABCA	38EN663303	50	47	5.8
042300	H21A463ABCA	38EN663304	50	47	7.2
048300	PC5316BD	PC5366HD	76	72	7.6
060300	PC6716AG	PC6766HG	76	72	9.6
060310	PC6716AG	PC6766HG	76	72	12.5
030500	H21A313DBD	38EN663501	40	37	5.6
036500	H21A373DBD	38EN663502	50	47	5.8
042500	H21A463DBD	38EN663500	50	47	7.2
048500	PY5316AD	See Note †	76	72	7.6
060500	PY6716AF	See Note ‡	76	72	9.6
060510	PY6716AF	See Note ‡	76	72	12.5
036600	H21A373DBE	38EN663600	50	47	5.8
042600	A21A463DBE	38EN663601	50	47	7.2
048600	PH5316AD	PH5366HD	76	72	7.6
060600	PH6716AF	PH6766HF	76	72	9.6
060610	PH6716AF	PH6766HF	76	72	12.5
ES-					
018	AB5515H	50SR661301	32	28	7.20
024	CRC1-0175-PFV	38VH660303	55	51	7.40
030	H23A263ABCA	50SR661333	50	46	6.50
036	CRH3-0275-PFV	51HK660304	55	51	7.50
042	CRK3-0325-PFV	48GH662302	55	51	7.80
048	AV5546H	50SR661331	54	50	12.50
060	—	—	—	—	—

*Factory refrigerant charge is adequate when indoor unit and outdoor unit are the same size and are connected with 25 ft or less of field tubing of recommended size or Carrier accessory tubing. For tubing requirements beyond 50 ft, consult Carrier distributor.

NOTE: Originally an extended voltage compressor. Select replacement compressor for voltage required:
 †PF5366HD (200-3-60), PG5366HD (230-3-60).
 ‡PF6766HF (200-3-60), PG6766HF (230-3-60).

Table 5 — Heat Pump Specifications

OUTDOOR UNIT MODEL NO. 38-	ORIGINAL COMPRESSOR MODEL	REPLACEMENT COMPRESSOR MODEL	OIL CHARGE		REFRIG CHARGE* (R-22)
			Initial	Recharge	
QH					
015	REZ3-0125-PFV	50QT662300	24	20	5.3
018	H22B173ABCA	38QF663300	40	37	5.5
024	CRC2-0175-PFV	38VH660303	55	52	7.8
030	AV5532E	50SR661333	54	50	7.8
036	AV5535H	50SR661336	54	50	7.9
042	AV5542H	50SR661330	54	50	11.0
048	AV5546H	50SR661331	54	50	12.5
060	WD6000AA	WD6051AA	76	74	14.1
060341	H23A563ABCA	—	55	50	14.0
030	AV5532E	50SR661415	54	50	7.8
036	AV5535E	50SR661413	54	50	7.9
042	AV5542E	50SR661414	54	50	11.0
048	AV5546E	50SR661500	54	50	12.5
060	WY6000AA	WY6051AA	76	74	14.1
036	AV5535E	50SR661623	54	50	7.9
042	AV5542E	50SR661624	54	50	11.0
048	AV5546E	50SR661622	54	50	12.5
060	WH6000AA	WH6051AA	76	74	14.1
QN					
015	REZ3-0125-PFV	38QB662301	24	20	3.6
018	AB5519H	50SR661311	32	28	4.1
024	MD2315GG	MD2364GE	46	44	5.6
030	MD3215GG	MD3264GE	46	44	6.1
036	MD3515GG	MD3564GE	46	44	8.9
042	AV5542E	50SR661330	54	50	9.5
048	PC5316BD	PC5366HD	76	72	9.7
060	PC6016BD	PC6066ED	76	72	10.8
036	MF3513GB	MF3563GE	46	44	8.9
042	AV5542E	50SR661330	54	50	9.5
048	PY5316AD	See Note †	76	72	9.7
060	PY6016BD	PY6066EF	76	72	10.8
036	MH3513GB	MH3563GE	46	44	8.9
042	PH4616AD	PH4666HD	76	72	9.5
048	PH5316AD	PH5366HD	76	72	9.7
060	PH6016BD	PH6066EF	76	72	10.8
QS					
018	AB5515H	50SR661301	32	28	6.8
024	JD2200AA	JD2251AA	50	46	7.5
030	JD2800AA	JD2851AA	50	46	8.5
036	JD3300AA	JD3300AA	50	46	10.6
042	CRJ3-0300-PFV	38EB660301	55	51	11.5

*Factory refrigerant charge is adequate when indoor unit and outdoor unit are the same size and are connected with 25 ft or less of field tubing of recommended size or Carrier accessory tubing. For tubing requirements beyond 50 ft, consult Carrier distributor.

NOTE: Originally an extended voltage compressor. Select replacement compressor for voltage required.
†PF5366HD (200-3-60), PG5366HD (230-3-60).

SAFETY CONSIDERATIONS

Service and repair of these units should be attempted only by trained service technicians familiar with Carrier Standard Service Instructions.

All equipment should be installed in accordance with accepted practices and in compliance with all national and local codes.

Power should be turned off when servicing or repairing electrical components. Extreme caution should be observed when troubleshooting electrical components with power on. Observe all warning notices posted on equipment.

Refrigeration system contains refrigerant under pressure. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operation, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

SERVICE

Cabinet — Certain maintenance routines and repairs require removal of cabinet panels. All condensing units and heat pump models of this series have same basic design with only minor differences. See Fig. 1.

REMOVING LOUVERED CASING — (See Fig. 2.)

1. Turn off all power to unit.
2. Loosen screws around circumference of fan orifice.
3. Remove screws around circumference of basepan.
4. Remove screws along control box support brackets.
5. Carefully remove louvered casing.

⚠ CAUTION

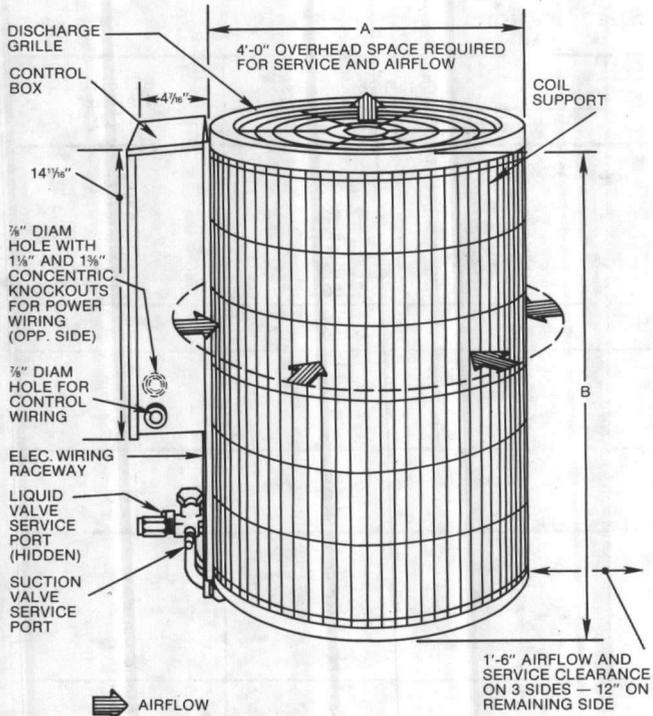
Do not attempt to remove wire grille around coil. Grille is integral part of coil structure and supports coil.

REMOVING FAN ORIFICE — (See Fig. 3.)

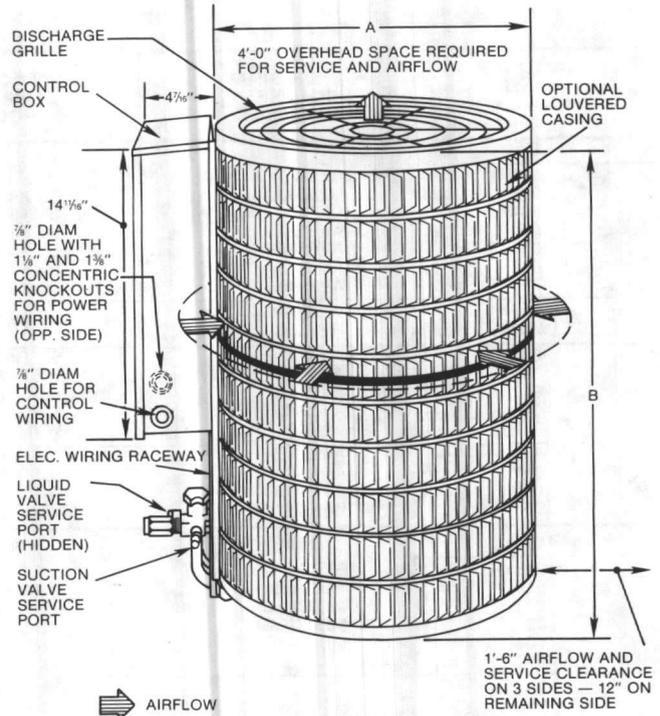
1. Turn off all power to unit.
2. Remove screws holding grille on top of fan orifice.
3. Unplug wires from fan motor. Fan blades on certain models may have to be removed. Refer to Service — Electrical.
4. Remove screws holding fan orifice to wire grille and control box.
5. Remove fan orifice.

ELECTRICAL BOX ACCESS — (See Fig. 1.)

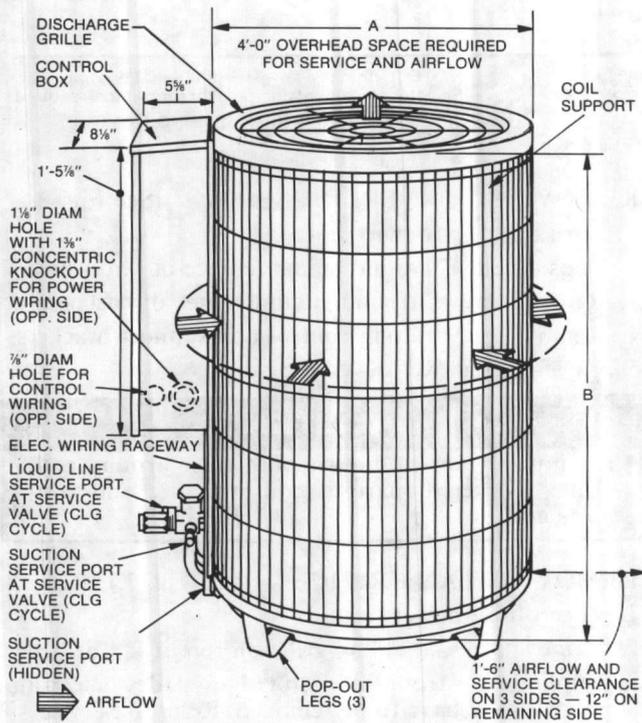
1. Turn off all power to unit.
2. Remove screws holding box cover.



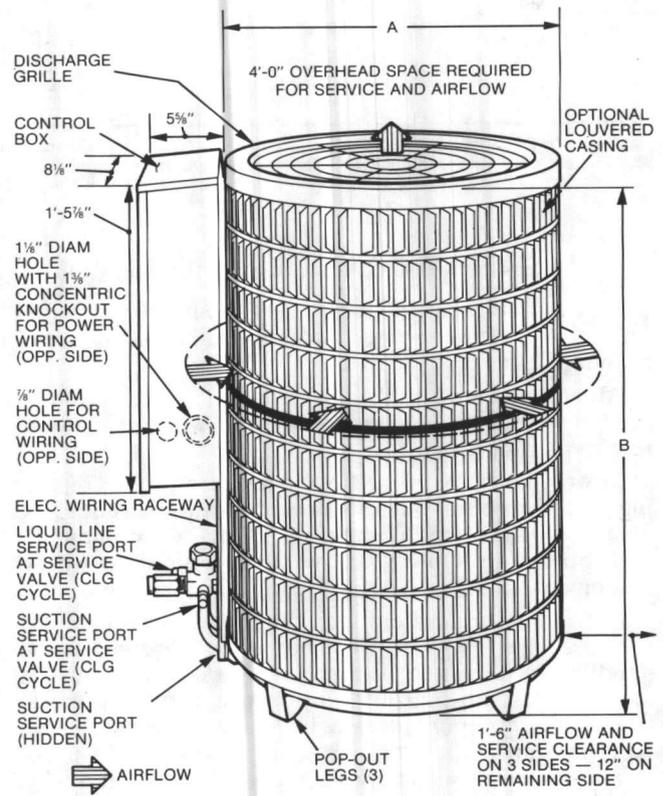
BASIC CONDENSING UNIT



LOUVERED CONDENSING UNIT



BASIC HEAT PUMP UNIT



LOUVERED HEAT PUMP UNIT

Fig. 1 — Condensing and Heat Pump Units

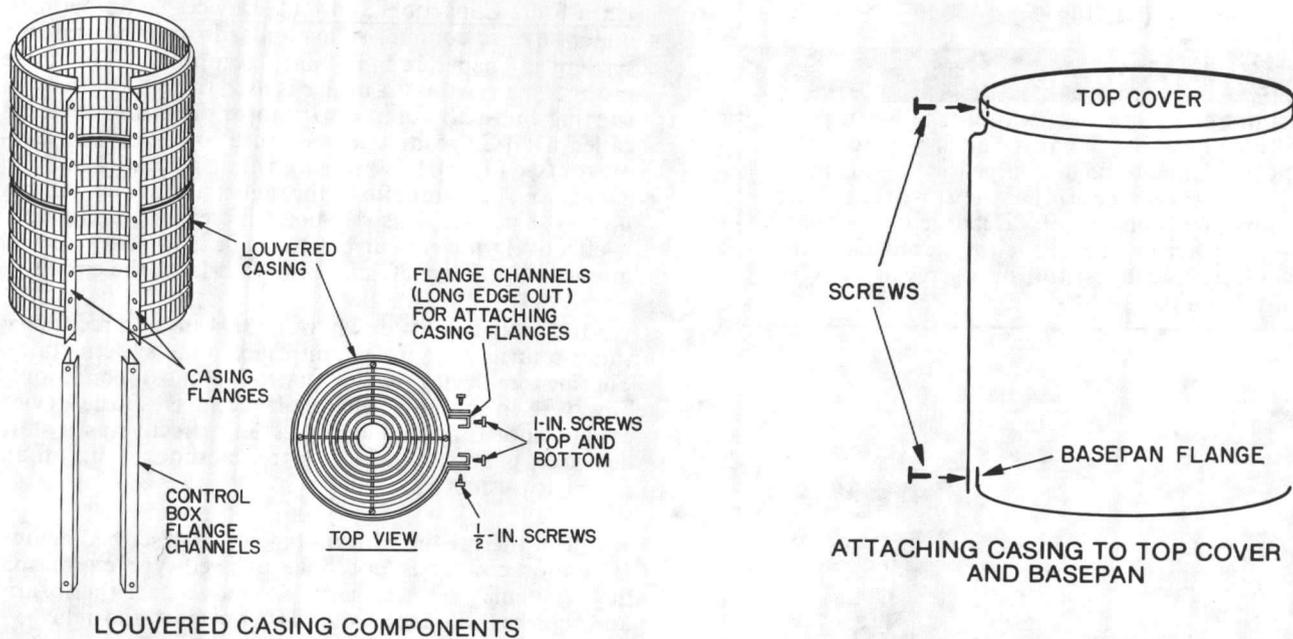


Fig. 2 — Louvered Casing Assembly

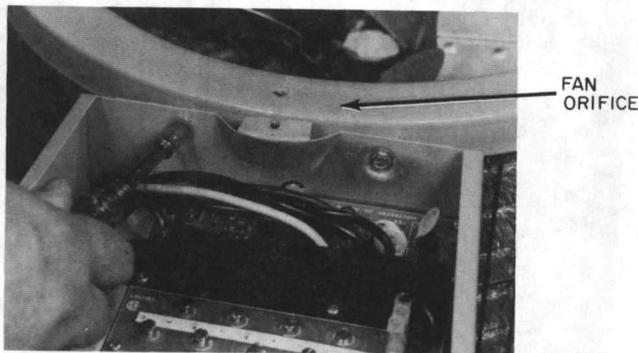


Fig. 3 — Removing Orifice Fan

Electrical — Exercise extreme caution when working on any electrical components. Shut off all power to system prior to troubleshooting. Some troubleshooting techniques require power to remain on. In these instances, exercise extreme caution to avoid danger of electrical shock. **ONLY TRAINED SERVICE PERSONNEL SHOULD PERFORM ELECTRICAL TROUBLESHOOTING.**

CONTACTORS — (See Fig. 4.) Contactor provides means of applying power to unit using lower power (24 v) from transformer in order to power the contactor coil. Depending on unit model, you may encounter single-, double- or triple-pole contactors to break power. One side of the line may be electrically hot, so extreme caution must be exercised when troubleshooting.

The contactor coil for these and most residential models of condensing units and heat pumps is powered by 24 vac. If contactor does not operate:

1. With power off, check whether contacts are free to move. Check for severe burning or arcing on contact points.

2. With power off, use ohmmeter to check for continuity of coil. Disconnect leads before checking. A low-resistance reading is normal. Do not look for a specific value as different part numbers used will have different resistance values.
3. Reconnect leads and apply low-voltage power to contactor coil. This may be done by leaving high-voltage power to outdoor unit off, and by turning thermostat to heat or cool. Check voltage at coil with voltmeter. Reading should be between 20 - 30 volts. Contactor should pull in if voltage is correct and coil is good. If contactor does not pull in, change contactor.
4. With high-voltage power off and contacts pulled in, check for continuity across contacts with ohmmeter. A very low or zero resistance should be read. Higher readings could indicate burned or pitted contacts which may cause future failures.

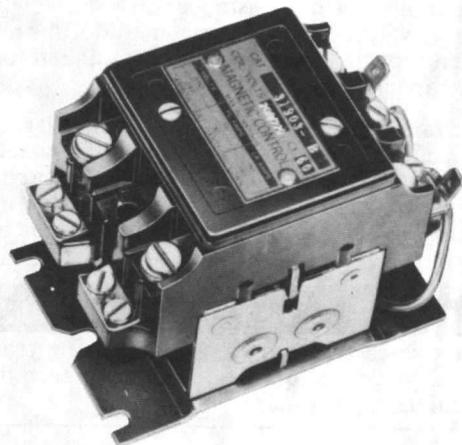
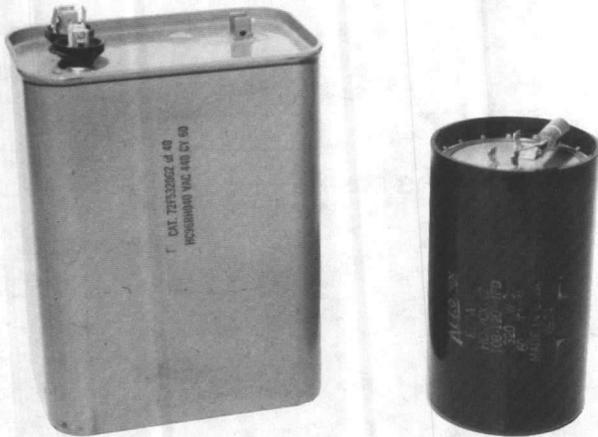


Fig. 4 — Contactor

CAPACITORS — (See Fig. 5.)

⚠ CAUTION

Capacitors can store electrical energy when power is off. Electrical shock can result if you touch the capacitor terminals and discharge this stored energy. Exercise extreme caution when working near capacitors. With power off, discharge stored energy by shorting across the capacitor terminals with a 15,000-ohm, 2-watt resistor, or a screwdriver blade with insulated handle.



RUN CAPACITOR

START CAPACITOR

Fig. 5 — Capacitors

Capacitors are used as a phase shifting device to aid in starting certain single-phase motors. Check capacitors as follows:

1. Always check capacitors with power off. Attempting to troubleshoot a capacitor with power on can be dangerous. Defective capacitors may explode when power is applied. Insulating fluid inside is combustible and may ignite, causing burns. After power is off, discharge capacitors as outlined above. Disconnect capacitor from circuit. Use ohmmeter, check each terminal to ground (use capacitor case). Discard any capacitor that shows resistance. Place ohmmeter leads across capacitor and place on R x 10k scale. Meter should jump to a low resistance value and slowly climb to higher value. Failure of meter to do this indicates an open capacitor. If resistance stays at zero or a low value, capacitor is shorted.
2. Capacitance testers are available which will read value of capacitor. If value is not within $\pm 10\%$ value stated on capacitor, it should be changed. If capacitor is not open or shorted, its capacitance value is calculated by measuring voltage across capacitor and current it draws.

⚠ WARNING

Exercise extreme caution when taking readings while power is on. Use following formula to calculate capacitance:

$$\text{Capacitance (mfd)} = \frac{2650 \times \text{amps}}{\text{volts}}$$

3. Remove any capacitor that shows signs of bulging, dents or leaking. Do not apply power to a defective capacitor as it may explode.

Hard-Start Capacitors and PTC Devices — Sometimes, under adverse conditions, a standard run capacitor in a system is inadequate to start compressor. In these instances, a start-assist device is used to provide an extra starting boost to compressor motor. The first device is called a PTC (positive temperature coefficient) or thermistor (see Fig. 6). It is a resistor wired in parallel with run capacitor. As current flows through it at start-up, it heats up. As it heats up, its resistance increases greatly, until it effectively lowers current through it to an extremely low value. This, in effect, removes it from the circuit.

After system shuts down, resistor cools and resistance value returns to normal, until next time system starts. Thermistor device is adequate for most conditions, however, in systems where off cycle is short, device cannot cool fully and becomes less effective as a start device. It is an easy device to troubleshoot. Turn off all power to system.

Check thermistor with ohmmeter as described below. If indoor coil does not have a bleed-type expansion device, it may be necessary to remove start thermistor and replace with accessory start capacitor and relay.

Shut off all power to unit. Remove PTC from unit. Wait at least 10 minutes for PTC to cool to ambient temperature.

Measure resistance of PTC with ohmmeter. Resistance of 25-ohm PTC is measured between center tab and end tab with jumper across 2 end terminals.

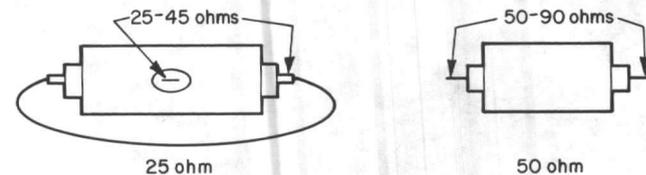


Fig. 6 — PTC Devices

The cold resistance (R_T) of any PTC device should be approximately 100 - 180% of device ohm rating.

50-ohm PTC = 50 - 90 ohm resistance
25-ohm PTC = 25 - 45 ohm resistance

If PTC resistance is appreciably lower or more than 200% higher than rating, device is defective.

If thermistor is good and compressor does not start, disconnect thermistor from starting circuit. Give compressor a temporary capacitance boost. Run compressor for 10 minutes, shut off, allow system pressure to equalize. Reconnect start thermistor. Try restarting compressor without boost capacitor. If after 2 attempts, compressor does not start, remove thermistor. Add an accessory start capacitor relay package.

Temporary Capacitance Boost — (See Fig. 7.) There are times when a temporary capacitance boost is needed to get compressor started. Do not under any circumstances attach temporary boost capacitor directly across compressor terminals. Serious personal injury can result. Exercise extreme caution with this procedure when high-voltage power is on. If compressor motor does not start, it may be due to low-line voltage, improper pressure equalization or weak run capacitor. Check each possibility, attempt capacitance boosting *before* adding auxiliary start capacitor and relay.

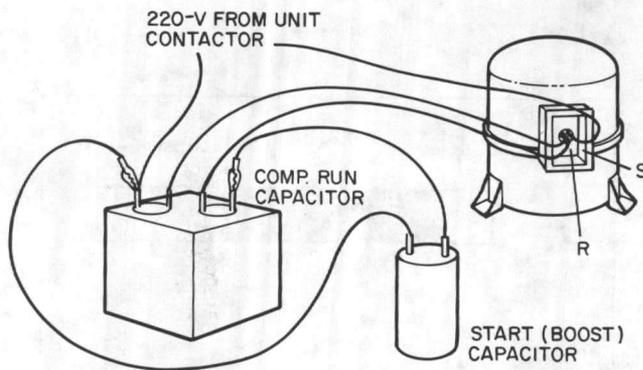


Fig. 7 — Capacitance Boosting

Turn off power. Check compressor for ground or open. If there is none, proceed. Obtain a start capacitor approved by compressor manufacturer. Connect wires with insulated probes to each terminal. Touch probes to each side of run capacitor. Energize and start compressor, pull probes away after about 3 seconds. *Discharge start capacitor.* Run compressor about 10 minutes. Stop and allow to sit idle about 5 minutes. Check system pressure equalization. Attempt to restart *without* capacitance boost. If compressor does not start after several attempts, add proper auxiliary start capacitor and relay.

If PTC thermistor device is inadequate as start device, a start capacitor and relay may be added to system to insure positive start. Capacitor is wired in parallel with run capacitor through normally closed set of contacts on a device called start relay. The relay coil is wired across start and common terminals of compressor. The added capacitance gets compressor started. As compressor comes up to speed, voltage across start and common terminals increases to a value high enough to cause start relay to energize. This opens normally closed contacts and removes start capacitor from circuit. In actual practice, this occurs in a fraction of a second.

To check start relay and capacitor, first turn off all power to unit. Discharge start and run capacitors as outlined earlier. Most start capacitors will have a 15,000-ohm, 2-watt bleed resistor. Disconnect these devices from system. Start capacitor can be inspected visually. It is designed for short duration or intermittent duty. If left in circuit for prolonged period it blows through a specially designed orifice. If it appears blown, check for stuck contacts in start relay. Start capacitor can be checked by ohmmeter method discussed earlier.

▲ CAUTION

If bleed resistor is wired across start capacitor, it must be disconnected to avoid erroneous readings when ohmmeter is applied across capacitor.

Start relay is checked with ohmmeter. Check for continuity across coil of relay. You should encounter a high resistance. Since relay contacts are normally closed, you should read low resistance across them.

Both PTC device and capacitor relay start system are standard equipment on some of these units. They are also available as accessories and may be field installed.

TIME GUARD II — (See Fig. 8.)

Description — Solid-state Time Guard device protects unit compressor by preventing short cycling. After a

system shutdown, Time Guard provides for a 5 ± 2 -minute delay before compressor restarts. On normal start-up, 5-minute delay occurs before thermostat closes. After thermostat closes, Time Guard device provides a 3-second delay to prevent contactor chattering.

Time Guard II device is simple to troubleshoot. Only a voltmeter capable of reading 24 v is needed. Device is in control circuit, therefore, troubleshooting is safe with control power (24 v) on and high-voltage power off.

With high-voltage power off, attach voltmeter leads across T1 and T3, set thermostat so that Y terminal is energized. Make sure all protective devices in series with Y terminal are closed. Voltmeter should read 24 v across T1 and T3. With 24 v still applied, move voltmeter lead from T1 terminal to T2 terminal. After 5 ± 2 minutes, voltmeter should read 24 v, indicating control is functioning normally. If no time delay is encountered, or device never times out, change control. A schematic diagram printed on device enables you to troubleshoot this device.

CRANKCASE HEATER — Crankcase heater is a device for keeping compressor oil warm. By keeping oil warm, refrigerant does not migrate to and condense in compressor shell. This prevents flooded starts which can severely damage compressor.

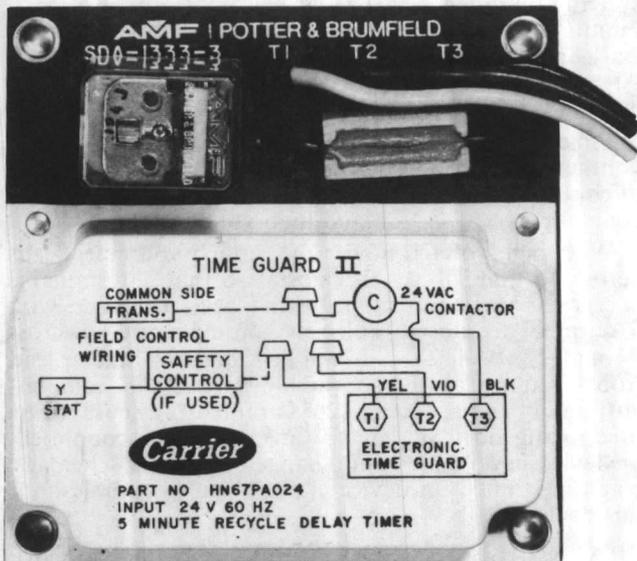
Crankcase heaters come in 2 basic types, wraparound (belly-band) type that is wrapped externally around compressor shell, and insertion type that is inserted into compressor oil well in shell of compressor. Both types are in this family of units.

Crankcase heater is powered by *high-voltage* power of unit. Use extreme caution troubleshooting this device with power on. Easiest method of troubleshooting is to apply voltmeter across crankcase heater leads to see if heater voltage is on. Carefully feel area around crankcase heater. If warm, crankcase heater is probably functioning. Do not rely on this method as absolute evidence heater is functioning. If compressor has been running, area will still be warm.

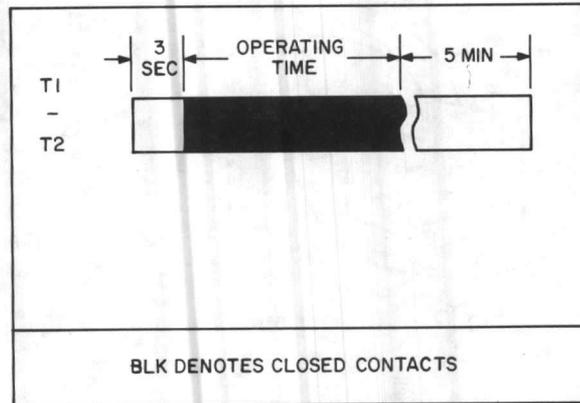
With power off, and heater leads disconnected, check across leads with ohmmeter. Do not look for a specific resistance reading. Check for resistance or an open circuit. Change heater if an open circuit is detected. Some crankcase heaters in this series of units are equipped with crankcase heater switch installed in series with heater. This energy-saving device shuts off power to heater when temperatures are high enough that heater is not needed. Be sure this switch is functioning normally before condemning crankcase heater.

PRESSURE SWITCHES — Pressure switches are protective devices wired into control circuit (low voltage). They shut compressor off if abnormally high or low pressures are present in refrigeration circuit. Depending on unit model, you may find a low- or high-pressure switch, or both, in system.

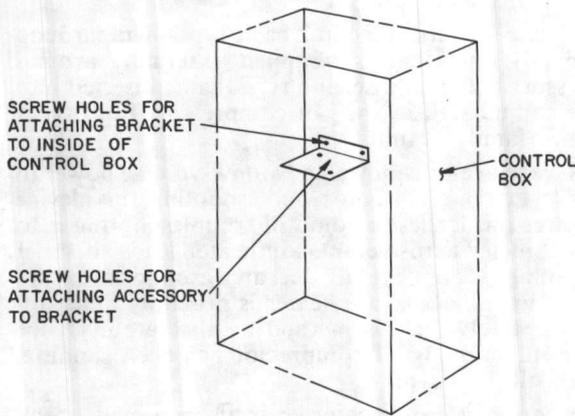
Low-Pressure Switch — Located on suction line, protects against low suction pressures caused by such events as loss of charge, low airflow across indoor coil, dirty filters, etc. It opens on a pressure drop at about 30 psi. If system pressure is above this, switch should be closed. To check switch, turn off all power to unit, disconnect leads on switch, apply ohmmeter leads across switch. You should have continuity on a good switch. Because these switches are attached to refrigeration system under pressure, it is not advisable to remove this device for troubleshooting unless you are reasonably certain that a problem exists. If switch must be removed, bleed all system charge so that pressure gage reads 0 psi.



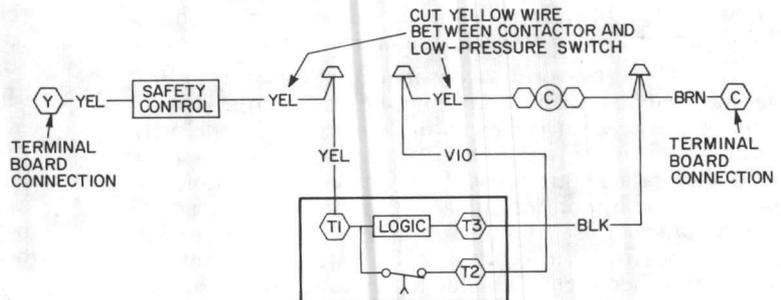
ACCESSORY TIME GUARD II DEVICE



TIME GUARD II SEQUENCE CHART



MOUNTING ACCESSORY TIME GUARD II ON MODEL 38QH,QS,QN



NOTE: When accessory Time Guard II is used with accessory Service Sentry control on 38QH,QN,QS units, refer to wiring instructions packed with Service Sentry control.

TIME GUARD II CONTROL WIRING CONNECTIONS FOR 38QH,QN,QS UNITS

Fig. 8 — Solid-State Time Guard II Description

CAUTION

Wear safety glasses and gloves when working with refrigerants. Apply heat with a torch to solder joint and remove switch. Wear safety glasses when using torch. Have quenching cloth available. Oil vapor in line may ignite when switch is removed.

Braze in 1/4-in. flare fitting and screw on replacement pressure switch. Wear safety glasses, observe all safety precautions.

High-Pressure Switch — Located on discharge line, protects against high discharge pressures caused by such events as overcharge, condenser fan motor failure, system restriction, etc. It opens on pressure rise at about 425 psi. If system pressures go above this setting during abnormal condition, switch opens. Do not attempt to simulate these system abnormalities, as high pressures pose a serious safety hazard. High-pressure switch is also checked with an ohmmeter similar to checking low-pressure switch. If system pressure is below 425 psi, switch shows continuity. It is replaced in same manner as low-pressure switch. Observe all safety precautions.

Liquid Line Pressure Switch — Located on liquid line, used in heat pump only. Function is similar to conventional low-pressure switch. Because heat pumps experience very low suction pressures during normal system operation, a conventional low-pressure switch cannot be installed on suction line. Switch is installed in liquid line instead and acts as loss-of-charge protector. It operates identically to low-pressure switch except it opens at 5 psi. Troubleshooting and removing this switch is identical to procedures used on other switches. Observe same safety precautions.

DEFROST THERMOSTATS — Defrost thermostat signals heat pump that conditions are right for defrost or that conditions have changed to terminate defrost. It is a thermally actuated switch clamped to liquid line to sense its temperature. Normal temperature range is: closed at 27 ± 5 F, open at 80 ± 5 F.

Since defrost thermostat is the heart of the defrost system, its troubleshooting procedure is described below.

PRINTED-CIRCUIT CONTROL BOARD — Solid-state defrost control used on 38QH,QN,QS heat pumps replaces electro-mechanical timer and defrost relay found on previous Carrier Chronotemp™ defrost systems. Defrost control board can be set to check need for defrost

every 30, 50 or 90 minutes of operating time. Control board has additional feature that allows unit to restart in defrost cycle if room thermostat is satisfied during defrost.

Troubleshooting defrost control involves a series of simple steps that indicate whether board is defective.

NOTE: Procedure allows mechanic to check control board and defrost thermostat for defects. First, troubleshoot to make sure unit operates properly in heating and cooling modes. This ensures problems are not attributed to the defrost control board. Additional steps follow:

1. Turn thermostat to OFF. Disconnect all power to outdoor unit.
2. Remove control box cover for access to electrical components and defrost control board.
3. Disconnect defrost thermostat leads from control board, connect to ohmmeter. Thermostat leads are the heavy-gage black insulated wires connected to DFT and C terminals on control board. Resistance reading may be 0 (indicating closed defrost thermostat) or infinity (∞ for open thermostat) depending on outdoor temperature.
4. Jumper between DFT and C terminals on control board as shown in Fig. 9.

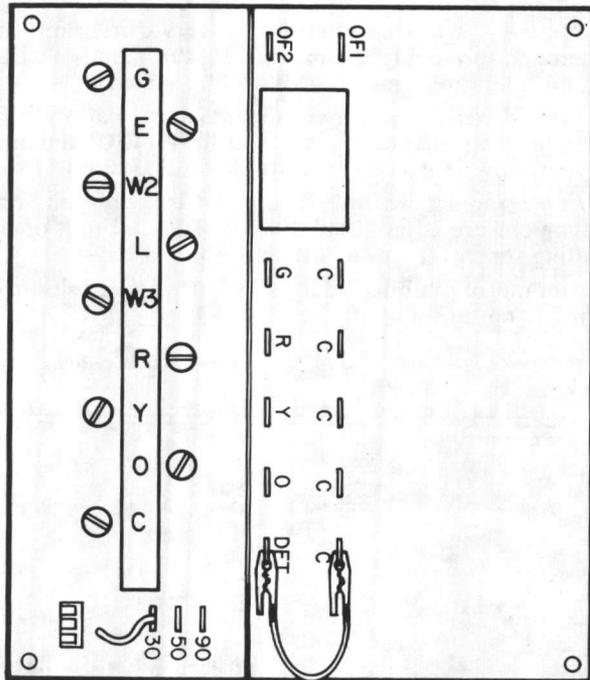


Fig. 9 — Jumper DFT and C Terminals

5. Disconnect outdoor fan motor lead. Tape lead to prevent grounding.
6. Restart unit in heating, allowing frost to accumulate on outdoor coil.
7. After a few minutes in heating, liquid line temperature should drop below closing set point of defrost thermostat. Using ohmmeter, check resistance across defrost thermostat leads. Resistance of 0 indicates defrost thermostat is closed and operating properly.
8. Remove protective cover from TP1 and TP2 speed-up terminals. Insert jumper wire into protective cover, reinsert protective cover on speed-up terminals. This reduces by 1/4 timing sequence of original time (see Fig. 10). Since Fig. 10 shows timing cycle set at 30 minutes, unit initiates defrost within approximately 30 seconds; if setting is at 50 minutes, within

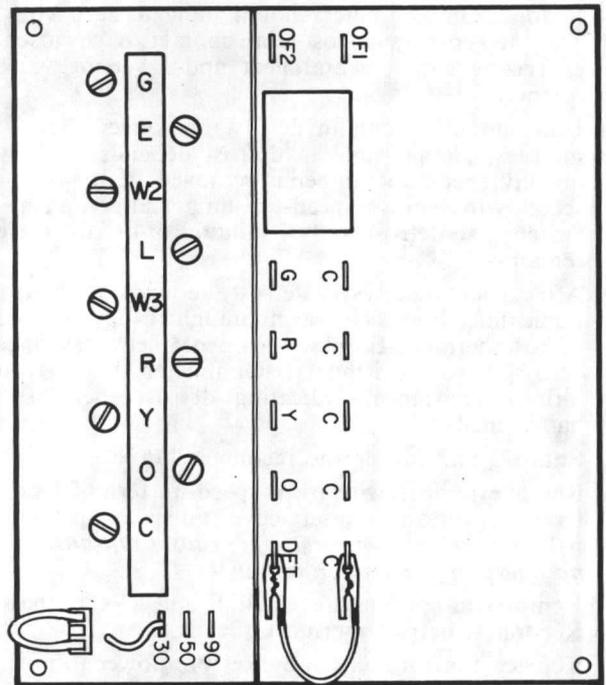


Fig. 10 — Inserting Jumper Wire into Protective Cover

50 seconds; 90 minutes, within 90 seconds. When you hear reversing valve change position, remove protective cover/jumper, otherwise control will terminate normal 10-minute defrost cycle in approximately 10 seconds.

⚠ CAUTION

Do not use screwdriver or other means to short speed-up pins. If pins are accidentally grounded, control board is destroyed.

9. Unit is now operating in defrost mode. Using voltmeter, check between R and W2 as shown in Fig. 11.

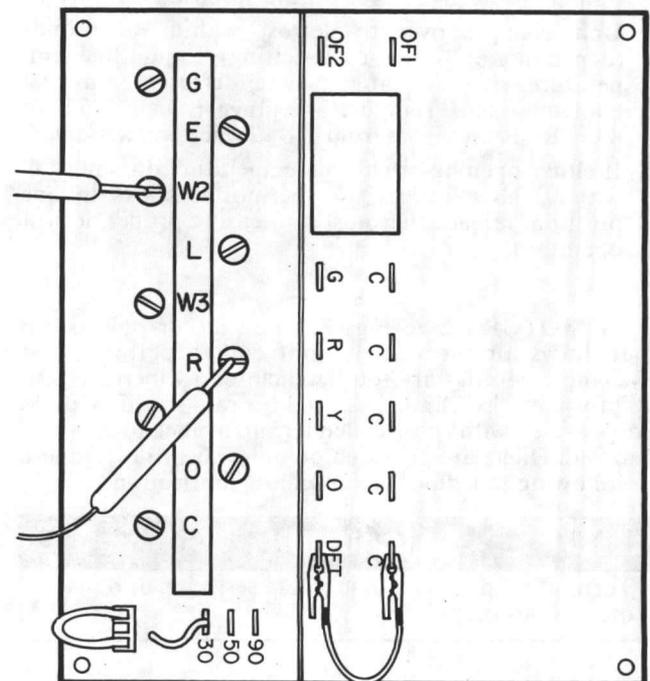


Fig. 11 — Checking Between R and W2

Reading on voltmeter should indicate zero volts. This step ensures defrost relay contacts have closed, energizing supplemental heat and reversing valve solenoid.

10. Unit should remain in defrost no longer than 10 minutes. Actual time in defrost depends on how quickly speed-up jumper is removed. If it takes 3 seconds to remove speed-up jumper after unit has switched to defrost, only 7 minutes of defrost cycle remains.
11. After a few minutes in defrost (cooling) operation, liquid line should be warm enough to have caused defrost thermostat contacts to open. Check resistance across defrost thermostat. Ohmmeter should read infinite resistance, indicating defrost thermostat has opened.
12. Shut off unit power and reconnect fan lead.
13. Remove jumper wire from speed-up terminal protective cover and reinsert cover on speed-up terminals. *Failure to remove jumper causes unit to speed up operating cycles continuously.*
14. Remove jumper between DFT and C terminals. Reconnect defrost thermostat leads.
15. Replace control box cover. Restore power to unit.

If defrost thermostat does not check out following above steps or incorrect calibration is suspected, check for a defective thermostat as follows:

1. Follow steps 1 - 5 above.
2. Using thermocouple temperature measuring device, route sensor or probe underneath coil (or other convenient location). Attach to liquid line near defrost thermostat. Insulate for more accurate reading.
3. Restart unit in heating.
4. Within a few minutes, liquid line temperature drops within a range causing defrost thermostat contacts to close. Temperature range is from 32 F to 22 F. Notice temperature at which ohmmeter reading goes from ∞ to 0 ohms. Thermostat contacts close at this point.
5. Remove protective cover from TP1 and TP2 speed-up terminals, insert jumper wire into protective cover, reinsert protective cover on the speed-up terminals.
6. Unit changes over to defrost within 90 seconds (depending on timing cycle setting). Liquid line temperature rises to range where defrost thermostat contacts open. Temperature range is from 75 F to 85 F. Resistance goes from 0 to ∞ when contacts open.
7. If either opening or closing temperature does not fall within above ranges, or thermostat sticks in one position, replace thermostat to ensure proper defrost operation.

FAN MOTORS (See Fig. 12.) Fan motor powers fan that draws air through outdoor coil to perform heat exchange. Motors are totally enclosed to increase reliability. This also eliminates need for rain shield. Motors are provided with color-coded terminal block to facilitate removal. Oilers are provided on motor bearings. Adhere to following schedule for fan motor lubrication.

⚠ CAUTION

Turn off all power to unit before servicing or replacing fan motor.

Fan Motor Bearings — Oiling holes are provided at each end of condenser fan motor. Remove fan motor, lubricate

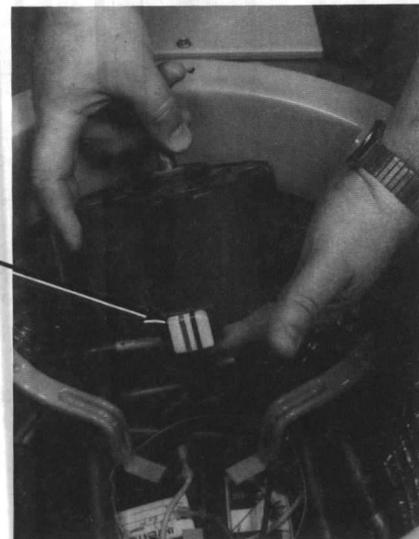


Fig. 12 — Removing Outdoor Fan Motor

motor with 32 drops (16 drops per hole) of SAE 10 non-detergent oil at intervals described below:

- a. *Annually*, when environment is very dirty, ambient temperature is higher than 105 F (40 C), and average unit operating time exceeds 15 hours a day.
- b. *Every 3 years*, when environment is reasonably clean, ambient temperature is less than 105 F (40 C) and unit operating time averages 8 to 15 hours a day.
- c. *Every 5 years*, when environment is clean, ambient temperature is less than 105 F (40 C) and unit operating time averages less than 8 hours a day.

After motor is lubricated, be sure fan prop is positioned correctly on motor shaft. See Fig. 13.

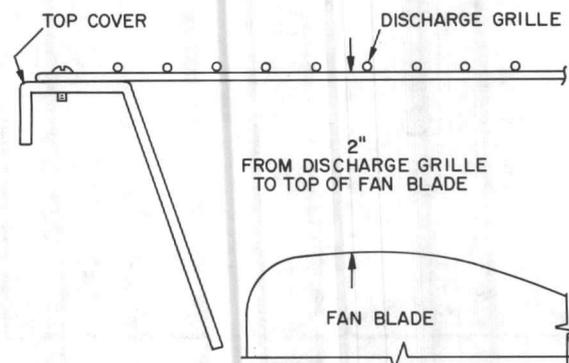


Fig. 13 — Condenser Fan Position

Fan motors should present no problem in troubleshooting. A motor with seized or tight bearings can sometimes be saved or have its life extended by adding oil to the bearings.

⚠ CAUTION

Be sure unit main power switch is turned off. Failure to do so may result in electric shock, or injury from rotating fan blade.

For suspected electrical failures, check for loose or faulty electrical connections, or defective fan motor

capacitor. Fan motor is equipped with thermal overload device in motor windings which may open under adverse operating conditions. Allow time for motor to cool so device can reset. Further checking of motor can be done with an ohmmeter. Set scale on R x 1 position, check for continuity between 3 leads. Replace motors that show an open circuit in any of the windings. Place one lead of ohmmeter on each motor lead. At same time, place other ohmmeter lead on motor case (ground). Replace any motor that shows resistance to ground. Obviously any motor that shows signs of arcing, burning or overheating should be suspect and replaced.

SERVICE SENTRY CONTROL BOARD — Service Sentry control provides immediate warning when outdoor heat pump requires servicing. It turns on indoor thermostat light if compressor doesn't operate for either heating or cooling. This enables owner to obtain speedy heat pump service during heating season, reducing supplementary electric heat costs, and during cooling season, reducing period of heat discomfort, Fig. 14.

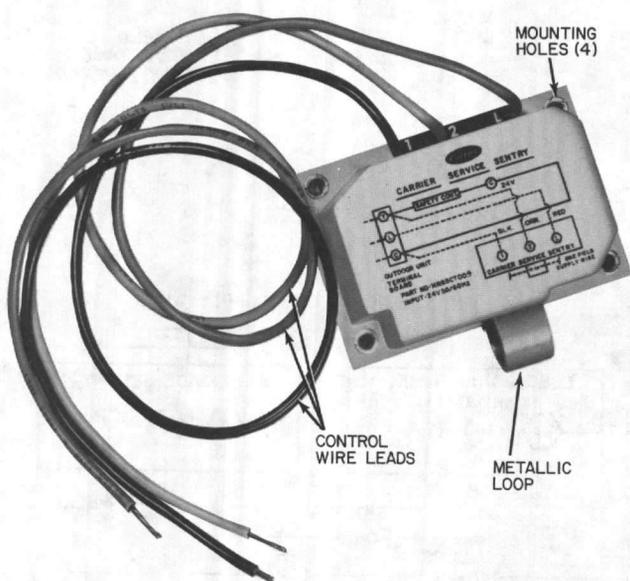


Fig. 14 — Service Sentry Control

Use Service Sentry control with single-phase Carrier heat pumps equipped with 24-v control circuit.

Connect black, orange and red pigtails (24 v) on Service Sentry to outdoor unit control circuit terminal board. See Fig. 15 and wiring diagram on unit. An extra control wire is required between L terminals on outdoor unit, indoor unit and thermostat subbase (the L terminal is currently being added to outdoor and indoor unit terminal blocks). If units do not already have L terminal, splice control wire between L terminals on Service Sentry and thermostat subbase. Terminal L is labeled terminal X on some thermostat subbases (all future subbases will read terminal L).

Connect all field line power wires to unit in usual manner. However, route *one field line power supply wire* through metallic loop on bottom of Service Sentry, then to normal unit connection. On 015 (230-1-60) and 018 (230-1-60) units, pass supply wire through metallic loop twice, as shown in Fig. 14 and 15. On all other units, pass supply wire through loop only once.

Refer to Fig. 15 for wiring connections when Service Sentry and solid-state Time Guard II accessories are used.

The Service Sentry is an accessory device. On heat pump DL and CD option packages, a slightly different version of Service Sentry is installed as standard equipment. It functions almost identically to accessory Service Sentry except that it locks out compressor under certain adverse operating conditions. System is manually reset by shutting it off at thermostat subbase, then turning it back on. If adverse condition is corrected, system restarts.

One example of an adverse condition would be if system is located in a desert climate where high operating temperatures may cause system to shut down on the high-pressure switch, or on the compressor internal overload.

Service Sentry Requires 2 Inputs:

1. It must sense a 24-v input from thermostat. As thermostat calls for heating or cooling, it supplies 24v to Service Sentry device.
2. A current transformer (or induction loop) similar to a clamp-on ammeter senses current draw in the compressor lead. Induction loop must sense a minimum current draw when thermostat is calling for heating or cooling.

NOTES:

1. On a single-phase compressor, induction loop senses current in common leg.
2. On a 3-phase compressor, induction loop senses current in one of the phases.

Troubleshooting Service Sentry device is easy. With thermostat calling for heating or cooling and compressor running, indoor thermostat light should be off. If on, check for wiring errors or replace the Service Sentry.

To check for correct operation, shut off circuit breaker or disconnect switch to outdoor unit *while it is running*. Signal light on thermostat should light. If this does not occur, check for wiring errors or replace the Service Sentry.

CAUTION

If Service Sentry needs replacing, shut off all power to unit before attempting repairs.

OUTDOOR THERMOSTATS — (See Fig. 16.) Outdoor thermostat brings on stages of electric heat as outdoor temperature and heat pump output drops. Setting at which thermostat closes is variable, depending on design of system. It is set at time of installation and should not be changed without good reason. Up to 2 outdoor thermostats may be installed. Some systems may not have any thermostat.

Although these devices are installed in control circuit (24 v), turn off all power to unit before attempting to troubleshoot thermostat.

Use a standard ohmmeter to check for continuity through thermostat. If you suspect thermostat is out of calibration, use calibrated electronic thermometer to determine correct outdoor temperature. Insert a screwdriver blade in adjustment slot and turn thermostat switch until it closes. Observe this using ohmmeter across switch. Read temperature setting when switch closes. It should be close to reading observed using electronic thermometer. Any setting within ± 5 degrees is acceptable.

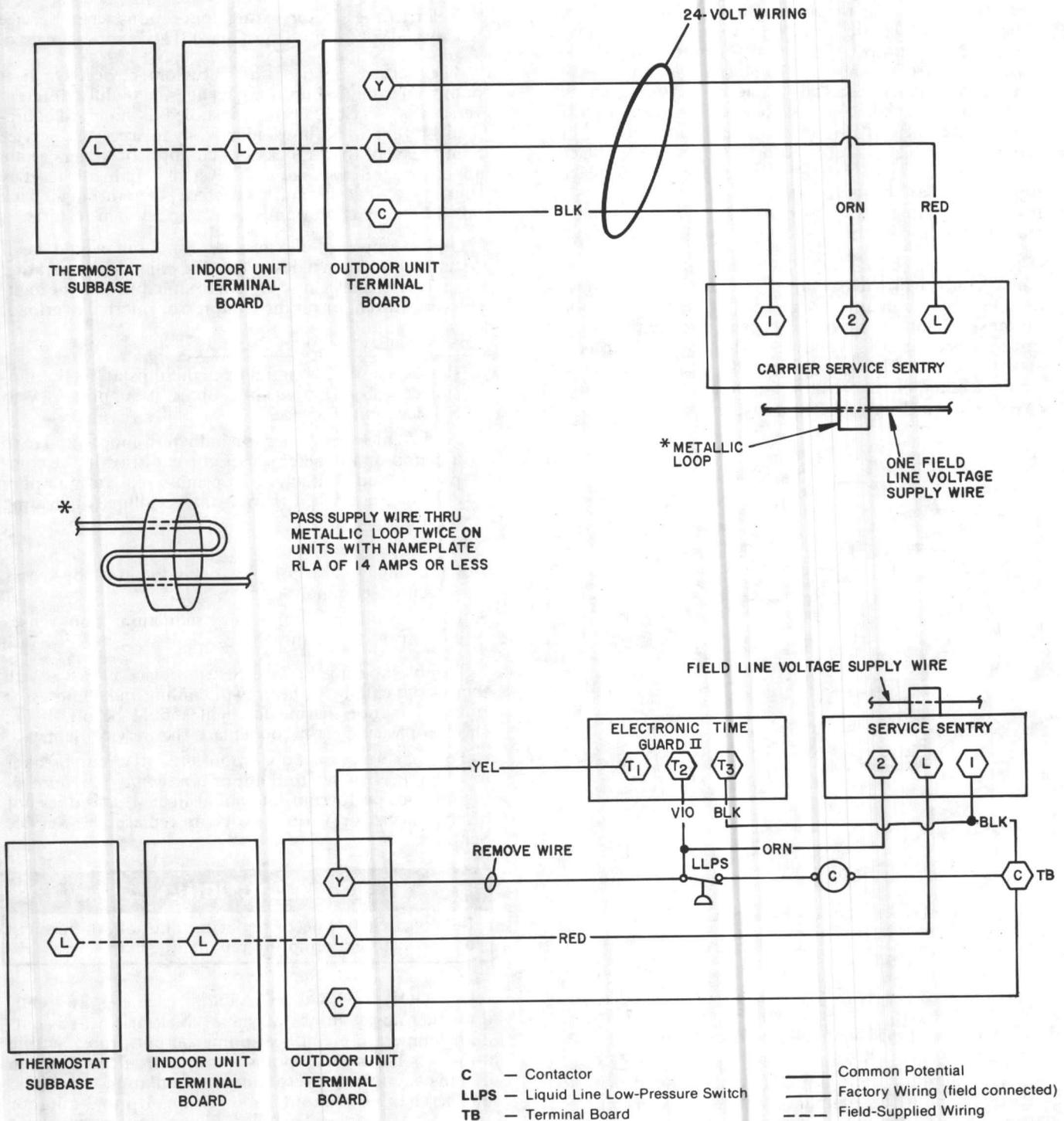


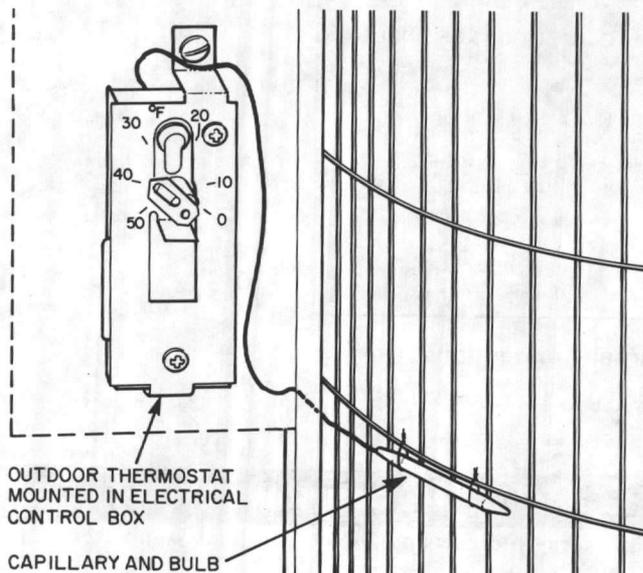
Fig. 15 — Wiring Connections for Service Sentry and Solid-State Time Guard II

Compressor — The compressor is the heart of the refrigeration system. It pumps refrigerant through the system. If it malfunctions, the whole system suffers.

The compressor is an electrical (as well as mechanical) device. Extreme caution should be exercised when working near compressors. Power should be shut off, if possible, for most troubleshooting techniques. Refrigerants in system present other safety hazards. *Always* wear safety glasses and gloves when handling refrigerants.

Compressor failures are classified in 2 broad failure categories, mechanical and electrical. Both types are discussed below and on page 13.

MECHANICAL FAILURES — Compressor is a mechanical pump driven by an electric motor contained in a welded or hermetic shell. In a mechanical failure, motor or electrical circuit appears normal, but compressor does not function normally.



- NOTES:
1. Affix capillary and bulb on outside of grille wire nearest control box.
 2. Secure bulb to grille with wire ties or suitable fastener.
 3. If necessary, shield bulb from direct sunlight using appropriate material.

Fig. 16 — Outdoor Thermostat Installation

⚠ CAUTION

Exercise extreme caution when reading compressor currents, as high-voltage power is on. Correct any of the problems described below before installing and running a replacement compressor. Wear safety glasses and gloves when handling refrigerants.

Locked Rotor — In this type of failure, compressor motor and all starting components are normal. When compressor attempts to start, it draws locked rotor current and cycles off on the internal protection. Locked rotor current is measured by applying a clamp-on ammeter around common lead of the compressor on a single-phase compressor, or any one of the leads on a 3-phase compressor. Then measure current it draws when it attempts to start. LRA (locked rotor amp value) is stamped on compressor nameplate.

If compressor draws locked rotor amps, and all other external sources of problems have been eliminated, compressor must be changed. Because compressor is a sealed unit, it is impossible to determine exact mechanical failure. However, complete system should be checked for abnormalities such as incorrect refrigerant charge, restrictions, insufficient airflow across indoor or outdoor coil, etc., which could be contributing to the failure.

Runs, Doesn't Pump — In this type of failure, compressor motor runs and turns compressor, but compressor does not pump the refrigerant. A clamp-on ammeter on common leg of a single-phase compressor, or any one lead of a 3-phase compressor, shows a very low current draw, much lower than RLA (rated load amps) value stamped on compressor nameplate. Because no refrigerant is being pumped, there is no return gas to cool compressor motor. It eventually overheats and shuts off on its internal protection.

Runs — Doesn't Pump, High-To-Low Side Leak — This failure is similar to previous one except compressor is

pumping. Usually, an internal problem such as blown head gasket or broken internal discharge line causes compressor to pump hot discharge gas back into its own shell rather than through system.

Using pressure gages on service valves shows high suction and low discharge pressure readings. Motor currents are lower than normal. Because hot gas is being discharged into shell, the shell becomes hot. The hot gas causes compressor motor to cycle off on its internal protection.

Runs and Pumps, Low Capacity — This failure type is difficult to pinpoint because extent of damage varies. Compressor is a pump with internal valves that enable compressor to pump properly. On multicylinder compressors, each cylinder has a complete set of suction and discharge valves. Any of these parts may become damaged or broken causing loss in pumping capacity. Severity of damage determines amount of capacity loss. Use pressure gages to find any abnormal system pressures if system charge and other conditions are normal.

An owner may complain that a unit is not handling the building's heating or cooling load. The compressor current draw may be abnormally low or high. Although this type of failure does occur, all other possible causes of capacity loss must be eliminated before condemning compressor.

Noisy Compressor — May be caused by variety of internal problems such as loosened hardware, broken mounting springs, etc. May also be caused by system problems. Overcharging a compressor causes operating noise, particularly at start-up. Certain single-cylinder compressors are noisy at start-up and may operate noisily. Too much oil in compressor may cause noise. Normally this problem is encountered only after a replacement compressor has been added, without purging oil from previous compressor. As new compressor pumps, excess oil in system returns and adds to volume already present, causing noise.

Compressor Leaks — Sometimes a leak is detected at weld seam around girth of compressor, or a fitting that joins compressor shell. Many of these leaks can be repaired and the compressor saved if correct procedure is followed. Turn off all power to unit. Remove all refrigerant from system so that gage pressure is 0 psi. Use safety glasses and gloves when handling refrigerants. Clean area around leak to bare metal. Apply flux and repair joint with silver solder. *Do not* use low-temperature solder such as 50-50. Clean off excess flux, check for leaks, and apply paint over repaired area to prevent corrosion. *Do not* use this method to repair a compressor leak due to severe corrosion. Never attempt to repair a compressor leaking at electric terminals. This type of failure requires compressor replacement.

ELECTRICAL FAILURES — The compressor mechanical pump is driven by an electric motor within hermetic shell. In electrical failures, compressor does not run although external electrical and mechanical systems appear normal. Compressor must be checked electrically for abnormalities.

Before troubleshooting compressor motor, review this description of compressor motor terminal identification.

Single-Phase Motors — See Fig. 17. To determine terminals C, S, and R: Turn off all unit power. Short the run (and start) capacitor to prevent shock. Remove all wires from motor terminals. Using an ohmmeter on 0-10 ohm scale, read resistance between all pairs of terminals. Determine 2 terminals that provide greatest resistance reading. Through elimination, remaining

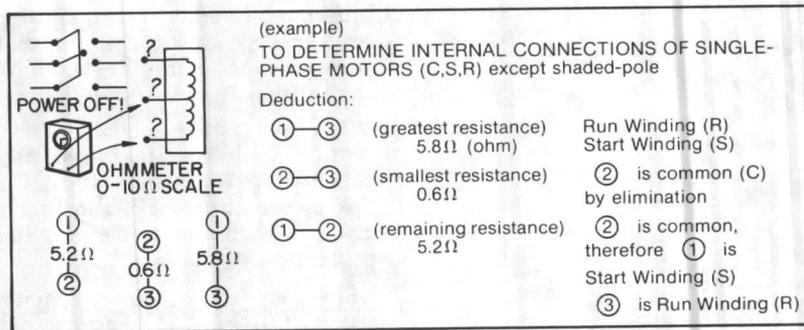


Fig. 17 — Determining Internal Connections

terminal must be common (C). Greatest resistance between common (C) and another terminal indicates start winding because it has more turns. This terminal is start (S). Remaining terminal will be run winding (R).

NOTE: If there is an internal line break protector, it must be closed.

Three-Phase Motors — See Fig. 18. Resistance readings between all 3 sets of windings should be the same.

All compressors are equipped with internal motor protection. If motor becomes hot for any reason, protector opens. Compressor should always be allowed to cool and protector to close before troubleshooting. Always turn off all power to unit and disconnect leads at compressor terminals before taking readings.

Most common motor failures are due to either an open, grounded or short circuit. Directions below are specifically for single-phase units, however, they also apply to 3-phase compressors. When a single-phase compressor fails to start or run, 3 tests can help determine the problem. First, all possible external causes should be eliminated, such as overloads, improper voltage, pressure equalization, defective capacitor(s), relays, wiring, etc. If compressor has internal line break overload, be sure it is closed.

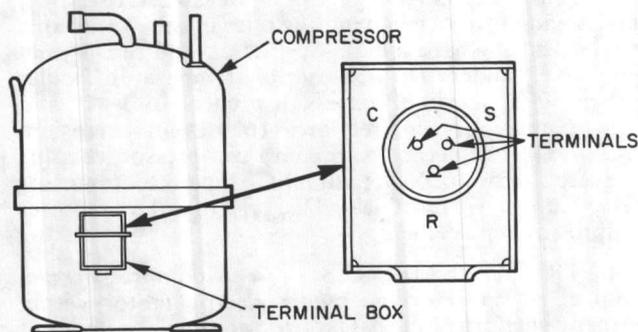


Fig. 18 — Compressor Terminals

Open Circuit — To determine if any winding has a break in the internal wires and current is unable to pass through: Be sure all power is off. Discharge all capacitors. Remove wires from terminals C, S and R. Use an ohmmeter on 0-1000 ohm scale to check resistance from C-R, C-S and R-S. Because winding resistances are usually less than 10 ohms, each reading appears to be approximately zero ohm. If resistance remains at 1000 ohms, an open or break exists and compressor should be replaced.

CAUTION

Be sure internal line break overload is not temporarily open.

Ground Circuit — To determine if a wire has broken or come in direct contact with shell, causing a direct short to ground: Be sure all power is off. Discharge all capacitors. Remove wires from terminals C, S and R. On hermetic compressors, allow crankcase heaters to remain on for several hours before checking motor to ensure windings are not saturated with refrigerant. Use an ohmmeter on R x 10,000 ohm scale. A megohmmeter may be used in place of ohmmeter (follow manufacturer's instructions). Place one meter probe on ground or on compressor shell. Make a good metal-to-metal contact. Place other probe on terminals C, S and R in sequence. Note meter scale. If reading of zero or low resistance is obtained, motor is grounded. Replace compressor.

A compressor of one-ton capacity or less is probably grounded if resistance is below one million ohms. On larger size single-phase compressors, resistance to ground should not be less than 1000 ohms per volt of operating voltage.

Example:

$$230-1-60 \dots 230 \times 1000 = 230,000 \text{ ohms minimum.}$$

Short Circuit — To determine if any wires within windings have broken through their insulation and made contact with other wires, thereby shorting all or part of the winding(s): First, be sure the following conditions are met:

1. Correct motor winding resistances must be known before testing, either from previous readings or from manufacturer's specifications.
2. Temperature of windings must be as specified, usually about 70 F.
3. Resistance measuring instrument must have an accuracy within $\pm 5\%$ - 10%. This requires accurate ohmmeter (such as a Wheatstone bridge or null balance-type instrument).
4. Motor must be dry or free from direct contact with liquid refrigerant.

Make This Critical Test — (Not advisable unless above conditions are met.) Be sure all power is off. Discharge all capacitors. Remove wires from terminals C, S and R. Place instrument probes together, determine probe and lead wire resistance. Check resistance readings from C-R, C-S and R-S. Subtract instrument probe and lead

resistance from each reading. If any reading is within $\pm 20\%$ of known resistance, motor is probably normal. Usually a considerable difference in reading is noted if a turn-to-turn short is present.

SYSTEM CLEAN-UP AFTER BURN-OUT

⚠ CAUTION

Turn off all power to unit before proceeding. Wear safety glasses and gloves when handling refrigerants. Acids formed as a result of motor burn-out can cause burns.

Some compressor electrical failures can cause motor to burn. When this occurs, byproducts of burn, which include sludge, carbon and acids contaminate system. If burn-out is severe enough, system must be cleaned before replacement compressor is installed. The 2 types of motor burn-out can be classified as mild or severe.

In *mild* burn-out, there is little or no odor detectable. Compressor oil is clear or slightly discolored. An acid test of compressor oil will be negative. This type of failure is treated the same as mechanical failure. Liquid line strainer should be removed and liquid line filter drier installed.

In a *severe* burn-out, there is a strong, pungent, rotten egg odor. Compressor oil is very dark. Evidence of burning may be present in tubing connected to compressor. An acid test of compressor oil will be positive. Complete system must be reverse-flushed with refrigerant. Accurater™ or TXV *must* be cleaned or replaced. In a heat pump, accumulator and reversing valve are replaced. These components are also removed and bypassed during reverse-flushing procedure. Remove and discard liquid line strainer. After system is reassembled, install liquid and suction line filter driers, run system for 2 hours. Discard both driers, install new liquid line drier only.

COMPRESSOR REMOVAL AND REPLACEMENT

— Once it is determined that compressor has failed and the reason established, compressor must be changed.

Shut off all power to unit. Remove all refrigerant from system until pressure gage reads 0 psi.

⚠ CAUTION

Wear safety glasses and gloves when handling refrigerants. Disconnect electrical leads from compressor. Disconnect or remove crankcase heater. Remove compressor holddown bolts.

Cut compressor from system with tubing cutters. Do not use brazing torch for compressor removal. Oil vapor may ignite when compressor is disconnected. Scratch matching marks on stubs in old compressor. Make corresponding marks on replacement compressor. Use torch to remove stubs from old compressor and to re-install them in replacement compressor. Use copper couplings to tie compressor back into system. Wear safety glasses when using brazing torch. Evacuate system, recharge, check for normal system operation.

Refrigeration System

REFRIGERATION CYCLE — In a refrigerant system, refrigerant moves heat from one place to another. It is useful to understand flow of refrigerant in a system. In a *straight cooling* system, compressed hot gas leaves compressor and enters condensing coil. As gas passes through condenser coil it rejects heat and condenses into liquid. The liquid leaves condensing unit through liquid

line and enters metering device at indoor coil. As it passes through metering device, it becomes a gas-liquid mixture. As it passes through indoor coil, it absorbs heat and refrigerant is again changed to gas. The gas is returned to compressor, where it is compressed to a hot gas, and cycle repeats.

In a *heat pump* (see Fig. 19), the basic cycle is the same. Reversing valve in system decides which coil, indoor or outdoor, becomes evaporator or condenser. In heating mode, indoor coil is condenser. It rejects heat into the home after heat is absorbed by outdoor evaporator coil. Thus, home is heated.

In *cooling cycle*, indoor coil becomes evaporator. It absorbs heat from home and rejects it out-of-doors through outdoor condenser coil. Thus, home is cooled.

A unique feature of the heat pump is that metering devices are designed to meter refrigerant in one direction of flow, and allow refrigerant to pass unhindered in other direction. If indoor metering device is metering refrigerant, outdoor device bypasses refrigerant and vice versa. This allows both coils to serve a dual function.

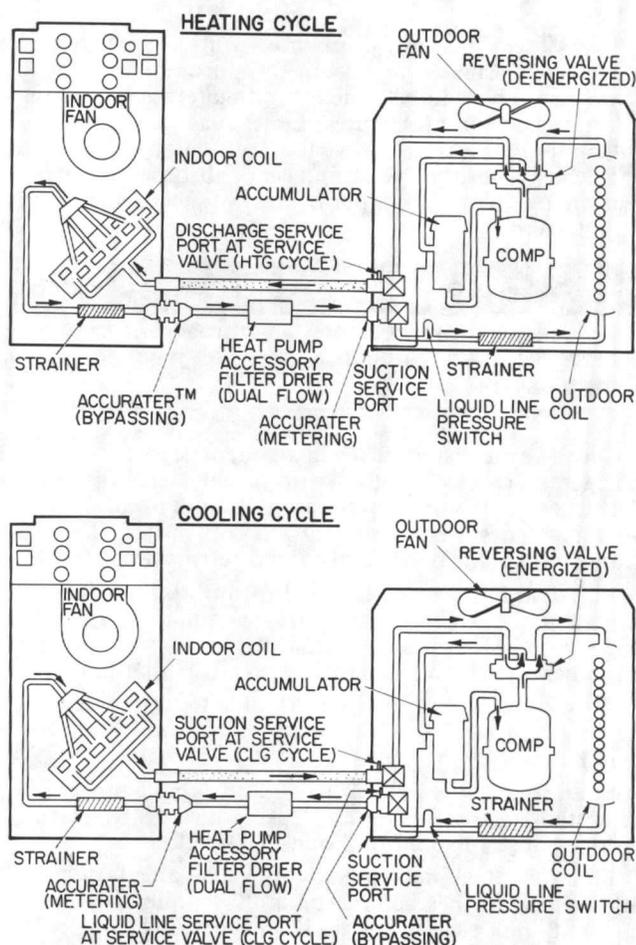


Fig. 19 — 38QN Heat Pump Refrigerant Flow Diagrams

LEAK DETECTING — (See Fig. 20.) New installations should be checked for leaks prior to complete charging.

⚠ CAUTION

Always wear safety glasses and gloves when handling refrigerants.

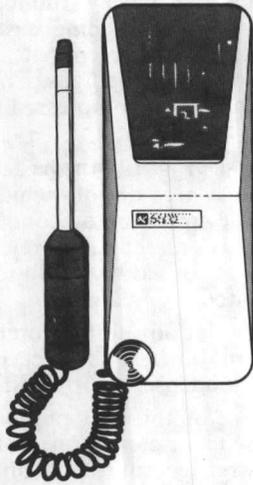


Fig. 20 — Leak Detector

If a system has lost all or most of its charge, system must be pressurized again, up to approximately 150 lb minimum. This can be done by adding refrigerant, using normal charging procedures. Or, it may be pressurized with nitrogen (less expensive than refrigerant). Nitrogen also leaks faster than R-22 and is not absorbed by refrigeration oil. Nitrogen cannot, however, be detected by leak detector.

CAUTION

Due to explosive pressures of nitrogen, it should never be used without a pressure regulator on the tank.

On the other hand, leaks in a system pressurized with refrigerant can be spotted with a leak detector which detects extremely small refrigerant leaks. This discussion assumes that system is pressurized with either all refrigerant or a mixture of nitrogen and refrigerant.

If system has been operating for some time, make first check for a leak visually. Since refrigerant carries a small quantity of oil, traces of oil at any joint or connection is an indication the refrigerant is leaking at that point.

A simple and inexpensive method of testing for leaks is to use soap bubbles. Any solution of water and soap may be used.

Soap solution is applied to all joints and connections in system. A small pinhole leak is located by tracing bubbles in soap solution around leak.

Electronic leak detectors are now available for checking for leaks. These unquestionably represent the most efficient and easiest method for checking for leaks. There are various types of electronic leak detectors. Generally speaking, they are all portable, most are lightweight, and consist of a box with several switches and a probe or sniffer. Detector is turned on and probe is passed around all fittings and connections in system. Leak is detected by either a movement of a pointer on detector dial, by a buzzing sound or a light.

In all instances, when a leak is found, system charge must be *bled down* and leak repaired before final charging and operation. After leak is repaired, evacuate system, and correct refrigerant charge.

SERVICE VALVES — (See Fig. 21.) Service valves provide means for holding original factory charge in outdoor unit prior to hookup to indoor coil. They also contain

gage ports for measuring system pressures, and provide shutoff convenience for certain types of repairs.

Vapor line on all units and liquid line on condensing units are connected to service valves by means of Compatible Fitting. This mechanical-type fitting is also used as a sweat fitting. Connections are made as follows:

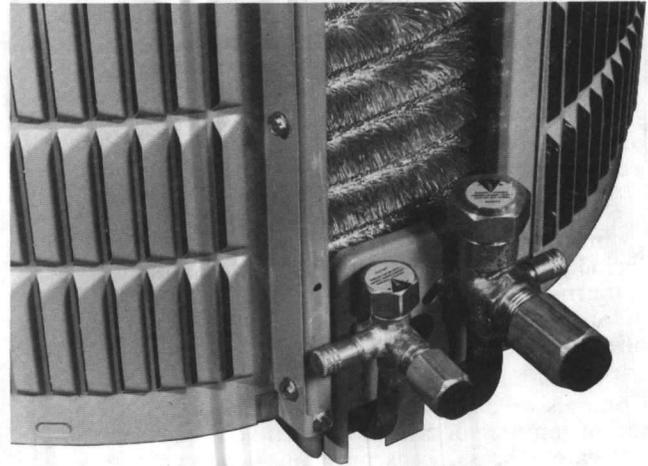


Fig. 21 — Service Valves

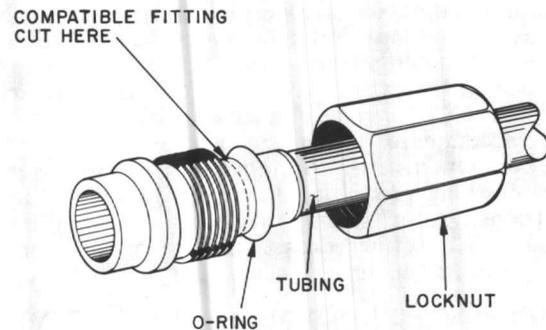


Fig. 22 — Carrier Compatible Fitting

CARRIER COMPATIBLE FITTING — (See Fig. 22.)
Mechanical Connection to Compatible Fitting — (Mate one set of connections at a time.)

1. Loosen nut on Compatible Fitting one turn. Do not remove.
2. Remove plug, be sure O-ring is in groove inside Compatible Fitting.
3. Cut tubing to correct length. Deburr and size properly.
4. Insert tube into Compatible Fitting until it bottoms.
5. Tighten nut until it bottoms on shoulder of fitting. Keep tube bottomed in Compatible Fitting while tightening nut.

Sweat Connection to Compatible Fitting — (Use refrigerant grade tubing.)

1. Remove locking nut, rubber O-ring and Schrader core from valve.
2. Cut tubing to correct length. Deburr and size properly.
3. Insert tube into Compatible Fitting.

NOTE: Wrap top and bottom of service valves in wet cloth to prevent damage by heat. Solder with low-temperature 430 F (221 C) silver alloy solder.

4. Replace Schrader core.
5. Evacuate or purge system with field-supplied refrigerant.

This type of fitting is easily repaired if leaks develop.

⚠ CAUTION

Wear safety glasses and gloves when handling refrigerants.

Frontseat outdoor section service valves after relieving refrigerant pressure in system. Back locknut off Carrier Compatible Fitting onto tube. Cut fitting between threads and O-ring. Remove tubing section remaining in threaded portion of fitting. Discard locknut.

Clean, flux and insert new tube end into remaining portion of Carrier Compatible Fitting. Wrap valve in wet cloth to prevent damaging valve. Heat and apply low-temperature solder (430 F [221 C]).

Leaking Sweat Connection — Frontseat service valves and relieve refrigerant pressure in tubing. Clean and flux area around leak and apply low-temperature solder (430 F [221 C]).

Liquid line service valves on all heat pump models differ from condensing unit valves in that heat pump connection has 3/8-in. male flare. When making connection, remove flare nut, install it on liquid line prior to flaring. Flare liquid line using standard flaring techniques. Valve also contains piston and retainer. Service as follows:

ACCURATER™ (Bypass Type) COMPONENTS — (See Fig. 23.) AccuRater piston has a refrigerant metering hole through it. Retainer forms a stop for piston in refrigerant bypass mode, and a sealing surface for liquid line flare connection. To check, clean or replace piston:

1. Shut off power to unit.
2. Pump unit down using Pumpdown Procedure described in this Service Manual.
3. Remove liquid line flare connection from AccuRater.
4. Pull retainer out of body, being careful not to scratch flare sealing surface. If retainer does not pull out easily, carefully use locking pliers to remove it.
5. Slide piston out by inserting a small soft wire, with small kinks, through metering hole. Do not damage metering hole, sealing surface around piston cones or fluted portion of piston.
6. Clean piston refrigerant metering hole.
7. Replace retainer O-ring (Part No. 99CC501052) before reassembling bypass-type AccuRater.

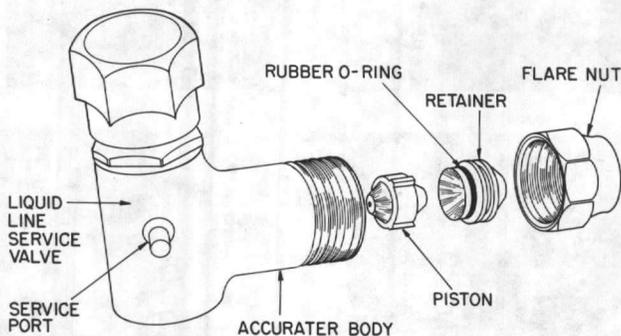


Fig. 23 — AccuRater™ (Bypass Type) Components

Service valves provide a convenient shutoff valve useful for certain refrigeration system repairs. System may be pumped down to make repairs on low side without losing complete refrigerant charge.

1. Attach pressure gage to suction service valve gage port.

2. Frontseat liquid line valve.
3. Start unit in cooling mode. Run until suction pressure reaches 5 psig (35 kPa).
4. Shut unit off. Frontseat suction valve.
5. Vent remaining pressure to atmosphere.

⚠ CAUTION

All outdoor unit coils will hold only factory-supplied amount of refrigerant. Excess refrigerant may cause unit to relieve pressure through internal pressure relief valve (indicated by sudden rise of suction pressure) before suction pressure reaches 5 psig (35 kPa). If this occurs, shut off unit immediately, frontseat suction valve, and vent remaining pressure to atmosphere.

REVERSING VALVE — (See Fig. 24.) In heat pumps, changeover between heating and cooling modes is accomplished with a valve that reverses flow of refrigerant in system. This reversing valve device is easy to troubleshoot and replace. The reversing valve solenoid can be checked with power off with an ohmmeter. Check for continuity and shorting to ground. With control circuit (24 v) power on, check for correct voltage at solenoid coil. Check for burned or overheated solenoid.

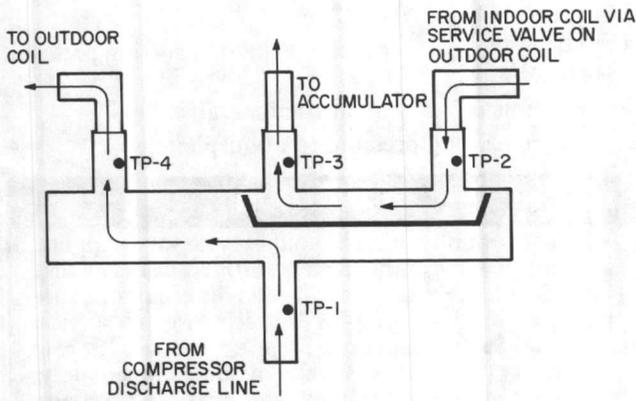


Fig. 24 — Reversing Valve

With unit operating, other items can be checked, such as frost or condensate water on refrigerant lines.

The sound made by a reversing valve, as it begins or ends defrost, is a loud whooshing noise, as reversing valve reverses, and pressures in system equalize. An experienced service person detects this sound and uses it as a valuable troubleshooting tool.

Using a remote measuring device, check inlet and outlet line temperatures. *Do not* touch lines. If reversing valve is operating normally, inlet and outlet temperatures on appropriate lines should be close. Any difference would be due to heat loss or gain across valve body. Temperatures are best checked with a remote reading electronic-type thermometer with multiple probes. Route thermocouple leads to inside of coil area through service valve mounting plate area underneath coil. Figures 25 and 26 show test points on reversing valve for recording temperatures. Insulate points for more accurate reading.

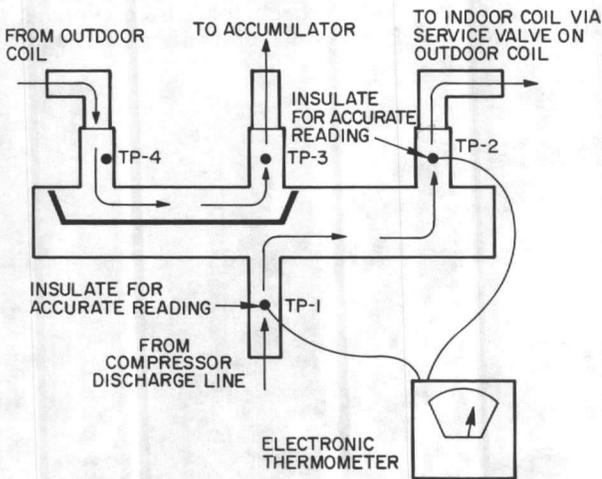


TP = Test Point

TP-2 and TP-3 Cool or cold, may have condensation or frost on both lines entering valve body, 5F to 10F maximum temperature difference across normally operating valve.

TP-1 and TP-4 Hot, 5F to 10F maximum temperature difference across normally operating valve.

Fig. 25 — Reversing Valve (Cooling Mode or Defrost Mode, Solenoid Energized)



TP = Test Point

TP-1 and TP-2 Hot, 5F to 10F maximum temperature difference across normally operating valve.

TP-3 and TP-4 Cool or cold, may have condensation or frost on both lines into valve body, 5F to 10F maximum temperature difference across normally operating valve.

Fig. 26 — Reversing Valve (Heating Mode Solenoid De-Energized)

If valve is defective: Shut off all power to unit. Some smaller sizes may require coil to be removed to gain access to reversing valve. See appropriate coil removal section. Remove all charge from system.

Remove solenoid coil from valve body. Remove valve by cutting it from system with tubing cutter. Repair person should cut in such a way that stubs can be easily rebrazed back into system. Do not use hacksaw. This introduces chips into system that cause failure. After defective valve is removed, wrap it in wet rag and carefully unbraid stubs. Save stubs for future use. Because defective valve is not overheated, it can be analyzed for cause of failure when it is returned.

Braze new valve onto used stubs. Keep stubs oriented correctly. Scratch corresponding matching marks on old valve and stubs, and new valve body, to aid in lining up new valve properly. When brazing stubs into valve, protect valve body with wet rag to prevent overheating.

Use slip couplings to install new valve with stubs back into system. Even if stubs are long, wrap valve with a wet rag to prevent overheating.

After valve is brazed in, check for leaks. Evacuate and charge system. Operate system in both modes several times to be sure valve functions properly.

COIL REMOVAL — (See Fig. 27.) Coils on this family of units are easy to remove if required for compressor removal, or to replace coil. Shut off all power to unit. Remove refrigerant from system through service valves.

CAUTION

Wear safety glasses and gloves when handling refrigerants. If unit is equipped with a louvered casing, refer to Cabinet Servicing for casing removal procedure.

1. Remove discharge grille by removing 3 (015-030) or 6 (036-060) screws.
2. Remove control box cover (3 screws).
3. Remove fan/motor/orifice assembly by removing 4 screws (2 in top of control box). Prior to lifting out assembly, unplug motor wires from base of motor.

WARNING

Avoid possibility of fire and personal injury by cutting tubing.

4. Use midget tubing cutter to cut liquid and vapor lines at both sides of coil. Cut in convenient location for easy reassembly with copper slip couplings.

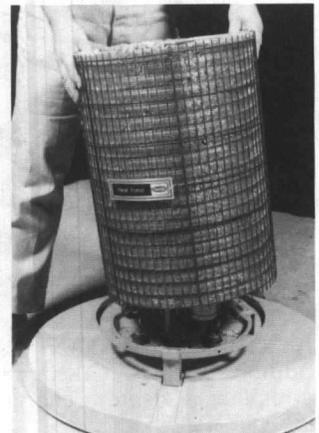
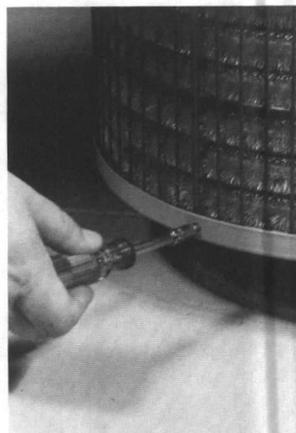


Fig. 27 — Removing Outdoor Coil

5. Remove 2 (015,018) or 4 (024,060) screws at base of coil (located at end of large vertical wires in coil support).
6. Lift coil vertically from basepan, place aside carefully.
NOTE: When coil is removed, use opportunity to also remove liquid line strainer. Strainer location is identified by label on liquid line.
7. Reverse procedure to reinstall coil.

COIL CLEANING — (See Fig. 28, 29.) For best unit efficiency, clean outdoor coil prior to start of each heating or cooling season. Shut off all power to unit if coil is equipped with louvered casing. Refer to Cabinet Servicing for casing removal procedure. To clean coil:

⚠ CAUTION

Coil fin damage can result in higher operating costs or compressor damage. Do not use flame, high-pressure water, steam, volatile or corrosive cleaners on fins or tubing.

Clean coil using vacuum cleaner and its crevice tool. Move crevice tool *vertically*, close to area being cleaned, making sure tool touches only the dirt on the fins and not the fins. To prevent fin damage, do not scrub fins with tool or move tool horizontally against fins.

If oil deposits are present, spray coil with ordinary household detergent. Wait 10 minutes, proceed to next step.

Using garden hose, spray coil vertically downward with constant stream of water at moderate pressure. Keep nozzle at a 15 to 20 degree angle, about 3 in. (76 mm) from coil face and 18 in. (457 mm) from tube. Spray so debris is washed out of coil. Reinstall louvered casing if necessary.

Restore power to unit.

LIQUID LINE STRAINER — Heating and cooling models are equipped with a strainer in liquid line. It is marked with identifying sticker. Strainer picks up harmful debris that may be in system. If it becomes plugged, system does not perform properly. System pressures become abnormal and compressor may become very hot and cycle off on its protection device. If strainer is plugged, it can be easily removed.

Shut off all power to unit. Bleed off all refrigerant from system.

⚠ CAUTION

Wear safety glasses and gloves when handling refrigerants. Remove fan blades and fan motor to gain access to liquid line. Cut tubing with midget tubing cutter near belled connection close to strainer. Peel off identifying sticker. Unbraid stub.

⚠ CAUTION

Wear safety glasses when brazing. Protect any aluminum tubing in vicinity of joint with wet rag to prevent overheating. After stub is removed, pull strainer from line with needle nose pliers. Discard strainer. *Do not* install another strainer. Braze liquid line together using copper coupling. Cut liquid line filter drier between indoor and outdoor units. Install liquid line filter drier (biflow drier for heat pump). Evacuate and charge system. Add charge to compensate for volume needed by drier. Check for normal system operation.

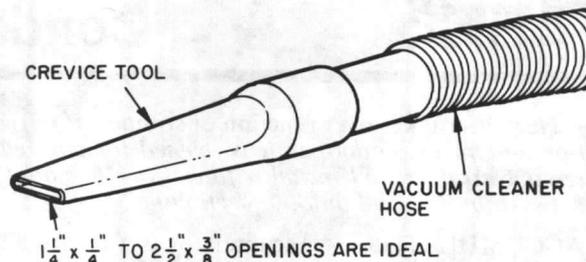


Fig. 28 — Crevice Cleaning Tool

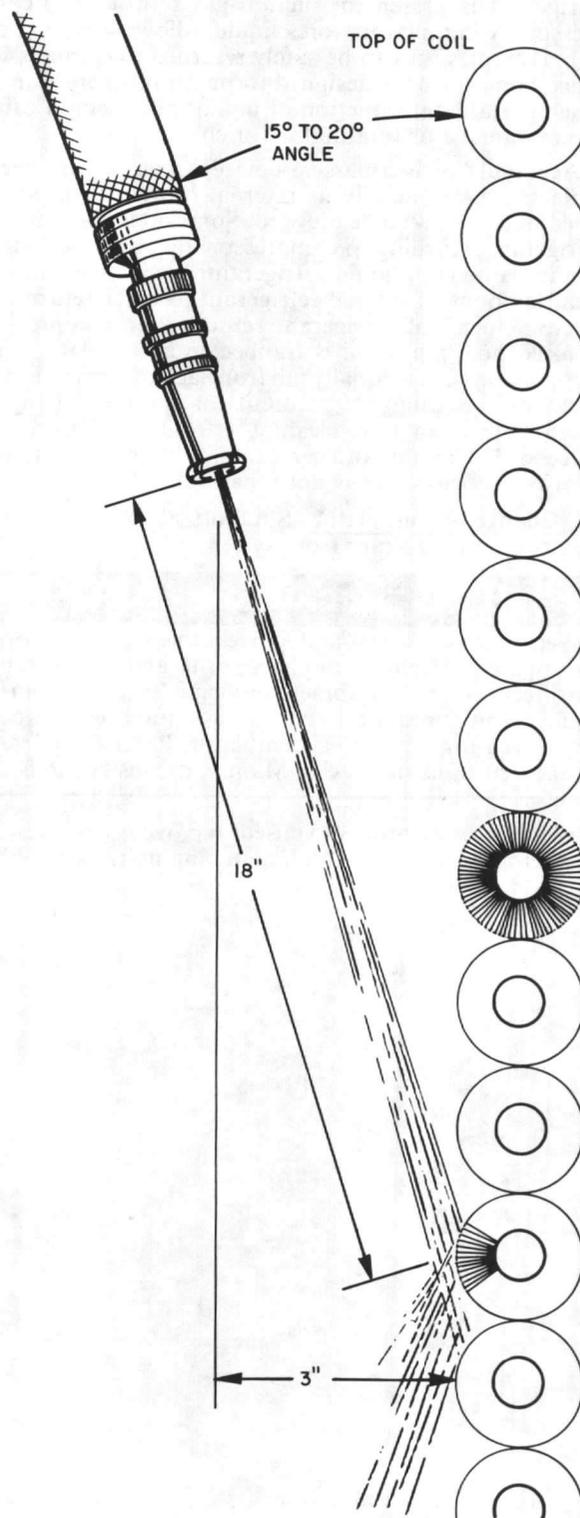


Fig. 29 — Positioning Hose to Spray Coil

New drier takes over function of strainer. *If refrigeration system in outdoor unit is opened for any reason, remove strainer and install a filter drier in liquid line between indoor and outdoor sections.*

ACCUMULATOR — Accumulator is a device always found in heat pumps and in some condensing unit models. Under some light-load conditions on indoor coils (on outdoor coil with heat pump in heating mode), some liquid refrigerant is present in suction gas returning to compressor. Accumulator stores liquid, allows it to boil off into a vapor so it can be safely returned to compressor. Since compressor is designed to pump refrigerant in its gaseous state, introduction of liquid into it could cause severe damage or total failure of compressor.

Accumulator is a passive device which seldom needs replacing. Occasionally its internal oil return orifice or bleed hole may become plugged. Some oil is contained in refrigerant returning to compressor. It cannot boil off in accumulator with liquid refrigerant. Bleed hole allows a small amount of oil and refrigerant to enter return line where velocity of refrigerant returns it to compressor. If bleed hole plugs, oil is trapped in accumulator, and compressor will eventually fail from lack of lubrication. If bleed hole is plugged, accumulator must be changed. Bleed hole is so tiny, cleaning efforts usually are not successful. The only other reason for changing accumulator is if it leaks and is not repairable.

To Change Accumulator: Shut off all power to unit. Remove all refrigerant from system.

⚠ CAUTION

Wear safety glasses and gloves when working on refrigerants. Remove discharge grille and remove fan orifice. Refer to Cabinet Servicing section. Some models may require louvered casing and coil to be removed for access to accumulator. Refer to appropriate sections of Service Manual for instructions.

When accumulator is exposed, remove it from system with tubing cutters. Scratch matching marks on tubing

stubs and old accumulator. Scratch matching marks on new accumulator. Unbrazed stubs from old accumulator and braze into new accumulator. Thoroughly rinse any flux residue from joints and paint with corrosion-resistant coating such as zinc-rich paint. Reinstall accumulator into system with copper slip couplings. Evacuate and charge system.

Pour and measure oil quantity (if any) from old accumulator. If more than 20% of oil charge is trapped in accumulator, add oil to compressor to make up for this loss.

SYSTEM CHARGING (for all approved combinations)
— System must be charged correctly for normal system operation and reliable operation of components.

⚠ CAUTION

Always wear safety glasses and gloves when handling refrigerants. If system has lost all charge, weigh in charge. Use dial-a-charge or digital scale.

If system has some charge, charts are available to check and add small amounts of refrigerant with system running. Refer to individual unit installation instructions for charge charts.

⚠ CAUTION

Heat pump charts are for checking charge and performance and for adding a *small* amount of charge. During heating mode, correct method of charging is the weight method. In heating mode, check should be made approximately 15 minutes after a defrost, with unit running with a clean coil. In cooling cycle, system should run at least 10 minutes for temperatures and pressures to stabilize. All charts assume there are no system abnormalities and indoor coil airflows are correct. If system abnormalities exist, correct them before checking system charge.

Wiring Diagrams

38EH, EN, ES, QH, QN, QS

GENERAL

This publication includes wiring labels for all new and improved 38 Series air-cooled condensing units and heat

pumps. Models include 38EH, EN, ES, QH, QN and QS. Labels for all sizes are not included since many are identical. Refer to Index for appropriate label diagram.

INDEX

→ **Wiring Schematic — Fig. 1 and Fig. 3 (Fig. 3 shows 38EH, EN, 3-ph only)**

MODEL 38EH	MODEL 38EN	MODEL 38ES
015	015	018
018	018	024
024	024	030
030	030	036
036	036	042
042	042	048
048	048	060
060	060	

Wiring Schematic — Fig. 2 and Fig. 4 (Fig. 4 shows 38QH, QN, 3-ph only)

MODEL 38QH	MODEL 38QN	MODEL 38QS
015	015	018
018	018	024
024	024	030
030	030	036
036	036	042
042	042	048
048	048	060
060	060	

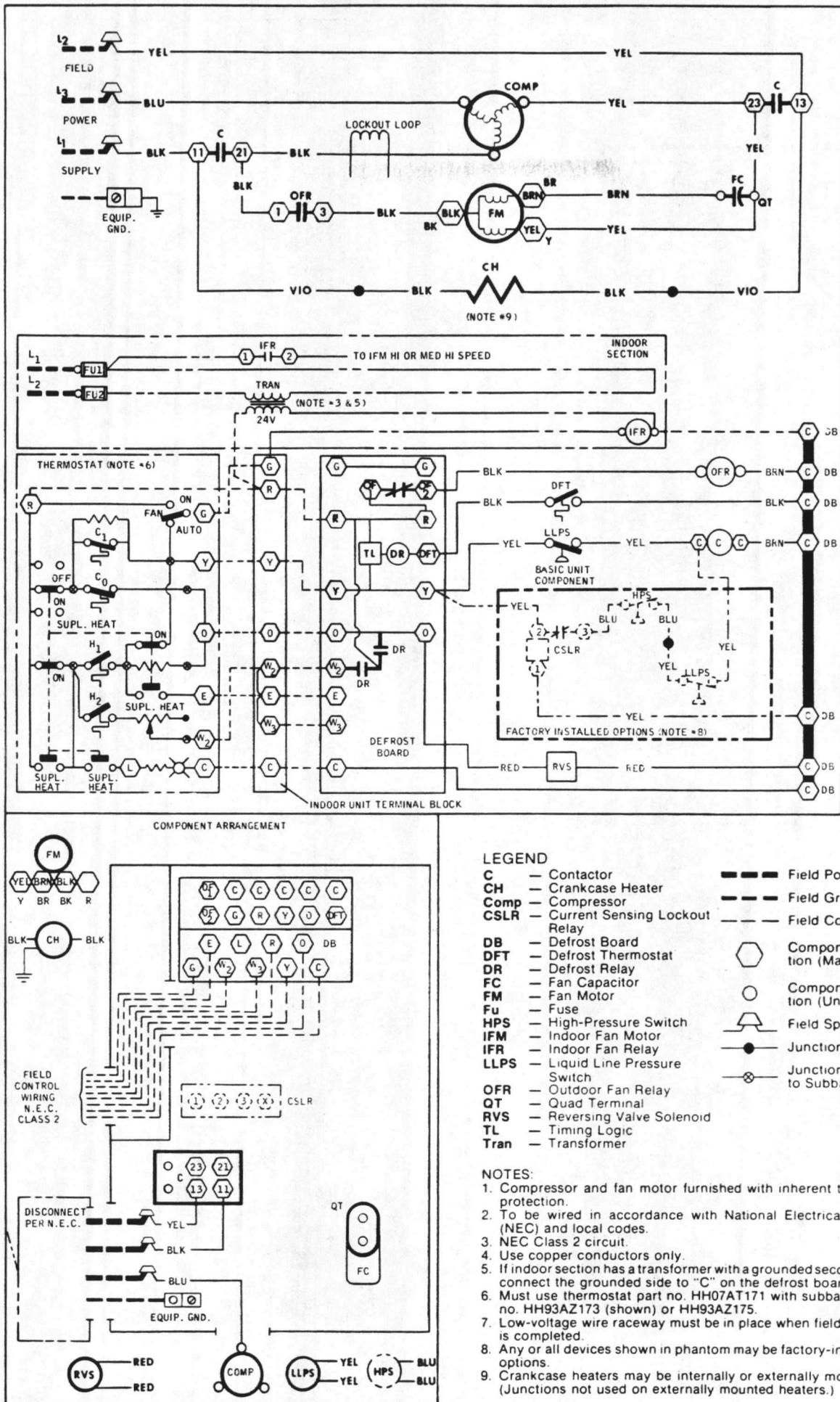
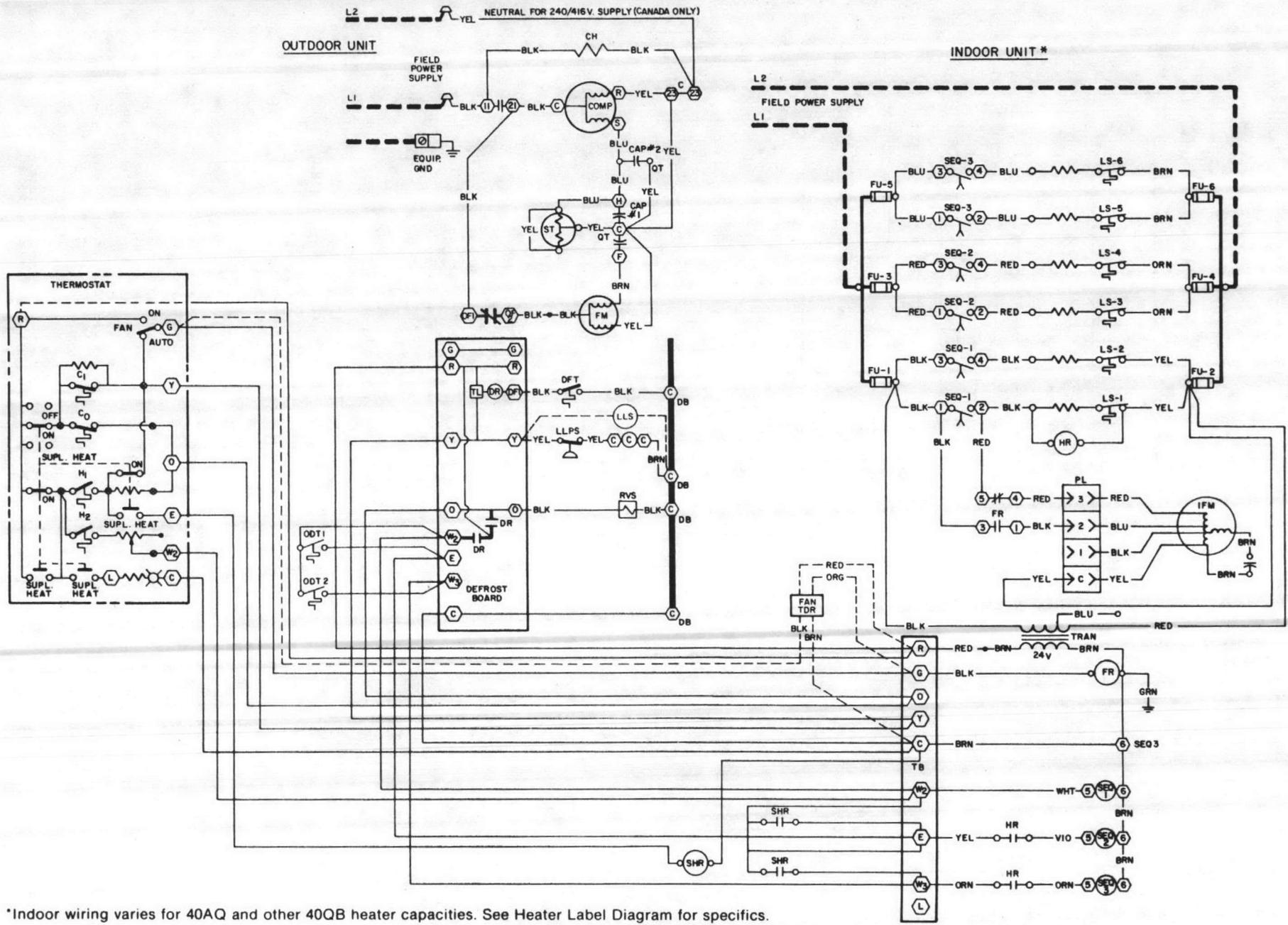


Fig. 4 — Wiring Schematic, 38QH, QN Only (3-ph)



*Indoor wiring varies for 40AQ and other 40QB heater capacities. See Heater Label Diagram for specifics.

SINGLE-PHASE; TWO OUTDOOR THERMOSTATS, SUPPLEMENTAL HEAT RELAY
Fig. 5 — Typical System Wiring Schematic, 38QN/40QB — 30 kW

MOTORMASTER® CONTROL INSTALLATION

Use these instructions to apply the Motormaster control to Models 38EH, EN, ES, QH, QN, QS. Also refer to separate installation instructions packaged with 32LT Motormaster solid-state head pressure control.

General — The 32LT Motormaster solid-state head pressure control is a fan speed control device activated by a temperature sensor. It is specifically designed to control outdoor fan motor speed in response to saturated condensing temperature. For outdoor temperatures down to -20 F, it maintains condensing temperature at 100 ± 10 F.

Considerations

1. Determine the required motor, run capacitor, sensor location and which 32LT Motormaster to use. See Table 1.
2. Determine whether outdoor unit needs a crankcase heater.
3. Decide on winter start modifications.
4. Establish where sensor wire should be routed.
5. Decide on isolation relay requirements for heat pumps.
6. Determine wind baffle requirements.

Table 1 — Required Unit Changes

UNIT MODEL NO. 38	VOLTS	FAN MOTOR	RUN CAPACITOR	MOTORMASTER	SENSOR LOCATION†
EH015,018,024	208/230	HC40MB701	HC90BB007	32LT900300	B
030,036,042		HC44SL601	HC91CA005		B
048,060			.		B
036,042	460	HC44SL460	.	32LT900610	B
048,060					B
EN015,018,024	208/230	HC40SL232	.	32LT900300	B
030,036		HC40MB701	HC90BB007		
042,048		HC44SL601	HC91CA005		
060	460	HC40MB549	HC90BB007	32LT900610	B
036		HC44SL460	HC91CA005		
042,048			.		
060	208/230	HC44SL601	HC91CA005	32LT900300	B
ES018,024,030			.		C
036			.		A
042			.		B
048,060	208/230	HC40MB701	HC90BB007	32LT900300	C
QH015,018		HC44SL601	HC91CA005		B
024,030,036			.		C
042,048,060	460	HC44SL460	HC91CA005	32LT900610	B
036			.		C
042,048,060			.		C
QN015,018	208/230	HC40SL232	.	32LT900300	A
024,030		HC40MB701	HC90BB007		
036,042,048		HC44SL601	.		
060	460	HC44SL460	.	32LT900610	B
036,042,048					B
060					B
QS018,024,030	208/230	HC44SL601	HC91CA005	32LT900300	B
036			.		C
042,048,060			.		C

*Use factory-installed run capacitor.

†See Fig. 11.

Power Wiring — See Fig. 7 for correct cooling unit power wiring, and Fig. 8 for heat pump power wiring. Power wiring must be checked to ensure it is as specified and in compliance with National Electrical Code (NEC) and all local requirements.

Crankcase Heaters — All factory supplied with units.

Winter Start Control (38EH,EN,ES) — To modify cooling units for winter start, jumper low-pressure switch (if so equipped) to make it inactive. Do not relocate. Install a new liquid line low-pressure switch (Part No. HK02AB026). Remove Schrader core before installing new LLPS.

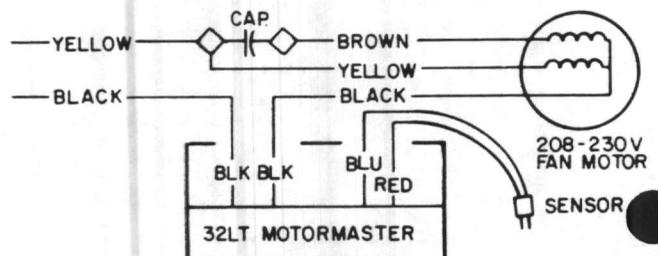
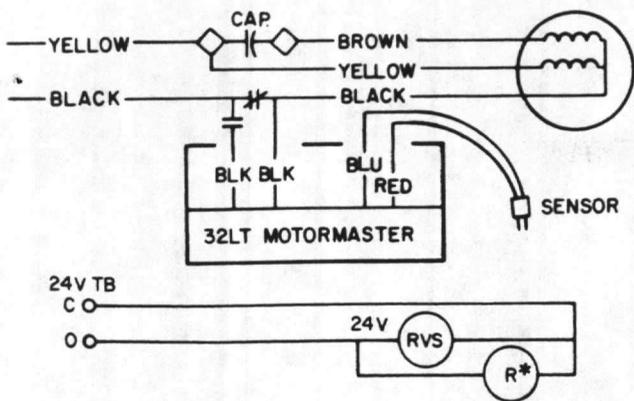


Fig. 7 — Power Wiring for 38EH,EN,ES

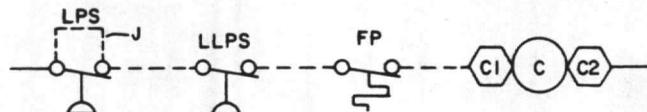


Cap. — Capacitor
 RVS — Reversing Valve Solenoid
 TB — Terminal Board

*Isolation Relay, 230-v-HN61KQ120, 460-v-HN61KK066.

→ Fig. 8 — Power Wiring for 38QH, QN, QS

When required by application (cooling and heat pumps), install a freeze-stat (Part No. HH22JB026) for freeze-up protection to indoor coils. Wire the freeze protection in series with contactor coil. See Fig. 9.



C — Contactor
 FP — Freeze Protection
 J — Jumper
 LPS — Low-Pressure Switch
 LLPS — Liquid Line Pressure Switch

Fig. 9 — Winter Start Control

Control Location — Locate Motormaster control on wind baffle to be assembled. See Fig. 10. Select a location anywhere on wind baffle, preferably on upper half of baffle where Motormaster can be conveniently inspected. Motormaster sensor wire must be able to reach coil tubing for easy attachment.

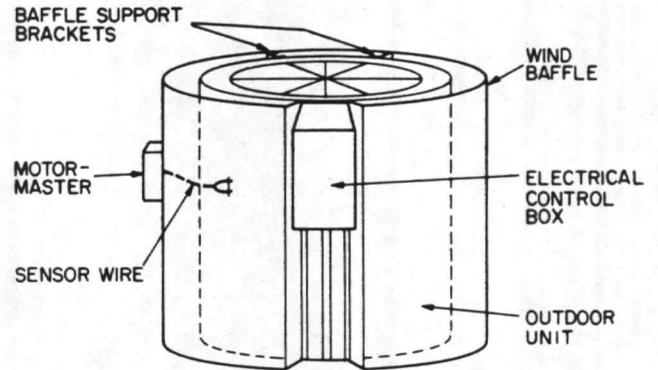


Fig. 10 — Motormaster and Baffle Assembled

Sensor Location — The recommended location for mounting the sensor is indicated in Fig. 11.

Locations (refer to Table 1):

- A — 6 Tubes Down
- B — 9 Tubes Down
- C — Top Tube Inside Row

Sensor Wire Routing — Route sensor wire from 32LT Motormaster through a hole in wind baffle to coil area shown as sensor location (Fig. 11).

Use a UL-approved bushing or grommet in wind baffle hole to protect sensor wire.

When attaching sensor bracket to coil tube, use inside hole in sensor bracket for 3/8-in. tubing. Use outside hole on sensor bracket for 1/2-in. tubing.

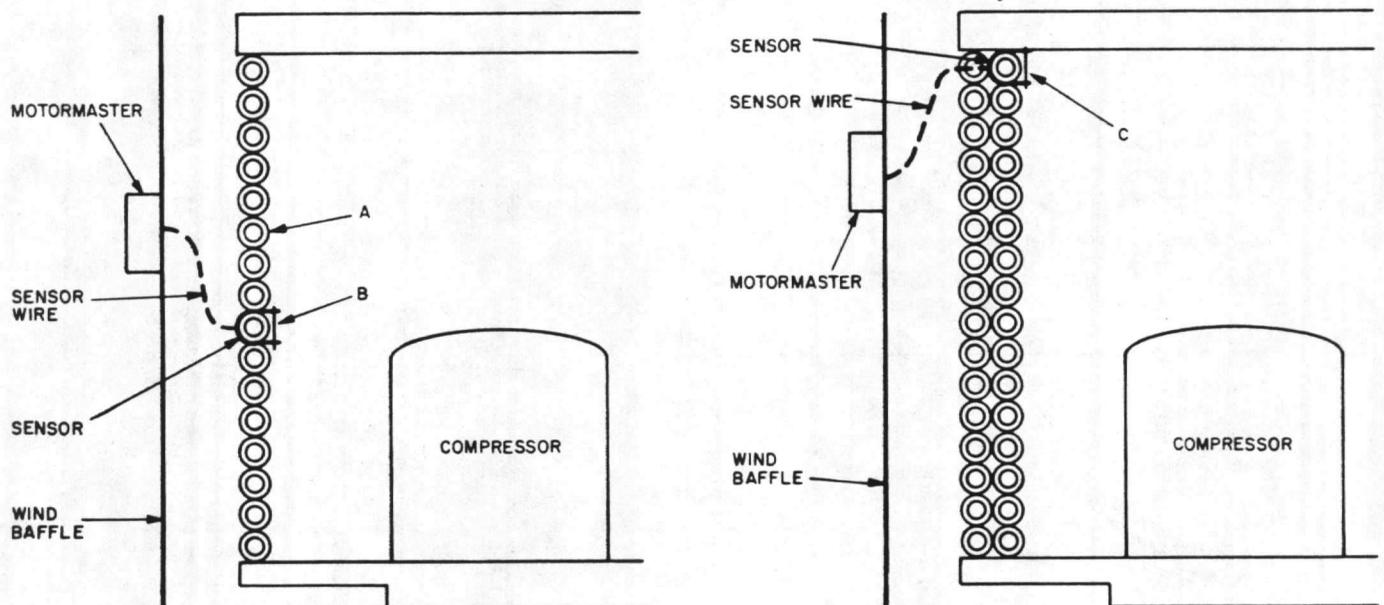


Fig. 11 — Sensor Locations

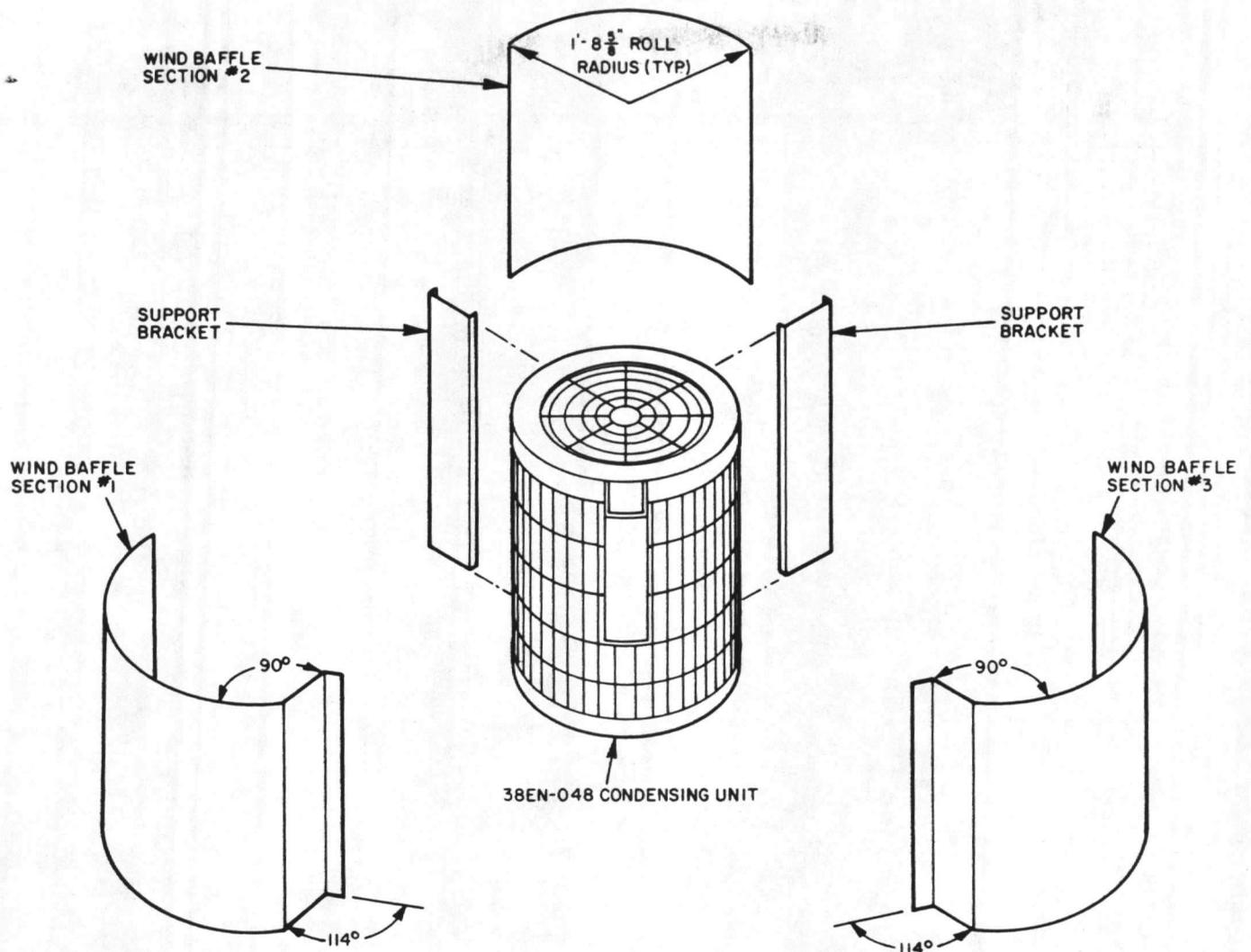


Fig. 14 — Assembly View

Table 2 — Wind Baffle/Support Bracket Dimensions (in.)

MODEL 38	WIND BAFFLE							SUPPORT BRACKETS		
	A	B	C	D	E	F	G	A	B	C
EH015,018,024 030,036,042 048,060	18 ³ / ₈	19 ⁷ / ₈	41 ¹ / ₆₄	41 ⁴⁹ / ₆₄	6	1 ¹ / ₂	28 ¹ / ₄	31	6	28 ¹ / ₄
	24 ¹ / ₃₂	25 ²³ / ₃₂	48 ⁵⁷ / ₆₄	49 ⁴¹ / ₆₄	8	1 ³ / ₄				
EN015,018,024 030,036 042,048,060300 048,060310	15 ⁵ / ₁₆	16 ¹⁵ / ₁₆	34 ²⁹ / ₆₄	35 ³ / ₁₆	6	1 ¹ / ₂	21 ¹⁹ / ₆₄	25	6	21 ¹⁹ / ₆₄
	18 ³ / ₈	19 ⁷ / ₈	41 ¹ / ₆₄	41 ⁴⁹ / ₆₄						
	24 ¹ / ₃₂	25 ²³ / ₃₂	48 ⁵⁷ / ₆₄	49 ⁴¹ / ₆₄	8	1 ³ / ₄	28 ¹ / ₄	31	8	28 ¹ / ₄
	26 ¹ / ₄	28 ¹ / ₈	52 ¹⁵ / ₁₆	53 ¹ / ₁₆						
ES018,024,030 036,042 048	24 ¹ / ₃₂	25 ²³ / ₃₂	48 ⁵⁷ / ₆₄	49 ⁴¹ / ₆₄	6	1 ³ / ₄	28 ¹ / ₄	31	6	28 ¹ / ₄
	26 ¹ / ₄	28 ¹ / ₈	52 ¹⁵ / ₁₆	53 ¹ / ₁₆	8					
QH015,018 024,030,036 042,048 060	18 ³ / ₈	19 ⁷ / ₈	41 ¹ / ₆₄	41 ⁴⁹ / ₆₄	6	1 ¹ / ₂	28 ¹ / ₄	31	6	28 ¹ / ₄
	24 ¹ / ₃₂	25 ²³ / ₃₂	48 ⁵⁷ / ₆₄	49 ⁴¹ / ₆₄						
	26 ¹ / ₄	28 ¹ / ₈	52 ¹⁵ / ₁₆	53 ¹ / ₁₆	8	1 ³ / ₄				
	30 ³ / ₁₆	31 ¹ / ₁₆	66 ³⁹ / ₆₄	67 ² / ₆₄						
QN015,018310 018300,024,030 036,042,048 060	15 ⁵ / ₁₆	16 ¹⁵ / ₁₆	34 ²⁹ / ₆₄	35 ³ / ₁₆	6	1 ¹ / ₂	21 ¹⁹ / ₆₄	25	6	21 ¹⁹ / ₆₄
	18 ³ / ₈	19 ⁷ / ₈	41 ¹ / ₆₄	41 ⁴⁹ / ₆₄						
	24 ¹ / ₃₂	25 ²³ / ₃₂	48 ⁵⁷ / ₆₄	49 ⁴¹ / ₆₄	8	1 ³ / ₄	28 ¹ / ₄	31	8	28 ¹ / ₄
	26 ¹ / ₄	28 ¹ / ₈	52 ¹⁵ / ₁₆	53 ¹ / ₁₆						
QS018,024,030 036,042 048	24 ¹ / ₃₂	25 ²³ / ₃₂	48 ⁵⁷ / ₆₄	49 ⁴¹ / ₆₄	6	1 ³ / ₄	28 ¹ / ₄	31	6	28 ¹ / ₄
	26 ¹ / ₄	28 ¹ / ₈	52 ¹⁵ / ₁₆	53 ¹ / ₁₆	8					



38E,Q Heat Pumps/Condensing Units

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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Tab	3a	5a	2a	5a

PC 101

Catalog No. 563-856

Printed in U.S.A.

Form 38E,Q-1W

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586

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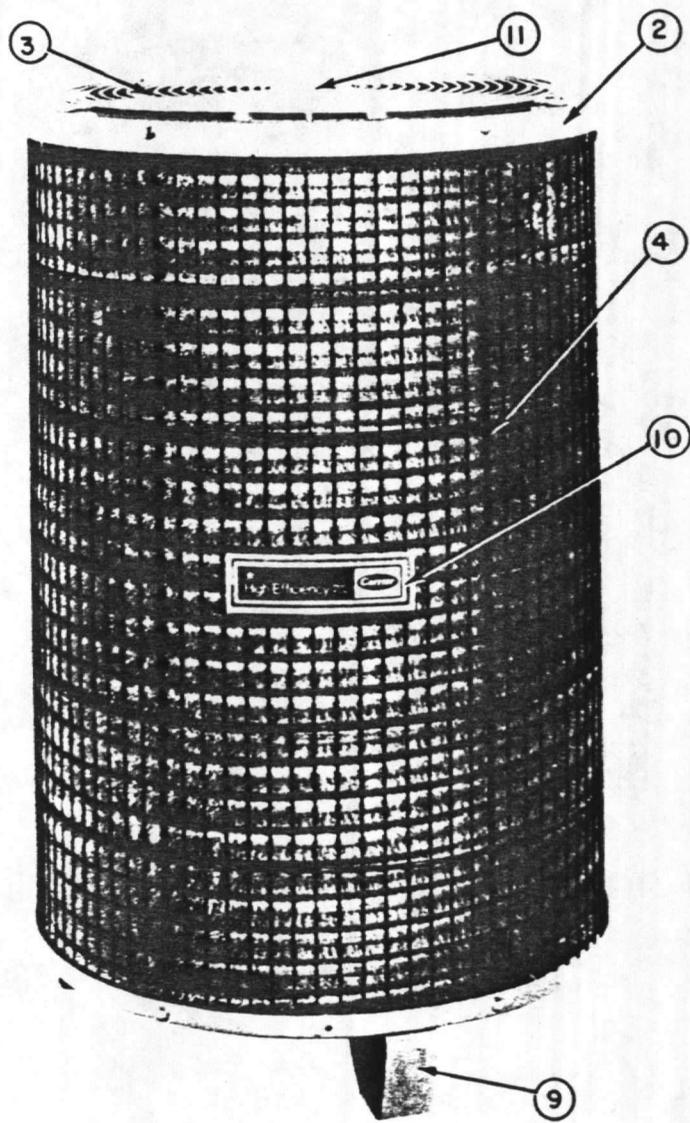
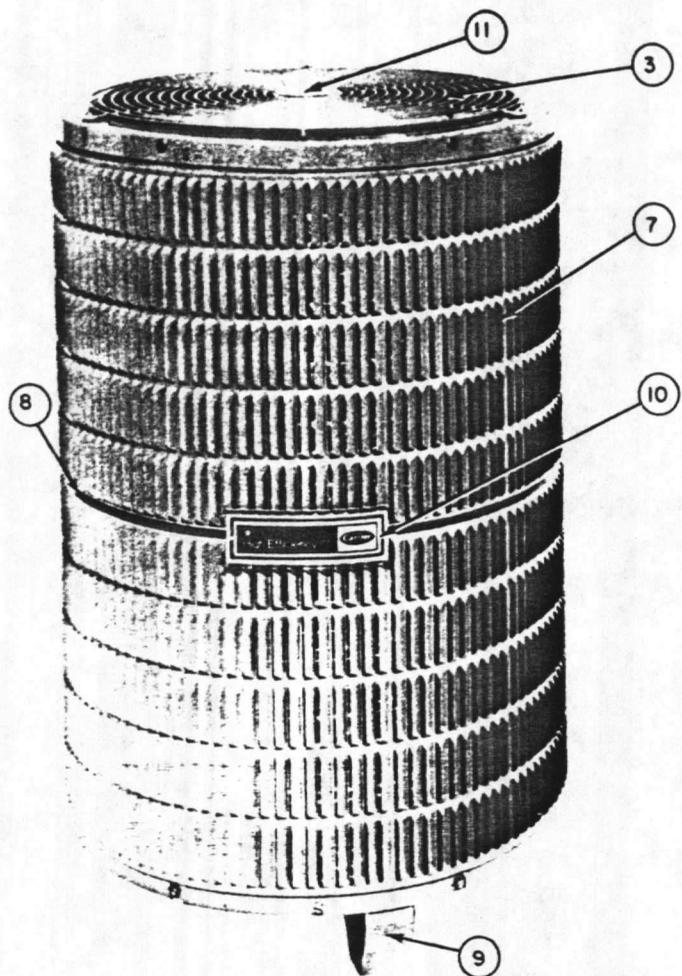
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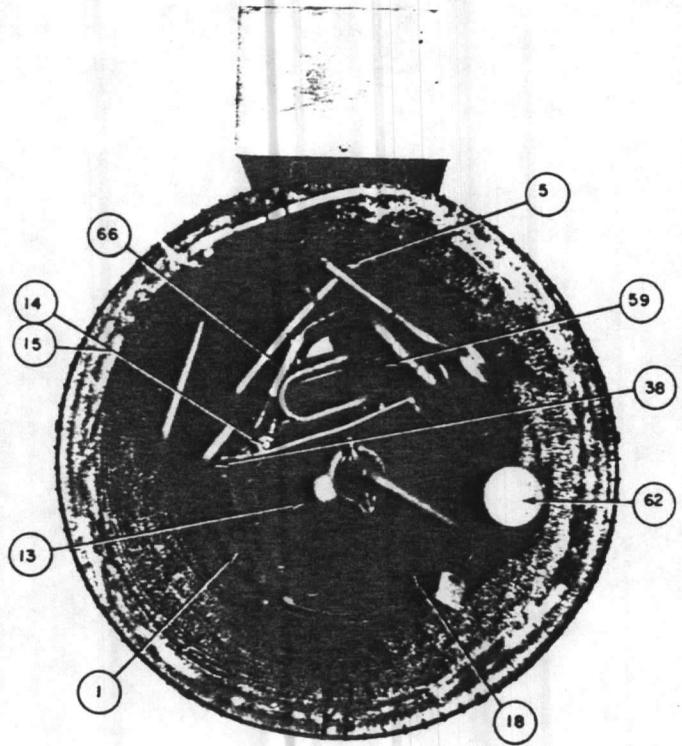
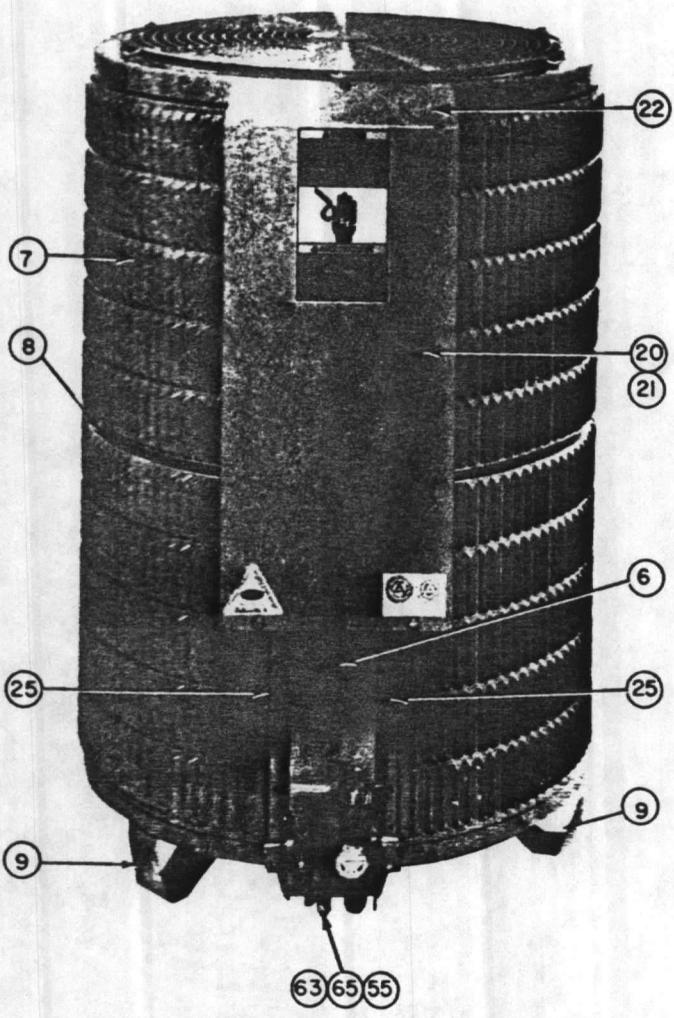
Carrier
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parts

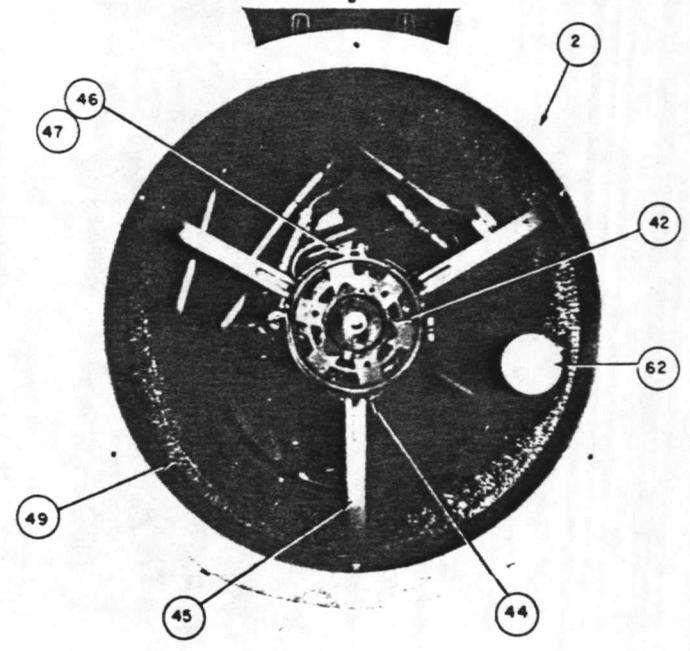
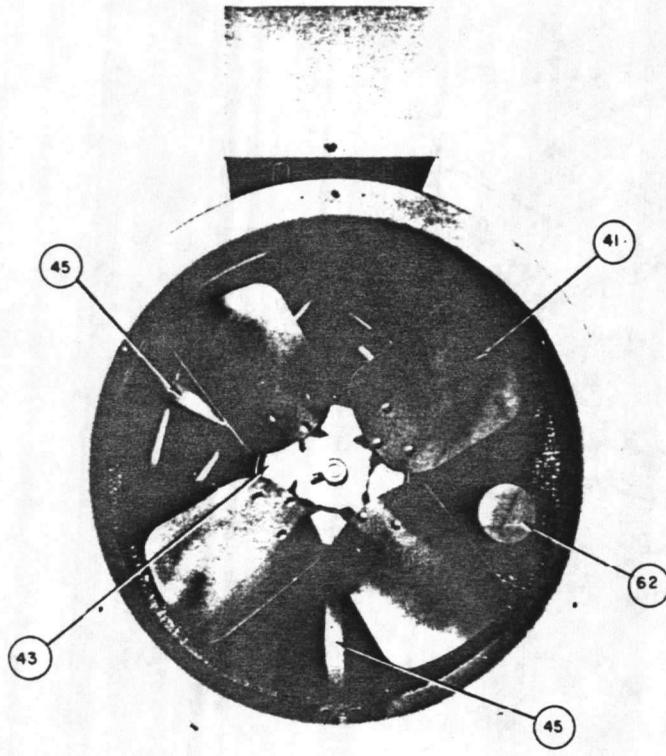
AIR-COOLED HEAT PUMP

38QN

015-060



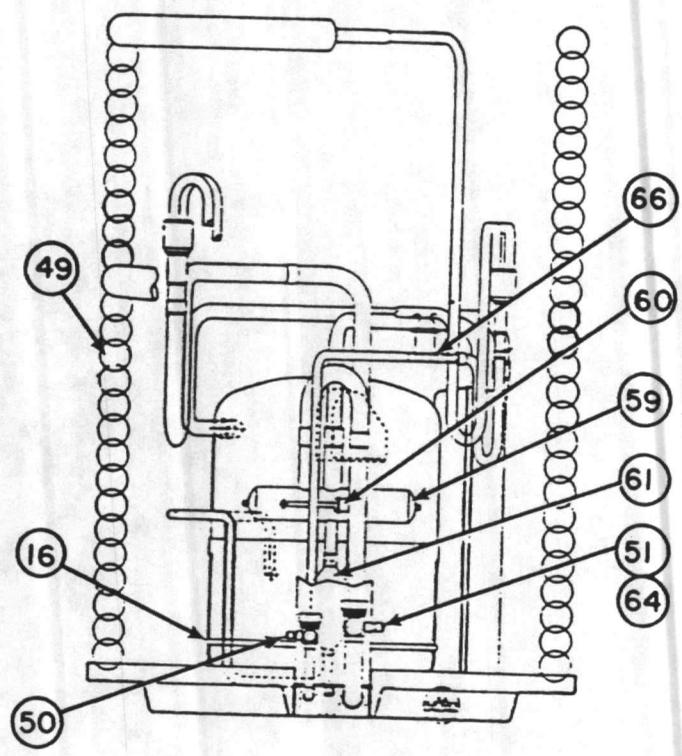
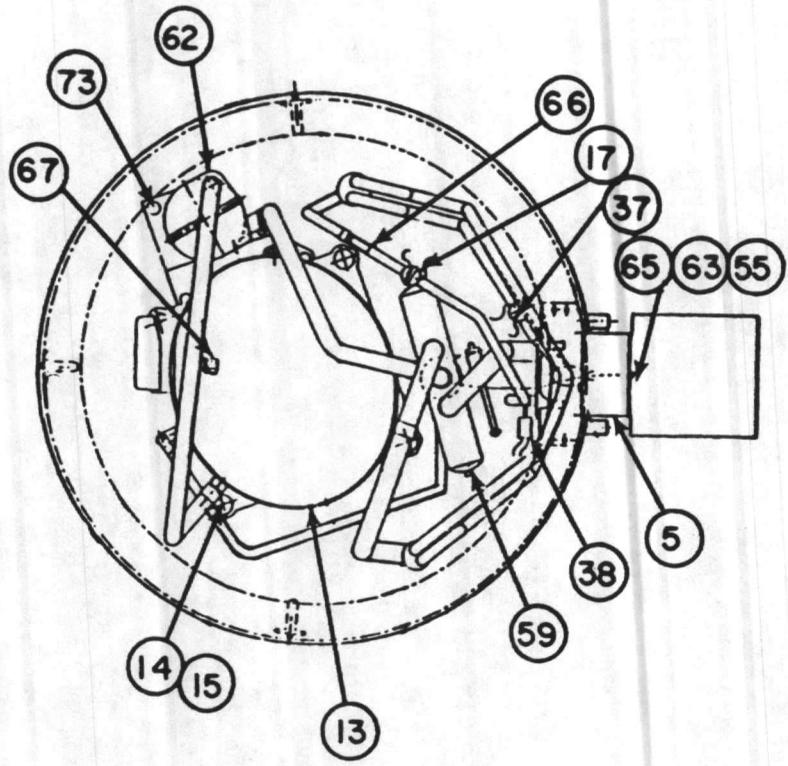


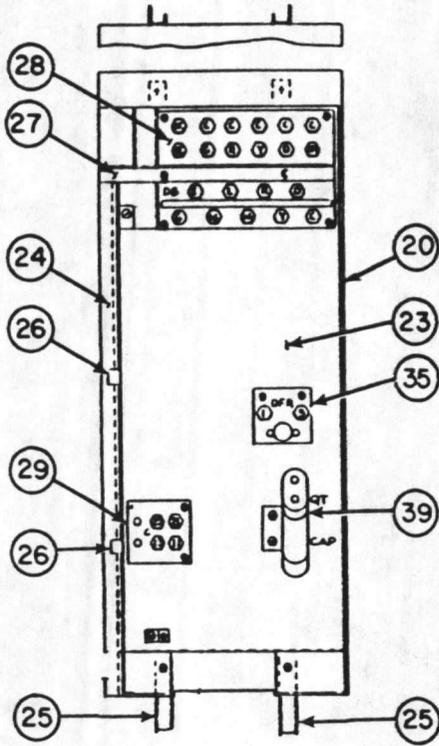


AIR-COOLED HEAT PUMP

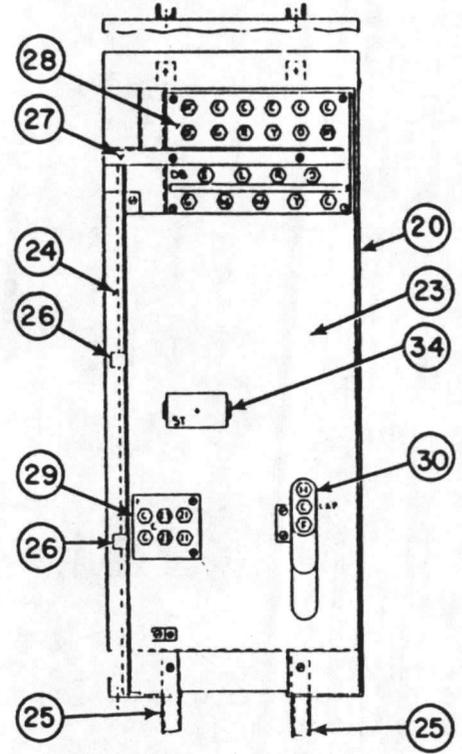
38QN

015-060

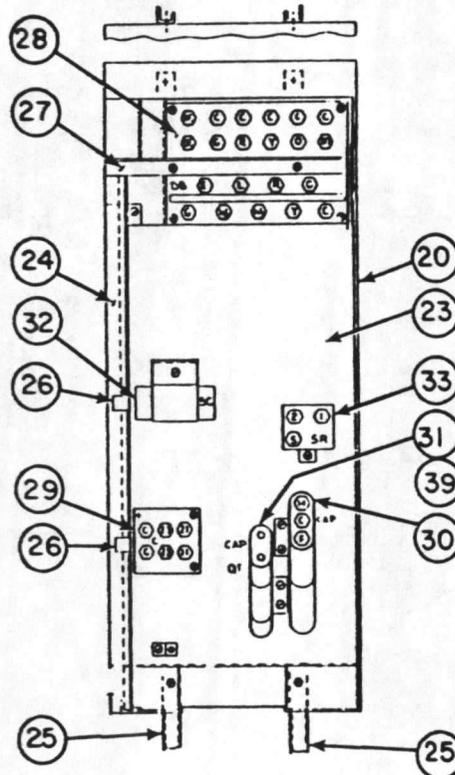




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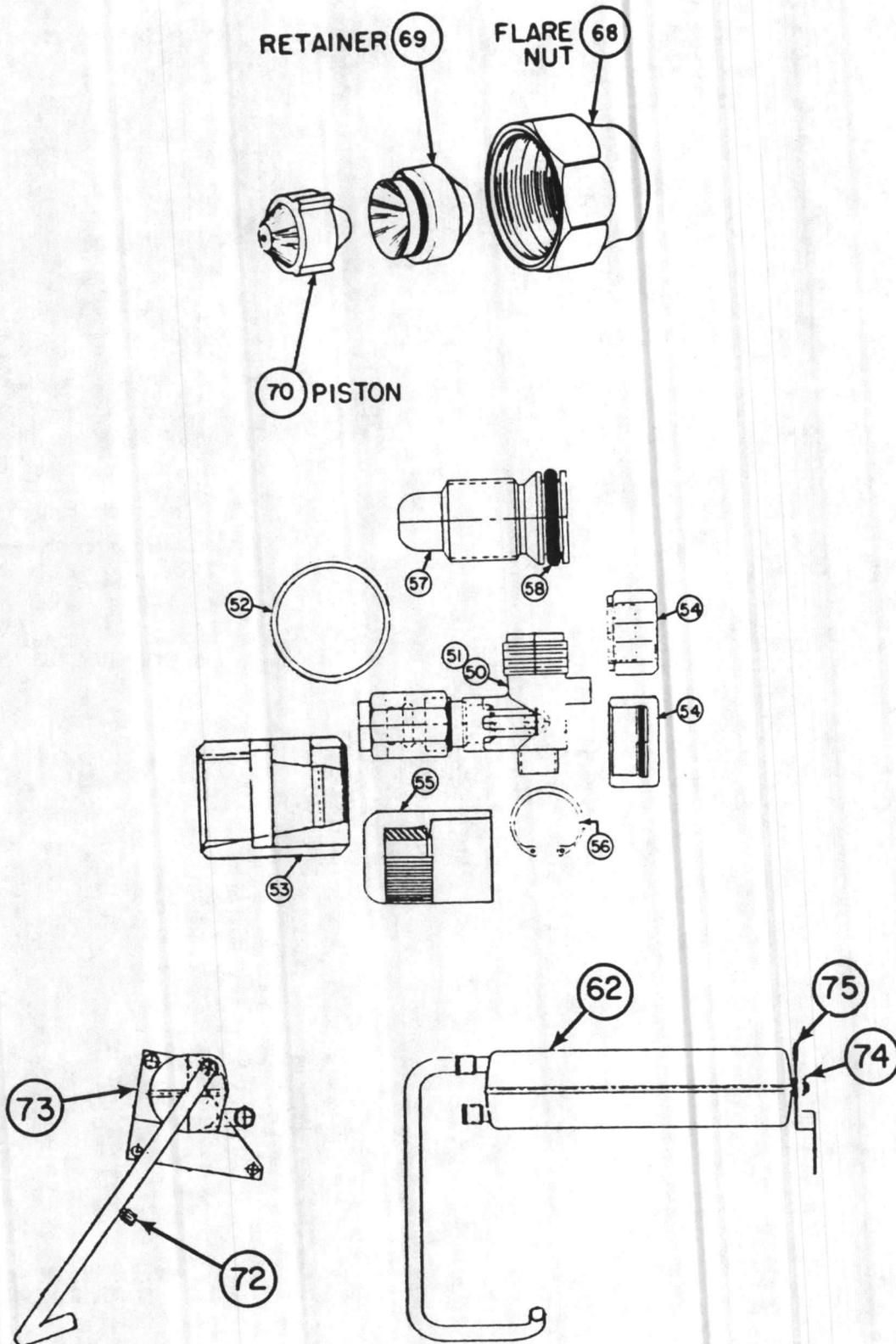
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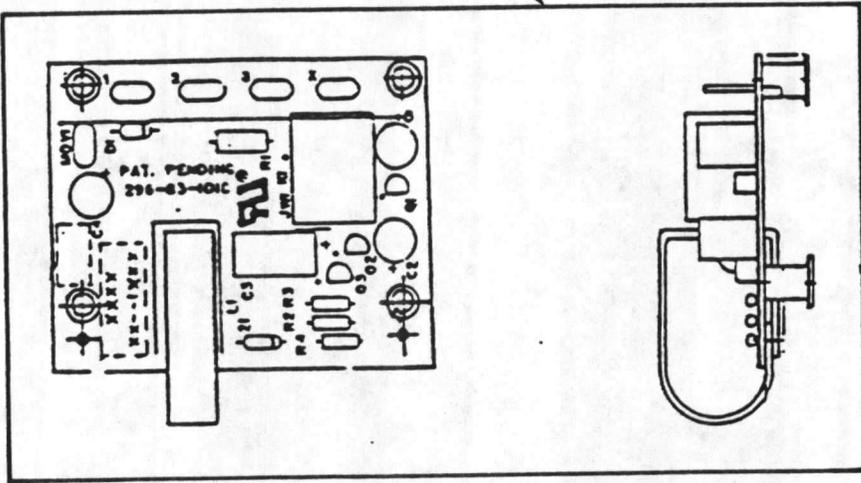
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CONTROL BOX ASSEMBLY**

AIR-COOLED HEAT PUMP

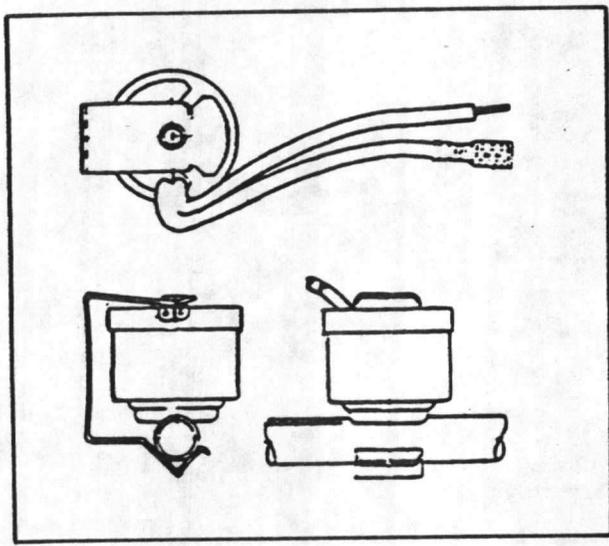
38QN
015-080



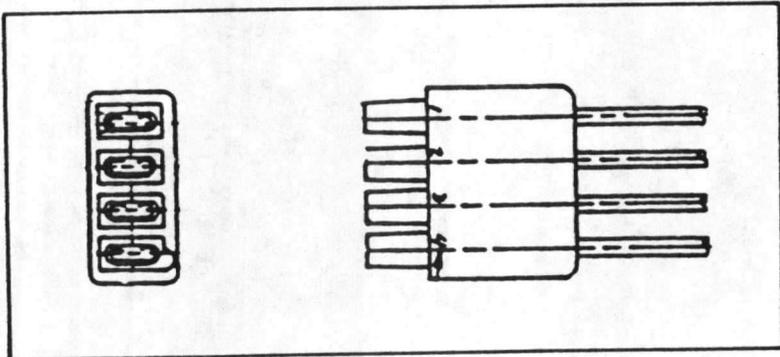
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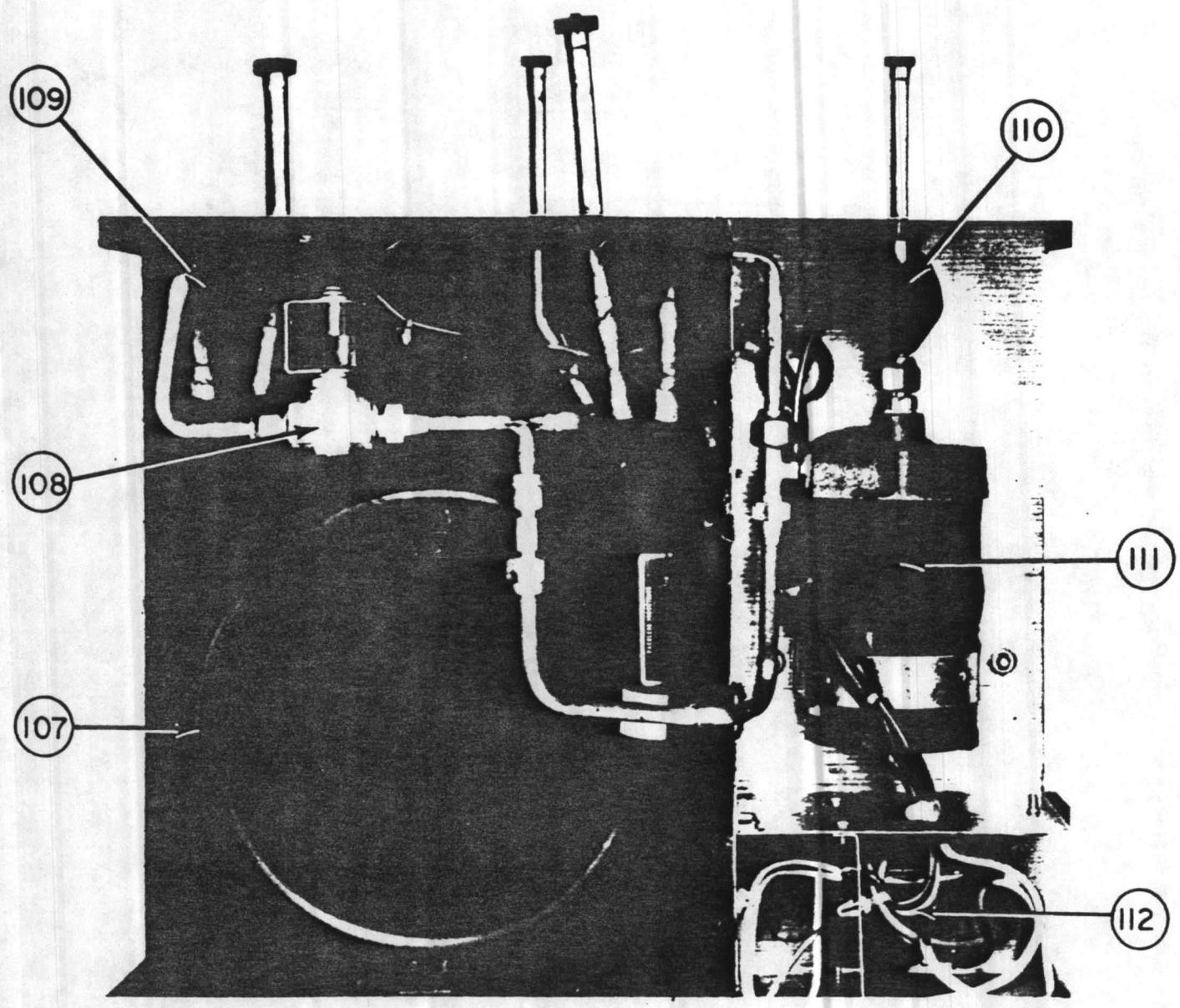


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AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN015300	38QN015310	38QN015310SM	38QN015320
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
CASING GROUP					
1	BASE PAN ASSEMBLY	38QN400094	-	-	38QN400074
2	TOP ORIFICE ASSEMBLY	38EN402254	-	-	38EN400064
3	TOP GRILLE ASSEMBLY	38EN400083	-	-	38EN400093
4	INLET GRILLE ASSEMBLY	38QN400574	310001-401	-	310002-401
5	WIRE GUIDE	38QN400914	-	-	38QN400434
6	WIRE GUIDE COVER(NORYL)	38QN500924	-	-	38QN500934
7	LOUVERED CASING ASSEMBLY	X	38QN401501	-	38QN401331
	INCLUDES:				
8	DECORATIVE TAPE	X	38QN501152	-	-
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3)	(3)	(3)
10	NAMEPLATE ASSEMBLY	38QN401863	310599-702	-	-
11	MEDALLION	99NB500153	-	-	-
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	-	-	-
COMPRESSOR GROUP					
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X
	COMPRESSOR ASSEMBLY	38QB662301	-	-	500T662300
14	MOUNTING BOLT	(4)AH01AM203	(4)	(4)	(4)
15	MOUNTING GROMMET	(4)KA56CR080	(4)KA56CR079	(4)	(4)KA56TR053
16	CRANKCASE HEATER	HT32BH246	-	-	-
17	CRANKCASE HEATER SWITCH	X	X	X	HH18HA076
18	SOUND SHIELD	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	-	-	-
ELECTRICAL GROUP					
20	COMPLETE CONTROL PANEL ASSY	38QN400181	-	-	38QH400001
21	CONTROL BOX ASSEMBLY	38QN400194	-	-	-
22	CONTROL BOX COVER	38QN400113	-	-	-
23	MOUNTING PANEL	38QN500124	-	-	-
24	LOW VOLTAGE CHANNEL	38QN500143	-	-	-
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38QN401943	(2)	(2)	(2)38ER400003
26	"U" CLIP	(2)AS42ZL010	(2)	(2)	(2)
27	PARTITION(DEFROST BOARD)	38QN500022	-	-	-
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	-	-	-
29	CONTACTOR	HN52KC051	-	-	-
30	CAPACITOR(DUAL) #1	HC93CA026	-	-	HC93CA021
31	SINGLE CAPACITOR #2	X	X	X	X
32	START CAPACITOR	X	X	X	X
33	START RELAY	X	X	X	X
34	START ASSIST(PTC THERMISTER)	06MC660004	-	-	-
35	FAN RELAY	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA094	-	-	HH18HA095
38	LOW PRESSURE SWITCH	HK02ZB003	-	-	-
39	FAN CAPACITOR	X	X	X	X
40	NI BODY COUPLING FOR LPS	DE08DA052	-	-	-
FAN AND MOTOR GROUP					
41	PROPELLER FAN	LA01EW013	-	-	LA01EW017
42	FAN MOTOR	HC39SL610	-	-	HC35SL230
43	RAIN SHIELD	HC99AA500	-	-	-
44	MOTOR BAND	HC98Z2500	-	-	-
45	MOTOR MOUNT ASSEMBLY	(3)38EN400534	(3)	(3)	(3)38EN400544
46	MOTOR BAND CAPSCREW	AA06BS173	-	-	-
47	MOTOR BAND NUT	AT31AG171	-	-	-
48	MOTOR PLUG	X	X	X	HY06MP105

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN018300	38QN018310	38QN018320	38QN018320SM	38QN018330
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
CASING GROUP						
1	BASE PAN ASSEMBLY	38QN400074	38QN400094	-	-	38QN400074
2	TOP ORIFICE ASSEMBLY	38EN400064	38EN402254	-	-	38EN400064
3	TOP GRILLE ASSEMBLY	38EN400093	38EN400083	-	-	38EN400093
4	INLET GRILLE ASSEMBLY	38QN400594	38QN400574	310001-401	38QN400574	310002-401
5	WIRE GUIDE	38QN400434	38QN400914	-	-	38QN400434
6	WIRE GUIDE COVER(NORYL)	38QN500233	38QN500924	-	-	38QN500934
7	LOUVERED CASING ASSEMBLY	X	38QN401501	-	-	38QN401331
	INCLUDES:					
8	DECORATIVE TAPE	X	38QN501152	-	-	-
9	MOUNTING LEG ASSEMBLY	(3)380B660001	(3) -	(3) -	(3) -	(3) -
10	NAMEPLATE ASSEMBLY	38QN400313	38QN401863	310599-704	38QN401873	310599-702
11	MEDALLION	99NB500153	-	-	-	-
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	-	-	-	-
COMPRESSOR GROUP						
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X	X
	COMPRESSOR ASSEMBLY	38GN662301	50SR661311	-	-	50SR661346
14	MOUNTING BOLT	(4)AH01AM203	(4) -	(4) -	(4) -	(4) -
15	MOUNTING GROMMET	(4)KA56TRD17	(4)KA56CR078	(4) -	(4) -	(4) -
16	CRANKCASE HEATER	HT32BH246	-	-	-	-
17	CRANKCASE HEATER SWITCH	X	X	X	X	X
18	SOUND SHIELD	X	X	X	X	X
19	NI COMPRESSOR OIL	SUN-36S	-	-	-	-
ELECTRICAL GROUP						
20	COMPLETE CONTROL PANEL ASSY	38QN400191	-	-	-	310789-701
21	CONTROL BOX ASSEMBLY	38QN400194	-	-	-	-
22	CONTROL BOX COVER	38QN400113	-	-	-	-
23	MOUNTING PANEL	38QN500124	-	-	-	-
24	LOW VOLTAGE CHANNEL	38QN500143	-	-	-	-
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38QN401943	(2) -	(2) -	(2) -	(2)38ER400003
26	"U" CLIP	(2)AS42L010	(2) -	(2) -	(2) -	(2) -
27	PARTITION(DEFROST BOARD)	38QN500022	-	-	-	-
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	-	-	-	-
29	CONTACTOR	HN51DB024	-	-	-	-
30	CAPACITOR(DUAL) #1	HC93CA026	-	-	-	-
31	SINGLE CAPACITOR #2	X	X	X	X	X
32	START CAPACITOR	X	X	X	X	X
33	START RELAY	X	X	X	X	X
34	START ASSIST(PTC THERMISTER)	06MC660004	-	-	-	-
35	FAN RELAY	X	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA094	-	-	-	HH18HA095
38	LOW PRESSURE SWITCH	HK02ZB003	-	-	-	-
39	FAN CAPACITOR	X	X	X	X	X
40	NI BODY COUPLING FOR LPS	DE08DA052	-	-	-	-
FAN AND MOTOR GROUP						
41	PROPELLER FAN	LA01EW017	LA01EW013	-	-	LA01EW017
42	FAN MOTOR	HC39SL711	-	-	-	HC35SL230
43	RAIN SHIELD	HC99AA500	-	-	-	-
44	MOTOR BAND	HC98ZZ480	HC98ZZ500	-	-	-
45	MOTOR MOUNT ASSEMBLY	(3)38EN400544	(3)38EN400534	(3) -	(3) -	(3)38EN400544
46	MOTOR BAND CAPSCREW	AA06BS173	-	-	-	-
47	MOTOR BAND NUT	AT31AG171	-	-	-	-
48	MOTOR PLUG	X	X	X	X	HY06MP105

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN024300	38QN024300SM	38QN024310	38QN024310SM	38QN024320
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
CASING GROUP						
1	BASE PAN ASSEMBLY	38QN400074	-	-	-	-
2	TOP ORIFICE ASSEMBLY	38EN400064	-	-	-	-
3	TOP GRILLE ASSEMBLY	38EN400093	-	-	-	-
4	INLET GRILLE ASSEMBLY	38QN400594	-	310002-401	-	-
5	WIRE GUIDE	38QN400434	-	-	-	-
6	WIRE GUIDE COVER(NORYL)	38QN500934	-	-	-	-
7	LOUVERED CASING ASSEMBLY	X	38QN401331	-	-	-
	INCLUDES:					
8	DECORATIVE TAPE	X	38QN501152	-	-	-
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3) -	(3) -	(3) -	(3) -
10	NAMEPLATE ASSEMBLY	38QN401863	38QN401873	310599-702	-	-
11	MEDALLION	99NB500153	-	-	-	-
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	-	-	-	-
COMPRESSOR GROUP						
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X	X
	COMPRESSOR ASSEMBLY	MD2365GG	-	-	-	JD2560AA
14	MOUNTING BOLT	(4)AH01AM203	(4) -	(4) -	(4) -	(4)AH01AM204
15	MOUNTING GROMMET	(4)KA56CR078	(4) -	(4) -	(4) -	(4)KA56TR017
16	CRANKCASE HEATER	HT32BH24E	-	-	-	-
17	CRANKCASE HEATER SWITCH	HH18HAD7E	-	-	-	-
18	SOUND SHIELD	X	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	-	-	-	-
ELECTRICAL GROUP						
20	COMPLETE CONTROL PANEL ASSY	38QN400201	-	-	-	311746-701
21	CONTROL BOX ASSEMBLY	38QN400194	-	-	-	-
22	CONTROL BOX COVER	38QN400113	-	-	-	-
23	MOUNTING PANEL	38QN500124	-	-	-	-
24	LOW VOLTAGE CHANNEL	38QN500143	-	-	-	-
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) -	(2) -	(2) -	(2) -
26	"U" CLIP	(2)AS42ZL010	(2) -	(2) -	(2) -	(2) -
27	PARTITION(DEFROST BOARD)	38QN500022	-	-	-	-
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	-	-	-	-
29	CONTACTOR	HN51DB024	-	-	-	-
30	CAPACITOR(DUAL) #1	HC93DA02E	-	-	-	HC93CA036
31	SINGLE CAPACITOR #2	X	X	X	X	X
32	START CAPACITOR	X	X	X	X	X
33	START RELAY	X	X	X	X	X
34	START ASSIST(PTC THERMISTER)	06MC660004	-	-	-	-
35	FAN RELAY	X	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	-	-	-	-
38	LOW PRESSURE SWITCH	HK02ZB003	-	-	-	-
39	FAN CAPACITOR	X	X	X	X	X
40	NI BODY COUPLING FOR LPS	DE08DA052	-	-	-	-
FAN AND MOTOR GROUP						
41	PROPELLER FAN	LA01EW017	-	-	-	-
42	FAN MOTOR	HC39SL711	-	-	-	-
43	RAIN SHIELD	HC99AA500	-	-	-	-
44	MOTOR BAND	HC98Z7500	-	-	-	-
45	MOTOR MOUNT ASSEMBLY	(3)38EN400544	(3) -	(3) -	(3) -	(3) -
46	MOTOR BAND CAPSCREW	AA06BS173	-	-	-	-
47	MOTOR BAND NUT	AT31AG171	-	-	-	-
48	MOTOR PLUG	X	X	X	X	HY06MP105

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN030300	38QN030300SM	38QN030310	38QN030310SM	38QN030330	38QN030330SM
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
CASING GROUP							
1	BASE PAN ASSEMBLY	38QN400074	-	-	-	38QN400054	-
2	TOP ORIFICE ASSEMBLY	38EN400064	-	-	-	38QH401014	-
3	TOP GRILLE ASSEMBLY	38EN400093	-	-	-	38EN400103	-
4	INLET GRILLE ASSEMBLY	38QN400574	-	-	-	310003-401	-
5	WIRE GUIDE	38QN400434	-	-	-	-	-
6	WIRE GUIDE COVER(NORYL)	38QN500934	-	-	-	-	-
7	LOUVERED CASING ASSEMBLY	X	38QN401331	X	38QN401331	38QN401341	-
	INCLUDES:						
8	DECORATIVE TAPE	X	38QN501152	X	38QN501152	-	-
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3)-	(3)-	(3)-	(3)-	(3)-
10	NAMEPLATE ASSEMBLY	38QN401863	38QN401873	38QN401863	38QN401873	310599-702	-
11	MEDALLION	99NB500153	-	-	-	-	-
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	-	-	-	-	-
COMPRESSOR GROUP							
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X	X	X
	COMPRESSOR ASSEMBLY	MD3265HG	-	-	-	-	-
14	MOUNTING BOLT	(4)AHD1AM203	(4)-	(4)-	(4)-	(4)-	(4)-
15	MOUNTING GROMMET	(4)KA56CR078	(4)-	(4)-	(4)-	(4)-	(4)-
16	CRANKCASE HEATER	HT32BH246	-	-	-	-	-
17	CRANKCASE HEATER SWITCH	X	X	X	X	X	X
18	SOUND SHIELD	X	X	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	-	-	-	-	-
ELECTRICAL GROUP							
20	COMPLETE CONTROL PANEL ASSY	38QN400211	-	-	-	38QN400221	-
21	CONTROL BOX ASSEMBLY	38QN400194	-	-	-	-	-
22	CONTROL BOX COVER	38QN400113	-	-	-	-	-
23	MOUNTING PANEL	38QN500124	-	-	-	-	-
24	LOW VOLTAGE CHANNEL	38QN500143	-	-	-	-	-
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2)-	(2)-	(2)-	(2)-	(2)-
26	"U" CLIP	(2)AS42ZL010	(2)-	(2)-	(2)-	(2)-	(2)-
27	PARTITION(DEFROST BOARD)	38QN500022	-	-	-	-	-
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	-	-	-	-	-
29	CONTACTOR	HN51DB024	-	-	-	HN52KD051	-
30	CAPACITOR(DUAL) #1	HCS3CA041	-	-	-	-	-
31	SINGLE CAPACITOR #2	X	X	X	X	X	X
32	START CAPACITOR	X	X	X	X	X	X
33	START RELAY	X	X	X	X	X	X
34	START ASSIST(PTC THERMISTER)	06MC660004	-	-	-	-	-
35	FAN RELAY	X	X	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	-	-	-	-	-
38	LOW PRESSURE SWITCH	HK02ZB003	-	-	-	-	-
39	FAN CAPACITOR	X	X	X	X	X	X
40	NI BODY COUPLING FOR LPS	DE08DA052	-	-	-	-	-
FAN AND MOTOR GROUP							
41	PROPELLER FAN	LA01EW017	-	-	-	LA01AB025	-
42	FAN MOTOR	HC39SL711	-	-	-	HC43VA233	-
43	RAIN SHIELD	HC99AA500	-	-	-	-	-
44	MOTOR BAND	HC98Z2500	-	-	-	HC98Z2501	-
45	MOTOR MOUNT ASSEMBLY	(3)38EN400544	(3)-	(3)-	(3)-	(3)38QH400954	(3)-
46	MOTOR BAND CAPSCREW	AA06BS173	-	-	-	-	-
47	MOTOR BAND NUT	AT31AG171	-	-	-	-	-
48	MOTOR PLUG	X	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN030340	38QN036300	38QN036300SM	38QN036310
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
CASING GROUP					
1	BASE PAN ASSEMBLY	38QN400074	38QN400054	→	→
2	TOP ORIFICE ASSEMBLY	38EN400064	38QH401014	→	→
3	TOP GRILLE ASSEMBLY	38EN400093	38EN400103	→	→
4	INLET GRILLE ASSEMBLY	310002-401	38QN400574	→	310003-401
5	WIRE GUIDE	38QN400434	→	→	→
6	WIRE GUIDE COVER(NORYL)	38QN500934	→	→	→
7	LOUVERED CASING ASSEMBLY	38QN401331	X	38QN401341	→
	INCLUDES:				
8	DECORATIVE TAPE	38QN501152	X	38QN501152	→
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3) →	(3) →	(3) →
10	NAMEPLATE ASSEMBLY	310599-702	38QN401863	38QN401873	310599-702
11	MEDALLION	99NB500153	→	→	→
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	→	→	→
COMPRESSOR GROUP					
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X
	COMPRESSOR ASSEMBLY	JD3360AA	MD3564GE	→	50SR661343
14	MOUNTING BOLT	(4)AH01AM204	(4)AH01AM203	(4) →	(4) →
15	MOUNTING GROMMET	(4)KA56TR017	(4)KA56CR078	(4) →	(4)KA56TR053
16	CRANKCASE HEATER	HT32BH246	→	→	X
17	CRANKCASE HEATER SWITCH	HH18HA076	X	X	X
18	SOUND SHIELD	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	→	→	→
ELECTRICAL GROUP					
20	COMPLETE CONTROL PANEL ASSY	311746-701	38QN400221	→	38QH400031
21	CONTROL BOX ASSEMBLY	38QN400194	→	→	→
22	CONTROL BOX COVER	38QN400113	→	→	→
23	MOUNTING PANEL	38QN500124	→	→	→
24	LOW VOLTAGE CHANNEL	38QN500143	→	→	→
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) →	(2) →	(2) →
26	"U" CLIP	(2)AS422L010	(2) →	(2) →	(2) →
27	PARTITION(DEFROST BOARD)	38QN500022	→	→	→
28	ELECTRIC DEFROST CONTROL BOARD	HK25S2359	→	→	→
29	CONTACTOR	HN51DB024	HN52KC051	→	→
30	CAPACITOR(DUAL) #1	HC93CA036	HC93CA041	→	HC93CA046
31	SINGLE CAPACITOR #2	X	X	X	X
32	START CAPACITOR	X	X	X	X
33	START RELAY	X	X	X	X
34	START ASSIST(PTC THERMISTER)	06MC660004	→	→	→
35	FAN RELAY	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	→	→	→
38	LOW PRESSURE SWITCH	HK02ZB003	→	→	→
39	FAN CAPACITOR	X	X	X	X
40	NI BODY COUPLING FOR LPS	DE08DA052	→	→	→
FAN AND MOTOR GROUP					
41	PROPELLER FAN	LA01EW017	LA01AB025	→	→
42	FAN MOTOR	HC39SL711	HC43VA233	→	HC35SL230
43	RAIN SHIELD	HC99AA500	→	→	→
44	MOTOR BAND	HC98ZZ500	HC98ZZ501	→	→
45	MOTOR MOUNT ASSEMBLY	(3)38EN400544	(3)38QH400954	(3) →	(3) →
46	MOTOR BAND CAPSCREW	AA06BS173	→	→	→
47	MOTOR BAND NUT	AT31AG171	→	→	→
48	MOTOR PLUG	HY06MP105	→	→	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN036500	38QN036500SM	38QN036510	38QN036600	38QN036600SM	38QN036610
		208/230-3-60	208/230-3-60	208/230-3-60	460-3-60	460-3-60	460-3-60
CASING GROUP							
1	BASE PAN ASSEMBLY	38QN400054	-	-	-	-	-
2	TOP ORIFICE ASSEMBLY	38QH401014	-	-	-	-	-
3	TOP GRILLE ASSEMBLY	38EN400103	-	-	-	-	-
4	INLET GRILLE ASSEMBLY	38QN400574	-	310003-401	38QN400574	-	310003-401
5	WIRE GUIDE	38QN400434	-	-	-	-	-
6	WIRE GUIDE COVER(NORYL)	38QN500934	-	-	-	-	-
7	LOUVERED CASING ASSEMBLY	X	38QN401341	-	X	38QN401341	-
	INCLUDES						
8	DECORATIVE TAPE	X	38QN501152	-	X	38QN501152	-
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3) -	(3) -	(3) -	(3) -	(3) -
10	NAMEPLATE ASSEMBLY	38QN401863	38QN401873	310599-702	38QN401863	38QN401873	310599-702
11	MEDALLION	99NB500153	-	-	-	-	-
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	-	-	-	-	-
COMPRESSOR GROUP							
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X	X	X
	COMPRESSOR ASSEMBLY	MF3563GE	-	50SR661428	MH3563GE	-	50SR661635
14	MOUNTING BOLT	(4)AH01AM203	(4) -	(4) -	(4) -	(4) -	(4) -
15	MOUNTING GROMMET	(4)KA56CR078	(4) -	(4)KA56TR053	(4)KA56CR078	(4) -	(4)KA56TR053
16	CRANKCASE HEATER	HT32BH246	-	X	HT32BH734	-	X
17	CRANKCASE HEATER SWITCH	X	X	X	X	X	X
18	SOUND SHIELD	X	X	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	-	-	-	-	-
ELECTRICAL GROUP							
20	COMPLETE CONTROL PANEL ASSY	38QN400261	-	38QH400891	38QN400281	-	38QH400921
21	CONTROL BOX ASSEMBLY	38QN400194	-	-	-	-	-
22	CONTROL BOX COVER	38QN400113	-	-	-	-	-
23	MOUNTING PANEL	38QN500124	-	-	-	-	-
24	LOW VOLTAGE CHANNEL	38QN500143	-	-	-	-	-
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) -	(2) -	(2) -	(2) -	(2) -
26	"U" CLIP	(2)AS422L010	(2) -	(2) -	(2) -	(2) -	(2) -
27	PARTITION(DEFROST BOARD)	38QN500022	-	-	-	-	-
28	ELECTRIC DEFROST CONTROL BOARD	HK25S2369	-	-	-	-	-
29	CONTACTOR	HNS2KC051	-	-	-	-	-
30	CAPACITOR(DUAL) #1	X	X	X	X	X	X
31	SINGLE CAPACITOR #2	X	X	X	X	X	X
32	START CAPACITOR	X	X	X	X	X	X
33	START RELAY	X	X	X	X	X	X
34	START ASSIST(PTC THERMISTER)	X	X	X	X	X	X
35	FAN RELAY	X	X	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X	X	HN61KK066
37	DEFROST THERMOSTAT	HH18HA095	-	-	-	-	X
38	LOW PRESSURE SWITCH	HK02ZB003	-	-	-	-	-
39	FAN CAPACITOR	HC91CA005	-	-	-	-	-
40	NI BODY COUPLING FOR LPS	DE08DA052	-	-	-	-	-
FAN AND MOTOR GROUP							
41	PROPELLER FAN	LA01AB025	-	-	-	-	-
42	FAN MOTOR	HC43VA233	-	HC35SL230	HC44SL461	-	-
43	RAIN SHIELD	HC99AA500	-	-	-	-	-
44	MOTOR BAND	HC98ZZ501	-	-	-	-	-
45	MOTOR MOUNT ASSEMBLY	(3)38QH400954	(3) -	(3) -	(3) -	(3) -	(3) -
46	MOTOR BAND CAPSCREW	AA06BS173	-	-	-	-	-
47	MOTOR BAND NUT	AT31AG171	-	-	-	-	-
48	MOTOR PLUG	X	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN042300	38QN042300SM	38QN042310	38QN042310SM
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
CASING GROUP					
1	BASE PAN ASSEMBLY	38QN400054	-	-	-
2	TOP ORIFICE ASSEMBLY	38EN400074	-	38QH401014	-
3	TOP GRILLE ASSEMBLY	38EN400103	-	-	-
4	INLET GRILLE ASSEMBLY	38QN400574	-	310003-401	-
5	WIRE GUIDE	38QN400444	-	-	-
6	WIRE GUIDE COVER(NORYL)	38QN400934	-	-	-
7	LOUVERED CASING ASSEMBLY	X	38QN401341	-	-
	INCLUDES:				
8	DECORATIVE TAPE	X	38QN501152	-	-
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3) -	(3) -	(3) -
10	NAMEPLATE ASSEMBLY	38QN401863	38QN401873	310599-702	-
11	MEDALLION	99NB500153	-	-	-
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	-	-	-
COMPRESSOR GROUP					
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X
	COMPRESSOR ASSEMBLY	PC4666HD	-	50SR661330	-
14	MOUNTING BOLT	(3)38EN500982	(3) -	(4)AH01AM203	(4) -
15	MOUNTING GROMMET	(3)KA56TR014	(3) -	(4)KA56TR053	(4) -
16	CRANKCASE HEATER	HT32BH246	-	X	X
17	CRANKCASE HEATER SWITCH	X	X	X	X
18	SOUND SHIELD	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	-	-	-
ELECTRICAL GROUP					
20	COMPLETE CONTROL PANEL ASSY	38QN400231	-	38QN401071	-
21	CONTROL BOX ASSEMBLY	38QN400113	-	-	-
22	CONTROL BOX COVER	38QN400194	-	-	-
23	MOUNTING PANEL	38QN500124	-	-	-
24	LOW VOLTAGE CHANNEL	38QN500143	-	-	-
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) -	(2) -	(2) -
26	"U" CLIP	(2)AS42ZL010	(2) -	(2) -	(2) -
27	PARTITION(DEFROST BOARD)	38QN500022	-	-	-
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	-	-	-
29	CONTACTOR	HN52KC051	-	-	-
30	CAPACITOR(DUAL) #1	HC93CA036	-	HC93DA041	-
31	SINGLE CAPACITOR #2	HC91CA025	-	X	X
32	START CAPACITOR	HC95DE088	-	HC95DE085	-
33	START RELAY	HN61HB496	-	-	-
34	START ASSIST(PTC THERMISTER)	X	X	X	X
35	FAN RELAY	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	-	-	-
38	LOW PRESSURE SWITCH	HK02ZB003	-	-	-
39	FAN CAPACITOR	X	X	X	X
40	NI BODY COUPLING FOR LPS	DE08DA052	-	-	-
FAN AND MOTOR GROUP					
41	PROPELLER FAN	LA01AB025	-	-	-
42	FAN MOTOR	HC43VA233	-	-	-
43	RAIN SHIELD	HC99AA500	-	-	-
44	MOTOR BAND	HC98ZZ500	-	HC98ZZ501	-
45	MOTOR MOUNT ASSEMBLY	(3)38EN400554	(3) -	(3)38QH400954	(3) -
46	MOTOR BAND CAPSCREW	AA06BS173	-	-	-
47	MOTOR BAND NUT	AT31AG171	-	-	-
48	MOTOR PLUG	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-080

ITEM	PART DESCRIPTION	38QN042500	38QN042500SM	38QN042600	38QN042600SM
		208/230-3-60	208/230-3-60	460-3-60	460-3-60
CASING GROUP					
1	BASE PAN ASSEMBLY	38QN400054	-	-	-
2	TOP ORIFICE ASSEMBLY	38QH401014	-	-	-
3	TOP GRILLE ASSEMBLY	38EN400103	-	-	-
4	INLET GRILLE ASSEMBLY	310003-401	-	-	-
5	WIRE GUIDE	38QN400444	-	-	-
6	WIRE GUIDE COVER(NORYL)	38QN500934	-	-	-
7	LOUVERED CASING ASSEMBLY	38QN401341	-	-	-
	INCLUDES:				
8	DECORATIVE TAPE	38QN501152	-	-	-
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3)	(3)	(3)
10	NAMEPLATE ASSEMBLY	310599-702	-	-	-
11	MEDALLION	99NB500153	-	-	-
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	-	-	-
COMPRESSOR GROUP					
13	COMPRESSOR ASSEMBLY(200-3-60)	PF4666HD *	- *	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	PG4666HD *	- *	X	X
	COMPRESSOR ASSEMBLY	X	X	PH4666HD	-
14	MOUNTING BOLT	(3)38EN500982	(3)	(3)	(3)
15	MOUNTING GROMMET	(3)KA56TR014	(3)	(3)	(3)
16	CRANKCASE HEATER	X	X	HT32BH734	-
17	CRANKCASE HEATER SWITCH	X	X	X	X
18	SOUND SHIELD	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	-	-	-
NOTE: (*) ORIGINAL COMPRESSOR IS AN EXTENDED VOLTAGE. SELECT REPLACEMENT COMPRESSOR FOR VOLTAGE REQUIRED.					
ELECTRICAL GROUP					
20	COMPLETE CONTROL PANEL ASSY	38QN400491	-	38QN400281	-
21	CONTROL BOX ASSEMBLY	38QN400194	-	-	-
22	CONTROL BOX COVER	38QN400113	-	-	-
23	MOUNTING PANEL	38QN500124	-	-	-
24	LOW VOLTAGE CHANNEL	38QN500143	-	-	-
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2)	(2)	(2)
26	"U" CLIP	(2)AS42ZL010	(2)	(2)	(2)
27	PARTITION(DEFROST BOARD)	38QN500022	-	-	-
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	-	-	-
29	CONTACTOR	HN52KC051	-	-	-
30	CAPACITOR(DUAL) #1	X	X	X	X
31	SINGLE CAPACITOR #2	X	X	X	X
32	START CAPACITOR	X	X	X	X
33	START RELAY	X	X	X	X
34	START ASSIST(PTC THERMISTER)	X	X	X	X
35	FAN RELAY	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	-	-	-
38	LOW PRESSURE SWITCH	HK02ZB003	-	-	-
39	FAN CAPACITOR	HC91CA005	-	-	-
40	NI BODY COUPLING FOR LPS	DE08DA052	-	-	-
FAN AND MOTOR GROUP					
41	PROPELLER FAN	LA01AB025	-	-	-
42	FAN MOTOR	HC43VA233	-	HC44SL461	-
43	RAIN SHIELD	HC99AA500	-	-	-
44	MOTOR BAND	HC98ZZ500	-	-	-
45	MOTOR MOUNT ASSEMBLY	(3)38QH400954	(3)	(3)	(3)
46	MOTOR BAND CAPSCREW	AA06BS173	-	-	-
47	MOTOR BAND NUT	AT31AG171	-	-	-
48	MOTOR PLUG	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN048300	38QN048300SM	38QN048310	38QN048500	38QN048500SM	38QN048510
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-3-60	208/230-3-60	208/230-3-60
CASING GROUP							
1	BASE PAN ASSEMBLY	38QN400054	--	38QN400374	38QN400054	--	38QN400374
2	TOP ORIFICE ASSEMBLY	38QH401014	--	38QH401024	38QH401014	--	38QH401024
3	TOP GRILLE ASSEMBLY	38EN400103	--	--	--	--	--
4	INLET GRILLE ASSEMBLY	38QN400604	--	310003-401	38QN400604	--	310003-401
5	WIRE GUIDE	38QN400444	--	--	--	--	--
6	WIRE GUIDE COVER(NORYL)	38QN500934	--	--	--	--	--
7	LOUVERED CASING ASSEMBLY	X	38QN401341	--	X	38QN401341	--
	INCLUDES:						
8	DECORATIVE TAPE	X	38QN501152	--	X	38QN501152	--
9	MOUNTING LEG ASSEMBLY	(3)38Q8660001	(3) --	(3) --	(3) --	(3) --	(3) --
10	NAMEPLATE ASSEMBLY	38QN401863	38QN401873	310599-702	38QN401863	38QN401873	310599-702
11	MEDALLION	99NB500153	--	--	--	--	--
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	--	--	--	--	--
COMPRESSOR GROUP							
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	PF5366HD *	--	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	PG5366HD *	--	X
	COMPRESSOR ASSEMBLY	PC5366HD	--	50SR661331	X	X	50SR661500
14	MOUNTING BOLT	(3)38EN500982	(3) --	(4)AH01AM203	(3)38EN500982	(3) --	(4)AM01AM203
15	MOUNTING GROMMET	(3)KA56TR014	(3) --	(4)KA56TR053	(3)KA56TR014	(3) --	(4)KA56TR053
16	CRANKCASE HEATER	HT32BH246	--	X	HT32BH246	--	X
17	CRANKCASE HEATER SWITCH	X	X	X	X	X	X
18	SOUND SHIELD	X	X	X	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	--	--	--	--	--
NOTE: (*) ORIGINAL COMPRESSOR IS AN EXTENDED VOLTAGE. SELECT REPLACEMENT COMPRESSOR FOR VOLTAGE REQUIRED.							
ELECTRICAL GROUP							
20	COMPLETE CONTROL PANEL ASSY	38QN400241	--	38QH400041	38QN400501	--	38QH400901
21	CONTROL BOX ASSEMBLY	38QN400194	--	--	--	--	--
22	CONTROL BOX COVER	38QN400113	--	--	--	--	--
23	MOUNTING PANEL	38QN500124	--	--	--	--	--
24	LOW VOLTAGE CHANNEL	38QN500143	--	--	--	--	--
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) --	(2) --	(2) --	(2) --	(2) --
26	"U" CLIP	(2)AS42ZL010	(2) --	(2) --	(2) --	(2) --	(2) --
27	PARTITION(DEFROST BOARD)	38QN500022	--	--	--	--	--
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	--	--	--	--	--
29	CONTACTOR	HN52KC051	--	--	--	--	--
30	CAPACITOR(DUAL) #1	HC93CA036	--	HC93DA045	X	X	X
31	SINGLE CAPACITOR #2	HC91CA035	--	X	X	X	X
32	START CAPACITOR	HC95DE086	--	X	X	X	X
33	START RELAY	HN61HB496	--	X	X	X	X
34	START ASSIST(PTC THERMISTER)	X	X	06MC660004	X	X	X
35	FAN RELAY	X	X	X	X	X	X
36	LOCKOUT RELAY	X	X	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	--	--	--	--	--
38	LOW PRESSURE SWITCH	HK02ZB003	--	--	--	--	--
39	FAN CAPACITOR	X	X	X	HC91CA005	--	--
40	NI BODY COUPLING FOR LPS	DE08DA052	--	--	--	--	--
FAN AND MOTOR GROUP							
41	PROPELLER FAN	LA01AB025	--	LA01EW025	LA01AB025	--	LA01EW025
42	FAN MOTOR	HC43VA233	--	HC41SL230	HC43VA233	--	HC41SL230
43	RAIN SHIELD	HC99AA500	--	--	--	--	--
44	MOTOR BAND	HC98Z7501	--	--	--	--	--
45	MOTOR MOUNT ASSEMBLY	(3)38QH400954	(3) --	(3)38QH400964	(3)38QH400954	(3) --	(3)38QH400964
46	MOTOR BAND CAPSCREW	AA06BS173	--	--	--	--	--
47	MOTOR BAND NUT	AT31AG171	--	--	--	--	--
48	MOTOR PLUG	X	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN048600	38QN048600SM	38QN048610
		460-3-60	460-3-60	460-3-60
CASING GROUP				
1	BASE PAN ASSEMBLY	38QN400054	→	38QN400374
2	TOP ORIFICE ASSEMBLY	38QH401014	→	38QH401024
3	TOP GRILLE ASSEMBLY	38EN400103	→	→
4	INLET GRILLE ASSEMBLY	38QN400604	→	310003-401
5	WIRE GUIDE	38QN400444	→	→
6	WIRE GUIDE COVER(NORYL)	38QN500934	→	→
7	LOUVERED CASING ASSEMBLY	X	38QN401341	→
INCLUDES:				
8	DECORATIVE TAPE	X	38QN501152	→
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3) →	(3) →
10	NAMEPLATE ASSEMBLY	38QN401863	38QN401873	310599-702
11	MEDALLION	99NB500153	→	→
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	→	→
COMPRESSOR GROUP				
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X
	COMPRESSOR ASSEMBLY	PH5366HD	→	50SR661622
14	MOUNTING BOLT	(3)38EN500982	(3) →	(4)AH01AM203
15	MOUNTING GROMMET	(3)KA56TR014	(3) →	(4)KA56TR053
16	CRANKCASE HEATER	HT32BH734	→	→
17	CRANKCASE HEATER SWITCH	X	X	X
18	SOUND SHIELD	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	→	→
ELECTRICAL GROUP				
20	COMPLETE CONTROL PANEL ASSY	38QN400291	→	38QH400921
21	CONTROL BOX ASSEMBLY	38QN400194	→	→
22	CONTROL BOX COVER	38QN400113	→	→
23	MOUNTING PANEL	38QN500124	→	→
24	LOW VOLTAGE CHANNEL	38QN500143	→	→
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) →	(2) →
26	"U" CLIP	(2)AS42ZL010	(2) →	(2) →
27	PARTITION(DEFROST BOARD)	38QN500022	→	→
28	ELECTRIC DEFROST CONTROL BOARD	HK25S2359	→	→
29	CONTACTOR	HN52KC051	→	→
30	CAPACITOR(DUAL) #1	X	X	X
31	SINGLE CAPACITOR #2	X	X	X
32	START CAPACITOR	X	X	X
33	START RELAY	X	X	X
34	START ASSIST(PTC THERMISTER)	X	X	X
35	FAN RELAY	HN61KK066	→	→
36	LOCKOUT RELAY	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	→	→
38	LOW PRESSURE SWITCH	HK022B003	→	→
39	FAN CAPACITOR	HC91CA005	→	→
40	NI BODY COUPLING FOR LPS	DE08DA052	→	→
FAN AND MOTOR GROUP				
41	PROPELLER FAN	LA01AB025	→	LA01EW025
42	FAN MOTOR	HC44SL461	→	→
43	RAIN SHIELD	HC99AA500	→	→
44	MOTOR BAND	HC98ZZ501	→	→
45	MOTOR MOUNT ASSEMBLY	(3)38QH400954	(3) →	(3)38QH400964
46	MOTOR BAND CAPSCREW	AA06BS173	→	→
47	MOTOR BAND NUT	AT31AG171	→	→
48	MOTOR PLUG	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN060300	38QN060300SM	38QN060310	38QN060500	38QN060500SM	38QN060510
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-3-60	208/230-3-60	208/230-3-60
CASING GROUP							
1	BASE PAN ASSEMBLY	38QN400374	--	38QH401204	38QN400374	--	38QH401204
2	TOP ORIFICE ASSEMBLY	38QH401024	--	38QH401034	38QH401024	--	38QH401034
3	TOP GRILLE ASSEMBLY	38EN400103	--	38QH400193	38EN400103	--	38QH400193
4	INLET GRILLE ASSEMBLY	310003-401	38QN400604	310004-401	310003-401	38QN400604	310004-401
5	WIRE GUIDE	38QN400444	--	38QN400434	38QN400444	--	--
6	WIRE GUIDE COVER(NORYL)	38QN500934	--	--	--	--	--
7	LOUVERED CASING ASSEMBLY	38QN401341	--	38QH400441	38QN401341	--	38QH400441
	INCLUDES:						
8	DECORATIVE TAPE	38QN501152	--	--	--	--	--
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3) --	(3) --	(3) --	(3) --	(3) --
10	NAMEPLATE ASSEMBLY	310599-704	38QN401873	310599-702	310599-704	38QN401873	310599-702
11	MEDALLION	99NB500153	--	--	--	--	--
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PED23	--	--	--	--	--
COMPRESSOR GROUP							
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X	X	X	X
	COMPRESSOR ASSEMBLY	PC6066ED	--	50EG662300	PY6066EF	--	50EG662400
14	MOUNTING BOLT	(3)38EN500982	(3) --	(4)AH01AM203	(3)38EN500982	(3) --	(4)AH01AM203
15	MOUNTING GROMMET	(3)KA56TR014	(3) --	(4)KA56CR079	(3)KA56TR014	(3) --	(4)KA56CR079
16	CRANKCASE HEATER	HT32BH246	--	X	HT32BH246	--	X
17	CRANKCASE HEATER SWITCH	X	X	X	X	X	X
18	SOUND SHIELD	X	X	X	X	X	X
19	NI COMPRESSOR OIL	SUN-36S	--	--	--	--	--
ELECTRICAL GROUP							
20	COMPLETE CONTROL PANEL ASSY	38QN400251	--	310591-701	38QN400271	--	--
21	CONTROL BOX ASSEMBLY	38QN400194	--	--	--	--	--
22	CONTROL BOX COVER	38QN400113	--	--	--	--	--
23	MOUNTING PANEL	38QN500124	--	--	--	--	--
24	LOW VOLTAGE CHANNEL	38QN500143	--	--	--	--	--
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) --	(2) --	(2) --	(2) --	(2) --
26	"U" CLIP	(2)AS42ZL010	(2) --	(2) --	(2) --	(2) --	(2) --
27	PARTITION(DEFROST BOARD)	38QN500022	--	--	--	--	--
28	ELECTRIC DEFROST CONTROL BOARD	HK25S2359	--	--	--	--	--
29	CONTACTOR	HN53CD024	--	--	HN52KC051	--	--
30	CAPACITOR(DUAL) #1	HC93CA036	--	HC93DA036	X	X	X
31	SINGLE CAPACITOR #2	HC91CA035	--	HC91DA020	X	X	X
32	START CAPACITOR	HC95DE088	--	HC95DE119	X	X	X
33	START RELAY	HN61HB496	--	--	X	X	X
34	START ASSIST(PTC THERMISTER)	X	X	X	X	X	X
35	FAN RELAY	X	X	X	X	X	X
36	LOCKOUT RELAY	38QH660014	--	X	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	--	--	--	--	--
38	LOW PRESSURE SWITCH	HK02ZB003	--	--	--	--	--
39	FAN CAPACITOR	X	X	X	HC91CA005	--	--
40	NI BODY COUPLING FOR LPS	DE08DA052	--	X	DE08DA052	--	X
FAN AND MOTOR GROUP							
41	PROPELLER FAN	LA01EW027	--	LA01EW033	LA01EW027	--	LA01EW033
42	FAN MOTOR	HC41SL230	--	--	--	--	--
43	RAIN SHIELD	HC99AA500	--	--	--	--	--
44	MOTOR BAND	HC98Z2501	--	HC98Z2511	HC98Z2501	--	HC98Z2511
45	MOTOR MOUNT ASSEMBLY	(3)38QH400964	(3) --	(3)38QH400974	(3)38QH400964	(3) --	(3)38QH400974
46	MOTOR BAND CAPSCREW	AA06BS173	--	AA06BS174	AA06BS173	--	AA06BS174
47	MOTOR BAND NUT	AT31AG171	--	--	--	--	--
48	MOTOR PLUG	X	X	HY06MP105	X	X	HY06MP105

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN060600	38QN060600SM	38QN060610
		460-3-60	460-3-60	460-3-60
CASING GROUP				
1	BASE PAN ASSEMBLY	38QN400374	→	38QH401204
2	TOP ORIFICE ASSEMBLY	38QH401024	→	38QH401034
3	TOP GRILLE ASSEMBLY	38EN400103	→	38QH400193
4	INLET GRILLE ASSEMBLY	310003-401	38QN400604	310004-401
5	WIRE GUIDE	38QN400444	→	→
6	WIRE GUIDE COVER(NORYL)	38QN500934	→	→
7	LOUVERED CASING ASSEMBLY	38QN401341	→	38QH400441
	INCLUDES:			
8	DECORATIVE TAPE	38QN501152	→	→
9	MOUNTING LEG ASSEMBLY	(3)38QB660001	(3) →	(3) →
10	NAMEPLATE ASSEMBLY	310599-704	38QN401873	310599-702
11	MEDALLION	99NB500153	→	→
12	NI PAINT(SILVER GRAY)16 OZ CAN	PH23PE023	→	→
COMPRESSOR GROUP				
13	COMPRESSOR ASSEMBLY(200-3-60)	X	X	X
	COMPRESSOR ASSEMBLY(230-3-60)	X	X	X
	COMPRESSOR ASSEMBLY	PH6066EF	→	50EG662600
14	MOUNTING BOLT	(3)38EN500982	(3) →	(4)AH01AM203
15	MOUNTING GROMMET	(3)KA56TR014	(3) →	(4)KA56CR079
16	CRANKCASE HEATER	HT32BH734	→	X
17	CRANKCASE HEATER SWITCH	X	X	X
18	SOUND SHIELD	X	X	X
19	NI COMPRESSOR OIL	SUN-3GS	→	→
ELECTRICAL GROUP				
20	COMPLETE CONTROL PANEL ASSY	38QN400291	→	→
21	CONTROL BOX ASSEMBLY	38QN400194	→	→
22	CONTROL BOX COVER	38QN400113	→	→
23	MOUNTING PANEL	38QN500124	→	→
24	LOW VOLTAGE CHANNEL	38QN500143	→	→
25	SUPPORT ASSEMBLY(CONTROL BOX)	(2)38ER400003	(2) →	(2) →
26	"U" CLIP	(2)AS42ZL010	(2) →	(2) →
27	PARTITION(DEFROST BOARD)	38QN500022	→	→
28	ELECTRIC DEFROST CONTROL BOARD	HK25SZ359	→	→
29	CONTACTOR	HN52KC051	→	→
30	CAPACITOR(DUAL) #1	X	X	X
31	SINGLE CAPACITOR #2	X	X	X
32	START CAPACITOR	X	X	X
33	START RELAY	X	X	X
34	START ASSIST(PTC THERMISTER)	X	X	X
35	FAN RELAY	HN61KK066	→	→
36	LOCKOUT RELAY	X	X	X
37	DEFROST THERMOSTAT	HH18HA095	→	→
38	LOW PRESSURE SWITCH	HK02ZB003	→	→
39	FAN CAPACITOR	HC91CA005	→	→
40	NI BODY COUPLING FOR LPS	DE08DA052	→	→
FAN AND MOTOR GROUP				
41	PROPELLER FAN	LA01EW027	→	LA01EW033
42	FAN MOTOR	HC44SL461	→	→
43	RAIN SHIELD	HC99AA500	→	→
44	MOTOR BAND	HC98ZZ501	→	→
45	MOTOR MOUNT ASSEMBLY	(3)38QH400964	(3) →	HC98ZZ511
46	MOTOR BAND CAPSCREW	AA06BS173	→	(3)38QH400974
47	MOTOR BAND NUT	AT31AG171	→	AA06BS174
48	MOTOR PLUG	X	X	HY06MP105

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN015300	38QN015310	38QN015310SM	38QN015320
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
COIL AND PIPING GROUP					
49	CONDENSER COIL	38QN400714	→	→	38QH401574
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	→	→	→
51	SUCTION VALVE ASSEMBLY 5/8"	99CC404564	→	→	→
	SUCTION VALVE ASSEMBLY 3/4"	X	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	X	X	X	X
52	SEAL RING 3/8"	99CC501052	→	→	→
	SEAL RING 5/8"	99CC501062	→	→	→
	SEAL RING 3/4"	X	X	X	X
	SEAL RING 7/8"	X	X	X	X
53	LOCKNUT 3/8"	99CC501073	→	→	→
	LOCKNUT 5/8"	99CC501053	→	→	→
	LOCKNUT 3/4"	X	X	X	X
	LOCKNUT 7/8"	X	X	X	X
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	→	→	→
	END CAP(HARDING) 3/8"	99CC410452	→	→	→
	END CAP(PARKER-HANNIFIN) 5/8"	99CC501212	→	→	→
	END CAP(HARDING) 5/8"	99CC410462	→	→	→
	END CAP(PARKER-HANNIFIN) 3/4"	X	X	X	X
	END CAP(HARDING) 3/4"	X	X	X	X
	END CAP(HARDING ONLY) 7/8"	X	X	X	X
55	FLARE SEAL CAP 1/4"	99CC409372	→	→	→
56	RETAINING RING(HARDING) 3/8"	AU47AA051	→	→	→
	RETAINING RING(HARDING) 5/8"	AU47AA090	→	→	→
	RETAINING RING(HARDING) 3/4"	X	X	X	X
	RETAINING RING(HARDING) 7/8"	X	X	X	X
57	VALVE STEM(HARDING) 3/8"	99CC501833	→	→	→
	VALVE STEM(HARDING) 5/8"	99CC501853	→	→	→
	VALVE STEM(HARDING) 3/4"	X	X	X	X
	VALVE STEM(HARDING) 7/8"	X	X	X	X
58	"O" RING(HARDING) 3/8"	99CC509382	→	→	→
	"O" RING(HARDING) 5/8"	99CC509392	→	→	→
	"O" RING(HARDING) 3/4"	X	X	X	X
	"O" RING(HARDING) 7/8"	X	X	X	X
59	REVERSING VALVE	EF17BE140	→	→	→
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZG029	→	→	→
61	MUFFLER	X	X	X	X
62	ACCUMULATOR	KH73EP118	→	→	KH73HL030
63	CAPILLARY ASSEMBLY	38QB400721	→	→	→
64	SUCTION VALVE PLUG	99CC411332	→	→	→
65	CHECK VALVE CORE	(3)EC39DM062	→	→	→
66	STRAINER INSERT	KH11HH060	→	→	→
67	FUSIBLE PLUG	EK02JA203	→	→	→
68	FLARE NUT 3/8"	DD02CA101	→	→	→
69	ACCU-RATER PISTON RETAINER	38C0660031	→	→	→
70	ACCU-RATER PISTON(OUTDOOR)	38C0660035	→	→	→
	ACCU-RATER PISTON(INDOOR)	38C0660046	→	→	→
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	→	→	→
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN018300	38QN018310	38QN018320	38QN018320SM	38QN018330
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
COIL AND PIPING GROUP						
49	CONDENSER COIL	38QN400714	38QN400994	-	-	-
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	-	-	-	-
51	SUCTION VALVE ASSEMBLY 5/8"	X	99CC404564	-	-	-
	SUCTION VALVE ASSEMBLY 3/4"	99CC404574	X	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	X	X	X	X	X
52	SEAL RING 3/8"	99CC501052	-	-	-	-
	SEAL RING 5/8"	X	99CC501062	-	-	-
	SEAL RING 3/4"	99CC501072	X	X	X	X
	SEAL RING 7/8"	X	X	X	X	X
53	LOCKNUT 3/8"	99CC501073	-	-	-	-
	LOCKNUT 5/8"	X	99CC501053	-	-	-
	LOCKNUT 3/4"	99CC501043	X	X	X	X
	LOCKNUT 7/8"	X	X	X	X	X
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	-	-	-	-
	END CAP(HARDING) 3/8"	99CC410452	-	-	-	-
	END CAP(PARKER-HANNIFIN) 5/8"	X	99CC501212	-	-	-
	END CAP(HARDING) 5/8"	X	99CC410462	-	-	-
	END CAP(PARKER-HANNIFIN) 3/4"	99CC501212	X	X	X	X
	END CAP(HARDING) 3/4"	99CC410462	X	X	X	X
	END CAP(HARDING ONLY) 7/8"	X	X	X	X	X
55	FLARE SEAL CAP 1/4"	99CC409372	-	-	-	-
56	RETAINING RING(HARDING) 3/8"	AU47AA051	-	-	-	-
	RETAINING RING(HARDING) 5/8"	X	AU47AA090	-	-	-
	RETAINING RING(HARDING) 3/4"	AU47AA090	X	X	X	X
	RETAINING RING(HARDING) 7/8"	X	X	X	X	X
57	VALVE STEM(HARDING) 3/8"	99CC501833	-	-	-	-
	VALVE STEM(HARDING) 5/8"	X	99CC501853	-	-	-
	VALVE STEM(HARDING) 3/4"	99CC501853	X	X	X	X
	VALVE STEM(HARDING) 7/8"	X	X	X	X	X
58	"O" RING(HARDING) 3/8"	99CC509382	-	-	-	-
	"O" RING(HARDING) 5/8"	X	99CC509392	-	-	-
	"O" RING(HARDING) 3/4"	99CC509392	X	X	X	X
	"O" RING(HARDING) 7/8"	X	X	X	X	X
59	REVERSING VALVE	EF17BE140	-	-	-	-
60	SOLENOID COIL(FOR RVRS VALVE)	EF192G029	-	-	-	-
61	MUFFLER	X	X	X	X	X
62	ACCUMULATOR	KH73ES139	-	KH73EP118	-	KH73HQ030
63	CAPILLARY ASSEMBLY	38QB400721	-	-	-	-
64	SUCTION VALVE PLUG	X	99CC411332	-	-	-
65	CHECK VALVE CORE	(3)EC39DM062	(3)-	(3)-	(3)-	(3)-
66	STRAINER INSERT	KH11HH061	KH11HH060	-	-	-
67	FUSIBLE PLUG	EK02JA203	-	-	-	-
68	FLARE NUT 3/8"	DD02CA101	-	-	-	-
69	ACCU-RATER PISTON RETAINER	38C0660031	-	-	-	-
70	ACCU-RATER PISTON(OUTDOOR)	38C0660046	38C0660035	-	-	38C0660040
	ACCU-RATER PISTON(INDOOR)	38C0660049	-	-	-	-
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	-	-	-	-
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN024300	38QN024300SM	38QN024310	38QN024310SM	38QN024320
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
COIL AND PIPING GROUP						
49	CONDENSER COIL	38QN400724	→	→	→	→
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	→	→	→	→
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	99CC404574	→	→	→	→
	SUCTION VALVE ASSEMBLY 7/8"	X	X	X	X	X
52	SEAL RING 3/8"	99CC501052	→	→	→	→
	SEAL RING 5/8"	X	X	X	X	X
	SEAL RING 3/4"	99CC501072	→	→	→	→
	SEAL RING 7/8"	X	X	X	X	X
53	LOCKNUT 3/8"	99CC501073	→	→	→	→
	LOCKNUT 5/8"	X	X	X	X	X
	LOCKNUT 3/4"	99CC501043	→	→	→	→
	LOCKNUT 7/8"	X	X	X	X	X
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	→	→	→	→
	END CAP(HARDING) 3/8"	99CC410452	→	→	→	→
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	99CC501212	→	→	→	→
	END CAP(HARDING) 3/4"	99CC410462	→	→	→	→
	END CAP(HARDING ONLY) 7/8"	X	X	X	X	X
55	FLARE SEAL CAP 1/4"	99CC409372	→	→	→	→
56	RETAINING RING(HARDING) 3/8"	AU47AA051	→	→	→	→
	RETAINING RING(HARDING) 5/8"	X	X	X	X	X
	RETAINING RING(HARDING) 3/4"	AU47AA090	→	→	→	→
	RETAINING RING(HARDING) 7/8"	X	X	X	X	X
57	VALVE STEM(HARDING) 3/8"	99CC501833	→	→	→	→
	VALVE STEM(HARDING) 5/8"	X	X	X	X	X
	VALVE STEM(HARDING) 3/4"	99CC501853	→	→	→	→
	VALVE STEM(HARDING) 7/8"	X	X	X	X	X
58	"O"RING(HARDING) 3/8"	99CC509382	→	→	→	→
	"O"RING(HARDING) 5/8"	X	X	X	X	X
	"O"RING(HARDING) 3/4"	99CC509392	→	→	→	→
	"O"RING(HARDING) 7/8"	X	X	X	X	X
59	REVERSING VALVE	EF17BE140	→	→	→	EF17BE241
60	SOLENOID COIL(FOR RVRS VALVE)	EF192G029	→	→	→	→
61	MUFFLER	X	X	X	X	LM10HK003
62	ACCUMULATOR	KH73ES139	→	→	→	KH71FT120
63	CAPILLARY ASSEMBLY	38QB400721	→	→	→	→
64	SUCTION VALVE PLUG	99CC411342	→	→	→	→
65	CHECK VALVE CORE	(3)EC39DM062	(3)	→	→	→
66	STRAINER INSERT	KH11HH060	→	→	→	→
67	FUSIBLE PLUG	EK02JA203	→	→	→	→
68	FLARE NUT 3/8"	DD02CA101	→	→	→	→
69	ACCU—RATER PISTON RETAINER	38C0660031	→	→	→	→
70	ACCU—RATER PISTON(OUTDOOR)	38C0660046	→	→	→	→
	ACCU—RATER PISTON(INDOOR)	38C0660061	→	→	→	→
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	→	→	→	→
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X	311745-301
74	HEX NUT WITH WASHER 3/8—16	X	X	X	X	AT31AB241
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X	KA56GR075

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

380N

015-060

ITEM	PART DESCRIPTION	380N030300	380N030300SM	380N030310	380N030310SM	380N030330	380N030330SM
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
COIL AND PIPING GROUP							
49	CONDENSER COIL	380N401004	-	-	-	380N400734	-
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	-	-	-	-	-
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	99CC404574	-	-	-	-	-
	SUCTION VALVE ASSEMBLY 7/8"	X	X	X	X	X	X
52	SEAL RING 3/8"	99CC501052	-	-	-	-	-
	SEAL RING 5/8"	X	X	X	X	X	X
	SEAL RING 3/4"	99CC501072	-	-	-	-	-
	SEAL RING 7/8"	X	X	X	X	X	X
53	LOCKNUT 3/8"	99CC501073	-	-	-	-	-
	LOCKNUT 5/8"	X	X	X	X	X	X
	LOCKNUT 3/4"	99CC501043	-	-	-	-	-
	LOCKNUT 7/8"	X	X	X	X	X	X
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	-	-	-	-	-
	END CAP(HARDING) 3/8"	99CC410452	-	-	-	-	-
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	99CC501212	-	-	-	-	-
	END CAP(HARDING) 3/4"	99CC410462	-	-	-	-	-
	END CAP(HARDING ONLY) 7/8"	X	X	X	X	X	X
55	FLARE SEAL CAP 1/4"	99CC409372	-	-	-	-	-
56	RETAINING RING(HARDING) 3/8"	AU47AA051	-	-	-	-	-
	RETAINING RING(HARDING) 5/8"	X	X	X	X	X	X
	RETAINING RING(HARDING) 3/4"	AU47AA090	-	-	-	-	-
	RETAINING RING(HARDING) 7/8"	X	X	X	X	X	X
57	VALVE STEM(HARDING) 3/8"	99CC501833	-	-	-	-	-
	VALVE STEM(HARDING) 5/8"	X	X	X	X	X	X
	VALVE STEM(HARDING) 3/4"	99CC501853	-	-	-	-	-
	VALVE STEM(HARDING) 7/8"	X	X	X	X	X	X
58	"O" RING(HARDING) 3/8"	99CC509382	-	-	-	-	-
	"O" RING(HARDING) 5/8"	X	X	X	X	X	X
	"O" RING(HARDING) 3/4"	99CC509392	-	-	-	-	-
	"O" RING(HARDING) 7/8"	X	X	X	X	X	X
59	REVERSING VALVE	EF17BE241	-	-	-	-	-
60	SOLENOID COIL(FOR RVRS VALVE)	EF192G029	-	-	-	-	-
61	MUFFLER	X	X	X	X	LM10HK002	-
62	ACCUMULATOR	KH73ES139	-	-	-	KH73HQ010	-
63	CAPILLARY ASSEMBLY	380B400721	-	-	-	-	-
64	SUCTION VALVE PLUG	99CC411342	-	-	-	-	-
65	CHECK VALVE CORE	(3)EC39DM062	(3)	(3)	(3)	(3)	(3)
66	STRAINER INSERT	KH11HH060	-	-	-	KH11HH061	-
67	FUSIBLE PLUG	EK02JA203	-	-	-	-	-
68	FLARE NUT 3/8"	DD02CA101	-	-	-	-	-
69	ACCU-RATER PISTON RETAINER	38C0660031	-	-	-	-	-
70	ACCU-RATER PISTON(OUTDOOR)	38C0660055	-	-	-	-	-
	ACCU-RATER PISTON(INDOOR)	38C0660063	-	-	-	-	-
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X	X	X
72	HALF COUPLING 1/4 OD.1/16 NPTF	DE11DA058	-	-	-	-	-
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN030340	38QN036300	38QN036300SM	38QN036310
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
COIL AND PIPING GROUP					
49	CONDENSER COIL	38QN400724	38QN400734	→	38QH400414
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	→	→	→
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	99CC404574	→	→	→
	SUCTION VALVE ASSEMBLY 7/8"	X	X	X	X
52	SEAL RING 3/8"	99CC501052	→	→	→
	SEAL RING 5/8"	X	X	X	X
	SEAL RING 3/4"	99CC501072	→	→	→
	SEAL RING 7/8"	X	X	X	X
53	LOCKNUT 3/8"	99CC501073	→	→	→
	LOCKNUT 5/8"	X	X	X	X
	LOCKNUT 3/4"	99CC501043	→	→	→
	LOCKNUT 7/8"	X	X	X	X
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	→	→	→
	END CAP(HARDING) 3/8"	99CC410452	→	→	→
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	99CC501212	→	→	→
	END CAP(HARDING) 3/4"	99CC410462	→	→	→
	END CAP(HARDING ONLY) 7/8"	X	X	X	X
55	FLARE SEAL CAP 1/4"	99CC409372	→	→	→
56	RETAINING RING(HARDING) 3/8"	AU47AA051	→	→	→
	RETAINING RING(HARDING) 5/8"	X	X	X	X
	RETAINING RING(HARDING) 3/4"	AU47AA090	→	→	→
	RETAINING RING(HARDING) 7/8"	X	X	X	X
57	VALVE STEM(HARDING) 3/8"	99CC501833	→	→	→
	VALVE STEM(HARDING) 5/8"	X	X	X	X
	VALVE STEM(HARDING) 3/4"	99CC501853	→	→	→
	VALVE STEM(HARDING) 7/8"	X	X	X	X
58	"O"RING(HARDING) 3/8"	99CC509382	→	→	→
	"O"RING(HARDING) 5/8"	X	X	X	X
	"O"RING(HARDING) 3/4"	99CC509392	→	→	→
	"O"RING(HARDING) 7/8"	X	X	X	X
59	REVERSING VALVE	EF17BE241	→	→	→
60	SOLENOID COIL(FOR RVRS VALVE)	EF192G029	→	→	→
61	MUFFLER	LM10KH001	LM10HK002	→	→
62	ACCUMULATOR	KH71FT120	KH73H0010	→	KH73H0030
63	CAPILLARY ASSEMBLY	38QB400721	→	→	→
64	SUCTION VALVE PLUG	99CC411342	→	→	→
65	CHECK VALVE CORE	(3)EC39DM062	(3) →	(3) →	(3) →
66	STRAINER INSERT	KH11HH060	KH11HH061	→	→
67	FUSIBLE PLUG	EK02JA203	→	→	→
68	FLARE NUT 3/8"	DD02CA101	→	→	→
69	ACCU—RATER PISTON RETAINER	38C0660031	→	→	→
70	ACCU—RATER PISTON(OUTDOOR)	38C0660046	38C0660061	→	→
	ACCU—RATER PISTON(INDOOR)	38C0660061	38C0660073	→	→
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X
72	HALF COUPLING 1/4 OD;1/16 NPTF	DE11DA058	→	→	→
73	ACCUMULATOR MOUNTING BRACKET	311745-301	X	X	X
74	HEX NUT WITH WASHER 3/8—16	AT31AB241	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	KA56GR075	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN036500	38QN036500SM	38QN036510	38QN036600	38QN036600SM	38QN036610
		208/230-3-60	208/230-3-60	208/230-3-60	460-3-60	460-3-60	460-3-60
COIL AND PIPING GROUP							
49	CONDENSER COIL	38QN400734	-	38QH400414	38QN400734	-	38QH400414
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	-	-	-	-	-
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	99CC404574	-	-	-	-	-
	SUCTION VALVE ASSEMBLY 7/8"	X	X	X	X	X	X
52	SEAL RING 3/8"	99CC501052	-	-	-	-	-
	SEAL RING 5/8"	X	X	X	X	X	X
	SEAL RING 3/4"	99CC501072	-	-	-	-	-
	SEAL RING 7/8"	X	X	X	X	X	X
53	LOCKNUT 3/8"	99CC501073	-	-	-	-	-
	LOCKNUT 5/8"	X	X	X	X	X	X
	LOCKNUT 3/4"	99CC501043	-	-	-	-	-
	LOCKNUT 7/8"	X	X	X	X	X	X
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	-	-	-	-	-
	END CAP(HARDING) 3/8"	99CC410452	-	-	-	-	-
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	99CC501212	-	-	-	-	-
	END CAP(HARDING) 3/4"	99CC410462	-	-	-	-	-
	END CAP(HARDING ONLY) 7/8"	X	X	X	X	X	X
55	FLARE SEAL CAP 1/4"	99CC409372	-	-	-	-	-
56	RETAINING RING(HARDING) 3/8"	AU47AA051	-	-	-	-	-
	RETAINING RING(HARDING) 5/8"	X	X	X	X	X	X
	RETAINING RING(HARDING) 3/4"	AU47AA090	-	-	-	-	-
	RETAINING RING(HARDING) 7/8"	X	X	X	X	X	X
57	VALVE STEM(HARDING) 3/8"	99CC501833	-	-	-	-	-
	VALVE STEM(HARDING) 5/8"	X	X	X	X	X	X
	VALVE STEM(HARDING) 3/4"	99CC501853	-	-	-	-	-
	VALVE STEM(HARDING) 7/8"	X	X	X	X	X	X
58	"O" RING(HARDING) 3/8"	99CC509382	-	-	-	-	-
	"O" RING(HARDING) 5/8"	X	X	X	X	X	X
	"O" RING(HARDING) 3/4"	99CC509392	-	-	-	-	-
	"O" RING(HARDING) 7/8"	X	X	X	X	X	X
59	REVERSING VALVE	EF17BE241	-	-	-	-	-
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZG029	-	EF19ZE335	-	-	-
61	MUFFLER	LM10HK002	-	-	-	-	-
62	ACCUMULATOR	KH73H0010	-	KH73H0030	-	-	-
63	CAPILLARY ASSEMBLY	38QB400721	-	-	-	-	-
64	SUCTION VALVE PLUG	99CC411342	-	-	-	-	-
65	CHECK VALVE CORE	(3)EC390M062	(3)	(3)	(3)	(3)	(3)
66	STRAINER INSERT	KH11HH061	-	-	-	-	-
67	FUSIBLE PLUG	EK02JA203	-	-	-	-	-
68	FLARE NUT 3/8"	DD02CA101	-	-	-	-	-
69	ACCU-RATER PISTON RETAINER	38C0660031	-	-	-	-	-
70	ACCU-RATER PISTON(OUTDOOR)	38C0660061	-	-	-	-	-
	ACCU-RATER PISTON(INDOOR)	38C0660073	-	-	-	-	-
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X	X	X
72	HALF COUPLING 1/4 OD, 1/16 NPTF	DE11DA058	X	X	X	X	X
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN042300	38QN042300SM	38QN042310	38QN042310SM
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
COIL AND PIPING GROUP					
49	CONDENSER COIL	38QN401014	→	→	→
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	→	→	→
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	X	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	99CC404584	→	→	→
52	SEAL RING 3/8"	99CC501052	→	→	→
	SEAL RING 5/8"	- X	X	X	X
	SEAL RING 3/4"	X	X	X	X
	SEAL RING 7/8"	99CC501072	→	→	→
53	LOCKNUT 3/8"	99CC501073	→	→	→
	LOCKNUT 5/8"	X	X	X	X
	LOCKNUT 3/4"	X	X	X	X
	LOCKNUT 7/8"	99CC501043	→	→	→
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	→	→	→
	END CAP(HARDING) 3/8"	99CC410452	→	→	→
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	X	X	X	X
	END CAP(HARDING) 3/4"	X	X	X	X
	END CAP(HARDING ONLY) 7/8"	99CC410472	→	→	→
55	FLARE SEAL CAP 1/4"	99CC409372	→	→	→
56	RETAINING RING(HARDING) 3/8"	AU47AA051	→	→	→
	RETAINING RING(HARDING) 5/8"	X	X	X	X
	RETAINING RING(HARDING) 3/4"	X	X	X	X
	RETAINING RING(HARDING) 7/8"	AU47AA101	→	→	→
57	VALVE STEM(HARDING) 3/8"	99CC501833	→	→	→
	VALVE STEM(HARDING) 5/8"	X	X	X	X
	VALVE STEM(HARDING) 3/4"	X	X	X	X
	VALVE STEM(HARDING) 7/8"	99CC501843	→	→	→
58	"O" RING(HARDING) 3/8"	99CC509392	→	→	→
	"O" RING(HARDING) 5/8"	X	X	X	X
	"O" RING(HARDING) 3/4"	X	X	X	X
	"O" RING(HARDING) 7/8"	99CC509402	→	→	→
59	REVERSING VALVE	EF17BE273	→	→	→
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZE335	→	→	→
61	MUFFLER	LM10HK002	→	→	→
62	ACCUMULATOR	KH73HQ020	→	→	→
63	CAPILLARY ASSEMBLY	38QB400721	→	→	→
64	SUCTION VALVE PLUG	99CC411342	→	→	→
65	CHECK VALVE CORE	(3)EC39DM062	(3)	(3)	(3)
66	STRAINER INSERT	KH11HH061	→	→	→
67	FUSIBLE PLUG	EK02JA203	→	→	→
68	FLARE NUT 3/8"	DD02CA101	→	→	→
69	ACCU-RATER PISTON RETAINER	38CQ660031	→	→	→
70	ACCU-RATER PISTON(OUTDOOR)	38CQ660067	→	→	→
	ACCU-RATER PISTON(INDOOR)	38CQ660073	→	→	→
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	→	→	→
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-080

ITEM	PART DESCRIPTION	38QN042500	38QN042500SM	38QN042600	38QN042600SM
		208/230-3-60	208/230-3-60	460-3-60	460-3-60
COIL AND PIPING GROUP					
49	CONDENSER COIL	38QN401014	→	→	→
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	→	→	→
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	X	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	99CC404584	→	→	→
52	SEAL RING 3/8"	99CC501052	→	→	→
	SEAL RING 5/8"	X	X	X	X
	SEAL RING 3/4"	X	X	X	X
	SEAL RING 7/8"	99CC501072	→	→	→
53	LOCKNUT 3/8"	99CC501073	→	→	→
	LOCKNUT 5/8"	X	X	X	X
	LOCKNUT 3/4"	X	X	X	X
	LOCKNUT 7/8"	99CC501043	→	→	→
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	→	→	→
	END CAP(HARDING) 3/8"	99CC410452	→	→	→
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	X	X	X	X
	END CAP(HARDING) 3/4"	X	X	X	X
	END CAP(HARDING ONLY) 7/8"	99CC410472	→	→	→
55	FLARE SEAL CAP 1/4"	99CC409372	→	→	→
56	RETAINING RING(HARDING) 3/8"	AU47AA051	→	→	→
	RETAINING RING(HARDING) 5/8"	X	X	X	X
	RETAINING RING(HARDING) 3/4"	X	X	X	X
	RETAINING RING(HARDING) 7/8"	AU47AA101	→	→	→
57	VALVE STEM(HARDING) 3/8"	99CC501833	→	→	→
	VALVE STEM(HARDING) 5/8"	X	X	X	X
	VALVE STEM(HARDING) 3/4"	X	X	X	X
	VALVE STEM(HARDING) 7/8"	99CC501843	→	→	→
58	"O" RING(HARDING) 3/8"	99CC509392	→	→	→
	"O" RING(HARDING) 5/8"	X	X	X	X
	"O" RING(HARDING) 3/4"	X	X	X	X
	"O" RING(HARDING) 7/8"	99CC509402	→	→	→
59	REVERSING VALVE	EF17BE273	→	→	→
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZE335	→	→	→
61	MUFFLER	LM10HK002	→	→	→
62	ACCUMULATOR	KH73HQ020	→	→	→
63	CAPILLARY ASSEMBLY	38QB400721	→	→	→
64	SUCTION VALVE PLUG	99CC411342	→	→	→
65	CHECK VALVE CORE	(3)EC39DM062	→	→	→
66	STRAINER INSERT	KH11HH061	→	→	→
67	FUSIBLE PLUG	EK02JA203	→	→	→
68	FLARE NUT 3/8"	DD02CA101	→	→	→
69	ACCU-RATER PISTON RETAINER	38C0660031	→	→	→
70	ACCU-RATER PISTON(OUTDOOR)	38C0660067	→	→	→
	ACCU-RATER PISTON(INDOOR)	38C0660073	→	→	→
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	→	→	→
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN048300	38QN048300SM	38QN048310	38QN048500	38QN048500SM	38QN048510
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-3-60	208/230-3-60	208/230-3-60
COIL AND PIPING GROUP							
49	CONDENSER COIL	38QN401014	-	38QH401594	38QN401014	-	38QH401594
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	-	-	-	-	-
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	X	X	X	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	99CC404584	-	-	-	-	-
52	SEAL RING 3/8"	99CC501052	-	-	-	-	-
	SEAL RING 5/8"	X	X	X	X	X	X
	SEAL RING 3/4"	X	X	X	X	X	X
	SEAL RING 7/8"	99CC501072	-	-	-	-	-
53	LOCKNUT 3/8"	99CC501073	-	-	-	-	-
	LOCKNUT 5/8"	X	X	X	X	X	X
	LOCKNUT 3/4"	X	X	X	X	X	X
	LOCKNUT 7/8"	99CC501043	-	-	-	-	-
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	-	-	-	-	-
	END CAP(HARDING) 3/8"	99CC410452	-	-	-	-	-
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	X	X	X	X	X	X
	END CAP(HARDING) 3/4"	X	X	X	X	X	X
	END CAP(HARDING ONLY) 7/8"	99CC410472	-	-	-	-	-
55	FLARE SEAL CAP 1/4"	99CC409372	-	-	-	-	-
56	RETAINING RING(HARDING) 3/8"	AU47AA051	-	-	-	-	-
	RETAINING RING(HARDING) 5/8"	X	X	X	X	X	X
	RETAINING RING(HARDING) 3/4"	X	X	X	X	X	X
	RETAINING RING(HARDING) 7/8"	AU47AA101	-	-	-	-	-
57	VALVE STEM(HARDING) 3/8"	99CC501833	-	-	-	-	-
	VALVE STEM(HARDING) 5/8"	X	X	X	X	X	X
	VALVE STEM(HARDING) 3/4"	X	X	X	X	X	X
	VALVE STEM(HARDING) 7/8"	99CC501843	-	-	-	-	-
58	"O" RING(HARDING) 3/8"	99CC509382	-	-	-	-	-
	"O" RING(HARDING) 5/8"	X	X	X	X	X	X
	"O" RING(HARDING) 3/4"	X	X	X	X	X	X
	"O" RING(HARDING) 7/8"	99CC509402	-	-	-	-	-
59	REVERSING VALVE	EF17BE273	-	-	-	-	-
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZE335	-	-	-	-	-
61	MUFFLER	LM10HK002	-	-	-	-	-
62	ACCUMULATOR	KH73HU020	-	KH73HU070	KH73HU020	-	KH73HU070
63	CAPILLARY ASSEMBLY	38QB400721	-	-	-	-	-
64	SUCTION VALVE PLUG	99CC411342	-	-	-	-	-
65	CHECK VALVE CORE	(3)EC39DM062	(3)	-	(3)	-	(3)
66	STRAINER INSERT	KH11HH061	-	-	-	-	-
67	FUSIBLE PLUG	EK02JA203	-	-	-	-	-
68	FLARE NUT 3/8"	DD02CA101	-	-	-	-	-
69	ACCU-RATER PISTON RETAINER	38C0660031	-	-	-	-	-
70	ACCU-RATER PISTON(OUTDOOR)	38C0660067	-	38C0660073	38C0660067	-	38C0660073
	ACCU-RATER PISTON(INDOOR)	38C0660084	-	38C0660082	38C0660084	-	38C0660082
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	-	-	-	-	-
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-000

ITEM	PART DESCRIPTION	38QN048600	38QN048600SM	38QN048610
		460-3-60	460-3-60	460-3-60
COIL AND PIPING GROUP				
49	CONDENSER COIL	38QN401014	→	38QH400414
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	→	→
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	99CC404584	→	→
52	SEAL RING 3/8"	99CC501052	→	→
	SEAL RING 5/8"	X	X	X
	SEAL RING 3/4"	X	X	X
	SEAL RING 7/8"	99CC501072	→	→
53	LOCKNUT 3/8"	99CC501073	→	→
	LOCKNUT 5/8"	X	X	X
	LOCKNUT 3/4"	X	X	X
	LOCKNUT 7/8"	99CC501043	→	→
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	→	→
	END CAP(HARDING) 3/8"	99CC410452	→	→
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X
	END CAP(HARDING) 5/8"	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	X	X	X
	END CAP(HARDING) 3/4"	X	X	X
	END CAP(HARDING ONLY) 7/8"	99CC410472	→	→
55	FLARE SEAL CAP 1/4"	99CC409372	→	→
56	RETAINING RING(HARDING) 3/8"	AU47AA051	→	→
	RETAINING RING(HARDING) 5/8"	X	X	X
	RETAINING RING(HARDING) 3/4"	X	X	X
	RETAINING RING(HARDING) 7/8"	AU47AA101	→	→
57	VALVE STEM(HARDING) 3/8"	99CC501833	→	→
	VALVE STEM(HARDING) 5/8"	X	X	X
	VALVE STEM(HARDING) 3/4"	X	X	X
	VALVE STEM(HARDING) 7/8"	99CC501843	→	→
58	"O" RING(HARDING) 3/8"	99CC509392	→	→
	"O" RING(HARDING) 5/8"	X	X	X
	"O" RING(HARDING) 3/4"	X	X	X
	"O" RING(HARDING) 7/8"	99CC509402	→	→
59	REVERSING VALVE	EF17BE273	→	→
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZE335	→	→
61	MUFFLER	LM10HK002	→	→
62	ACCUMULATOR	KH73HQ020	→	KH73HU070
63	CAPILLARY ASSEMBLY	38QB400721	→	→
64	SUCTION VALVE PLUG	99CC411342	→	→
65	CHECK VALVE CORE	(3)EC39DM062	(3) →	(3) →
66	STRAINER INSERT	KH11HH061	→	→
67	FUSIBLE PLUG	EK02JA203	→	→
68	FLARE NUT 3/8"	DD02CA101	→	→
69	ACCU-RATER PISTON RETAINER	38C0660031	→	→
70	ACCU-RATER PISTON(OUTDOOR)	38C0660067	→	38C0660073
	ACCU-RATER PISTON(INDOOR)	38C0660084	→	38C0660082
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	→	→
73	ACCUMULATOR MOUNTING BRACKET	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN060300	38QN060300SM	38QN060310	38QN060500	38QN060500SM	38QN060510
		208/230-1-60	208/230-1-60	208/230-1-60	208/230-3-60	208/230-3-60	208/230-3-60
COIL AND PIPING GROUP							
49	CONDENSER COIL	38QN400744	-	311299-701	38QN400744	-	311299-701
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	-	-	-	-	-
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	X	X	X	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	99CC404584	-	-	-	-	-
52	SEAL RING 3/8"	99CC501052	-	-	-	-	-
	SEAL RING 5/8"	X	X	X	X	X	X
	SEAL RING 3/4"	X	X	X	X	X	X
	SEAL RING 7/8"	99CC501072	-	-	-	-	-
53	LOCKNUT 3/8"	99CC501073	-	-	-	-	-
	LOCKNUT 5/8"	X	X	X	X	X	X
	LOCKNUT 3/4"	X	X	X	X	X	X
	LOCKNUT 7/8"	99CC501043	-	-	-	-	-
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	-	-	-	-	-
	END CAP(HARDING) 3/8"	99CC410452	-	-	-	-	-
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X	X	X	X
	END CAP(HARDING) 5/8"	X	X	X	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	X	X	X	X	X	X
	END CAP(HARDING) 3/4"	X	X	X	X	X	X
	END CAP(HARDING ONLY) 7/8"	99CC401472	-	-	-	-	-
55	FLARE SEAL CAP 1/4"	99CC409372	-	-	-	-	-
56	RETAINING RING(HARDING) 3/8"	AU47AA051	-	-	-	-	-
	RETAINING RING(HARDING) 5/8"	X	X	X	X	X	X
	RETAINING RING(HARDING) 3/4"	X	X	X	X	X	X
	RETAINING RING(HARDING) 7/8"	AU47AA101	-	-	-	-	-
57	VALVE STEM(HARDING) 3/8"	99CC501833	-	-	-	-	-
	VALVE STEM(HARDING) 5/8"	X	X	X	X	X	X
	VALVE STEM(HARDING) 3/4"	X	X	X	X	X	X
	VALVE STEM(HARDING) 7/8"	99CC501843	-	-	-	-	-
58	"O" RING(HARDING) 3/8"	99CC509392	-	-	-	-	-
	"O" RING(HARDING) 5/8"	X	X	X	X	X	X
	"O" RING(HARDING) 3/4"	X	X	X	X	X	X
	"O" RING(HARDING) 7/8"	99CC509402	-	-	-	-	-
59	REVERSING VALVE	EF17BE275	-	-	-	-	-
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZE335	-	EF19ZG029	EF19ZE335	-	EF19ZG029
61	MUFFLER	LM10HK002	-	-	-	-	-
62	ACCUMULATOR	KH73HU070	-	-	-	-	-
63	CAPILLARY ASSEMBLY	38QB400721	-	-	-	-	-
64	SUCTION VALVE PLUG	99CC411342	-	-	-	-	-
65	CHECK VALVE CORE	(3)EC39DM062	(3)	(3)	(3)	(3)	(3)
66	STRAINER INSERT	KH11HH061	-	KH11HH060	KH11HH061	-	KH11HH060
67	FUSIBLE PLUG	EK02JA203	-	-	-	-	-
68	FLARE NUT 3/8"	DD02CA101	-	-	-	-	-
69	ACCU-RATER PISTON RETAINER	38C0660031	-	-	-	-	-
70	ACCU-RATER PISTON(OUTDOOR)	38C0660080	-	38C0660078	38C0660080	-	38C0660078
	ACCU-RATER PISTON(INDOOR)	38C0660096	-	38C0660093	38C0660096	-	38C0660093
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X	X	X	X
72	HALF COUPLING 1/4 OD: 1/16 NPTF	DE11DA058	-	-	-	-	-
73	ACCUMULATOR MOUNTING BRACKET	X	X	X	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN060600	38QN060600SM	38QN060610
		460-3-60	460-3-60	460-3-60
COIL AND PIPING GROUP				
49	CONDENSER COIL	38QN400744	→	311299-701
50	LIQUID VALVE ASSEMBLY 3/8"	99CC404244	→	→
51	SUCTION VALVE ASSEMBLY 5/8"	X	X	X
	SUCTION VALVE ASSEMBLY 3/4"	X	X	X
	SUCTION VALVE ASSEMBLY 7/8"	99CC404584	→	→
52	SEAL RING 3/8"	99CC501052	→	→
	SEAL RING 5/8"	X	X	X
	SEAL RING 3/4"	X	X	X
	SEAL RING 7/8"	99CC501072	→	→
53	LOCKNUT 3/8"	99CC501073	→	→
	LOCKNUT 5/8"	X	X	X
	LOCKNUT 3/4"	X	X	X
	LOCKNUT 7/8"	99CC501043	→	→
54	END CAP(PARKER-HANNIFIN) 3/8"	99CC501202	→	→
	END CAP(HARDING) 3/8"	99CC410452	→	→
	END CAP(PARKER-HANNIFIN) 5/8"	X	X	X
	END CAP(HARDING) 5/8"	X	X	X
	END CAP(PARKER-HANNIFIN) 3/4"	X	X	X
	END CAP(HARDING) 3/4"	X	X	X
	END CAP(HARDING ONLY) 7/8"	99CC410472	→	→
55	FLARE SEAL CAP 1/4"	99CC409372	→	→
56	RETAINING RING(HARDING) 3/8"	AU47AA051	→	→
	RETAINING RING(HARDING) 5/8"	X	X	X
	RETAINING RING(HARDING) 3/4"	X	X	X
	RETAINING RING(HARDING) 7/8"	AU47AA101	→	→
57	VALVE STEM(HARDING) 3/8"	99CC501833	→	→
	VALVE STEM(HARDING) 5/8"	X	X	X
	VALVE STEM(HARDING) 3/4"	X	X	X
	VALVE STEM(HARDING) 7/8"	99CC501843	→	→
58	"O" RING(HARDING) 3/8"	99CC509392	→	→
	"O" RING(HARDING) 5/8"	X	X	X
	"O" RING(HARDING) 3/4"	X	X	X
	"O" RING(HARDING) 7/8"	99CC509402	→	→
59	REVERSING VALVE	EF17BE275	→	→
60	SOLENOID COIL(FOR RVRS VALVE)	EF19ZE335	→	EF19ZG029
61	MUFFLER	LM10HK002	→	→
62	ACCUMULATOR	KH73HU070	→	→
63	CAPILLARY ASSEMBLY	380B400721	→	→
64	SUCTION VALVE PLUG	99CC411342	→	→
65	CHECK VALVE CORE	EC39DM062	→	→
66	STRAINER INSERT	KH11HH061	→	→
67	FUSIBLE PLUG	EK02JA203	→	KH11HH060
68	FLARE NUT 3/8"	DD02CA101	→	→
69	ACCU-RATER PISTON RETAINER	38C0660031	→	→
70	ACCU-RATER PISTON(OUTDOOR)	38C0660080	→	38C0660078
	ACCU-RATER PISTON(INDOOR)	38C0660096	→	38C0660093
71	NI REDUCING BUSHING FOR KH73HU070	X	X	X
72	HALF COUPLING 1/4 OD:1/16 NPTF	DE11DA058	→	→
73	ACCUMULATOR MOUNTING BRACKET	X	X	X
74	HEX NUT WITH WASHER 3/8-16	X	X	X
75	GROMMET FOR ACCUMULATOR ASSY	X	X	X

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



AIR-COOLED HEAT PUMP

38QN

015-060

ITEM	PART DESCRIPTION	38QN015-060	38QN036-060	38QN042-060
		ALL VOLTAGE	460-3-60 ONLY	ALL VOLTAGE
ACCESSORY GROUP				
104	NI MOTOR MASTER(ALL 208/230 VOLT)	32LT900301	X	X
105	NI MOTOR MASTER(ALL 460 VOLT)	X	32LT900611	X
106	DOMESTIC WATER PRE-HEATER	38HQ900011	->	->
	INCLUDES:			
107	HEAT EXCHANGER	38HQ500574	->	->
108	SOLENOID WATER VALVE	EF23AE123	->	->
109	LOW WATER TEMPERATURE SWITCH	HH18HA100	->	->
110	LOW WATER TEMPERATURE SWITCH	HH18HA142	->	->
111	WATER PUMP	KK02MA037	->	->
112	CONTROL RELAY	HN61KK324	->	->
113	NI FILTER DRIER PACKAGE	38CQ900132	->	->
	INCLUDES:			
114	NI FILTER DRIER	433-103	->	->
115	NI BY-FLOW FILTER DRIER	38RQ90008106	->	->
	INCLUDES:			
116	NI FILTER DRIER	433-053	->	->
117	NI FUEL SAVER OPTOMIZER KIT #1	38CQ900172	->	->
	INCLUDES:			
118	NI OPTOMIZER CONTROL	HH22AG106	->	->
119	NI FUEL SAVER OPTOMIZER KIT #2	38RQ90009106	->	->
	INCLUDES:			
120	NI TRANSFORMER (60VA)	HT01AW232	->	->
121	NI TERMINAL STRIP	38HQ305723-201	->	->
122	NI TERMINAL BOARD	38HQ305734-201	->	->
123	NI EMERGENCY HEAT RELAY	38RQ900012	->	->
	INCLUDES:			
124	NI RELAY	HN61KL704	->	->
125	NI OUTDOOR THERMOSTAT PACKAGE	38QN90002106	->	->
	INCLUDES:			
126	NI THERMOSTAT	HH22QA040	->	->
127	NI THERMOSTAT AND SUB-BASE PKG	99TZ90040106	->	->
	INCLUDES:			
128	NI THERMOSTAT (AUTOMATIC)	HH07AT171	->	->
129	NI SUB-BASE	HH93AZ173	->	->
130	NI ADAPTER PACKAGE	X	X	28AU90006112
	INCLUDES:			
131	NI TUBE ASSEMBLY	X	X	38GC400712
132	NI THERMOSTAT AND SUB-BASE	99TZ90041106	->	->
	INCLUDES:			
133	NI THERMOSTAT (MANUAL)	HH07AT171	->	->
134	NI SUB-BASE	HH93AZ175	->	->
135	NI LIQUID LINE SOLENOID COIL	38QF90001106	->	->
	INCLUDES:			
136	NI SOLENOID COIL	EF23BS121	->	->
137	NI HEAT PUMP RACK (ON 015&018)	38QB90000106	X	X
138	NI HEAT PUMP PACK (ON 024-030)	38QB90001106	X	X
139	NI HEAT PUMP PACK (ON 036-060)	38QF90000106	X	X
140	NI SERVICE SENTRY	38QB90002106	->	->
	INCLUDES:			
141	NI SENSING RELAY	38HQ660014	->	->
142	NI WRAPPER PKG. (ON 015-018)	38QN90005106	->	->
143	NI WRAPPER PKG. (ON 024-030)	38QN90003106	->	->
144	NI WRAPPER PKG. (ON 036-060)	38QN90004106	->	->

NOTE: See "Catalog Notes" on last page for explanation of symbolism.



ORDERING INSTRUCTIONS

1. All orders should include the complete model and serial number of the unit on which the parts are to be used, and the part number and description of each part.
2. Dealers should forward orders to their Carrier distributor.

GENERAL NOTES

1. This catalog contains those items most commonly required for replacement purposes. If parts other than those cataloged are required, please provide the model number and serial number of the unit on which the parts are to be used and a complete description including references to items which are cataloged.
2. Casing parts and panels are not normally stocked, but are available upon request while in production. Requests for casing parts and panels for units no longer in production must be cleared for availability prior to submitting an order.
3. Complete "Accessory Packages" of "F.I.O.P.'s" (Factory-Installed Option Plan) are not normally stocked or supplied by the Replacement Components Division. (Refer to Master Price Pages and order from your normal source for finished goods.)
Accessory packages and F.I.O.P.'s are listed in this catalog only for reference and to assist in the selection and ordering of replacement components.
4. The replacement parts listed in this catalog are "Carrier Specified Parts" and, as a result of "standardization," may not be identical to the original part furnished on the equipment.

CATALOG NOTES

1. The part number in the model column indicates the part number required for that model, size and/or voltage.
2. An arrow → in the model column indicates that the model, size, and/or voltage uses the same part number as the part number shown to the left.
3. An X in the model column indicates that the part is not used on that model, size and/or voltage.
4. A number in parenthesis before the part number indicates the quantity required for that model, size, and/or voltage. Part number only in the column indicates a quantity of one.
5. The notation "NI" following the item number indicates that the item is not illustrated in the catalog.



Direct-Expansion Fan Coil Units

Installation, Start-Up and Service Instructions

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SAFETY CONSIDERATIONS

Installation and servicing of air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service air conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available for all brazing operations.

▲ WARNING

Before performing service or maintenance operations on system, turn off main power switches in indoor unit and outdoor unit. Turn off accessory heater power switch if applicable. Electrical shock could cause personal injury.

IMPORTANT: This unit may include a factory-installed fan coil drip eliminator. The eliminator has been installed especially for high-humidity application, for vertical installation only.

▲ CAUTION

Do not install eliminator-equipped fan coils in horizontal applications.

DESCRIPTION AND USAGE

Use standard Models 40AQ in cooling-only, electric heat and heat pump systems. Units consist of a coil (with a vertical condensate pan), a horizontal drain pan, cooling controls or electric heaters, 3-speed direct-drive fan motor assembly and filter section with cleanable filter — all within an insulated cabinet. Units may be mounted in vertical upflow, downflow or horizontal airflow arrangements and are suitable for "attic type" installations.

Models 40AQ — BB (bare box) are identical to standard units except that electric heaters, horizontal drain pan and cooling controls are offered as accessories only. Units may be mounted in vertical upflow or downflow arrangements.

Models 40AQ — BU (bare universal) contain a standard horizontal drain pan and can be mounted in vertical upflow, downflow and horizontal arrangements. Electric heaters and cooling controls are offered as accessories.

Models 40AQ080 and 40AQ120 Fan Units consist of a multi-speed direct-drive blower and permanent, washable air filter in an insulated casing with access panels. The 40ET900024 evaporator coil is available as an accessory for 40AQ080; the 40ET900036 evaporator coil is available as an accessory for 40AQ120.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

Table 1 — Physical Data and Dimensions
(See Fig. 1)

MODEL 40AQ		018	024,080	030	036,120
OPERATING WT*					
	(lb)	69	83.74	100	114.105
	(Kg)	31.4	37.6, 33.6	45.5	51.7, 47.6
FAN		950/850/750			
Rpm (3-Speed)		Upflow/Horizontal/Downflow			
Air Discharge					
Nominal					
	(Cfm)	675	900	1050	1150
	(L/s)	319	425	495	543
PSC Motor					
	(Hp)	1/8	1/4	1/3	1/3
	(kW)	.09	.18	.24	.24
DIMENSIONS					
Length	A	(ft.-in.) 1-0 3/16	1-2 3/8	1-5 1/4	1-9
		(mm)	310	365	438
Width	B	(ft.-in.) 1-9 1/2	546		
		(mm)	546		
Height	C	(ft.-in.) 2-9 1/4	3-2 3/8	3-4 1/16	3-6
		(mm)	845	975	1034
DUCT INLET					
	D	(ft.-in.) 0-9 7/8	1-0 1/8	1-2 1/16	1-6 3/8
		(mm)	251	308	373
	E	(ft.-in.) 1-6 3/4	476		
		(mm)	476		
DUCT OUTLET					
	F	(ft.-in.) 0-9 9/16	1-0 1/16	1-2 1/16	1-6 3/8
		(mm)	299	306	379
	G	(in.) 9 1/16	246		
		(mm)	246		
CONNECTIONS					
Suction, ODF†	H	(in.) 3/8	15.87	3/4	19.05
		(mm)			
Liquid, ODF†	J	(in.) 3/8	9.52		
		(mm)	9.52		
Condensate, FPT		(in.) 3/4	3/4		
			3/4		

PSC — Permanent Split Capacitor

*Weights indicated are for standard units. Bare box 40AQ weights are 59, 78, 96 and 110 lb (26.8, 35.4, 43.5, 49.9 kg) respectively.

†Suction line connection is Compatible Fitting, liquid line connection is 3/8-in. SAE flare fitting.

Horizontal condensate pan, downflow kit and base, and accessory return air plenum are also available as accessories.

All 40AQ units may be used with ductwork; or for free-blow applications when not equipped with electric heaters. Use accessory downflow kit for all downflow applications. Install units in conditioned or unconditioned spaces. All units are tested for installation in unconditioned spaces per ARI standards (80 F [26.7 C] db, 75 F [23.9 C] wb indoor temperature; 80 F [26.7 C] db outdoor temperature).

IMPORTANT: When any fan coil is installed over a finished ceiling and or living area, a secondary condensate pan should be installed under the entire unit (see Step 6).

Insulate supply and return air ductwork in unconditioned spaces. Cover insulation with a vapor barrier.

Filter Section comes mounted on return air end of fan coil. Filter section includes a reversible filter rack with 5/8-in. (16-mm) duct connection flange on one side. The filter section is attached to unit either with flanges exposed or turned over so flanges are inside unit. The permanent one-in. (25-mm) filter media pulls out for easy removal and cleaning.

Electric Heater — See Table 4 and 5 for fan coil/electric heater combinations. Electric heaters have both heating and cooling controls that include a control circuit transformer, indoor fan relay and low-voltage connection.

Cooling Control Kit is a field-installed option required on 40AQ, BB or BU units without electric heater. The kit contains a 60-v transformer, indoor fan relay and low-voltage connections. Cooling control kit is not required when electric heater is used. Heaters are equipped with cooling and heating controls.

AccuRater™ System Refrigerant Control (bypass type) is factory installed on 40AQ units. See Table 7 for factory-supplied pistons. Certain combinations of heat pump or condensing unit and fan coil require field replacement of the piston for optimum efficiency. See outdoor unit instructions for required piston.

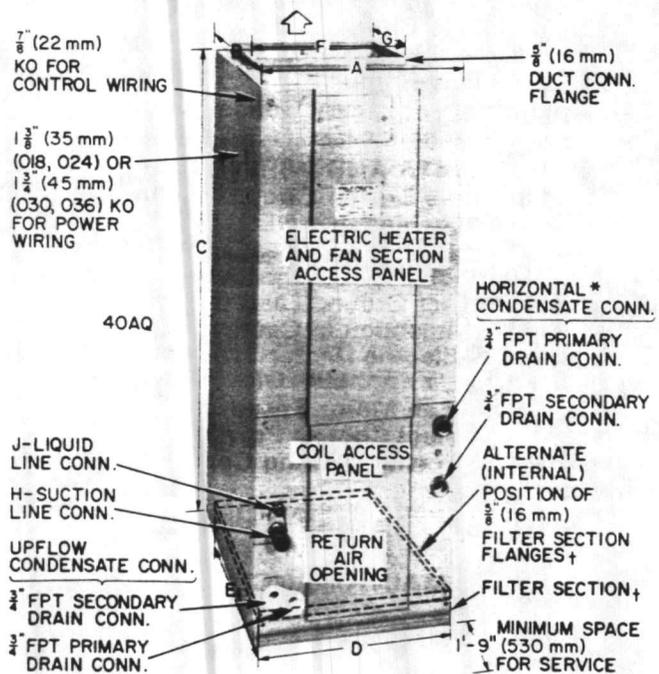
Bypass Type AccuRater Components are shown in Fig. 16. The AccuRater piston has a refrigerant metering hole through it and is field replaceable.

INSTALLATION

Step 1 — Inspect Equipment — File claim with shipping company if shipment is damaged or incomplete.
NOTES:

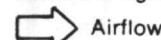
1. A drain pan extender is taped under the coil unit (exc. on 018 size). For vertical upflow or downflow applications, remove and discard pan. For horizontal application, drain pan extender must be repositioned (024, 030, 036 sizes only) as described in Step 2, horizontal airflow position. See Fig. 4.
2. An absorbent pad (Fig. 2) is factory installed over end of suction tube manifold. Pad eliminates condensate drip from end of suction manifold when unit is in horizontal position. Leave pad in position, *do not remove*.

Step 2 — Mount Fan Coil — Unit can stand or lie on floor, or hang from ceiling or wall. Allow space for wiring, piping and servicing unit, Fig. 1.



*Install accessory condensate pan on 40AQ bare box units to provide horizontal condensate drains.

†Filter section may be turned over to provide external duct connection flange.



Certified dimension drawings available on request.

Fig. 1 — Dimensions and Connections
(See Table 1)

Before mounting, adjust filter section as required. Filter section can be mounted with its 5/8-in. (16-mm) return air duct connection flange inside or outside of unit casing. When flanges are required, remove filter section from unit, turn it over so flanges are exposed, and reinstall on unit. Remove filter media and turn it over so cross-sectional binding faces upward toward coil.

FLOOR MOUNTING IN VERTICAL UPFLOW AIR-FLOW POSITION with filter section flange outside unit casing — Size floor opening large enough to accept duct connection flange on filter section. Make duct flush with floor. Set unit on floor over opening with filter section flange inserted through floor into duct. Use fireproof of resilient gasket, 1/8-in. (3-mm) to 1/4-in. (6-mm) thick between duct, unit and floor.

ACCESSORY RETURN AIR PLENUM is available in 3 sizes for use in upflow installations where return air inlet is required. See Table 2.

Set 40AQ heating and/or cooling assembly in place on top of plenum. Cut opening in either side or back of plenum and make return air ductwork connection. Return air plenums and typical installations are shown in Fig. 3.

Table 2 — Accessory Return Air Plenums

MODEL 40AQ	ACCESSORY PART NO.	PLENUM WIDTH	
		ft-in.	mm
024, 080	40AQ900111	1-2 $\frac{3}{8}$	365
030	40AQ900121	1-5 $\frac{1}{4}$	438
036, 120	40FS900141	1-9	533

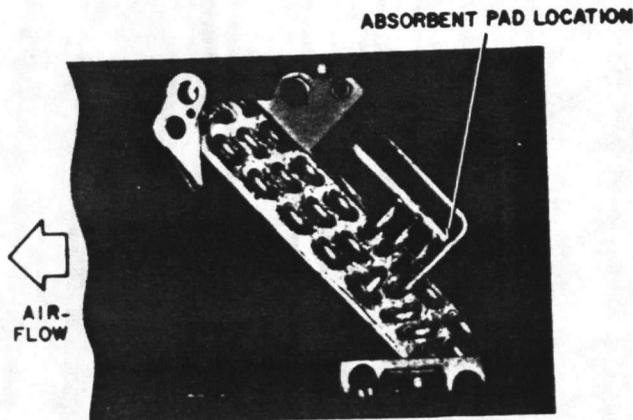


Fig. 2 — Coil Positioned for Left-Hand Discharge

FLOOR, WALL OR CEILING MOUNTING IN HORIZONTAL AIRFLOW POSITION — Place unit on its right side by turning it clockwise 90°. (Do not install unit on its back.) This provides horizontal airflow to the right. For horizontal airflow to the left or vertical downflow applications, reposition the coil as follows:

1. Lay unit on its back and remove front access panels.
2. Remove screws holding coil with condensate pans in cabinet.
3. Rotate coil and condensate pans from cabinet and rotate 180°.
4. Leaving both condensate pans in place, reinstall coil in cabinet as shown in Fig. 2. Ensure the coil positioning tabs enter slots provided in rear of cabinet.
5. For horizontal application, install drain pan extender. See Fig. 4.

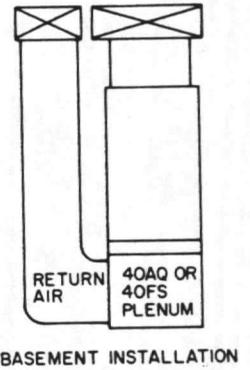
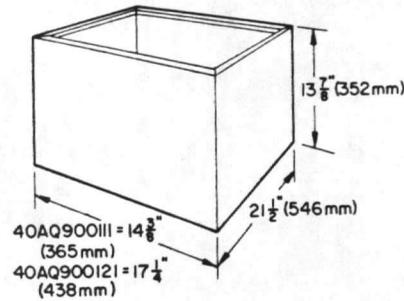
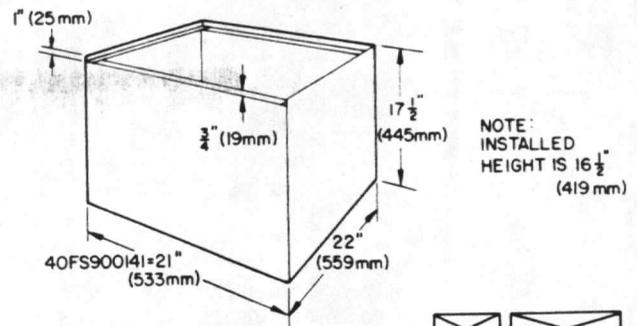


Fig. 3 — Accessory Return Air Plenum

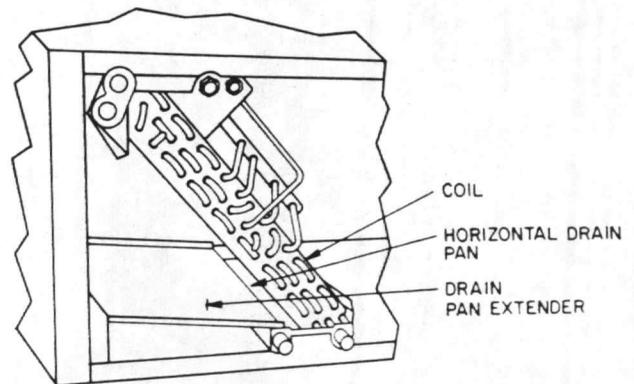


Fig. 4 — Installing Drain Pan Extender, Horizontal Position (024, 030, 036 sizes only)

6. Blower motor must be positioned so that oil ports are a minimum of 45° above horizontal center line of motor.
7. On vertical downflow applications, refer to downflow kit installation instructions.
8. Replace access panels.

Place unit on its left side by turning it counter-clockwise 90°.

WHEN SUSPENDING UNIT FROM THE CEILING OR WALL, provide an adequate level support that extends the full length of unit. Provide means to isolate unit vibration from structure as required.

CAUTION

Install accessory condensate pan in all 40AQ bare box units in horizontal applications. Install secondary condensate pan under units in horizontal applications over finished ceiling.

A drain pan extender is taped beneath coil (exc. on 018 size). Remove pan and reposition as shown in Fig. 4. Drain pan extender is *not* provided with 018 coil size. For 024,030,036 sizes only in horizontal position, insert 3/8-in. flange into standard horizontal drain pan being careful to avoid damaging coil fins. Check to ensure pan is installed straight and in proper position.

MOUNTING IN DOWNFLOW POSITION — An accessory downflow kit, Part No. 40AQ900181, is required for downflow applications. Complete installation instructions are included with the downflow kit.

To install for downflow operation (see Fig. 5) — Follow steps under Floor, Wall or Ceiling Mounting in Horizontal Airflow Position (page 3) except no. 5.

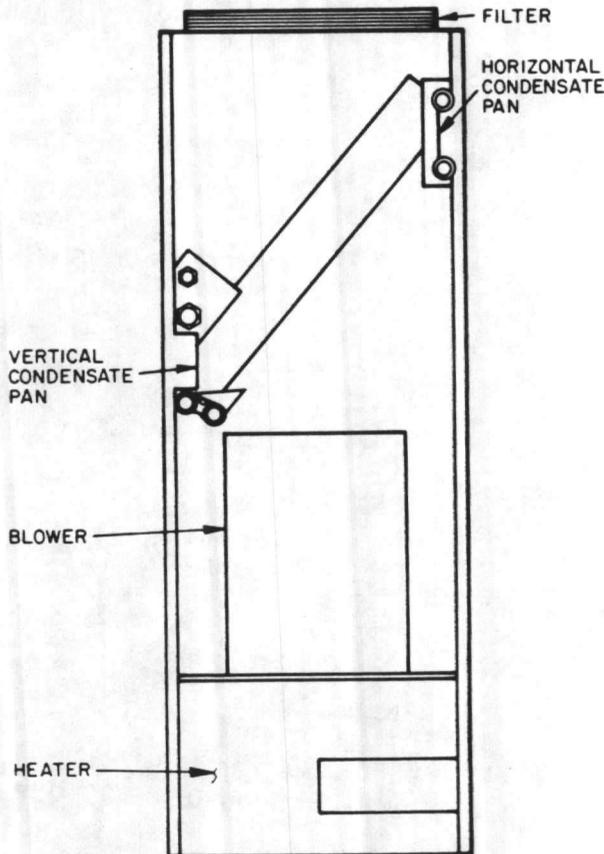


Fig. 5 — Downflow Arrangement

DUCTWORK — When using 40AQ units with electric heaters, maintain a one-in. (25-mm) minimum clearance between discharge plenum and ductwork to combustible materials for a distance of 36 in. (900 mm) from unit. (0-in. [0-mm] clearance to heater cabinet is permissible.) Use an accessory downflow base to maintain clearance on downflow installations. Downflow base part numbers are: 40AQ900221 for 018; 40AQ900231 for 024, 080; 40AQ900241 for 030; 40AQ900251 for 036, 120. Installation instructions are included with downflow base.

Step 3 — Connect Ductwork to Unit Supply and Return Air Openings — Duct connection flanges are provided on unit air discharge connection and filter section, Fig. 1. When filter section is installed on fan coil with duct connection flange inside unit casing, field fabricate return air duct connection. For upflow return air connection through the floor, see Floor Mounting, page 3.

CAUTION

Do not screw ductwork directly to filter section. Screws prevent removal of filter.

DUCTWORK SPECIFICATIONS — When fan is equipped with electric heater, install air ducts in accordance with standards of the National Fire Protection Association, NFPA, numbers 90A and 90B and in compliance with paragraph 46.1-E of UL Standard 1096. If necessary, refer to Carrier System Design Manual, Part 2, for system air duct design. Use flexible connectors between ductwork and unit to prevent transmission of vibration. (See Ductwork Acoustical Treatment.) When electric heater is installed, use heat resistant material for flexible connector between ductwork and unit air discharge connection. Ductwork passing through unconditioned space must be insulated and covered with vapor barrier. External ductwork must be insulated and weatherproofed.

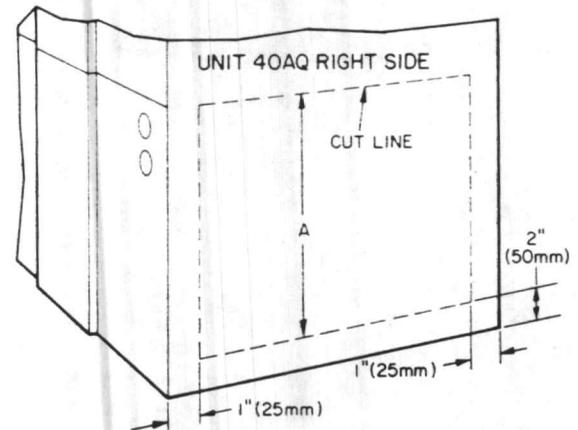
DUCTWORK ACOUSTICAL TREATMENT — On metal duct systems that do not have one 90° elbow and 10 ft (3 m) of main duct to first branch takeoff, install internal acoustical insulation lining per the following procedure:

Line the inside of plenum, branch runs and main duct with acoustical insulation in accordance with the latest edition of SMACNA (Sheet Metal and Air Conditioning Contractors National Association) application standard for duct liner. Duct liners should be UL classified batts and blankets with a fire hazard classification working of FHC-25/50 or less. Ensure main duct lining is extended 6 to 8 ft (1.8 to 2.3 m) down the duct from plenum.

As an alternative to above, fibrous glass ductwork may be used if constructed and installed in accordance with the latest SMACNA construction standard on fibrous glass duct.

Both acoustical lining and fibrous ductwork shall comply with National Fire Protection Association as tested by UL Standard 181 for Class I air ducts.

RIGHT-SIDE RETURN (Fig. 6) — A return-air connection may be made directly into the right side (only) on 40AQ units. It is recommended that when this right side connection is made, the standard return air opening



MODEL 40AQ	DIMENSION A	
	in.	mm
018	8½	216
024, 080	10⅞	265
030	13⅞	335
036, 120	18⅞	472

Fig. 6 — Right-Side Return Air Connection Details

is blanked-off with sheet metal even when not required by local code.

To make right-side return air opening:

1. Remove horizontal condensate pan where supplied.
2. Cut opening as indicated in Fig. 6.
3. Blank-off standard return air opening in bottom of unit (as required).
4. Install return air filter section on right-side return air opening. Use field-supplied sheet metal screws as required.
5. Reinstall horizontal condensate pan as applicable.

Step 4 — Connect Refrigerant Liquid and Suction Lines to refrigerant line connections. See Fig. 1 and Table 1 for line connection sizes, type and location. Use accessory tubing package or field-supplied tubing of refrigerant grade. Insulate entire suction line if field-supplied tubing is needed. Tubing package has an insulated suction line. Do not use damaged, dirty or contaminated tubing because it may plug up the AccuRater™ refrigerant flow control. When tubing package is used and mechanical connections are made within 60 seconds, coil and tubing system do not require purging or evacuation. Always evacuate or purge if field-supplied tubing is used, when sweat connections are made or when tubing must be flared.

Units have Comptible Fitting suction line connection and a 3/8-in. (9.52-mm) SAE flare fitting liquid line connection. Make suction line connection first. Comptible Fitting(s) permits mechanical later in this section. When making liquid line connection, slide flare nut on liquid line connection, slide flare nut on liquid line, then flare and connect liquid line. It is not necessary to flare liquid line if an accessory flare-to-Comptible Fitting coupler (Part No. 38CQ900061) is used.

MECHANICAL CONNECTION (Mate one set of connections at a time.)

1. Loosen locknut on Comptible Fitting one turn. Do not remove. See Fig. 7.

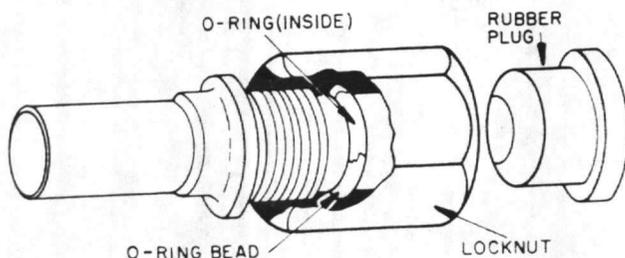


Fig. 7 — Comptible Fitting

2. Remove plug and be sure O-ring is in the groove inside the Comptible Fitting.
3. Cut tubing to correct length.
4. Insert tube into Comptible Fitting until it bottoms.
5. Tighten nut until it bottoms on back coupler flange. Keep tube bottomed in Comptible Fitting while tightening nut.

SWEAT CONNECTION (Use refrigerant grade tubing.)

1. Remove locknut, and rubber O-ring from inside of Comptible Fitting. Refer to Fig. 7.
2. Cut tubing to correct length.
3. Insert tube into Comptible Fitting until it bottoms.

4. Solder with low-temperature 430 F (221 C) silver alloy solder.

NOTE: Wrap a wet cloth around rear of fitting to prevent damaging factory-made joints.

5. Evacuate or purge coil and tubing system with field-supplied refrigerant.

Step 5 — Make Primary Condensate Drain Line Connection to connection provided on unit (see Fig. 1). Install a trap in condensate line as close to unit as possible. Trap must be at least 3 in. (76 mm) deep and not higher than the bottom of unit condensate drain opening (see Fig. 8). Pitch condensate line to open drain or sump. Minimum recommended drain line size is 7/8-in. (22.22-mm) OD copper tubing or 3/4-in. (26.70-mm) OD galvanized pipe. Insulate condensate drain line(s) located above a living area.

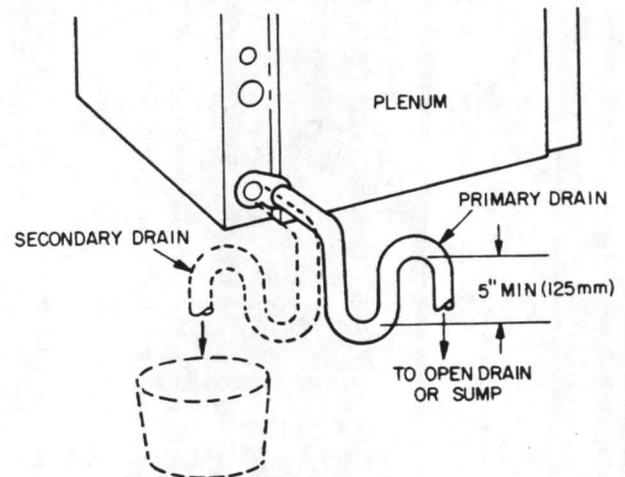


Fig. 8 — Condensate Trap

Step 6 — Make Secondary Condensate Drain Line Connection if required. A connection is provided on unit. Use secondary drain if fan coil is installed above occupied or usable space. If this drain is used, it must be trapped similar to the primary drain. (Plug secondary drain connection if not used.) Connect piping to secondary drain so that any discharge is visible to owner as applicable to FHA or local code requirements. When fan coil is installed over a finished ceiling and/or living area, fabricate and install a secondary condensate pan under entire unit. Pipe secondary drain to discharge into the pan. Pipe drain line from pan so any discharge is visible to owner.

ELECTRICAL DATA AND WIRING

Field wiring must comply with local and national fire, safety and electrical codes. Voltage to unit must be within $\pm 10\%$ of voltage as indicated on nameplate. These are the permissible limits of the voltage range at which the unit will operate satisfactorily. Contact local power company for correction of improper line voltage.

NOTE: Operation of unit on improper line voltage constitutes abuse and could affect warranty.

See Tables 3 and 5 for recommended wire and fuse sizes.

Step 7 — Install a Branch Circuit Disconnect Switch(es) per NEC of adequate size to handle unit

current. Locate disconnect switch(es) within sight from and readily accessible from unit per section 440-14 of National Electrical Code (NEC).

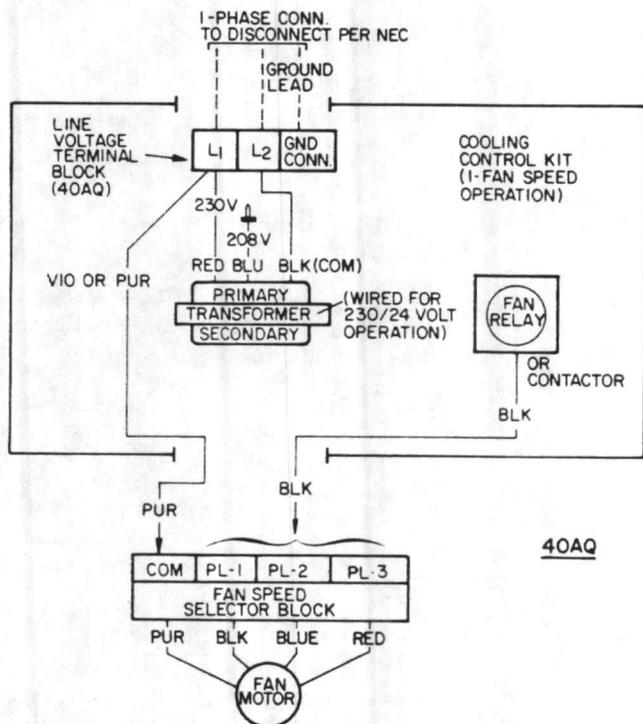
All units with cooling control kit or electric heater are factory wired to have a single line power circuit and require one disconnect switch. If one line power circuit using one disconnect switch is required, attach an accessory line power connection conversion lug set (Part No. 40FS900271) to fuse terminals in electric heater. See Fig. 12.

Units with 11- to 20-kW heater may be wired for operation with 2 line power circuit by removing orange jumpers from heater line power connection terminals (see Fig. 11). Dual-circuited units require 2 disconnect switches.

Step 8 — Bring Line Power Leads into Unit — Extend leads from disconnect per NEC through hole provided (Fig. 1) to cooling control kit or electric heater line power connections. Be sure power is off before making connections.

Step 9 — Connect Ground Lead to the Ground Connection in Cooling Control Kit or Electric Heater for safety. Connect power wiring, Fig. 9 and 11. Splice power leads to pigtails or connect leads to fuse terminals or terminal board. Use wire nuts for splice connections. Tape each connection.

Cooling control kit and electric heater are factory wired for 230/24-volt transformer operation. For 208/24-volt operation, interchange blue (208-v) and red (230-v) transformer leads at the primary connection. Cap unused transformer lead with wire nuts.



NOTE: Tape unused leads.

--- Field Wiring
 ——— Factory Wiring

SELECTOR BLOCK TERMINATIONS	
COM — Common	PL-3 — Low
PL-1 — High	—
PL-2 — Medium	—

Fig. 9 — Cooling Unit Line Power Connections

THREE-SPEED FAN MOTOR on all units may be field connected for high, medium or low fan speeds. Fan coil units with cooling control kit come factory connected for high-speed fan operation. Units with electric heater come factory connected for 2-speed fan operation — unit fan operates at high speed when outdoor unit operates (on cooling or heating cycle), medium speed when electric heater is on and outdoor unit is off. Refer to Table 6 for minimum allowable fan speeds when electric heater is used and set fan motor speeds as required.

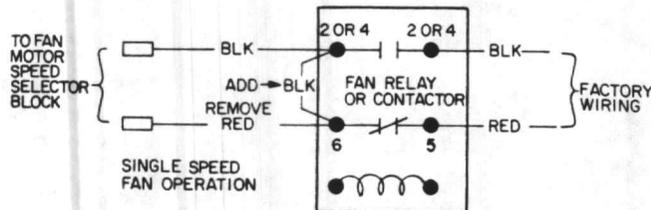


Fig. 10 — Single-Speed Fan Operation

Step 10 — Set Fan Motor Speed — High, medium or low fan speed leads are provided on motor for choice of fan speeds. Motor leads are factory connected to Molex fan speed selector block located on fan housing, Fig. 12. Selector block terminal 1 is high fan speed, terminal 2 is medium fan speed and terminal 3 is low fan speed.

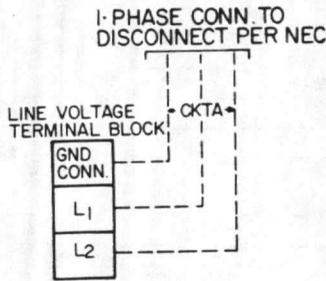
Line power leads supplied with cooling control kit or electric heater are factory connected to selector block for one or 2 fan speeds as described in Step 9. Change speed by changing position of black and/or red power leads on selector block. See Fig. 9 and 11.

One fan speed may be selected on units with cooling control kit; 2 fan speeds on units with electric heater. For single-speed operation on electric heater units: remove red lead from heater fan relay (or contactor) terminal 6; connect a jumper between fan relay terminal 2 (or 4) and 6; connect black heater lead from fan relay terminal 2 (or 4) to fan speed selector block for speed required (see Fig. 10).

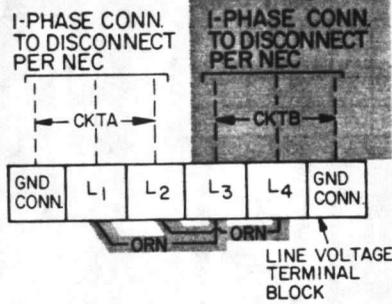
Step 11 — Connect Control Power Wiring (24-Volt) with Cooling Control Kit or Electronic Heater — For system 24-v supply, use 60-va transformer from cooling control kit or use electric heater controls. A one-transformer control wiring hookup is recommended for ease of installation. When an outdoor unit transformer is used together with control kit (or heater) transformer, a phasing problem may result. If both transformers are used, also use a thermostat with isolating contacts to prevent interconnection of Class 2 (24-volt) outputs.

COOLING WIRING CONNECTIONS — Install rubber grommet (supplied) in hole provided in unit for low-voltage wires, Fig. 1. Extend control wire leads through grommet and route to cooling control kit or to heater low-voltage connections. Connect leads to terminal board (see Fig. 13).

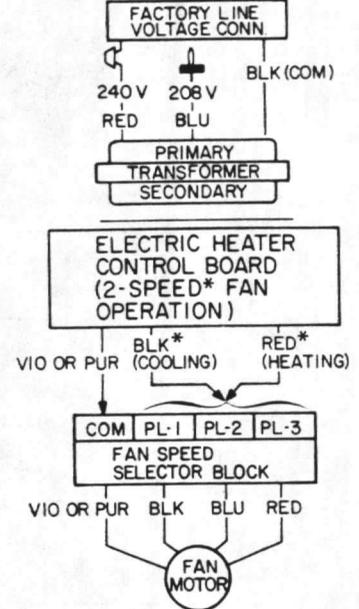
3 KW TO 10 KW HEATERS



11 KW TO 20 KW HEATERS



TRANSFORMER CONN. FOR
208 V/24 V OR 240 V/24 V;
FACTORY CONN. FOR 240 V/24 V



SELECTOR BLOCK TERMINATIONS	
COM — Common	PL-3 — Low
PL-1 — High	—
PL-2 — Medium	—

When 2 line power circuits are required, remove orange jumpers and connect a second disconnect per NEC to L3, L4 and ground connection. See Table 4.

*For 1-speed fan operation, see text for power wiring.

NOTE: Tape unused leads.

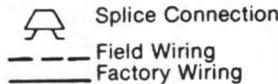


Fig. 11 — Heating and Cooling Unit Line Power Connections

**Table 3 — Fan Coil Electrical Data
(Units Equipped with Cooling Control Kit)**

MODEL 40AQ	VOLTS (1-Ph)	FLA	BRANCH CIRCUIT			Fuse Amps
			Min Wire Size* (AWG)	Max Wire Length		
				ft	m	
018	208/240	1.5	14	200	60.9	15
024, 080		2.9		200	60.9	
030		3.6		100	30.5	
036, 120		3.6		100	30.5	

FLA — Full Load Amps

*Copper wire sizes based on 60 C.

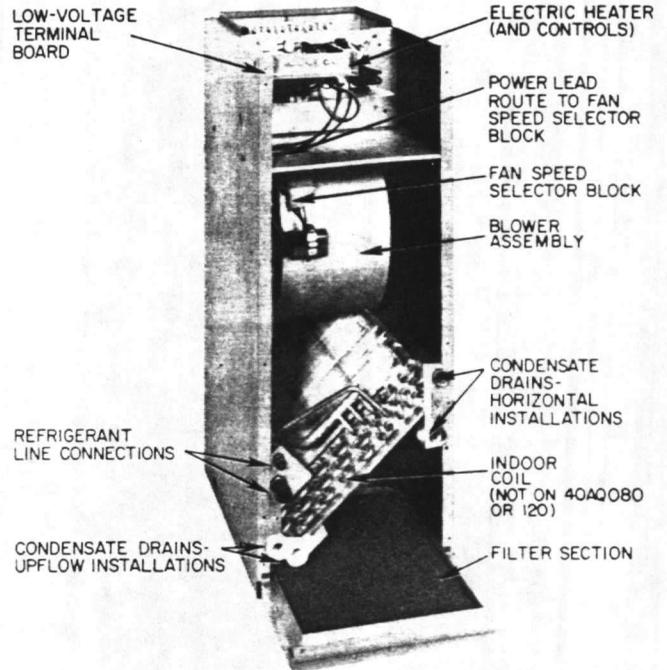
NOTES:

1. Fan motor line power supplied from electric heat line power circuit.
2. All models above equipped with cooling control kit. See Table 4 for units equipped with electric heater.

**Table 4 — Electrical Data, Bare Box Fan Coil
and Fan Units**

MODEL	AVAILABLE HEATERS (kW at 240 v)
40AQ018300 BB/BU	3, 5, 7.5, 10
40AQ024300 BB/BU, 40AQ080	5, 7.5, 10, 12, 15
40AQ030300 BB/BU	7.5, 10, 12, 15, 20
40AQ036300 BB/BU, 40AQ120	7.5, 10, 12, 15, 20

NOTE: Bare box units with field-installed heaters as shown are equivalent to 40AQ fan-coil units having factory-installed heaters of comparable kW. Install heaters in accordance with instructions shipped with heaters.



**Fig. 12 — Component Location
(Fully-Equipped Unit Shown)**

Table 5 — Electrical Data, Fan Coil with Electric Heater (208/240 V — 1 Ph)

MODEL††	kW		BRANCH CIRCUIT													
			No. Ckts	Amps		Min Wire Size (AWG)*		Max Wire Length				Min Gnd Wire Size		Fuse Amps		
	240 V	208 V		240 V	208 V	240 V	208 V	240 V		208 V		240 V	208 V	240 V	208 V	
40AQ018310BG	3.0	2.25	1	A	13.5	12.3	12	12	45	13.7	45	13.7	12	12	20	20
40AQ018330CD	5.0	3.75	1	A	21.5	18.7	10	10	45	13.7	45	13.7	10	10	30	25
40AQ018331DF	7.5	5.60	1	A	31.5	27.5	8	8	50	15.2	50	15.2	10	10	40	35
40AQ018331EH	10.0	7.50	1	A	41.5	36.2	6	6	60	18.3	60	18.3	10	10	60	50
40AQ024331CD	5.0	3.75	1	A	23.0	20.2	10	10	40	12.2	40	12.2	10	10	30	30
40AQ024331DF	7.5	5.60	1	A	33.0	29.0	6	8	70	21.3	45	13.7	10	10	45	40
40AQ024330EH 40AQ024330EH†	10.0	7.50	1	A	43.0	37.7	6	6	55	16.7	55	16.7	10	10	60	50
40AQ024331FE††** 40AQ024340FE**	12.0	9.00	1	A	51.0	44.5	4	4	70	21.3	70	21.3	8	10	70	60
			2	A	20.0	17.3	10	10	50	15.2	50	15.2	10	10	25	25
				B	28.0	26.0	10	10	35	10.6	35	10.6	10	10	35	35
40AQ024330GM††** 40AQ024340GM††**	15.0	11.25	1	A	63.0	55.0	2	4	95	29.0	60	18.3	8	8	80	70
			2	A	20.0	17.3	10	10	50	15.2	50	15.2	10	10	25	25
				B	43.6	38.6	6	6	55	16.7	55	16.7	10	10	60	50
40AQ030330DF	7.5	5.60	1	A	33.6	29.6	6	8	70	21.3	45	13.7	10	10	45	40
40AQ030330EH 40AQ030340EH†	10.0	7.50	1	A	43.6	38.3	6	6	55	16.7	55	16.7	10	10	60	50
40AQ030330FE††** 40AQ030340FE††**	12.0	9.00	1	A	51.6	45.1	4	4	70	21.3	70	21.3	8	10	70	60
			2	A	20.0	17.3	10	10	50	15.2	50	15.2	10	10	25	25
				B	28.0	26.0	10	10	35	10.6	35	10.6	10	10	35	35
40AQ030330GM††** 40AQ030340GM††**	15.0	11.25	1	A	63.6	55.6	2	4	95	29.0	60	18.3	8	8	80	70
			2	A	20.0	17.3	10	10	50	15.2	50	15.2	10	10	25	25
				B	43.6	38.6	6	6	55	16.7	55	16.7	10	10	60	50
40AQ030330JR††** 40AQ030340JR††**	20.0	15.00	1	A	83.6	72.9	2	2	70	21.3	70	21.3	6	8	110	100
			2	A	40.0	35.0	6	6	60	18.3	60	18.3	10	10	50	45
				B	43.6	38.6	6	6	55	16.7	55	16.7	10	10	60	50
40AQ036330DF	7.5	5.60	1	A	33.6	29.6	6	8	70	21.3	45	13.7	10	10	45	40
40AQ036330EH†	10.0	7.50	1	A	43.6	38.3	6	6	55	16.7	55	16.7	10	10	60	50
40AQ036330FE††** 40AQ036340FE††**	12.0	9.00	1	A	51.6	45.1	4	4	70	21.3	70	21.3	8	10	70	60
			2	A	20.0	17.3	10	10	50	15.2	50	15.2	10	10	25	25
				B	28.0	26.0	10	10	35	10.6	35	10.6	10	10	35	35
40AQ036330GM††** 40AQ036340GM††**	15.0	11.25	1	A	63.6	55.6	2	4	95	29.0	60	18.3	8	8	80	70
			2	A	20.0	17.3	10	10	50	15.2	50	15.2	10	10	25	25
				B	43.6	38.6	6	6	55	16.7	55	16.7	10	10	60	50
40AQ036330JR††** 40AQ036340JR††**	20.0	15.00	1	A	83.6	72.9	2	2	70	21.3	70	21.3	6	8	110	100
			2	A	40.0	35.0	6	6	60	18.3	60	18.3	10	10	50	45
				B	43.6	38.6	6	6	55	16.7	55	16.7	10	10	60	50

□ Circuit breaker models. Remaining models over 10 kW are internally fused.

*Minimum wire sizes based on using copper wire with a minimum 75 C (90 C, 40AQ018) insulation rating. Use copper wire only.

†Heater models which may be field wired for operation with one or 2 line power circuits. See Step 9 and Fig. 9.

‡Two-stage heaters. Remaining heaters are single stage; see Fig. 13 for control wiring.

**These models are internally protected. Field-supplied branch circuit over-current protection may be either fuse or circuit breaker.

††Model 40AQ080 electrical data corresponds to 40AQ024; Model 40AQ120 corresponds to 40AQ036.

NOTES:

1. Heaters are equipped with a 60-volt transformer for system control circuit.
2. Field-selected wire sizes must not create a voltage drop between power source and unit in excess of 2% of unit rated voltage.

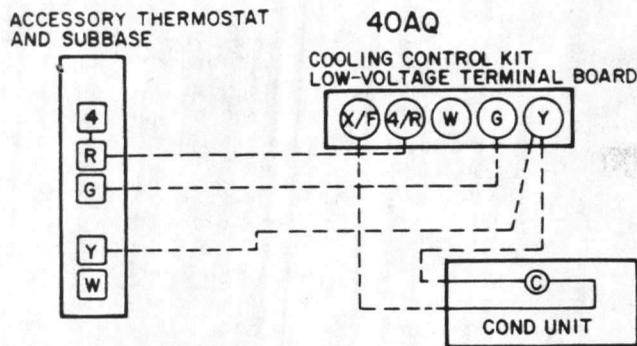
Table 6 — Airflow Data

FAN SECTION 40AQ	HEATER kW		MIN FAN SPEED*	MIN CFM†	MIN L/s†
	240 V	208 V			
018	3.0	2.25	Med	500	240
	5.0	3.75	Med		
	7.5	5.60	Med		
	10.0	7.50	Med		
024, 080	5.0	3.75	Low	700	330
	7.5	5.60	Low		
	10.0	7.50	Low		
	15.0	11.25	Med		

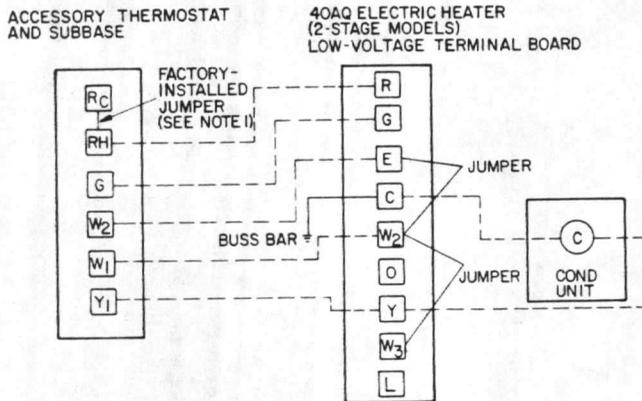
*Minimum fan speeds for safe electric heater operation.

FAN SECTION 40AQ	HEATER kW		MIN FAN SPEED*	MIN CFM†	MIN L/s†
	240 V	208 V			
030, 120	7.5	5.60	Med	1000	470
	10.0	7.50	Med		
	15.0	11.25	Med		
	20.0	15.00	Med		
036	7.5	5.60	Med	1000	470
	10.0	7.50	Med		
	15.0	11.25	Med		
	20.0	15.00	Med		

†Minimum air for prevention of nuisance heater cycling on 40AQ units.



ARRANGEMENT A — 40AQ WITH CONDENSING UNIT. COOLING ONLY SYSTEM. TRANSFORMER IN COOLING CONTROL KIT.



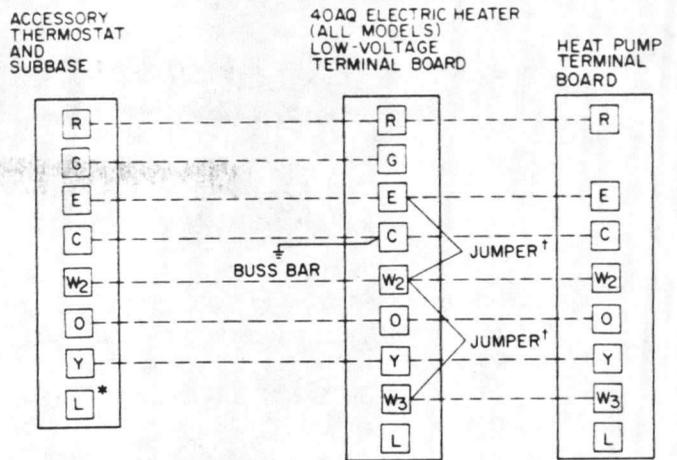
ARRANGEMENT B — 40AQ (EXCEPT 018) WITH CONDENSING UNIT. COOLING AND/OR 2-STAGE HEATING SYSTEM. TRANSFORMER IN ELECTRIC HEATER.

- C — Contactor
- Field Wiring
- Factory Wiring

*Terminal L is identified as terminal X on some former thermostats (required for system malfunction warning indicator on compressor section).

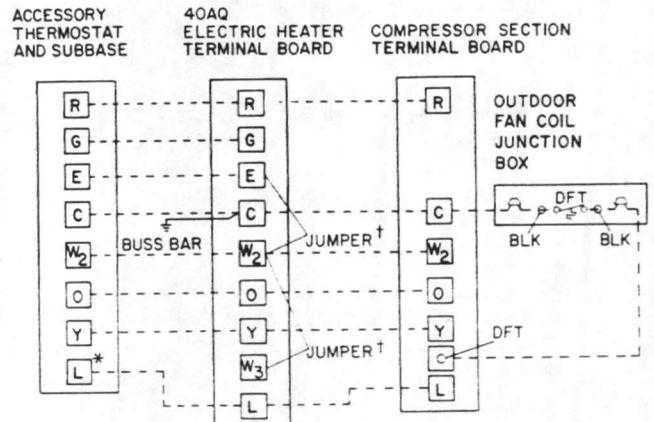
†Remove one or both factory-installed jumpers (Arrangements C and D) when installing outdoor thermostats (ODT) shown in installation instructions for heat pump — outdoor section.

NOTE: On 40AQ 2-stage heaters, remove factory-installed jumper for 2-stage operation. See Arrangement B.



IMPORTANT: Refer to outdoor unit Installation Instructions if outdoor thermostats are used.

ARRANGEMENT C — 40AQ WITH HEAT PUMP. COOLING AND 2-STAGE HEATING SYSTEM; SUPPLEMENTAL HEAT, NO OUTDOOR THERMOSTAT. TRANSFORMER IN ELECTRIC HEATER.



IMPORTANT: Refer to outdoor unit Installation Instructions if outdoor thermostats are used.

ARRANGEMENT D — 40AQ WITH HEAT PUMP. COOLING AND 2-STAGE HEATING SYSTEM; SUPPLEMENTAL HEAT, NO OUTDOOR THERMOSTAT. TRANSFORMER IN ELECTRIC HEATER.

Fig. 13 — Control Wiring Connections

START-UP

Refer to outdoor unit Installation, Start-Up and Service booklet for system start-up instructions and refrigerant charging method details.

Set Heat Anticipator — To set heat anticipator, move heat anticipator to maximum setting. Determine the W terminal that powers the electric heater controls. With heaters energized, measure amperage between appropriate W and R terminals and set heat anticipator to same value. See Fig. 14 for simple method of obtaining actual amp draw.

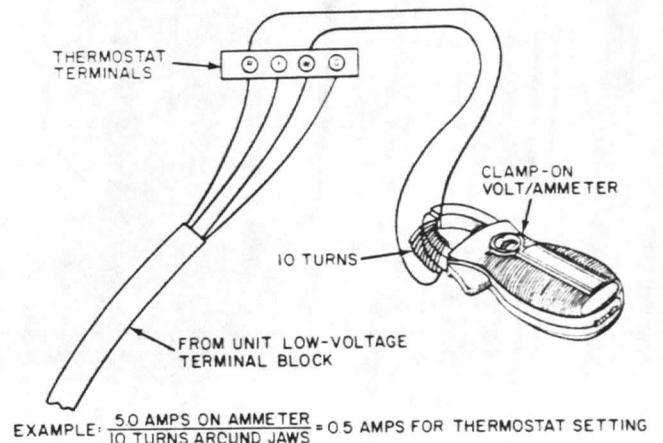


Fig. 14 — Amp Draw Check with Ammeter

SERVICE AND MAINTENANCE

▲ WARNING

Disconnect power to all circuits before servicing unit to avoid electric shock.

Remove unit front and top access panels for cleaning, lubrication or parts replacement (Fig. 12).

Minimum Maintenance

1. Check and clean or replace air filter each month or as required.
2. Check cooling coil, drain pan and condensate drain each cooling season for cleanliness. Clean as necessary.
3. Check fan motor and wheel for cleanliness each heating and cooling season. See Fan Motor and Wheel.
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

Return Air Filter — To clean or replace air filter, remove plastic plunger retainers on each side (no tools required) and remove filter access door. Slide out filter. Clean filter by using hot soapy water. Rinse clean and let dry. No oiling or coating of filter is required. New filters are available from a local dealer. Place filter in slot with cross-sectional binding up or facing the cooling coil, and replace filter access door securing with plunger retainers.

▲ CAUTION

Never operate unit without a filter or with filter access door removed. Damage to blower motor may result.

Coil, Drain Pan, and Condensate Drain — Disconnect electrical power before removing any access panels or electrical shock may result.

The coil is easily cleaned when it is dry; therefore, the coil should be checked and cleaned (if necessary) before each season. To check or clean coil, remove both the coil access panel and the fan heater access panel. Removal of these panels gives full access to the coil. If the coil is coated with dirt or lint, vacuum with a soft-brush attachment.

Be careful not to bend the fins. If the coil is coated with oil or grease, it may be cleaned with a mild detergent and water solution. Rinse coil with clear water. Be careful not to splash water on insulation or filter.

Check drain pan and condensate drain at the same time cooling coil is checked. Clean drain pan and condensate drain by removing any foreign matter from pan. Flush pan and drain tube with clear water. If drain tube is restricted, it can generally be cleared with high-pressure water. If this does not work, try a plumber's snake or similar probe device.

Fan Motor and Wheel — Clean the fan motor and the wheel when the cooling coil is cleaned. Lubricate motor every 5 years if motor is used on intermittent operation (thermostat FAN switch at AUTO. position), or every 2 years if the motor is in continuous operation (thermostat FAN switch at ON position).

▲ CAUTION

Remember to disconnect electrical power before removing any access panels.

To clean or lubricate fan motor or clean fan wheel, remove coil access panel, fan and heater access panel. Remove 3 electrical leads from bottom of Molex connector located on the fan housing. Note location of wires for reassembly. Remove 2 (outside) screws holding fan/motor assembly against the fan deck flange and slide assembly out of cabinet. Squeeze the side tabs and pull the Molex connector block off fan housing. Loosen screw in strap holding motor capacitor to fan housing and slide capacitor out from under strap. Remove screw with green wire from fan housing. Mark the fan wheel, motor and motor support in relation to the fan housing before disassembly to ensure proper reassembly. (Note position of blades on wheel.) Loosen setscrew holding fan wheel onto motor shaft.

Remove 3 bolts holding motor mount to fan housing and slide motor and mount out of housing. Further disassembly should not be necessary as adequate clearance is available to clean or lubricate motor. Remove fan wheel from housing by removing cutoff plate from fan housing outlet. Note wheel orientation and cutoff location for reassembly. The fan motor and wheel may be cleaned by using a vacuum with a soft-brush attachment. Remove grease with a mild solvent such as hot water and detergent. Be careful not to disturb the balance weights (clips) on the fan wheel vanes. Also, do not drop or bend wheel, as balance will be affected.

To oil motor, remove dust caps or plugs from oil holes located at each end of the motor. Use a teaspoon, 5 cc, 3/16 oz or 16 to 25 drops of a good grade of SAE 20 nondetergent motor oil in each oil hole. Allow time for total quantity of oil to be absorbed into each bearing. After oiling motor, be sure to wipe off excess oil from housing and replace cap or plugs on oil port.

To reassemble fan, place fan wheel back into housing. Be sure to position correctly for proper location. Reassemble cutoff plate to housing, using identified holes from disassembly procedure. Position motor and mount in same position as before when fan housing was in unit. Secure motor mount to housing, using bolts removed. Make sure mount or motor is grounded to fan housing. Locate fan wheel setscrew over flat on motor shaft. Rotate wheel in housing. It should not rub housing and should be centered in inlet opening. If not, loosen setscrew and align as necessary. Attach green wire to fan housing with screw. Secure motor capacitor under strap and tighten strap screw. Replace Molex connector in bracket by snapping into position. Slide blower assembly to blower deck with screws removed. Reconnect electrical leads into Molex connector at the proper position. Please note that connections are polarized for assembly — *do not force*. Reconnect electrical power to unit and test fan for proper rotation and necessary speed changes between heating and cooling.

Refrigerant Circuit — The 40AQ coils have a vapor holding charge. Evacuation or purging is not required if accessory tubing package is used and mechanically connected to Compatible Fittings within 60 seconds. If tubing or coil is left open longer than 60 seconds, field-supplied tubing is used, sweat or flare connections are made — purge or evacuate coil and tubing. Refer to outdoor unit installation booklet for system refrigerant charging method details.

LEAK MECHANICAL CONNECTION

1. Pump down (system refrigerant) to outdoor unit. Close outdoor unit service valves, and relieve refrigerant pressure in tubing and coil.
2. Back locknut off Compatible Fitting onto tube at indoor coil as in Fig. 15.

- Cut fitting with hacksaw between threads and O-ring bead.
- Remove tubing section remaining in threaded portion of fitting. Discard locknut.

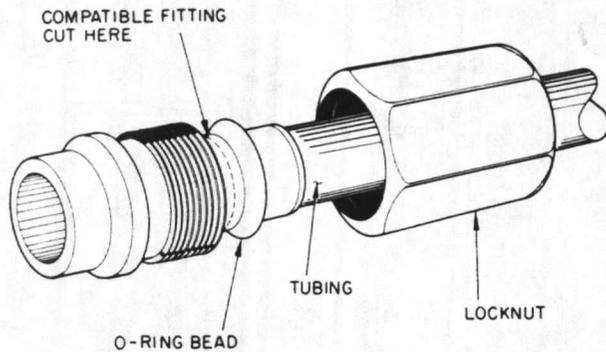


Fig. 15 — Repair of Mechanical Connection

Reconnecting Refrigerant Tubing

- Remove all burrs and filings from remaining portion of Compatible Fitting.
- Insert tube end into remaining portion of Compatible Fitting.
- Solder with low-temperature (430 F [221 C]) solder such as Allstate 430 or equivalent silver bearing solder.
- Evacuate indoor coil and tubing system at the outdoor unit service valves.

LEAKING SWEAT CONNECTION — Pump down system refrigerant to outdoor unit. Close outdoor unit service valves, and relieve refrigerant pressure in tubing and coil. Clean and flux area around leak and apply low-temperature (430 F [221 C]) solder.

Evacuate or purge evaporator coil and tubing system. Add refrigerant charge (see charging instructions).

ACCURATER™ (BYPASS TYPE) REFRIGERANT FLOW CONTROL SERVICING — See Fig. 16 for bypass type AccuRater components. *The piston has a refrigerant metering orifice through it. The retainer forms a stop for the piston in the refrigerant bypass mode and a sealing surface for liquid line flare connection. To check, clean or replace piston:*

- Pump down system refrigerant to outdoor unit. Close outdoor unit service valves, and relieve pressure in tubing and coil.
- Shut off power to unit.
- Remove coil liquid line flare connection from AccuRater.
- Pull retainer out of body being careful not to scratch flare sealing surface. If retainer does not pull out easily, carefully use locking pliers to remove retainer. (If retainer flare seat is damaged, replace with new retainer, Part No. 99CC409892.)
- Slide piston out by inserting a small soft wire through metering orifice. Ensure metering orifice sealing surface around piston cones and fluted portion of piston are not damaged.
- Clean piston refrigerant metering orifice or replace piston as required. Replacement pistons are available from Service Parts.
- Replace retainer O-ring on retainer before reassembling AccuRater. O-ring Part No. is 99CC501052.

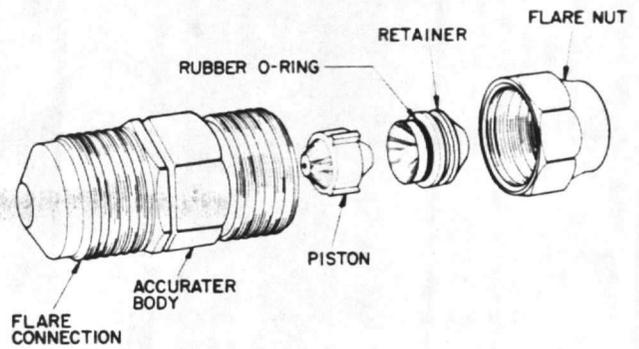


Fig. 16 — AccuRater (Bypass Type) Components

Table 7 — Factory-Supplied AccuRater Pistons

MODEL 40AQ	018	024	030	036
PISTON NO.	46	52	59	67

LIQUID LINE STRAINER — The outdoor bypass AccuRater is protected on the indoor coil side by a wire mesh strainer. It normally does not require servicing; however, if it becomes plugged, proceed as follows for inspection and cleaning.

- Complete steps 1 through 3 under AccuRater Refrigerant Flow Control Servicing.
- Remove coil access panel.
- Loosen flare fitting joint connecting AccuRater to coil liquid refrigerant line.
- Remove sheet metal screw holding bracket clip in place. Screw is located below and between liquid and suction line fittings.
- Pull bracket clip out.
- Remove bypass AccuRater assembly.
- Pull strainer out of coil liquid refrigerant line and replace with new strainer.

Electric Heater Service — See Fig. 12 for component location. All service can be completed with heater in place. Ensure all power is shut off before servicing.

LIMIT SWITCH malfunction prevents heating element from coming on or causes fusible link to blow. Replace switch if malfunction occurs.

SEQUENCER malfunction will cause heater not to come on or never shut off — replace sequencer.

TRANSFORMER is 60 va. Transformer supplies 24-volt power for control circuit. Replace transformer if faulty.

⚠ CAUTION

The 60-va transformer on 40AQ electric heater is fused — do not short circuit.

FAN RELAY malfunction will cause unit fan not to run or to run continuously — replace relay.

HEATER REMOVAL — Electric heater is held in place by 5 sheet metal screws. If heater removal is required, disconnect wiring, remove screws and pull heater out through front of unit. When replacing heater, ensure heater element support bars enter holes in rear of unit heat shield.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

Book 1 4
Tab 3c 2c

PC 101

Catalog No. 534-025

Printed in U S A

Form 40AQ-17SIM

Pg 12

12-86

Replaces: 40AQ-14SIM

For replacement items contact Distributor.

Direct Expansion Fan-Coil Units

(With Cooling Control Kit or Electric Heater)

INDEX

FIG. NO.	MODEL 40AQ		VOLTS		LABEL DIAGRAM	INTERNAL CIRCUIT PROTECTION	HEATER STAGE
			240	208			
			KW				
1	018300	BG	3.0	2.25	300822-301	None	1
	018300	CD	5.0	3.75			
2	018300	DF	7.5	5.60	300823-302	None	
	018300	EH	10.0	7.50			
3	018320	EH	10.0	7.50	300824-303	None	2
CIRCUIT CONNECTIONS							
4	Control Circuit						
5	Heating and Cooling Unit Line Power						
6	Single-Speed Fan Operation						

GENERAL NOTES

- All wiring must comply with National Electrical Code (NEC) and all applicable local codes.
- Units are suitable for use with copper or copper-clad aluminum supply conductors unless noted otherwise on the diagram.
- Fused disconnect for incoming unit power must be within sight of unit and readily accessible in accordance with NEC, Section 440-14.
- Transformer Primary Code: 208 v - BLK & BLU
240 v - BLK & RED
- Unused transformer lead must be taped.
- Transformer secondary is internally fused; do not short control wiring.
- If any of the original wire, as supplied, must be replaced, use the same wire or equivalent.

FAN MOTOR SPEED

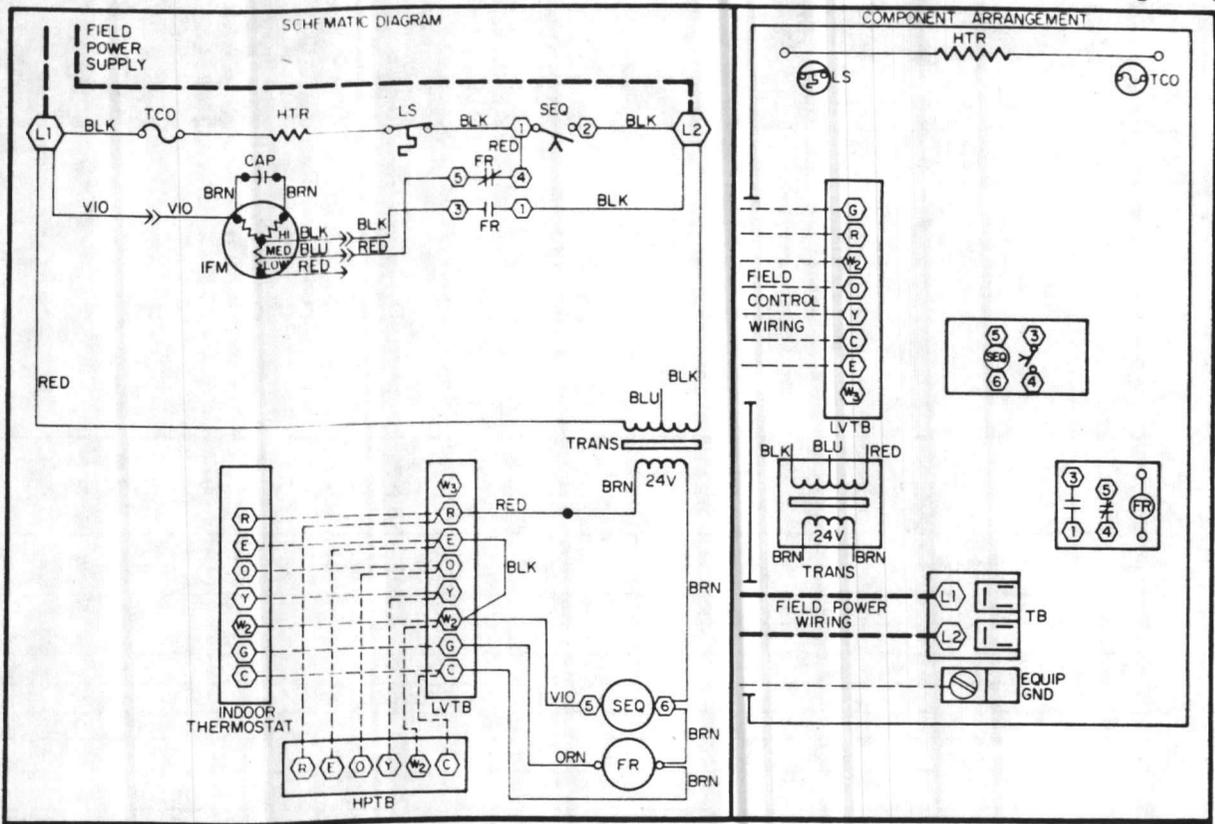
High, medium or low fan speed leads are provided on motor for choice of fan speeds. Motor leads are factory connected to Molex fan speed selector block located on fan housing. Selector block terminal 1 is high fan speed, terminal 2 is medium fan speed and terminal 3 is low fan speed.

Line power leads supplied with cooling control kit or electric heater are factory connected to selector block for 1 or 2 fan speeds as described above. Change fan speed by changing position of black and/or red line power leads on selector block. See Fig. 5.

One fan speed may be selected on units with cooling control kit; 2 fan speeds on units with electric heater. For single-speed operation on electric heater units; remove red lead from heater fan relay terminal 5; connect a jumper between fan contactor terminal 3 and 5; connect black heater lead from fan relay terminal 3 to fan speed selector block for speed required. See Fig. 6.

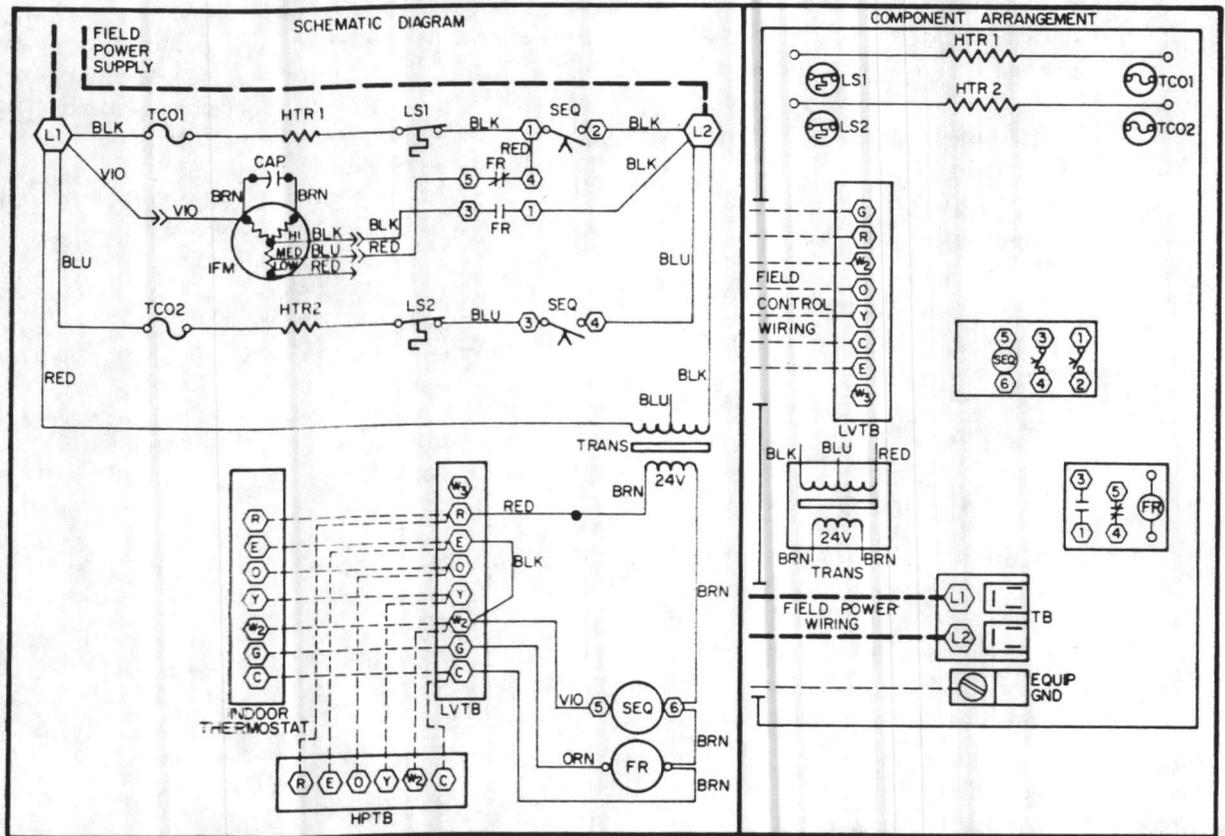
LEGEND (Fig. 1 - 3)

Cap.	- Capacitor
CB	- Circuit Breaker
Equip Gnd	- Equipment Ground
FR	- Fan Relay
Fu	- Fuse
HPTB	- Heat Pump Terminal Board
Htr	- Heater
HVTB	- High Voltage Terminal Board
IFM	- Indoor Fan Motor
LS	- Limit Switch
LVTB	- Low Voltage Terminal Board
Seq	- Sequencer
TB	- Terminal Block
TCO	- Thermal Cutoff
Trans	- Transformer
	Marked Connection
	Unmarked Connection
	Junction
	Plug-Receptacle Connection
	Factory Wiring
	Field Wiring - Power
	Field Wiring - Control



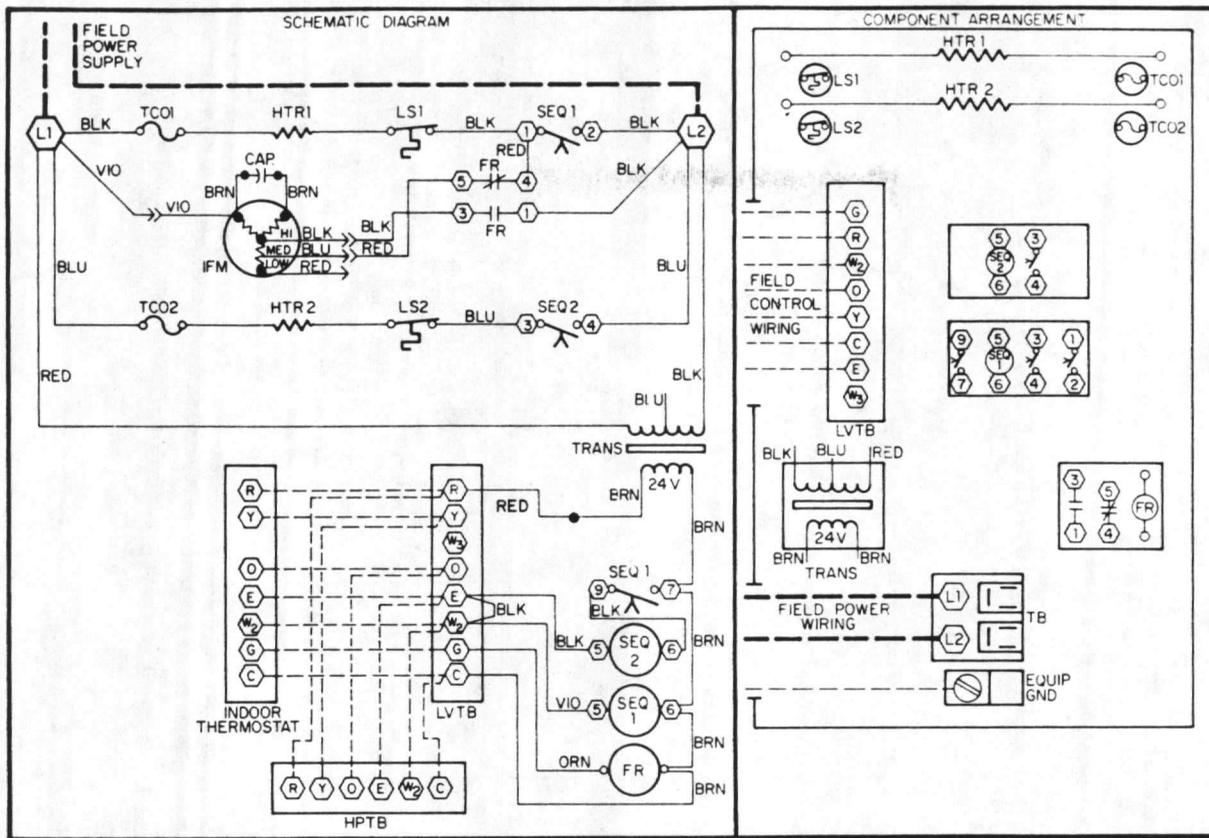
NOTE: Suitable for use with copper, No. 10 AWG, or copper-clad aluminum, No. 8 AWG, supply conductors rated 75 C minimum.

Fig. 1 – Label Diagram – 40AQ018300BG,CD: 208/240-1-60



NOTE: Suitable for use with copper, No. 6 AWG, or copper-clad aluminum, No. 4 AWG, supply conductors rated 90 C minimum for 030 & 036 and 75 C minimum for 024.

Fig. 2 – Label Diagram – 40AQ018300DF,EH: 208/240-1-60



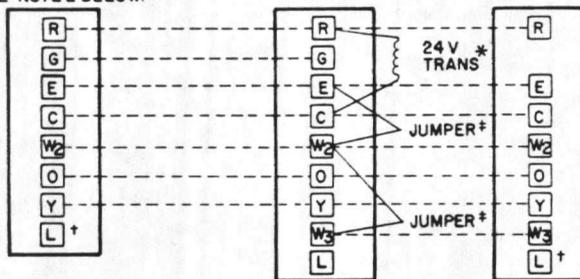
NOTE: Suitable for use with copper, No. 6 AWG, or copper-clad aluminum, No. 4 AWG, supply conductors rated 90 C minimum for 030 & 036 and 75 C minimum for 024.

Fig. 3 - Label Diagram - 40AQ018320EH: 208/240-1-60

THERMOSTAT HH07AT071 WITH HH93AZ073 (AUTOMATIC CHANGEOVER) OR HH93AZ075 (MANUAL CHANGEOVER) SUBBASE. SEE NOTE 2 BELOW.

40AQ ELECTRIC HEATER (ALL MODELS) LOW VOLTAGE TERMINAL BOARD

38CQ OR 38RQ (HEAT PUMP) TERMINAL BOARD



40AQ WITH 38CQ OR 38RQ HEAT PUMP

COOLING AND 2-STAGE HEATING SYSTEM; EMERGENCY HEAT, NO OUTDOOR THERMOSTAT, See Note 1. TRANSFORMER IN ELECTRIC HEATER.

IMPORTANT: Refer to 38CQ, 38RQ Installation Instructions if outdoor thermostats are used.

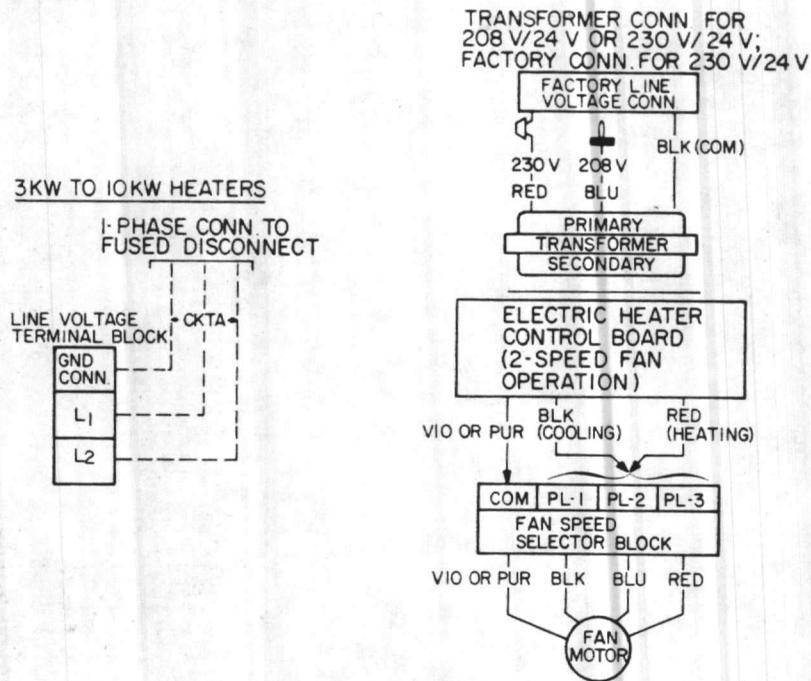
C - Contactor
 --- Field Wiring
 ——— Factory Wiring

* Transformer (60 va) located in cooling control kit or electric heater.
 † Terminal L is identified as terminal X on some former thermostats (required for system malfunction warning indicator on compressor section).
 ‡ Remove 1 or both factory-installed jumpers when installing outdoor thermostats (ODT) shown in installation instructions for heat pump - outdoor section.

NOTES

1. The 40AQ electric heaters, identified as 2-stage in Index may be wired for 2 separate stages of electric heat by removing jumper wire shown above and installing an outdoor thermostat. See 38CQ, RO and HO Heat Pump Installation Instructions for wiring diagrams.
2. Thermostat/Subbase package numbers 38CQ900081 for HH07AT071/HH93AZ073 (Automatic Changeover), 38CQ900111 for HH07AT071/HH93AZ075 (Manual Changeover).
3. L terminals are currently being added to all fan coil and heat pump terminal boards and will be indicated on future wiring label diagrams.

Fig. 4 - Control Circuit Connections



SELECTOR BLOCK TERMINATIONS	
COM - Common	PL-3 - Low
PL-1 - High	-
PL-2 - Medium	-

Splice Conn.
 Field Wiring
 Factory Wiring

Fig. 5 – Heating and Cooling Unit Line Power Connections

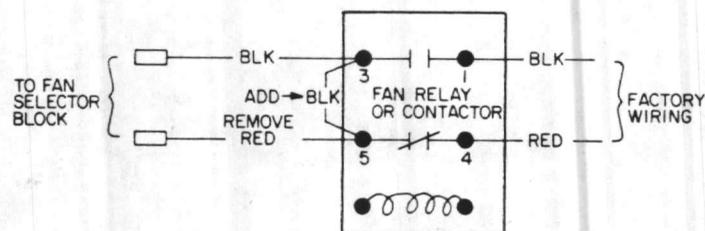


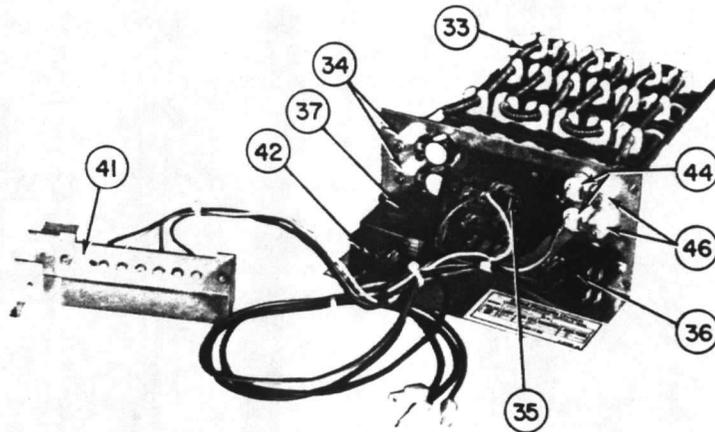
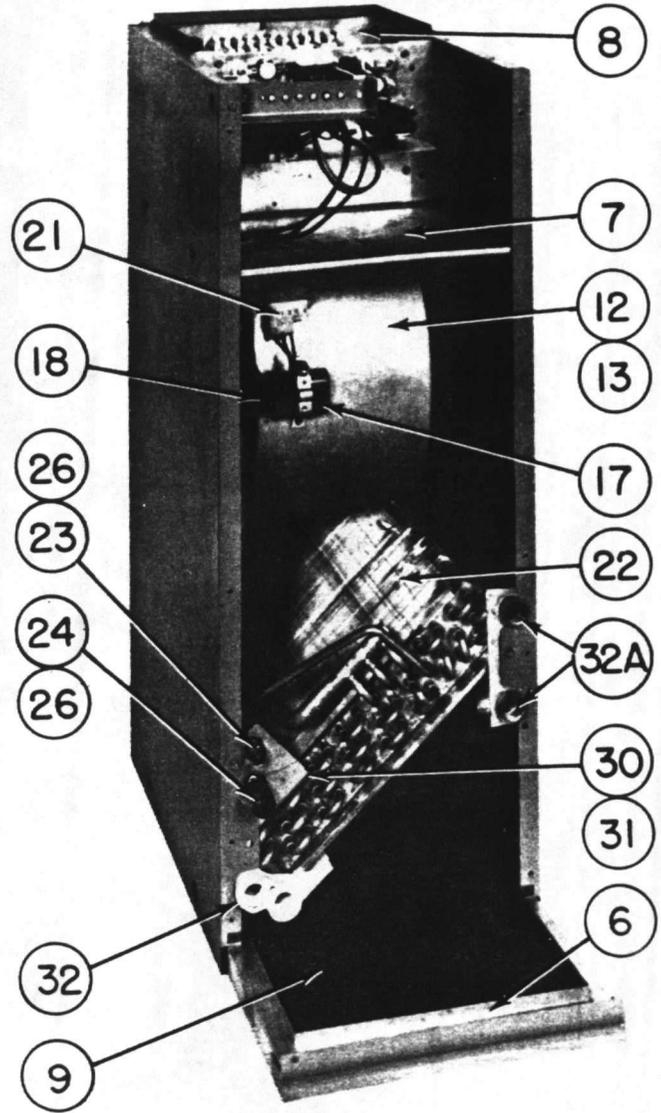
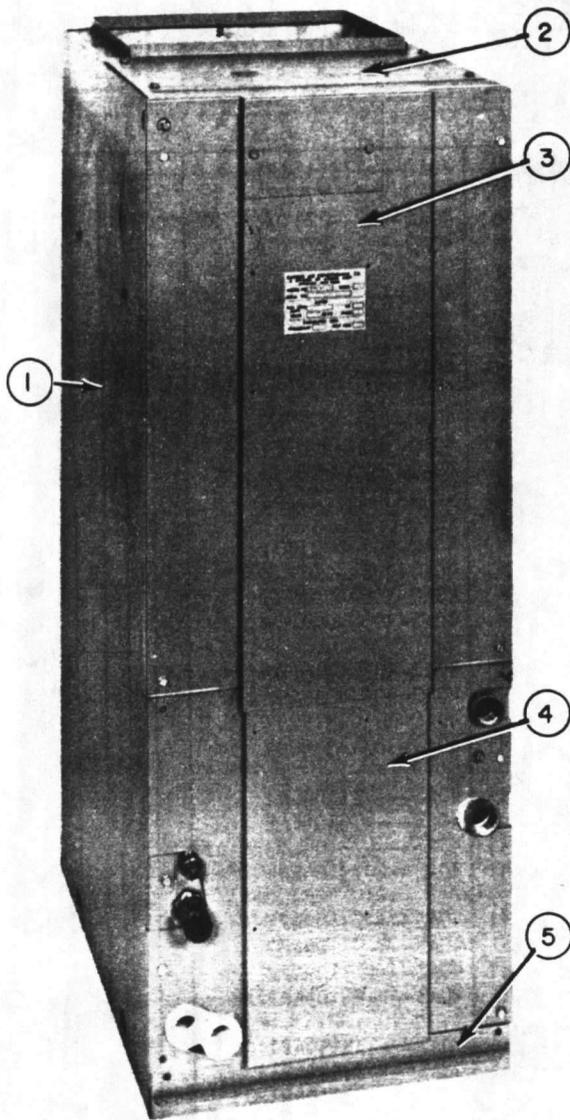
Fig. 6 – Connections for Single-Speed Fan Operation

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

Carrier
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parts

INDOOR ENCASED FAN COIL UNITS

40AQ/AS



CATALOG NO. 40.005 (4-84)
SUPERSEDES CATALOG NO. 554-048

Litho in U.S.A.

PAGE 1



INDOOR ENCASED FAN COIL UNITS

40AQ/AS

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	USED ON 40AQ/AS			
				000	010	030	040
CASING GROUP							
1	WRAPPER ASSEMBLY	SM1	40AQ---73118AP1	1			
		SM1	40AQ-302--274401		1		
		SM1	40AQ-302--274402			1	
		SM1	40AQ-302--274403				1
2	TOP COVER ASSEMBLY	SM1	40AS---73107LA5	1			
		SM1	40AS---73107LA6		1		
		SM1	40AS---73107LA7			1	
		SM1	40AS---73107LA8				1
3	FRONT DOOR ASSEMBLY	SM1	40AQ-302--275767	1			
		SM1	40AQ-302--275751		1		
		SM1	40AQ-302--275752			1	
		SM1	40AQ-302--275753				1
4	COIL DOOR ASSEMBLY	SM1	40AQ-306--001701	1			
		SM1	40AQ-306--001702		1		
		SM1	40AQ-306--001703			1	
		SM1	40AQ-306--001704				1
5	FILTER COVER ASSEMBLY	SM1	40AQ-303--315201	1			
		SM1	40AQ-303--315202		1		
		SM1	40AQ-303--315203			1	
		SM1	40AQ-303--315204				1
6	FILTER RACK ASSEMBLY	SM1	40AS---73104LA1	1			
		SM1	40AS---73104LA2		1		
		SM1	40AS---73104LA3			1	
		SM1	40AS---73104LA4				1
7	BLOWER DECK	SM1	40AS---73109AP1	1			
		SM1	40AS---73109AP2		1		
		SM1	40AS---73109AP2			1	
		SM1	40AS---73109AP2				1
8	HEAT SHIELD	SM1	40AS---73110AP1	1			
		SM1	40AS---73110AP2		1		
		SM1	40AS---73110AP3			1	
		SM1	40AS---73110AP4				1
9	AIR FILTER - 11 3/4" X 21 1/4" X 1"	NS	40AQ---68941DP24	1			
	14" X 21 1/4" X 1"	NS	40AQ---68941DP25		1		
	16 5/8" X 21 1/4" X 1"	NS	40AQ---68941DP26			1	
	20 3/8" X 21 1/4" X 1"	NS	40AQ---68941DP27				1
NI/10	THUMB SCREW (KNURLED), FOR FITLER RACK	NS	40AQ---72097D1	2	2	2	2
NI/11	PAINT, TOUCH-UP (MALIBU BEIGE) 16 OZ. PRESS. CAN	MP	---PH-23NB-015--				AS REQ'D



INDOOR ENCASED FAN COIL UNITS

40AQ/AS

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	USED ON 40AQ/AS			
				0	0	0	0
BLOWER AND MOTOR GROUP							
12	COMPLETE BLOWER AND HOUSING ASSEMBLY INCLUDES:	NS	40AQ---73147LA12	1			
		NS	40AS----73147LA3		1		
		NS	40AS----73147LA4			1	
		NS	40AQ---73147LA15				1
13	HOUSING ASSEMBLY	SM1	40AS----73143LA1	1			
		SM1	40AS----73143LA2		1		
		AC	40AS----73143LA3			1	
		SM1	40AS----73143LA4				1
14	AIR CUT-OFF (HOUSING)	SM1	40AS----73130BP1	1			
		SM1	40AS----73130BP2		1		
		SM1	40AS----73130BP3			1	
		SM1	40AS----73130BP4				1
NI/15	BLOWER WHEEL 1/2"BORE;48 BLADES;11 1/8 O.D. X 4 1/2 W. (50/60HZ) 1/2"BORE;48 BLADES;11 1/8 O.D. X 6 W. (50/60HZ) 1/2"BORE;48 BLADES;10 1/2 O.D. X 7 1/4 W. (50/60HZ) 1/2"BORE;48 BLADES;11 1/8 O.D. X 8 W. (50/60HZ)	AC	--LA--22XC-040--	1			
		AC	--LA--22XC-060--		1		
		NPS	--LA--22XC-069--			1	
		AC	--LA--22XC-100--				1
NI/16	BLOWER MOTOR - 1/4HP;208/230-1-60;1075 RPM;48 FRAME (SEE NOTE*) - 1/3HP;208/230-1-60;1075 RPM;48 FRAME BLOWER MOTOR (50HZ) (50HZ)	AC	--HC--39SB-231--*	1	1		
		AC	--HC--41SB-232--			1	1
		AC	--HC--39SE-231--	1	1		
		NPS	--HC--43SE-233--			1	1
*NOTE: THE 40AQ/AS018,024 UNITS HAVE BEEN REDESIGNED TO USE A 48 FRAME MOTOR (5.6 INCH DIA.) EARLIER MODELS WERE BUILT WITH A 42 FRAME MOTOR (5.0 INCH DIA.). IN ORDER TO MOUNT THE LARGER DIAMETER HC39SB-231 MOTOR IN THE 40AQ/AS018,024 UNITS WHICH WERE ORIGINALLY BUILT WITH A 42 FRAME MOTOR, THE FOLLOWING IS REQUIRED: (1) HC98ZZ-480 MOUNTING BAND (3) HC98ZZ-252 MOUNTING ARMS FOR ANY FURTHER INFORMATION, SEE (PMB45-81)							
17	CAPACITOR, RUN - 5 MFD;370 VOLT (50/60HZ) 7.5 MFD;370 VOLT (60HZ) 10 MFD;370 VOLT (50/60HZ) (50HZ)	AC	--HC--91CA-005--	1			
		AC	--HC--91CA-007--		1	1	
		AC	--HC--91CA-010--				1
		AC	--HC--91DA-010--			1	
18	BOOT (RUN CAPACITOR)	AC	--HC--97ZZ-071--	1	1	1	1
NI/19	MOUNTING BAND	AC	--HC--98ZZ-480--	1	1	1	1
NI/20	MOUNTING ARM	AC	--HC--98ZZ-252--	3	3	3	3
21	MOTOR PLUG, 5 CIRCUIT	AC	58GA-660---003--	1	1	1	1



INDOOR ENCASED FAN COIL UNITS

40AQ/AS

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	USED ON 40AQ/AS			
				0	0	0	0
				1	2	3	3
				8	4	0	6
COIL AND PIPING GROUP							
22	EVAPORATOR COIL	AC	40AQ-305--986771	1			
		AC	40AQ-305--936771		1		
		AC	40AQ-305--986773			1	
		AC	40AQ-305--986774				1
23	ACCU-RATER BODY - LIQUID 3/8" 3/8"	AC	28GS-401--953--	1			
		AC	99CC-502--363--		1	1	1
24	SUCTION FITTING - 5/8" 3/4"	AC	99CC-402--193--	1	1		
		AC	99CC-402--203--			1	1
NI/25	SEAL RING - 3/8" 5/8" 3/4"	MP	99CC-501--052--	1			
		MP	99CC-501--062--	1	1		
		MP	99CC-501--072--			1	1
26	LOCKNUT - 3/8" 5/8" 3/4"	MP	99CC-501--073--	1			
		MP	99CC-501--053--	1	1		
		MP	99CC-501--043--			1	1
NI/27	BY-PASS ACCU-RATER PISTON PACKAGE - IDENT. #46 IDENT. #52 IDENT. #59 IDENT. #67	MP	38CQ-660--046--	1			
		MP	38CQ-660--052--		1		
		MP	38CQ-660--059--			1	
		MP	38CQ-660--067--				1
NI/28	BY-PASS ACCU-RATER PISTON RETAINER PACKAGE	MP	38CQ-660--031--	1	1	1	1
NI/29	STRAINER, INSERT	NS	--KH--11HH-068--	1	1	1	1
30	BRACKET-COUPLING	SM 1	28VQ-500--973--	1	1		
		SM 1	28VQ-500--983--			1	1
31	BRACKET-RETAINER	SM 1	28GS-500--162--	1	1		
		SM 1	28GS-500--172--			1	1
32	CONDENSATE PAN (LOWER)	AC	28MC-500--384--	1	1	1	1
32A	CONDENSATE PAN ASSEMBLY (UPPER)	AC	28MC-400--644--	1	1	1	1
NI/32B	SHIELD (FOR ITEM #32)	AC	28MC-500--494--	1	1	1	1
NI/32C	ABSORBENT PAD (SSN U3A) JULY 1983	AC	40AQ-307--172201	1	1	1	1
NI/32D	DRAIN PAN (SSN Y2A) NOV. 1982	AC	28HQ-660--001--		1		
		AC	28HQ-660--002--			1	
		AC	28HQ-660--003--				1



INDOOR ENCASED FAN COIL UNITS

40AQ/AS

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	USED ON 40AQ/AS			
				0	0	0	0
				1	2	3	3
				8	4	0	6

ACCESSORY GROUP

LEGEND FOR 40AQ900 SERIES ELECTRIC HEATERS-USED ON 40AQ SERIES													
A=	40AQ-900---011--	5 KW. NON-FUSED											
B=	40AQ-900---021--	7.5 KW. NON-FUSED											
C=	40AQ-900---031--	10 KW. NON-FUSED											
D=	40AQ-900---051--	15 KW. FUSED											
E=	40AQ-900---061--	15 KW. CIRCUIT BREAKER											
F=	40AQ-900---071--	20 KW. FUSED											
G=	40AQ-900---081--	20 KW. CIRCUIT BREAKER											
H=	40AQ-900---091--	12 KW. FUSED											
I=	40AQ-900---101--	12 KW. CIRCUIT BREAKER											
J=	40AQ-900---131--	5 KW. NON-FUSED											
K=	40AQ-900---141--	7.5 KW. NON-FUSED											
L=	40AQ-900---151--	10 KW. NON-FUSED											

PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	LEGEND											
			A	B	C	D	E	F	G	H	I	J	K	L
33 HEATER COIL ASSEMBLY (5 KW) (3.75 KW) (3.5 KW)	AC	40AS-680---017--	1		2	3	3	4	4	1	1	1	1	2
	AC	40AS-680---018--		2								2	2	1
	AC	88RC0000CB300018												
34 SWITCH TEMP. ACT. - OPEN 140 ;CLOSE 100 - OPEN 145 ;CLOSE 105 - OPEN 175 ;CLOSE 135	AC	--HH--19ZA-140--	1	2	2	3	3		4	4		3	3	
	AC	--HH--19ZA-145--												
	AC	--HH--19ZA-175--										1	1	2
35 SEQUENCER (MFG. #TDS-3LA) (MFG. #TDS-3DA)	AC	--HN--67--680004					1	1	1	1	1	1	1	
	AC	--HN--67BD-001--					1	1	1	1	1	1	1	
	NPS	--HN--67QC-005--	1	1	1								1	1
36 RELAY (FAN)	AC	--HN--61KK-911--	1	1	1	1	1	1	1	1	1	1	1	1
37 TRANSFORMER - PRIMARY;200/230 V. (60 VA.) SEC.;24 V.	MP	--HT--01AW-230--	1	1	1	1	1	1	1	1	1	1	1	1
NI/38 CIRCUIT BREAKER - 30 AMP 50 AMP	AC	--HH--83DH-030--						1					1	
	AC	--HH--83DH-060--						1		2			1	
NI/39 FUSE - 60 AMP 30 AMP	AC	--HY--10MJ-060--					2		4			2		
	AC	--HY--10MJ-030--					2					2		
NI/40 FUSE BLOCK-(2) 30 AMP HOLDER;(2) 60 AMP HOLDER (4) HOLDER	AC	--HY--11UM-461--					1					1		
	AC	--HY--11UM-601--							1					
41 TERMINAL BOARD - W3,E,C,Y,O,W2,R,G	AC	--HY--84HA-058--	1	1	1	1	1	1	1	1	1	1	1	1
42 TERMINAL BLOCK - 2 CONNECTORS	AC	--HY--84FE-302--	1	1	1									
NI/43 TERMINAL BOARD - L1,L2,L3,L4	AC	--HY--84FE-069--					1	1	1	1	1	1		
44 FUSIBLE LINK	AC	--HH--12--680002	1	2	2	3	3	4	4	3	3	1	1	2
NI/45 TERMINAL INSULATOR (MALE)	MP	50MH-660---016--	2	4	4	4	4	8	8	4	4	2	4	4
46 TERMINAL INSULATOR (FEMALE)	MP	50MH-660---017--	2	4	4	4	4	8	8	4	4	2	4	4



INDOOR ENCASED FAN COIL UNITS

40AQ/AS

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	USED ON 40AQ/AS			
				0	0	0	0
				1	2	3	3
				8	4	0	6

ACCESSORY GROUP

LEGEND FOR 40AQ901 SERIES ELECTRIC HEATERS-USED ON 40AQ SERIES			
A=	40AQ-901---011--	5 KW. HEATER	1 1 1
B=	40AQ-901---021--	7.5 KW. HEATER	1 1 1
C=	40AQ-901---031--	10 KW. HEATER	1 1 1
D=	40AQ-901---051--	15 KW. HEATER-FUSED	1 1 1
E=	40AQ-901---061--	15 KW. CIRCUIT BREAKER	1 1 1
F=	40AQ-901---071--	20 KW. HEATER-FUSED	1 1 1
G=	40AQ-901---081--	20 KW. HEATER-CIRCUIT BREAKER	1 1 1
H=	40AQ-901---091--	12 KW. FUSED	1 1 1
I=	40AQ-901---101--	12 KW. HEATER-CIRCUIT BREAKER	1 1 1
J=	40AQ-901---131--	5 KW. HEATER	1 1 1
K=	40AQ-901---141--	7.5 KW. HEATER	1 1 1
L=	40AQ-901---151--	10 KW. HEATER	1 1 1
M=	40AQ-901---171--	3 KW. HEATER	1 1 1
N=	40AQ-901---191--	7.5 KW. HEATER-CIRCUIT BREAKER	1 1 1
P=	40AQ-901---201--	10 KW. HEATER-CIRCUIT BREAKER	1 1 1

PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	LEGEND													
			A	B	C	D	E	F	G	H	I	J	K	L	M	N
33 HEATER COIL ASSEMBLY (5 KW) (3.75 KW) (3.5 KW)	AC	88RC0000CB145016	1	2	3	3	4	4	1	1	1	2	2	2		
	AC	88RC0000CB165717		2								2				
	AC	88RC0000CB300018								2	2		1			
34 SWITCH TEMP. ACT. - OPEN 140 ;CLOSE 100 OPEN 145 ;CLOSE 105 OPEN 175 ;CLOSE 135	AC	--HH--19ZA-140--	1	2	2											
	AC	--HH--19ZA-145--				3	3	4	4	3	3			2	2	
	AC	--HH--19ZA-175--										1	2	2	1	
35 SEQUENCER (MFG. #TDS-3LA) (MFG. #TDS-3DA)	AC	--HN--67--680004				1	1	1	1	1	1					
	AC	--HN--67BD-001--				1	1	1	1	1	1					
	NPS	--HN--67QC-005--	1	1	1							1	1	1	1	1
36 RELAY (FAN)	AC	--HN--61KK-911--	1	1	1	1	1	1	1	1	1	1	1	1	1	1
37 TRANSFORMER - PRIMARY;200/230 V. (60 VA.) SEC;24 V.	MP	--HT--01AW-230--	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NI/38 CIRCUIT BREAKER - 30 AMP 60 AMP 40 AMP	AC	--HH--83DH-030--					2			2						
	AC	--HH--83DH-060--					2	4		2					2	
	NS	--HH--83DH-040--													2	
NI/39 FUSE - 60 AMP 30 AMP 40 AMP	AC	--HY--10MJ-060--			2		4									
	AC	--HY--10MJ-030--			2				2							
	AC	--HY--10MJ-045--							2							
NI/40 FUSE BLOCK - (2) 30 AMP HOLDER (2) 60 AMP HOLDER (4) 60 AMP HOLDER	AC	--HY--11UM-461--			1				1							
	AC	--HY--11UM-601--						1								
41 TERMINAL BOARD	AC	--HY--84HA-068--	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NI/45 TERMINAL INSULATOR (MALE)	MP	50MH-660---016--	2	4	4	6	6	8	8	6	6	2	4	4	2	4
46 TERMINAL INSULATOR (FEMALE)	MP	50MH-660---017--	2	4	4	6	6	8	8	6	6	2	4	4	2	4



INDOOR ENCASED FAN COIL UNITS

40AQ/AS

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	USED ON 40AQ/AS					
				0	0	0	0	0	0
				1	2	3	3		
				8	4	0	6		

ACCESSORY GROUP

LEGEND FOR 40AQ903 SERIES ELECTRIC HEATERS - USED ON 40AQ SERIES								
A=	40AQ-903---051--	15 KW. FUSED				1	1	1
B=	40AQ-903---061--	15 KW. CIRCUIT BREAKER				1	1	1
C=	40AQ-903---071--	20 KW. FUSED					1	1
D=	40AQ-903---081--	20 KW. CIRCUIT BREAKER					1	1
E=	40AQ-903---091--	12 KW. FUSED				1	1	1
F=	40AQ-903---101--	12 KW. CIRCUIT BREAKER				1	1	1

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	LEGEND					
				A	B	C	D	E	F
33	HEATER COIL ASSEMBLY (5 KW) (7 KW)	AC	88RC0000CB145016	3	3	4	4	1	1
		AC	88RC0000CB300018					1	1
34	SWTICH TEMP. ACT. - OPEN 145°;CLOSE 105°	AC	--HH--192A-145--	3	3	4	4	3	3
35	SEQUENCER	NPS	--HN--67QE-005--	1	1			1	1
		NPS	--HN--67QG-005--			1	1		
36 NI/36A	RELAY (FAN) RELAY (HEATER)	AC	--HN--61KK-911--	1	1	1	1	1	1
		AC	--HN--61KX-010--	1	1	1	1	1	1
37	TRANSFORMER - PRIMARY;200/230 V. (60 VA) SEC;24 V.	MP	--HT--01AW-230--	1	1	1	1	1	1
NI/38	CIRCUIT BREAKER - 30 AMP 60 AMP 40 AMP	AC	--HH--83DH-030--		2				2
		AC	--HH--83DH-060--		2		4		
		AC	--HH--83DH-040--						2
NI/39	FUSE - 60 AMP 30 AMP 40 AMP	AC	--HY--10MJ-060--	2		4			
		AC	--HY--10MJ-030--	2				2	
		AC	--HY--10MJ-040--						2
NI/40	FUSE BLOCK - (2) 30 AMP HOLDER;(2) 60 AMP HOLDER (4) 60 AMP HOLDER	AC	--HY--11UM-461--	1				1	
		AC	--HY--11UM-601--			1			
41	TERMINAL BOARD	NS	--HY--84HA-083--	1	1	1	1	1	1
NI/45 46	TERMINAL INSULATOR (MALE) TERMINAL INSULATOR (FEMALE)	MP	50MH-680---015--	6	6	8	8	6	6
		MP	50MH-680---017--	6	6	8	8	6	6



INDOOR ENCASED FAN COIL UNITS

40AQ/AS

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	USED ON 40AQ/AS			
				0	0	0	0
				1	2	3	3
				8	4	0	6

ACCESSORY GROUP

LEGEND FOR 88EF SERIES ELECTRIC HEATERS - USED ON 40AS SERIES

A = 88EF0050MA01	5 KW. NON-FUSED	1	1		
B = 88EF0075MA01	7.5 KW. NON-FUSED	1	1	1	1
C = 88EF0100MA01	10 KW. NON-FUSED	1	1	1	1
D = 88EF1150MA01	15 KW. FUSED	1	1	1	1
E = 88EF1200MA01	20 KW. FUSED		1	1	1

ITEM NO.	PART NAME AND DESCRIPTION	LDC	REPLACEMENT PART NUMBER	LEGEND				
				A	B	C	D	E
33	HEATER COIL ASSEMBLY (5 KW) (3.75 KW)	AC	40AS-680---017--	1		2	3	4
		AC	40AS-680---018--		2			
34	SWITCH TEMP. ACT.	AC	--HH--19ZA-456--	1	2	2		
		AC	--HH--19ZA-425--				3	4
35	SEQUENCER - NO. OF SWITCHES - 1 MAIN 2 MAIN; 1 AUX. 3 MAIN; 1 AUX. 2 MAIN;	AC	--HN--67--680001	1				
		AC	--HN--67--680004		1	1		1
		AC	--HN--67--680005					1
		AC	--HN--67--680007					1
36	RELAY (CONTROL) FAN	AC	--HN--61KK-911--	1	1	1	1	1
37	TRANSFORMER - 60VA; PRIM. 200/230V; SEC. 24V.	MP	--HT--01AW-230--	1	1	1	1	1
NI/38	FUSE - 60 AMP. 30 AMP.	AC	--HY--10MJ-060--				2	4
		AC	--HY--10MJ-030--				2	
NI/39	FUSE BLOCK - (2) 30 AMP HOLDER; (2) 60 AMP HOLDER (4) 60 AMP HOLDER	AC	--HY--11UM-461--					1
		AC	--HY--11UM-601--					1
40	TERMINAL BOARD (X/F, 4/R, W,G,Y)	NS	40GS-----69813C1	1	1	1	1	1
NI/41	BRANCH CIRCUIT BOARD (L1,L2,L3,L4) 2 X 5 1/2" LG.	AC	--HY--84FE-069--				1	1
42	TERMINAL BLOCK (2 CONNECTIONS)	AC	--HY--84FE-302--	1	1	1		
43	FUSIBLE LINK	AC	--HN--12--680002	1	2	2	3	4

ORDERING INSTRUCTIONS

- A. All orders and inquiries should include the complete model and serial number of the unit on which the parts are to be used, and the part number and description of each part.
- B. Dealers should forward orders to their Carrier Distributor.

GENERAL NOTES

1. Casing parts and panels are not normally stocked, but are available upon request while in production. Requests for casing parts and panels, for units no longer in production, must be cleared for availability prior to submitting an order. Certain "sheet metal" parts are omitted in the interest of simplicity as orders for them are so infrequent that a simple description of the part, plus the model and serial number of the unit, will be acceptable.
2. Complete "Accessory Packages" or "F.I.O.P.'s" (Factory-Installed Option Plan) are not normally stocked or supplied by the Parts Center. (Refer to "Master Price Pages" and order from your normal source for finished goods. Accessory Packages and F.I.O.P.'s are listed in this catalog only for reference and to assist in the selection and ordering of components.
3. The replacement parts listed in this catalog are "Carrier Specified Parts" and, as a result of "standardization," may not be identical to the original part furnished on the equipment.
4. Letter designations (appearing in the LDC column preceding the part number column) are used throughout this catalog to represent the classification of those parts. These letter designations are listed below for ease of interpretation and identification. LDC designation in effect when original catalog is issued. Contact your Order Correspondent for latest parts availability.

AC — Available Component

AP — Accessory Package

CD — Contact your authorized Carrier Distributor for procurement information.

FIOP — Factory-Installed Option Plan

FF — Field Fabricate

FG — Finished Goods

MP — Multiple Package — Order sufficient number of packages to meet the unit requirements listed in the "Used On" column. Refer to Price Pages for order quantity.

NI — Not Illustrated

NA — Part is Not Available

NPS — New Part or Item that is Stocked

NPN — New Part or Item that is Not Stocked

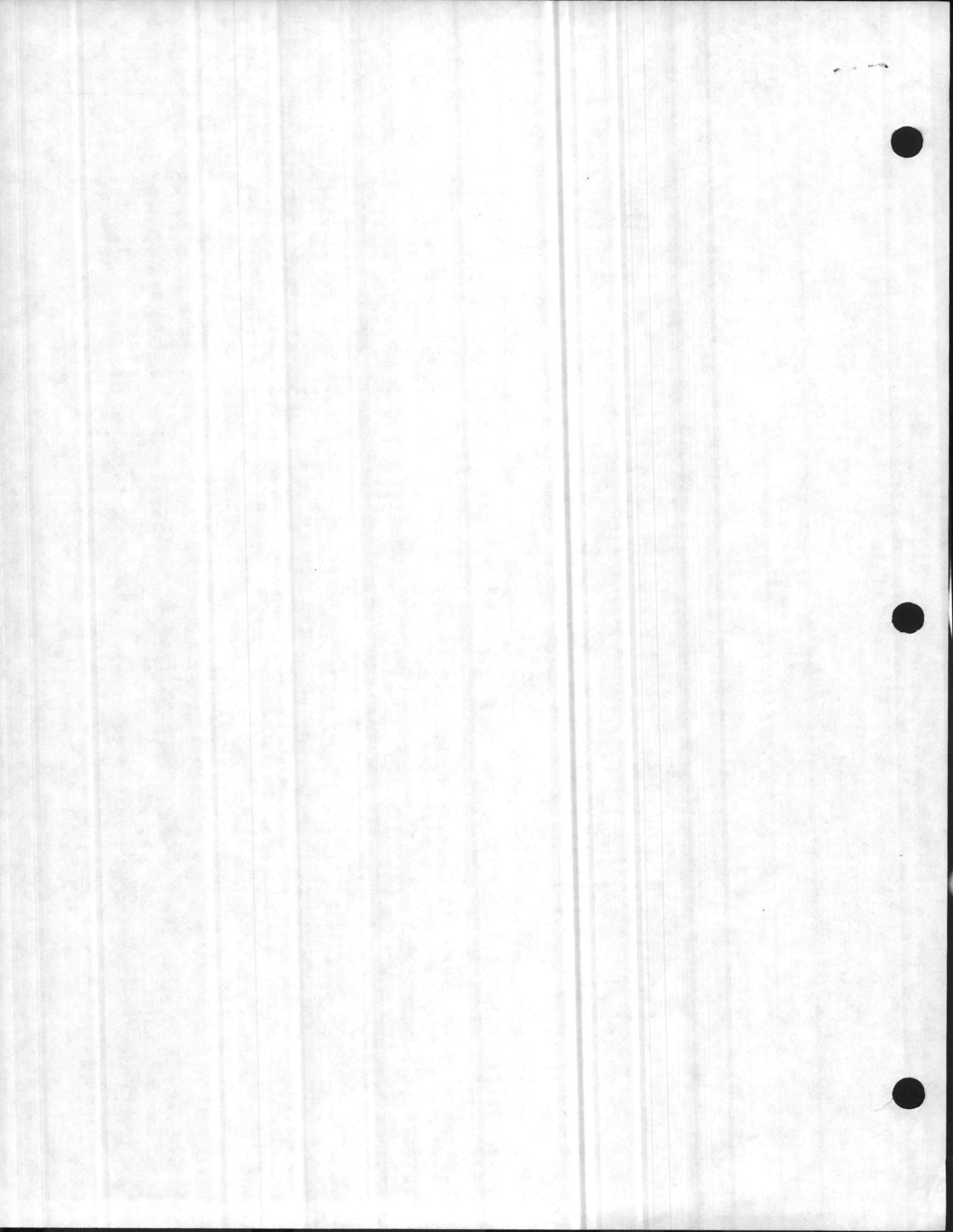
NS — Not Stocked

NSS — Not Sold Separately — Order complete assembly

SM1 — Sheet Metal 1. Current production unit. Available production component. Normal lead times. Order will be placed on factory for delivery after next production run.

SM2 — Sheet Metal 2. Obsolete production unit. May be supplied on a special order basis for a period up to two years following last production run. Longer lead times than SM1. Price and delivery will be supplied to the customer for his approval before placing the order. Where customer does not want to place an order because of excessive cost, we will supply drawings, if he so requests.

SM3 — Obsolete production unit. Tooling is not available, or fabrication cost excessive. Part no longer available. Drawings of these parts will be made available on request.



ZURN REFRIGERATED AIR DRYER

QDD INSTRUCTION MANUAL
QDD PARTS LIST

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REFRIGERATED AIR DRYER INSTRUCTION MANUAL

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ZURN INDUSTRIES, INC.
GENERAL AIR DIV.
1335 WEST 12TH ST.
P.O. BOX 13801
ERIE, PA, U.S.A. 16514
PHONE: 814/453-3651
TELEX: 291-936

FOREWORD

This manual contains Parts List, information and recommendations for installing, operating, and servicing the Zurn Refrigerated Air Dryer. The unit is complete, designed and manufactured to the highest standard of quality. All totally self-contained units have been fully tested and inspected by the manufacturer before shipment from the factory.

The information, specifications and illustrations in this manual are in accord with the information in effect at the time of printing. The manufacturer reserves the right to change design and specifications without notice and without incurring obligation.

Direct any questions regarding special conditions or problems not covered herein, to the General Air Distributor from whom the unit was purchased, or the General Air Div. of Zurn Industries, Inc., 1335 W. 12th St., Erie, PA 16501, Phone: 814/453-3651. Always specify the Model and Serial No. of the dryer in all correspondence regarding Service and Parts.

Returning Parts to Factory:

Authorization and shipping instructions must be obtained from the factory before returning parts. The manufacturer will not be responsible for parts returned without proper authorization or identification.

WARRANTY

***WARRANTY:** All products are warranted by the Seller to be free from defective materials and workmanship for a period of one year from date of shipment. Any equipment, material or part proving so defective will be replaced free of charge, provided that within a reasonable time for inspection after delivery, the Seller is notified of such defect and the equipment, material or part claimed to be defective is delivered prepaid to Seller at Erie, Pennsylvania with evidence that it has been properly maintained and used in accordance with instructions. We assume no responsibility that the goods concerned herein are fit for any particular purpose for which they are being bought other than the general purpose of goods of the description. **THE IMPLIED WARRANTY OF MERCHANTABILITY IS EXPRESSLY EXCLUDED.**

All guarantees and warranties shall be discharged by such replacement and in no event shall Seller be liable for interruption of operations, loss of profits, damages for delay, personal injury, or any other special, incidental, consequential, or indirect damages. Oversea shipments are excluded from warranty.

***NOTE:** Zurn Refrigerated Air Dryers have established an exceptional record of minimal, after installation service requirements. Therefore, the following procedure supplementing the foregoing warranty and subject to cancellation at any time upon written notice to all GAD distributors and representatives, has been adopted for servicing the Refrigerated Air Dryers during the warranty period: Models R2A thru R110W requiring service will be replaced by the factory with rebuilt units of similar age, or new units, freight free. Removal and re-installation costs accrue to the Purchaser. Replacement units will be invoiced at standard prices. Upon return of the defective unit, full credit will be issued providing the unit shows no

sign of mistreatment. Costs for repairing or replacing mistreated cabinet enclosures, gauges, fittings, etc., will be deducted from the credit to be allowed.

When Models R140A and larger, require warranty service, contact the factory, describing the malfunction. The factory will then provide the services of a service technician, or authorize procurement of the services of a competent local refrigeration service organization. Unauthorized service claims will be disallowed.

The **WARRANTY CARD** accompanying each dryer should be mailed to the factory to activate the warranty. If equipment requires service during the warranty period, telephone the factory at 814/453-3651 (Service Dept.) prior to servicing unit.

Most replacement parts can be easily obtained locally. Condenser/Compressor units are serviceable by any reputable refrigeration service firm. Local service people should call the factory Service Dept. for discussion prior to making any repairs, for guidance.

INSPECTION

Upon receipt of your Refrigerated Air Dryer, inspect the crate for signs of damage in transit. Large models are crated only to protect the instrument panel.

Inspect the unit thoroughly. Any sign of damage should be reported immediately to the carrier, and to the distributor who sold the unit.

APPLICATION

Units used at increased capacities and/or higher inlet air temperatures require special control settings. Applications and use for other than design rated conditions must be specified on purchase order for Warranty protection.

Customer responsibility includes the following routine preventive maintenance:

1. Proper ventilation for air-cooled units; 2. Keep air-cooled condenser fins clean; 3. Proper volume, pressure, and temperature water supply to water-cooled units; 4. Keep water-cooled condenser tubes clean, internally and externally; 5. Keep all float-actuated condensate traps clean; 6. All utilities serving the equipment must be properly maintained; 7. Compressed air supply must be kept free of all **corrosive elements**.

All service required as a result of the above, ARE NOT chargeable service charges to the factory. When a factory technician is requested for service found to be the result of the above, customer will be invoiced as a non-warranty service call.

INSTALLATION

Location: Always select an installation site where ample ventilation exists, particularly for air-cooled condensing units. An adequate supply of outside air may be made available by using an exhaust system to avoid recirculation of room air. Example: A unit processing 700 SCFM can place over 42,000 BTUH into the room. This would be a fairly high heat load for a small compressor room. An area with a high ambient temperature will affect the efficiency of an air-cooled condenser with a resultant increase in work load upon the refrigeration compressor unit. This can conceivably reduce the life of the equipment, and hinder its operation.

Units should be placed to allow adequate space (**min. 2 ft. per side**) for walking around the unit for inspection and servicing, if required. Under no circumstances should the unit be placed in an area where the ambient temperature will be **BELOW 50°F**, unless the unit has been ordered with a low ambient temperature kit and is protected with heat tracing elements in critical areas. For Air Cooled Units, see Page 4.

Outdoor Installation: Dryer Models ordered for outdoor or unheated areas should be factory equipped with NEMA-3 electricals and low temperature package. When placed outdoors, it is the customer's responsibility to protect the unit from the elements. Air-cooled machines must be protected against cold winter winds.

Foundation: All Refrigerated Dryers are complete with mounting bases. Foundation must be dead level and smooth, sufficiently strong for supporting the weight of the unit. Models R2A thru R10A are equipped for back panel wall mounting and with rubber feet. They may be placed on any suitable support such as a floor stand or bench.

Piping: When piped, pressurize the unit for leak testing units, **BUT, DO NOT MAINTAIN AIR FLOW AT ANY TIME PRIOR TO THE ACTUAL START-UP** which requires a "NO LOAD" condition. Compressed air piping should be of equal size as furnished on the inlet and outlet ports of the unit. Larger pipe, reduced to the inlet/outlet pipe size may be used. Flexible connections or union joints are recommended to avoid piping stresses and vibration transmission. It is mandatory that shutoff valves be placed at the air inlet and outlet ports, with a valved by-pass between the two, to permit isolation of

the unit for servicing, and eliminate the need for shutting down the plant air system. (See page 24 for schematic.) Warranty service on units without air by-pass piping may create an on the job service delay. The user will be charged for the service delay at service rates in effect at the time, including transportation costs, etc., if appropriate.

Refrigerated Dryers have either air-cooled or water-cooled condensing units, designated by the first suffix letter "A" or "W" at the end of each model number. On water-cooled units, connect the water supply line to the piping port marked "water in". Use the same pipe size as the fitting on the unit. Do not throttle the flow volume of water to the unit. This is done automatically by internal controls. Pipe the port marked "water out" to a drain or to a water recovery system. **DO NOT VALVE THIS LINE OR CONNECT TO ANY OTHER AIR SYSTEM DRAIN LINE.** See Installation Note page 24.

NOTE: The factory ships all water-cooled units piped for tower water flow, unless otherwise specified. (Okay for city water also.)

The condensate drain line is marked "DRAIN". Models R2A through R150W are equipped with float type drains. Models R200A through R360W have Model ET-4 Electronic Timer/Motor operated Ball Valve with adjustable cycle sequence and blowdown settings. Models R440A and larger have DT-3 Timer-Controlled, Motor-Operated Ball Valve Drains. Combination Refrigerated/Desiccant Dryers have either ET-4 or DT-3 Drains. Pipe these drains to any suitable waste system. **DO NOT VALVE THIS LINE** or connect with air receiver tank drain or any other air system drain.

Electrical Requirements: The nameplate on the instrument panel of each unit identifies the power supply requirements. All units requiring magnetic starters are so equipped internally. A suitable wall-mounted disconnect switch in accordance with National and Local Code requirements is recommended. See page 12 for AMP rating.

Compressor Mounting Bolts: When loosening is required, there will be an instruction tag on front of unit. If needed, rubber grommets for the bolts are in a bag wired to the unit.

GENERAL DATA

STANDARD REFRIGERATED DRYERS

Refrigerated Air Dryers are constant running hermetic type units with either air-cooled or water-cooled condensing units.

The Refrigerated Air Dryer is a five-step unit:

- Step 1 - Precooling - a unique Air Drying Module carries the inlet air in opposite flow to the refrigerated air leaving the unit, reducing its temperature to about 70°F, when inlet temperature is 100°F.
- Step 2 - Refrigeration - the Air Drying Module further carries the pre-cooled inlet air through a tube(s) within a refrigerant jacket. The air stream is cooled to 35°-38°F at this point, reducing its dewpoint to this temperature. (50°F when specified.)
- Step 3 - The refrigerated air passes thru a generously sized centrifugal and baffled separator/accumulator, where all condensed moisture and oil are separated from the air stream and collected for draining.
- Step 4 - Units equipped with Automatic Drain Devices have these attached to the drain lines of the separators. (With a manual by-pass valve on Models R200A and larger.)
- Step 5 - The cold air leaves the separator at about 40°F, and passes through the reheat side of the Air Drying Module, where it is reheated to within 20°-25°F of inlet air temperature.

The five-step method reduces the work-load demand upon the refrigeration unit for very economical operating costs and assurance of long unit life.

COMBINATION REFRIGERATED/DESICCANT DRYERS

The Combination Refrigerated/Desiccant Air Dryer combines the advantages of drying air by refrigeration and non-regenerative desiccant into one unit. This technique provides a pressure dewpoint of 15°F (±5°F) @ 100°F ambient temperature, 100°F inlet air and 100 PSIG.

After the air is cooled to 35°F in the refrigeration portion of the combination dryer (as described previously in this manual), it then passes into the desiccant dryer which has replaced the separator/accumulator tank in the standard refrigeration dryer. Here the dewpoint is chemically lowered approximately 20°F below the 35°F pressure dewpoint achieved by the refrigeration system. The air then proceeds into the reheater and then into the plant system. The Combination Refrigerated/Desiccant Dryer is a patented unit with only two air connections in the entire system.

In the event of failure in the refrigeration circuit, the desiccant dryer may be used as a backup until repairs can be made to the refrigerated dryer. The only stipulation is that the inlet air temperature to the desiccant vessel must not exceed 100°F.

DESIGN RATINGS

Capacities

Constant Maximum Flow capacity @ 100°F inlet, 100°F ambient. (See Page 8.) Operation above rated capacity and/or 100°F inlet requires special control settings.

Temperatures

Ambient temperature range of operation,
standard air-cooled unit +50°F to +100°F; (90% capacity at +110°F).
water-cooled, 50°F to 130°F
with low ambient temperature package: air-cooled - 0°F to +110°F; water-cooled - 0°F to +130°F.

Dryer must be protected from the elements and the wind chill factor.

Inlet air temperature, 50°F to +100°F (to +130°F by special adjustment).

Heat Rejection

Air-cooled units - approximately 115 BTU/minute per 100 SCFM to ambient

Water-cooled units - approximately 115 BTU/minute per 100 SCFM to water

Water Requirements - Water-cooled units only

Pressure - 20 PSI minimum differential pressure required, inlet-vs-outlet. All units are piped for tower water, but can be used for city water without modification. Approximately 3-gpm tower or city water at 90°F per refrigeration H.P. With colder water, the unit's water regulating valve automatically reduces water flow.

NOTE: Flow is modulated from minimum-gpm to maximum-gpm, dependent upon workload, by a pressure controlled valve sensing condensing pressure (head pressure).

REFRIGERATED AIR DRYER CIRCUITS

Refrigerant (R12 or R22), is pumped through a closed-loop system with two basic sections commonly referred to as high and low pressure sections. The circuit leaving the pressure regulator valve through the refrigerant heat exchanger to the compressor intake is known as the low pressure or suction side (low side). The circuit leaving the refrigerant compressor to the pressure regulator device is known as the high pressure or high side.

The compressor takes in low pressure refrigerant gas and compresses it to a high pressure, high temperature gas. This hot refrigerant gas passes into the refrigerant condenser where it is cooled and liquified. It then passes into a liquid receiver. The refrigerant then passes through a sight glass/moisture indicator for observation, Models R200A & larger. When the unit is operating on FULL LOAD, no bubbles should be noted in the sight glass. The moisture indicator in the sight glass changes color, to indicate whether moisture is present in the refrigerant. If moisture is present, the system must be evacuated by vacuum until dry, then recharged with refrigerant. (See Service Instruction Card attached to the refrigerant compressor for recharging instructions on page 20).

The refrigerant then passes to a pressure regulating device(s), where the liquid refrigerant is throttled and a temperature drop occurs as part of the liquid changes to a gas. The cold refrigerant gas and liquid then enter the refrigerant-to-air heat exchanger, where it adsorbs the heat from the compressed air as it evaporates. The low pressure refrigerant gas returns to the compressor for continuation of the process.

SINGLE VALVE SYSTEM

Models R2A thru R150W.

The liquid refrigerant passes to a pressure regulating valve which senses lowside pressure and automatically maintains the suction pressure by passing the proper amount of liquid refrigerant and hot gas. This prevents freeze-ups during light load or no load operation. The regulating valve has been set at the factory and no adjustment should be necessary. However, it can be adjusted in the field, if necessary, to change the pressure setting. It must be adjusted with no compressed air flowing through the unit. (Consult the factory for instructions on this adjustment.)

THREE VALVE SYSTEM

Models R200A & Larger.

The expansion of the refrigerant is controlled by a Thermostatic Expansion Valve and pressure regulating valves. (Hot Gas By-pass Valves.)

The expansion valve responds to suction-line temperature, sensed by a temperature bulb strapped to the suction line, and connected through a capillary tube to the control diaphragm of the expansion valve. As suction line temperature increases, the expansion valve is opened to allow more liquid refrigerant to feed into the evaporator. This increased volume of liquid causes a greater cooling effect, suction line temperature drops, and the valve throttles back.

In addition, the circuit incorporates two hot gas by-pass valves. A main pressure regulating valve for the evaporator and a smaller valve feeding a small amount of gas into the suction line, to enable easier control of the expansion valve at light loads. This small proportion of hot gas also assists in oil return and slugging prevention.

Under "NO LOAD" or light load conditions, the Expansion Valve will be nearly closed and evaporator pressure low. This low pressure causes the Hot Gas By-pass Valve to open wider and admit more hot gas into the evaporator along with the liquid refrigerant. As load lessens, the Hot Gas Valve opens further and, with the Expansion Valve, will continuously modulate the proportions of gas and liquid to maintain proper liquid level in the evaporator.

As load increases, evaporator temperature and pressure begin to rise. The increase in temperature acts upon the Expansion Valve temperature sensor, opening the valve to admit more liquid refrigerant. At the same time, the increased pressure acts to close the Hot Gas Valve. This action continues until at full load the Expansion Valve has full control, and the Hot Gas Valve is closed.

AIR COOLED CONDENSING UNITS.

Models with first suffix letter "A" have air-cooled condensing units similar to an automobile radiator, and are equipped with motor-operated fans for cooling. Fans are cycled automatically to maintain a normal condensing temperature when operating in low ambient temperatures, or under low load conditions. Condenser fins **MUST BE KEPT CLEAN.**

Air-cooled condensing units need a consistent "ambient" air for proper performance & effectiveness. Quite often, this basic requirement seems to have been overlooked when selecting a site for an air dryer.

When choosing a location for an air dryer, one of the prime considerations should be assurance of full unrestricted flow of clean, unheated, unrecirculated air to the condenser. A unit processing 700 SCFM of air can eject over 42,000 BTUH.

This would be a high heat load for a small space. A high ambient temperature lowers condenser efficiency, with a corresponding increase of compressor work load, tending to reduce equipment life span.

To ensure proper air supply, consider:

1. Adequate opening areas.

The condenser must have a full flow of air, unrestricted. If the room in which the dryer is located has tunnel-like passages to admit & discharge air, each opening must be equal to or larger than the face area of the condenser.

2. Unheated air required.

The air supplied to the condenser must be unheated. Proximity of the dryer cabinet air inlet to any heat-producing situations must be avoided.

3. Avoid recirculation.

Locate the dryer unit such that the hot air exhausted from the condenser cannot be picked up and sent through again. Be sure that the cabinet is not so placed that a near-by wall can affect the air-flow pattern.

4. Clean air and condenser surface are imperative.

Situate the dryer so that the condenser is easily accessible for cleaning. It is obvious that the probability of the condenser being cleaned thoroughly, repeatedly, periodically is in direct ratio to its accessibility.

Install a readily replaceable oversized filter if no clean air supply exists.

These recommendations are offered with the premise that they will reduce field failures of equipment. It is hoped that they will be accepted and used in the same vein.

WATER COOLED CONDENSING UNITS.

Models with first suffix letter "W" have water-cooled condensing units.

The refrigeration cycle in the water-cooled system is basically the same as in the air-cooled, the main difference occurring in the condenser of the unit. In the water-cooled system, the refrigerant is condensed by cold water flowing in an opposite direction to the refrigerant in a tube-in-tube or tube and shell heat exchanger as opposed to the use of fans for condensing in the air-cooled system.

A modulating water-flow control valve, controlled by the high side pressure, regulates the amount of water flowing through the condenser. This maintains the condenser temperature at 115°F, which is preset at the factory. However, this setting can be manually adjusted to meet varying conditions in the field. These features give the water-cooled condensing units the flexibility to perform efficiently under various loads and conditions.

ADDITIONAL CAPACITY CONTROL FEATURES

Larger units of 25 HP or more, have various stages of capacity reduction in the compressor, which loads and unloads to meet the work load. Example: The 25 HP unit loads or unloads individual cylinders in accordance with the work load.

CONTROLS

PANEL MOUNTED

The following controls are used on Zurn Refrigerated Air Dryers:
(See Pages 14 & 15)

(NOTE: Models R2A and R3A are not available with options. Models R5A through R10A will accept two (2) gauges only, no timer drains.)

Refrigerant Low Pressure Gauge

(Optional on Models R5A through R110W)

30" Vac/150 PSIG, indicates pressure on the low side of refrigerant system. R12 units normally indicate 32-35 PSIG; R22 units normally indicate 60-64 PSIG. Sensor connected adjacent to refrigerant compressor inlet.

Refrigerant High Pressure Gauge

(Standard on Models R140A and larger. Optional on Models R5A through R110W)

0 to 300 PSIG, indicates pressure on high side of refrigerant system. Units using R12 refrigerant, air-cooled, normally indicate 125 to 165 PSIG. Water-cooled R12 units normally indicate 125-150 PSIG. Units using R22 refrigerant, air-cooled, normally indicate 225-265 PSIG. Water-cooled R22 units normally indicate 210-245 PSIG. Sensor connected adjacent to refrigerant compressor outlet.

Elapsed Time Counter

(Optional, all Models — Not available on Models R2A and R3A)
An electric hour-counter connected to the Manual On/Off switch.

Automatic Drain

(See Installation, Page 2)

Models R2A through R150W have a float type drain as standard. Models R200A and larger have the Model ET-4 Automatic Drain Assembly as standard.

High Temperature Red Indicating Light

(Standard on Models R200A and larger. Optional on Models R5A through R150W)

When lighted, indicates an overload condition. Activated by temperature switch sensing high-suction line temperature adjacent to Air Drying Module. Normally activates at about 55°F on, 50°F off.

NOTE: Indicator will light on start up for two or three minutes until system balances.

Power On Indicator

An indicating light connected across manual power switch.

Compressor On Indicator (Models R200A and larger)

(Optional, all Models except on Model R2A & R3A)

An amber light indicating that the refrigerant compressor is in operation. Connected across coil.

Audible Alarm

(Optional, all Models except on Models R2A and R3A)

Signals malfunction by sensing suction line high temperature.

Inlet Air Temperature Gauge

(Standard on Models R140A and larger. Optional on Models R5A through R110W)

40°F to 200°F, indicates temperature of inlet air. Sensor connected to air inlet piping.

Outlet Air Temperature Gauge

(Optional on Models R5A and larger)

40°F to 200°F, indicates temperature of outlet air. Sensor connected to air outlet piping.

Outlet Air Pressure Gauge

(Standard on Models R15A and larger. Optional on Models R5A through R10A)

0-200 PSIG, indicates air pressure with sensor connected to air outlet piping.

Inlet Air Pressure Gauge

(Optional on Models R5A and larger)

0-200 PSIG, indicates air pressure with sensor connected to air inlet piping.

Refrigerant Analyzer Gauge

(Optional on Models R5A through R10A)

0°F to 130°F (R-12) or 0°F to 135°F (R-22) indicates pressure dewpoint of the refrigerated air system. (Does not indicate final dewpoint on combination desiccant/refrigerated dryers.)

INTERNAL

Dead System Pressure Switch

(Optional, all Models — Not available on Models R2A and R3A)

Controls startup sensing air pressure at outlet. Adjustable, 20 PSI differential. Factory startup setting is 50 PSIG. Shutdown setting is 30 PSIG. Automatically turns off power on air pressure loss in system. Automatic restart on re-pressurization.

Dryer/Filter

To collect moisture and trap foreign particles. Should be replaced if any major work is done on refrigerant piping.

Sight Glass (Model R200A and larger)

Located in the liquid line, indicates liquid refrigerant content and moisture content.

Expansion Valve

Also referred to as the "Pressure Regulating Valve." Senses "low side" or suction pressure, (temperature). Meters refrigerant flow into evaporator. Adjust only with no air flow. (No load condition)

High-Low Refrigerant Cut-Out Switch

(Models R15A and larger)

Settings Hi Side

R-12 225 PSI cut-out, air-cooled

R-22 340 PSI cut-out, air-cooled

R-12 175 PSI cut-out, water-cooled

R-22 270 PSI cut-out, water-cooled

Settings Low Side (R15A through R150W)

R-12 27 PSI cut-out; 32 PSI cut-in

R-22 55 PSI cut-out; 60 PSI cut-in

Settings Low Side (R200A and larger)

R-12 10 PSI cut-out; 32 PSI cut-in

R-22 25 PSI cut-out; 60 PSI cut-in

A safety control senses high and low refrigerant pressure at refrigerant compressor outlet and inlet respectively. Turns off power on excessive pressure variation.

Water Regulating Valve

(On Water-Cooled Units Only)

Senses compressor discharge pressure, regulates water flow to maintain an average 115°F condensing temperature. Setting is reflected on refrigerant high-pressure gauge. May be adjusted to 105°F or 120°F, dependent upon water temperature and supply. Decreasing temperature increases water flow.

Cooling Fan Regulating Switch

Settings Models R2A through R10A

R-12 170 cut-in; 135 cut-out

Settings Models R15A and larger

165 PSI cut-in; 125 PSI cut-out

R-22 265 cut-in; 225 cut-out

Senses compressor discharge pressure. Regulates operation of the cooling fan to maintain a minimum 115°F condensing temperature. Setting is reflected on refrigerant high-pressure gauge.

Motor-Operated Drain Valve

Controlled by electric timer(s), attached to the condensate drain line with a manual by-pass. Automatically drains condensate on signal from the panel mounted or valve mounted timers.

Manual Drain By-Pass Valve

(Models R200A and larger)

A ball valve located on the condensate drain for manually bypassing Automatic Drain, or, used in lieu of the Automatic Drain.

Low Oil Safety Control

(Models R250A and larger)

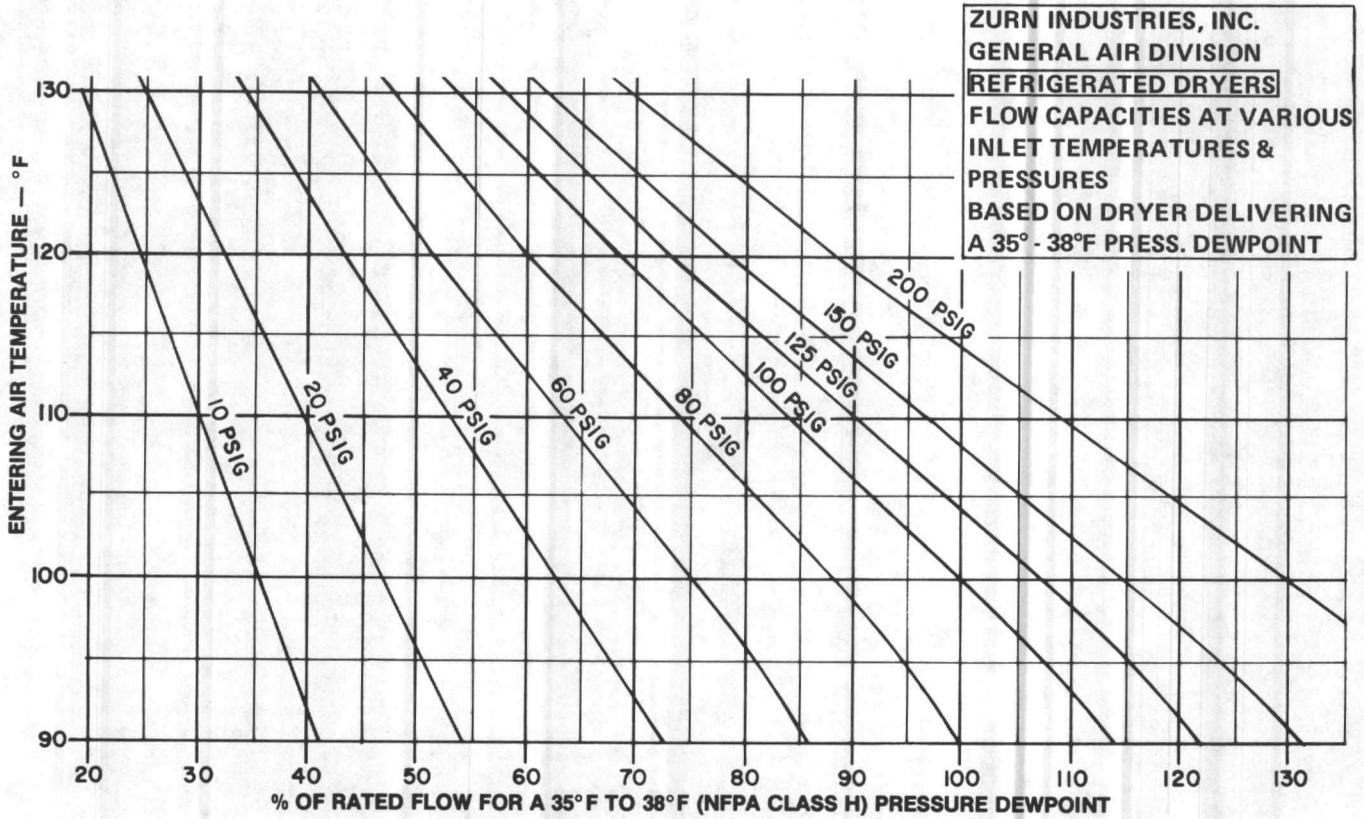
A safety switch located on all forced lubricated compressors, sensing lubrication pressure. Shuts down compressor on low oil pressure condition. Time delay type (90 sec. or 120 sec.).

Crankcase Heater

(Models R10A and larger)

A safety device to insure against refrigerant migration back to the compressor during periods of shutdown.

PERFORMANCE CHARTS – REFRIGERATED DRYERS



NOTE: For 50°F - 54°F pressure dewpoints (NFPA Class M), flow percentages may be multiplied by 1.3 (30% increase);
 For 45°F - 49°F pressure dewpoints (NFPA Class K), multiply percentages by 1.2;
 For 40°F - 44°F pressure dewpoints (NFPA Class J), multiply percentages by 1.1;
 but pressure drop may exceed 5-PSI. Check the pressure drop curve (Page 7) before final sizing the dryer.

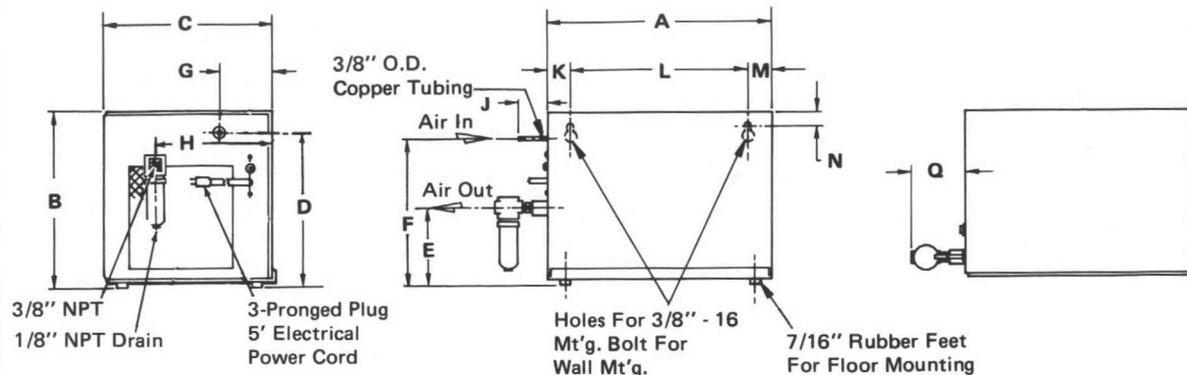
Capacities based on 100°F ambient temperature for air-cooled models. For maximum ambient temperature of 110°F, multiply flow percentages by 0.9 (10% decrease). For water-cooled units, cooling water must not exceed 90°F.

SCFM Capacities At 100° F Inlet And 100° F Ambient Temperatures

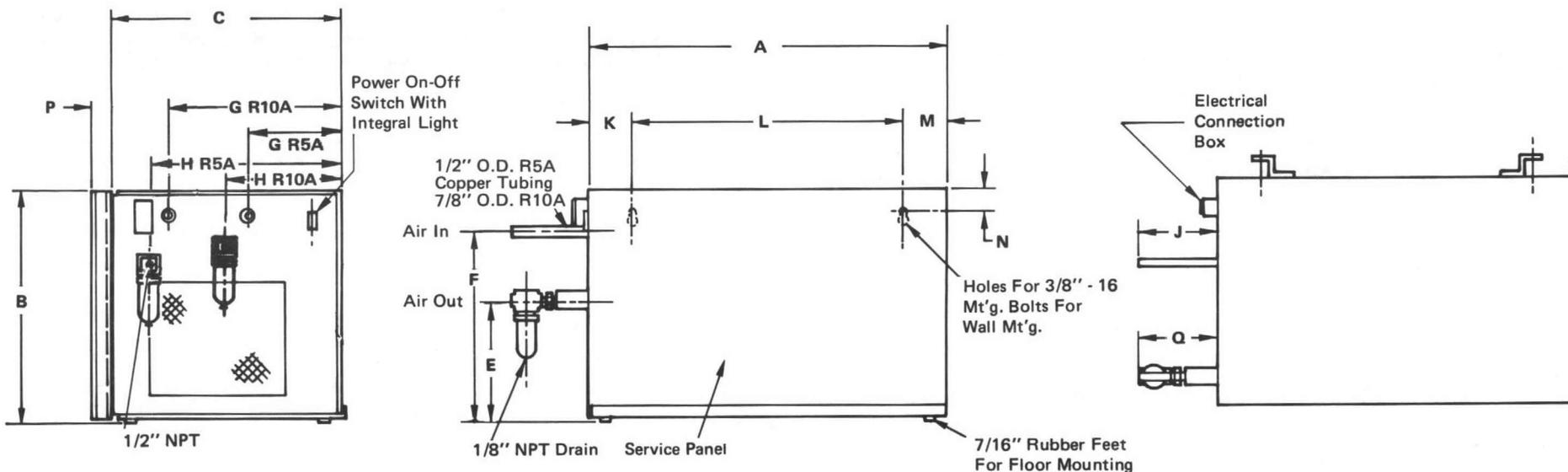
Model	Operating Pressure (PSIG)									
	10	20	30	40	50	60	70	80	90	100
R2A	4	5	5.5	6	7	7.5	8	9	9.5	10
R3A	5.5	7	8.5	9.5	10.5	11.5	12.5	13	14	15
R5A	11	14	17	19	21	23	25	26	28	30
R10A	18	24	28	32	35	38	41	44	47	50
R15A	32	42	50	57	62	68	74	79	85	90
R18W	36	47	55	63	69	75	82	88	94	100
R20A	45	59	69	79	86	94	103	110	118	125
R25W	50	66	77	88	97	105	115	123	132	140
R40A	72	94	110	126	138	150	164	176	188	200
R45W	81	106	124	142	155	169	185	198	212	225
R55A	99	129	151	173	190	206	226	242	259	275
R65W	117	153	179	205	224	244	267	286	306	325
R75A	135	176	206	236	259	281	306	330	353	375
R80W	144	188	220	252	276	300	328	352	376	400
R100A	180	235	275	315	345	375	410	440	470	500
R110W	198	259	303	347	380	413	451	484	517	550
R140A	252	329	385	441	483	525	574	616	658	700
R150W	270	353	413	473	518	563	615	660	705	750
R200A	360	470	550	630	690	750	820	880	940	1,000
R220W	396	517	605	693	766	825	902	968	1,034	1,100
R250A	450	588	688	788	863	938	1,025	1,100	1,175	1,250
R320A	576	752	880	1,008	1,104	1,200	1,312	1,408	1,504	1,600
R360W	648	846	990	1,134	1,242	1,350	1,476	1,584	1,692	1,800
R440A	792	1,034	1,210	1,386	1,518	1,650	1,804	1,936	2,068	2,200
R480W	864	1,128	1,320	1,512	1,656	1,800	1,968	2,112	2,256	2,400
R590A	1,062	1,387	1,623	1,859	2,036	2,213	2,419	2,596	2,773	2,950
R660W	1,188	1,551	1,815	2,079	2,277	2,475	2,706	2,904	3,102	3,300
R690A	1,242	1,622	1,898	2,174	2,381	2,588	2,829	3,036	3,243	3,450
R770W	1,386	1,810	2,118	2,426	2,657	2,888	3,157	3,388	3,619	3,850
R880W	1,584	2,068	2,420	2,772	3,036	3,300	3,608	3,872	4,136	4,400
R940A	1,692	2,209	2,585	2,961	3,243	3,525	3,854	4,136	4,418	4,700
R1050W	1,890	2,468	2,888	3,308	3,623	3,938	4,305	4,620	4,935	5,250
R1100A	1,980	2,585	3,025	3,465	3,795	4,125	4,510	4,840	5,170	5,500
R1230W	2,214	2,891	3,383	3,875	4,244	4,613	5,043	5,412	5,781	6,150
R1480A	2,664	3,478	4,070	4,662	5,106	5,550	6,068	6,512	6,956	7,400
R1650W	2,970	3,878	4,538	5,198	5,693	6,188	6,765	7,260	7,755	8,250
R1980A	3,564	4,653	5,445	6,237	6,831	7,425	8,118	8,712	9,306	9,900
R2200W	3,996	5,217	6,105	6,993	7,659	8,325	9,102	9,768	10,434	11,100
R2640A	4,752	6,204	7,260	8,316	9,108	9,900	10,824	11,616	12,408	13,200
R3000W	5,400	7,050	8,250	9,450	10,350	11,250	12,300	13,200	14,100	15,000
R3100A	5,580	7,285	8,525	9,765	10,695	11,625	12,710	13,640	14,570	15,500
R3500W	6,300	8,225	9,625	11,025	12,075	13,125	14,350	15,400	16,450	17,500
R4180A	7,524	9,823	11,495	13,167	14,421	15,675	17,138	18,392	19,646	20,900
R4600W	8,280	10,810	12,650	14,490	15,870	17,250	18,860	20,240	21,620	23,000
R5400A	9,720	12,690	14,850	17,010	18,630	20,250	22,140	23,760	25,380	27,000
R5800W	10,440	13,630	15,950	18,270	20,010	21,750	23,780	25,520	27,260	29,000

NOTES

1. Minimum clearance around dryer 24" (front and sides).
2. **Ambient Temperature**
Air-cooled air dryers should be installed in areas where the ambient temperature will not drop below +50°F or exceed +100°F.
3. Maximum working pressure 200 PSIG. Consult factory for higher operating pressure.
4. Models R2A and R3A equipped with a 3-prong male plug for electrical connection.
5. 3/8" - 16 bolts required for wall mounting.
6. On those units without reheat - R2A, R3A, R5A and R10A - the compressed air will come out of the dryer rather cold (50° - 60°F). It is advisable to insulate this line for a few feet, as it is susceptible to sweating.



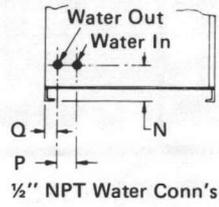
Models R5A, R10A



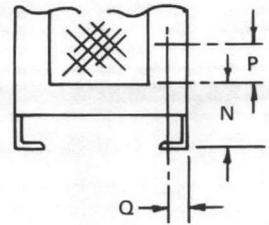
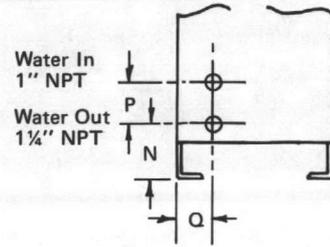
MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
R2A	19-1/4	14-9/16	14-3/16	12-3/4	11-1/2	13-3/4	5-3/4	9-1/2	3	2-1/16	15-1/8	2-1/16	1-1/4	-	4-1/4
R3A	19-1/4	14-9/16	14-3/16	12-3/4	11-1/2	13-3/4	5-3/4	9-1/2	3	2-1/16	15-1/8	2-1/16	1-1/4	-	4-1/4
R5A	31-3/8	22-7/16	23	18	13-13/16	18	7-1/2	19-1/4	6-3/4	5-11/16	23-1/2	5-11/16	2-1/4	1-3/4	5-5/8
R10A	31-3/8	22-7/16	23	19-1/2	19-9/16	18-9/16	18-13/16	7-3/16	6-3/4	5-11/16	23-1/2	5-11/16	2-1/4	1-3/4	6

LEFT SIDE VIEWS

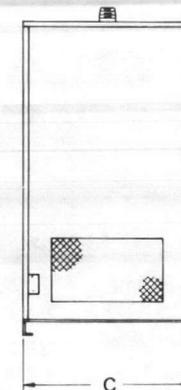
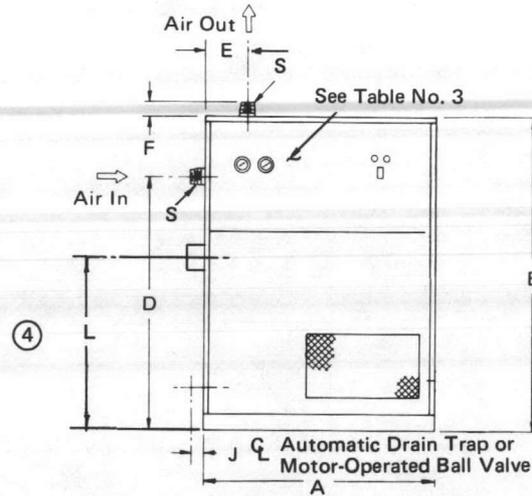
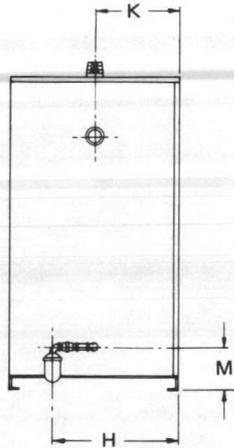
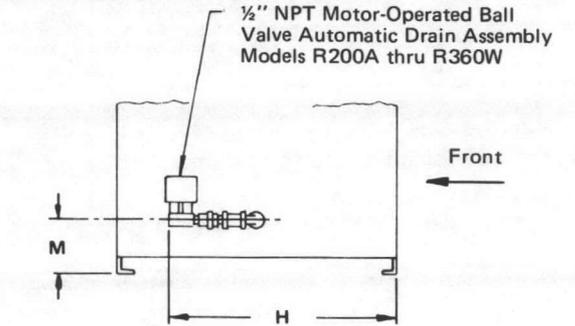
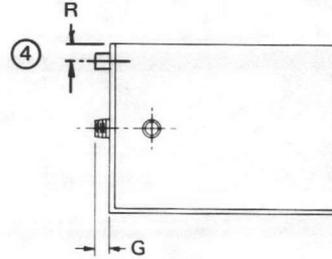
Models R45W, R65W,
R80W, R110W and R150W



Water Conn's R220W and R360W



1/2" O.D. Copper Tube
Water Conn's R18W and R25W



MODELS R15A THROUGH R360W
(See Tables 1 and 2 Page 11)

NOTES

1. Minimum clearance around air dryer - 24".
2. **Ambient Temperature**
Air-cooled air dryers should be installed in areas where ambient temperature will not drop below +50°F or exceed +100°F. Water-cooled units, 130°F maximum ambient. (See Design Ratings - Page 3.)
3. Maximum working pressure 200 PSIG. Consult factory for higher operating pressures.
- ④ Electrical connection.
5. All air drain pipe connections are 1/2" NPT.

Table 1

Model	DIMENSIONS																
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
R15A	28 ³ / ₈	46 ¹ / ₈	22 ¹ / ₈	42 ³ / ₈	6 ¹ / ₂	1 ⁷ / ₈	1 ⁷ / ₈	18 ¹ / ₄	4 ³ / ₁₆	18 ¹ / ₈	16	23 ¹ / ₂	—	—	—	3	1" NPT
R18W	28 ³ / ₈	46 ¹ / ₈	22 ¹ / ₈	42 ³ / ₈	6 ¹ / ₂	1 ⁷ / ₈	1 ⁷ / ₈	18 ¹ / ₄	4 ³ / ₁₆	18 ¹ / ₈	16	23 ¹ / ₂	5 ¹ / ₂	2	3 ¹ / ₈	3	1" NPT
R20A	28 ³ / ₈	46 ¹ / ₈	22 ¹ / ₈	42 ³ / ₈	6 ¹ / ₂	1 ⁷ / ₈	1 ⁷ / ₈	18 ¹ / ₄	4 ³ / ₁₆	18 ¹ / ₈	16	23 ¹ / ₂	—	—	—	3	1" NPT
R25W	28 ³ / ₈	46 ¹ / ₈	22 ¹ / ₈	42 ³ / ₈	6 ¹ / ₂	1 ⁷ / ₈	1 ⁷ / ₈	18 ¹ / ₄	4 ³ / ₁₆	18 ¹ / ₈	16	23 ¹ / ₂	5 ¹ / ₂	2	3 ¹ / ₈	3	1" NPT
R40A	29 ¹ / ₄	50 ¹ / ₈	22 ¹ / ₈	43 ³ / ₄	7 ⁵ / ₈	1 ³ / ₈	1 ³ / ₈	18 ¹ / ₄	2 ¹ / ₂	11 ¹ / ₈	32	19 ¹ / ₄	—	—	—	4 ¹ / ₂	2" NPT
R45W	29 ¹ / ₄	50 ¹ / ₈	22 ¹ / ₈	43 ³ / ₄	7 ⁵ / ₈	1 ³ / ₈	1 ³ / ₈	18 ¹ / ₄	2 ¹ / ₂	11 ¹ / ₈	32	19 ¹ / ₄	8 ¹¹ / ₁₆	2 ¹ / ₂	15 ⁵ / ₈	4 ¹ / ₂	2" NPT
R55A	34 ¹ / ₄	58 ¹ / ₈	24 ¹ / ₈	51 ³ / ₄	7 ⁵ / ₈	1 ³ / ₈	1 ³ / ₈	19 ¹ / ₄	2 ¹ / ₂	12 ¹ / ₈	36	25 ³ / ₈	—	—	—	4	2" NPT
R65W	34 ¹ / ₄	58 ¹ / ₈	24 ¹ / ₈	51 ³ / ₄	7 ⁵ / ₈	1 ³ / ₈	1 ³ / ₈	19 ¹ / ₄	2 ¹ / ₂	12 ¹ / ₂	36	25 ³ / ₈	7 ⁹ / ₁₆	4	16 ⁵ / ₈	4	2" NPT
R75A	52 ¹ / ₄	65	36 ¹ / ₈	55 ³ / ₈	8 ³ / ₁₆	2 ¹¹ / ₁₆	2 ⁷ / ₈	25 ¹ / ₄	2 ¹ / ₂	18 ¹ / ₈	10 ¹ / ₂	9	—	—	—	32 ¹ / ₈	2" NPT
R80W	52 ¹ / ₄	65	36 ¹ / ₈	55 ³ / ₈	8 ³ / ₁₆	2 ¹¹ / ₁₆	2 ⁷ / ₈	25 ¹ / ₄	2 ¹ / ₂	18 ¹ / ₈	10 ¹ / ₂	9	7 ⁵ / ₈	4	3 ¹ / ₂	31 ⁷ / ₈	2" NPT
R100A	52 ¹ / ₄	65	36 ¹ / ₈	54 ³ / ₄	9	2 ³ / ₄	3	25 ¹ / ₄	2 ¹ / ₂	18 ¹ / ₈	10 ¹ / ₂	9	—	—	—	32 ¹ / ₈	3" NPT
R110W	52 ¹ / ₄	65	36 ¹ / ₈	54 ³ / ₄	9	2 ³ / ₄	3	25 ¹ / ₄	2 ¹ / ₂	18 ¹ / ₈	10 ¹ / ₂	9	7 ⁵ / ₈	4	3 ¹ / ₂	31 ⁷ / ₈	3" NPT
R140A	52 ¹ / ₄	65	36 ¹ / ₈	54 ³ / ₄	9	2 ³ / ₄	3	25 ¹ / ₄	2 ¹ / ₂	18 ¹ / ₈	10 ¹ / ₂	9	—	—	—	31 ⁷ / ₈	3" NPT
R150W	52 ¹ / ₄	65	36 ¹ / ₈	54 ³ / ₄	9	2 ³ / ₄	3	25 ¹ / ₄	2 ¹ / ₂	18 ¹ / ₈	10 ¹ / ₂	9	7 ⁵ / ₈	4	3 ¹ / ₂	31 ⁷ / ₈	3" NPT
R200A	72 ¹ / ₈	71	36 ¹ / ₄	59 ⁵ / ₈	12 ³ / ₁₆	2 ³ / ₁₆	2 ¹³ / ₁₆	26 ⁹ / ₁₆	2 ³ / ₈	18 ³ / ₁₆	22	6 ¹⁵ / ₁₆	—	—	—	4 ¹ / ₂	4" NPT
R220W	72 ¹ / ₈	71	36 ¹ / ₄	59 ⁵ / ₈	12 ³ / ₁₆	2 ³ / ₁₆	2 ¹³ / ₁₆	26 ⁹ / ₁₆	2 ³ / ₈	18 ³ / ₁₆	22	6 ¹⁵ / ₁₆	6 ⁵ / ₈	4	4 ³ / ₄	4 ¹ / ₂	4" NPT
R250A	72 ¹ / ₈	71	36 ¹ / ₄	59 ⁵ / ₈	12 ³ / ₁₆	2 ³ / ₁₆	2 ¹³ / ₁₆	26 ⁹ / ₁₆	2 ³ / ₈	18 ³ / ₁₆	22	6 ¹⁵ / ₁₆	—	—	—	4 ¹ / ₂	4" NPT
R320A	72 ¹ / ₈	71	36 ¹ / ₄	59 ⁵ / ₈	12 ³ / ₁₆	2 ³ / ₁₆	2 ¹³ / ₁₆	26 ⁹ / ₁₆	2 ³ / ₈	18 ³ / ₁₆	22	6 ¹⁵ / ₁₆	—	—	—	4 ¹ / ₂	4" NPT
R360W	72 ¹ / ₈	71	36 ¹ / ₄	59 ⁵ / ₈	12 ³ / ₁₆	2 ³ / ₁₆	2 ¹³ / ₁₆	26 ⁹ / ₁₆	2 ³ / ₈	18 ³ / ₁₆	22	6 ¹⁵ / ₁₆	6 ⁵ / ₈	4	4 ³ / ₄	4 ¹ / ₂	4" NPT

Table 2

STANDARD INSTRUMENTATION INCLUDED AS SHOWN								
Model No.	Outlet Air Pressure Gauge	Inlet Air Temperature Gauge	Refrigerant Low Pressure Gauge	Refrigerant High Pressure Gauge	High Dewpoint Red Indicating Light	Automatic Drain Float Trap	Automatic Drain ET-4 Electronic Timer	Compressor Running Light
			Refrigerant Analyzer					
R2A & R3A								
R5A thru R10A							X	
R15A thru R110W	X		X*				X	
R140A and R150W	X	X	X	X			X	
R200A thru R360W	X	X	X	X	X		X	X
R440A and larger	X	X	X	X	X		X	X

*Models R15A thru R110W have this gauge, identified as "Refrigerant Analyzer Gauge", only.

35°F DEWPOINT UNITS:

MODEL NO.	HP	FULL LOAD AMPS			
		115/1/60	208-230/1/60	208-230/3/60	440-460/3/60
R2A	1/6	3.9 Amps			
R3A	1/5	3.9 Amps			
R5A	1/3	4.6 Amps			
R10A	1/2	12.7 Amps	6.4 Amps	3.0 Amps	
R15A	1/2	12.7 Amps	6.4 Amps	3.0 Amps	
R18W	1/2	9.4 Amps	6.2 Amps	2.5 Amps	
R20A	3/4	16.7 Amps	9.8 Amps	4.4 Amps	14.0 Amps
R25W	3/4	14.5 Amps	8.7 Amps	3.3 Amps	
R40A	1	17.0 Amps	9.8 Amps	6.0 Amps	4.0 Amps
R45W	1	14.7 Amps	13.9 Amps	6.1 Amps	2.9 Amps
R55A	1-1/2		13.6 Amps	6.8 Amps	5.0 Amps
R65W	1-1/2		11.7 Amps	5.5 Amps	3.8 Amps
R75A	2		19.7 Amps	13.6 Amps	5.1 Amps
R80W	2		16.0 Amps	10.5 Amps	4.7 Amps
R100A	2		19.7 Amps	13.6 Amps	5.1 Amps
R110W	2		16.0 Amps	10.5 Amps	4.7 Amps
R140A	3			20.8 Amps	9.5 Amps
R150W	3			12.5 Amps	7.3 Amps
R200A	5			31.3 Amps	16.7 Amps
R220W	5			22.7 Amps	11.9 Amps
R250A	7-1/2			35.03 Amps	17.8 Amps
R320A	7-1/2			35.03 Amps	17.8 Amps
R360W	7-1/2			28.0 Amps	14.2 Amps
R440A	10				26.3 Amps
R480W	10				19.0 Amps
R590A	15				30.3 Amps
R660W	15				24.0 Amps
R690A	17-1/2				
R770W	17-1/2				
R880W	20				
R940A	25				
R1050W	25				
R1100A	30				
R1230W	30				
R1480A	40				
R1650W	40				
R1980A	50				
R2200W	50				
R2640A	60				
R3000W	60				
R3100A	75				
R3500W	75				
R4180A	100				
R4600W	100				
R5400A	125				
R5800W	125				

CHECK AMP RATING
ON UNIT NAMEPLATE.

AMPERE RATINGS WILL VARY,
DEPENDENT UPON BRAND OF
CONDENSING UNITS AND
ELECTRICAL OPTIONAL
COMPONENTS.

AMP RATINGS HEREIN ARE FOR
REFERENCE ONLY AND DO NOT
NECESSARILY DEPICT MAIN
FUSE SIZES.

DUAL RATED 50HZ/60HZ VOLTAGES*

115-1-60	100-1-50	208-230-1-60	230-1-50	208-230-3-60	200-3-50	460-3-60	380-3-50	575-3-60	500-3-50	50 HZ** SCFM-CAP.
X	X		X							8.3
X	X		X							16.6
X	X		X							24.9
X	X		X							41.5
X	X	X	X	X						74.7
X	X	X	X	X	X					83.0
X	X	X	X	X	X	X	X			103.
X	X	X	X	X	X	X	X			116.
X	X	X	X	X	X	X	X			166.
X	X	X	X	X	X	X	X			186.
		X	X	X	X	X	X	X		228.
		X	X	X	X	X	X	X		269.
		X	X	X	X	X	X	X	X	311.
		X	X	X	X	X	X	X	X	333.
		X	X	X	X	X	X	X	X	415.
		X	X	X	X	X	X	X	X	456.
				X	X	X	X	X	X	581.
				X	X	X	X	X	X	622.
				X	X	X	X	X	X	830.
				X	X	X	X	X	X	913.
				X	X	X	X	X	X	1041.
				X	X	X	X	X	X	1328.
				X	X	X	X	X	X	1494.

† 440-460 Volt R20A unit has 1 HP motor.

CHECK WITH FACTORY FOR AVAILABILITY
OF 10-H.P. & LARGER UNITS AS 50-HZ.

SEVERAL MODELS ARE AVAILABLE
AS STRICTLY 50-HZ UNITS.
THESE MUST BE SPECIAL ORDERED AND
WILL USUALLY INCUR SHIPMENT DELAYS.

ELECTRICAL DATA

* 50 HZ. Capacities shown are 83% of the 60 HZ. operating capacities. Only the models shown above which are dual rated may be used on 50 HZ. electrical supply.

**NOTE: SCFM Capacities at 100°F Inlet, 100°F Ambient Temperature and 100 PSIG.

OPERATION

OPERATION (Models R940A and larger are to be started by a factory technician.)

Initial Start-Up: All Dryers are shipped fully charged with refrigerant, ready for start-up. Units with separate air-cooled condensers for remote installation, require on job site installation of connecting tubing, and evacuation of the condenser, prior to start-up, by the customer. Models R2A and R3A may require up to a 30-minute delay between restarts to allow the refrigerant to equalize.

Models R2A thru R880W which are to be operated with inlet temperatures over 100°F: Maximum inlet is 130°F. If inlet air temperature exceeds 100°F, call the factory Service Department at 814/453-3651 BEFORE STARTUP, for control adjustment instructions unless unit was ordered for the purpose. Operation with inlet air temperature exceeding 100°F voids the warranty, if not specified on order.

Models R2A and R3A: Plug in 3-pronged electrical plug to start the unit, allow dryer to run approximately 5 minutes. Open inlet and outlet air valves and close the air by-pass valve.

Model R5A:

1. Be sure main disconnect switch is off.
2. Put power switch in the off position.
3. On water cooled units, open water supply manual valve wide.
4. Turn on disconnect.
5. Pressurize the unit by opening air inlet valve only.
6. Turn on power switch to start dryer, run for approximately 5 minutes.
7. Open air outlet valves and close by-pass valve.

Models R10A thru R150W:

1. Be sure main disconnect switch is off.
2. Put power switch in the off position.
3. Turn on disconnect; this will energize crankcase heater(s). Allow unit to stand for 24 hours before continuing.
4. On water cooled units, open water supply manual valve wide.
5. Pressurize the unit by opening air inlet valve only.
6. Turn on power switch to start dryer, run for approximately 5 minutes.
7. Open air outlet valves and close by-pass valve.

INITIAL START-UP

Models R200A thru R360W: Equipped with a "Power" switch and "Function" switch, for ease of starting the unit and to prevent damage to the refrigerant compressor.

1. Be sure main disconnect switch is off.
2. Put "Power" switch and "Function" switch in off position.
3. These units are shipped in "pumped down" condition, and service valves closed. Some units have a receiver tank beneath compressor base. **Be sure** to open outlet valve on this tank. Open all tagged service valves (counterclockwise). On compressor service valves with gauge connections, turn in one turn after backseating.
4. On water-cooled units, open water supply valve wide.
5. Turn on disconnect — this will energize crankcase heater(s). Allow the unit to stand for 24 hours before continuing.
6. Pressurize the unit by opening one air valve.
7. Turn on Power switch. Unit will start and pump down, if necessary, when temperature reading on the low side refrigeration gauge is above 30°F. Low side refrigeration

temperature will drop and unit will stop at approximately 15°F.

8. Turn on function switch. Low side refrigeration gauge will go up to 30°F and dryer will start and run continuously. High side refrigeration gauge will be 105°F to 120°F. On air-cooled units, fans will cycle. The high temperature warning light may come on for a short period. This is normal. As the unit stabilizes, it will turn off.
9. Open air valves through dryer, close by-pass valve.

If equipped with the optional dead system Pressure Control Switch, the dryer will normally not need to be turned completely off even if there is no flow in the air system. The condensing unit will pump down and stop if there is no air pressure. It will automatically re-start on return of air pressure.

NORMAL SHUT-DOWN:

1. Turn off function switch only, allowing unit's compressor to pump down evaporator. On water-cooled units water supply must be maintained. If water supply is to be shut off then the unit **must** be pumped down a minimum of **one hour** before air compressors are shut off.
2. Leave unit panel power switch on. If refrigerant low pressure rises to the operating range, the unit will restart and pump down again automatically.
3. Do not turn off the main disconnect as the crankcase heater must remain energized. If a major repair requires total shut-down including the main disconnect, the main disconnect must be left on line for a 24 hour period following shut-down to guarantee that compressor is free of liquid refrigerant.

NORMAL START-UP:

1. Check that crankcase heater has been active for 24 hours or more.
2. Turn on function switch. The low pressure side will rise to normal operating range and unit will now start.
3. Check drain assembly for proper operation to assure water removal.

If these procedures are followed, compressor "rattling" will normally not occur. If compressor does "rattle", call the factory service department at 814/453-3651.

At this point, no further attendance or maintenance is required except for malfunction. Models R200A and larger are equipped with high temperature red indicating lights to signal a malfunction. Audible alarms are optional.

For **EMERGENCY** shut-down and start-up procedures see instructions on gauge panel or call the factory service department.

When unit is a Combination Refrigerated/Desiccant type Dryer, place Chemsaver Pebbles (if furnished) in desiccant bed chamber, spread evenly, fill with desiccant and then follow the standard refrigerated start-up procedure.

INITIAL START-UP INSTRUCTIONS

Models R440A thru R880W

1. Put system control switch (called "Function" on Models R200A - R360W) in "Off-Pumpdown" position.
2. Open all tagged service valves counterclockwise. On some units, one valve is on the receiver tank under the compressor baseplate. On compressor valves with gauge connections, turn in one turn after backseating.
3. On water-cooled units, open water supply valve as far as possible.
4. Turn on disconnect — This will energize crankcase heater(s). Allow the unit to stand for 24 hours before continuing.
5. Pressurize the unit by opening the air inlet valve with by-pass valve open and air outlet valve closed.

6. Push "start" button in restart control box. Unit will start and pump down if necessary. Refrigerant low pressure (gauge) will drop and stop at approximately 15°F. If unit does not start, proceed to next step.
7. Turn system control switch to "on-operate". Refrigerant low pressure (gauge) will go up to 32°F or higher and dryer will start and run continuously. Refrigerant high pressure (gauge) will be 105°F to 120°F. On air-cooled units, fans will cycle. High dewpoint warning light may come on for a short period.
8. Open air outlet valve to pass air through dryer, close by-pass valve.

When unit is a combination refrigerated/desiccant type dryer, place chemsaver pebbles (if furnished) in desiccant bed chamber, spread evenly, fill with desiccant and then follow the standard refrigerated start-up procedure.

EMERGENCY SHUT-DOWN:

1. Push "emergency off" button and turn system control switch to "off-pumpdown".
2. Turn off main disconnect, only if necessary.

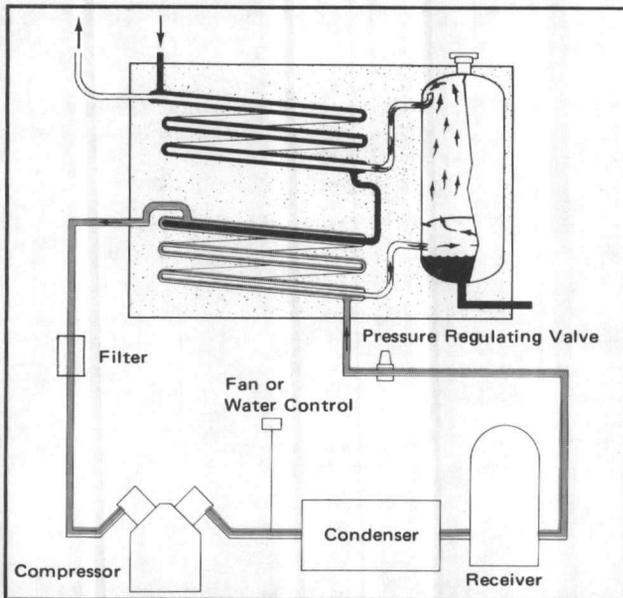
RESTART: (Should be performed only by competent refrigeration people.)

This procedure should be used after any emergency shut-down including power failure or internal shut-down by safety controls such as oil failure, excessive head pressure, electrical overload or motor thermal protectors. **Before restarting the unit, make sure that unit's system control switch**

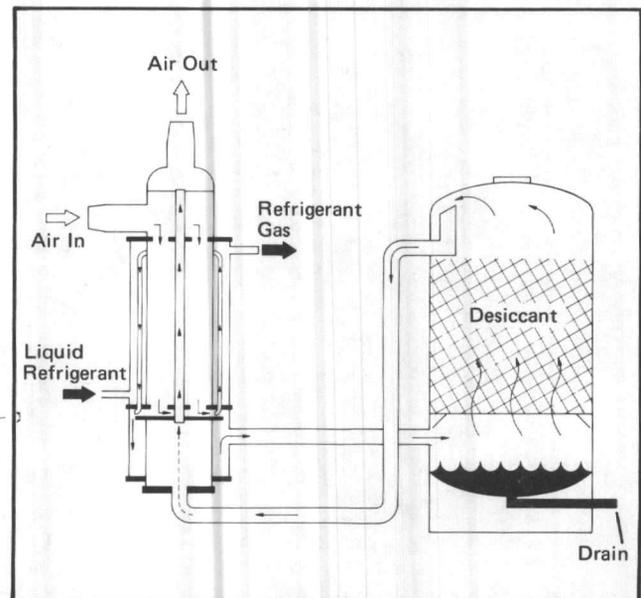
is in "off-pumpdown" position. Reset all safety switches as required. Switches must not be reset more than once or severe compressor damage may occur. Call the factory Service Dept. if any reset switch does not hold following the first reset.

1. Shut down less than 5 minutes:
 - A. Push "start" button and allow dryer to pump down and shut off. Turn system control switch to "on-operate". Dryer should start and run.
 - B. Check refrigeration pressure gauges to assure normal operating ranges.
2. Shut down exceeding 5 minutes:
 - A. Open air by-pass valve and close air outlet valve.
 - B. Check crankcase heater. If crankcase is cool make sure crankcase heater is energized and operating. The bottom of crankcase must be warm before proceeding further. (It may take up to 24 hours to reheat it.)
 - C. Front seat compressor suction valve.
 - D. Jog "start" and "stop" push buttons until compressor runs smoothly, pumps down and shuts off.
 - E. Slowly open suction valve until compressor starts, carefully guarding against compressor slugging. Continue to slowly open suction valve until the unit pumps down and shuts off.
 - F. Slowly open air outlet valve, then slowly close the air by-pass valve.
 - G. Turn system control switch to "on-operate". Dryer should start and run.
 - H. Check refrigeration pressure gauges to assure normal operating ranges.

TYPICAL REFRIGERATION SCHEMATICS

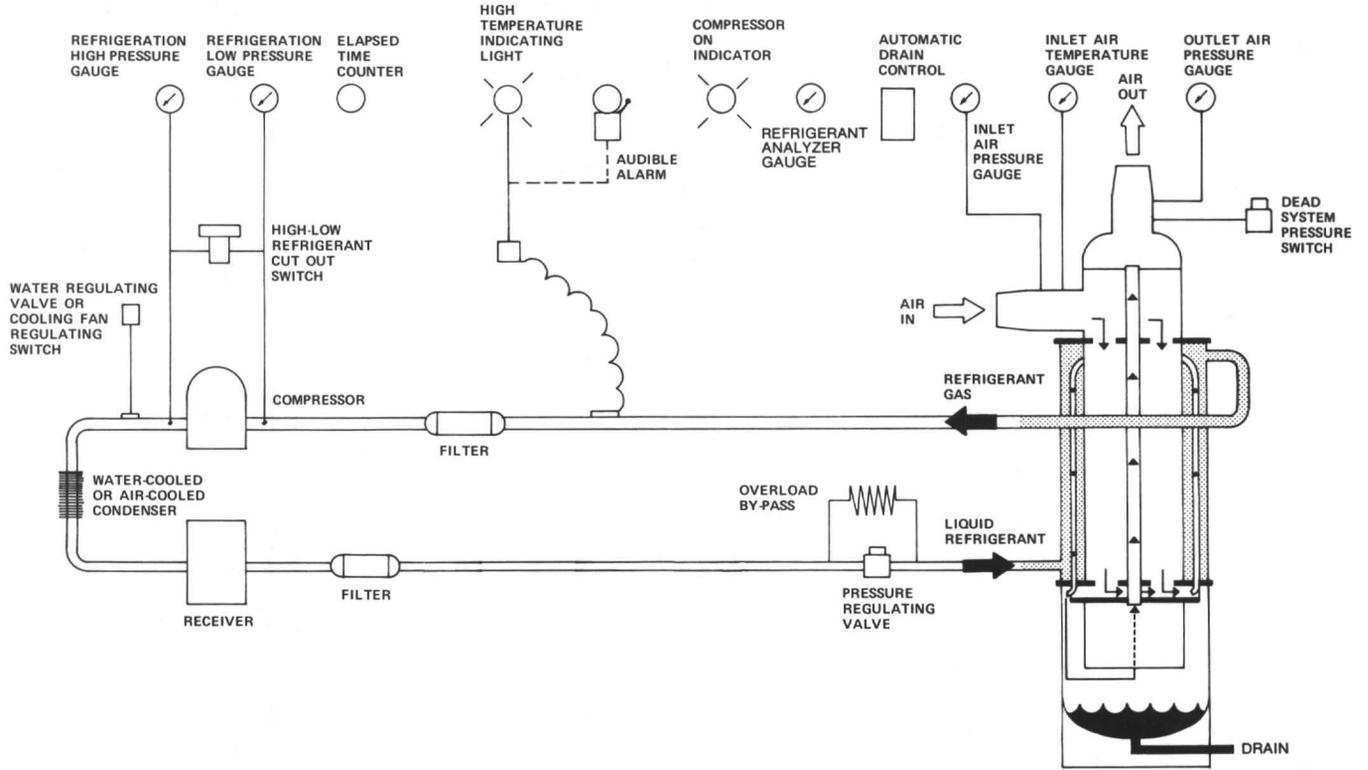


Models 2R3A thru 7R10A



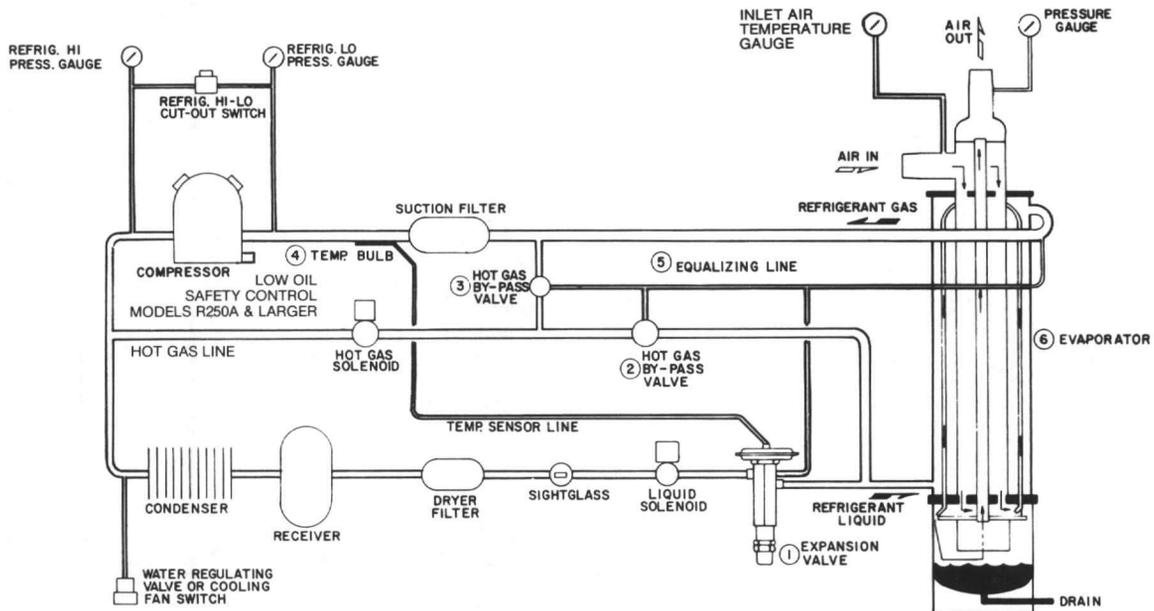
COMBINATION REFRIGERATED/DESICCANT AIR DRYERS
TYPICAL AIR FLOW SCHEMATIC
Models 15R15A and Larger

SIMPLIFIED CONTROL CIRCUIT SHOWING POPULAR INSTRUMENTATION



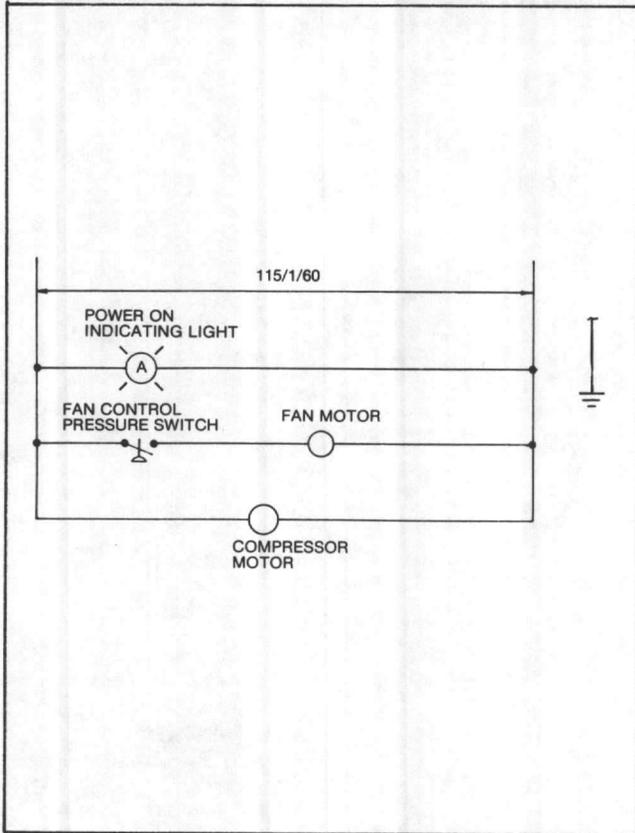
Models R40A thru R150W

(See Page 11, Table 2, for Standard Instrumentation)

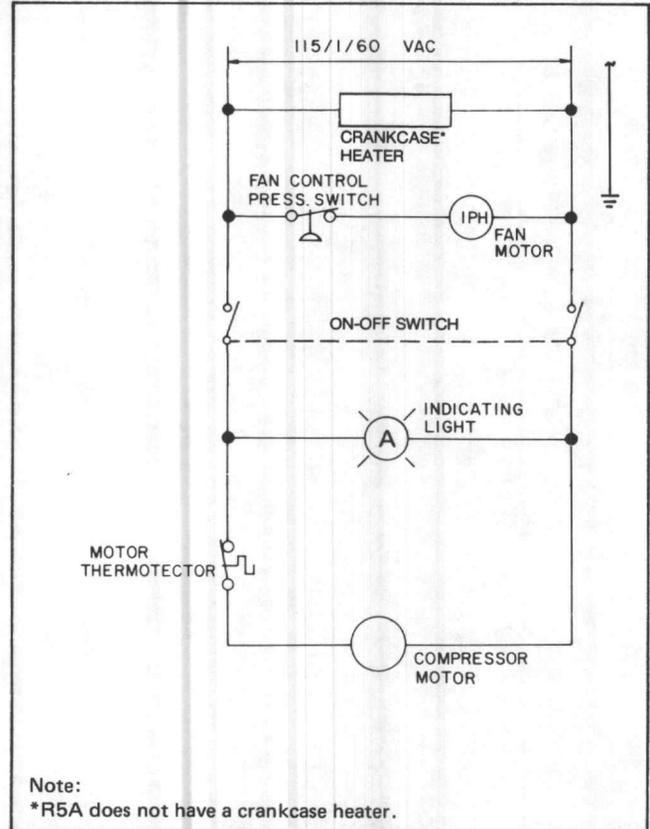


THE THREE VALVE SYSTEM
Models R200A and Larger

TYPICAL ELECTRICAL SCHEMATICS (Control Voltages are 115 Volts)

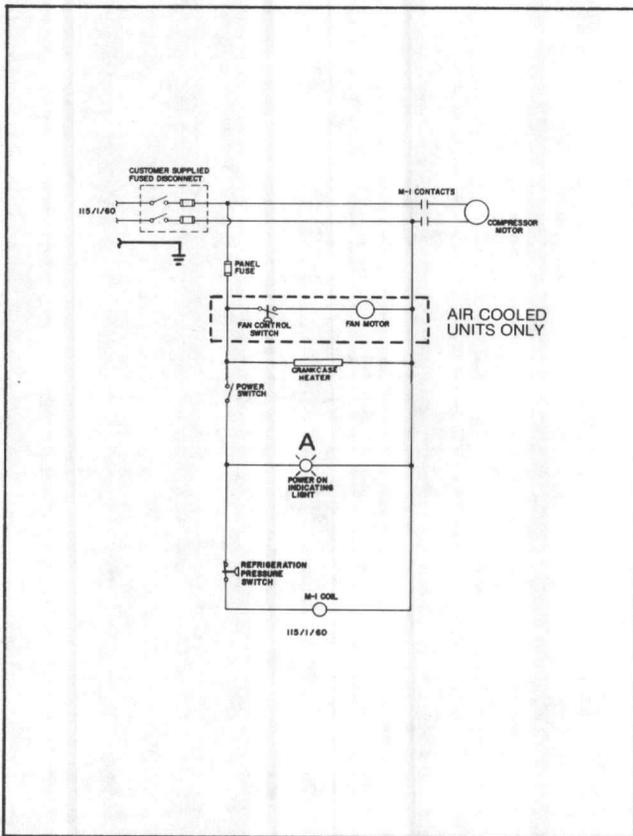


Model R-2A, R-3A 115/1/60

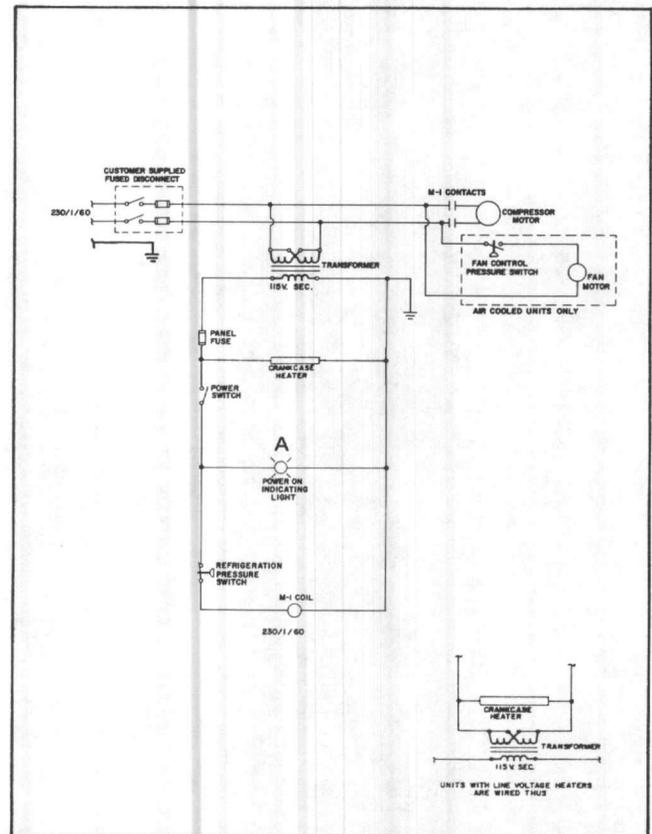


Note:
*R5A does not have a crankcase heater.

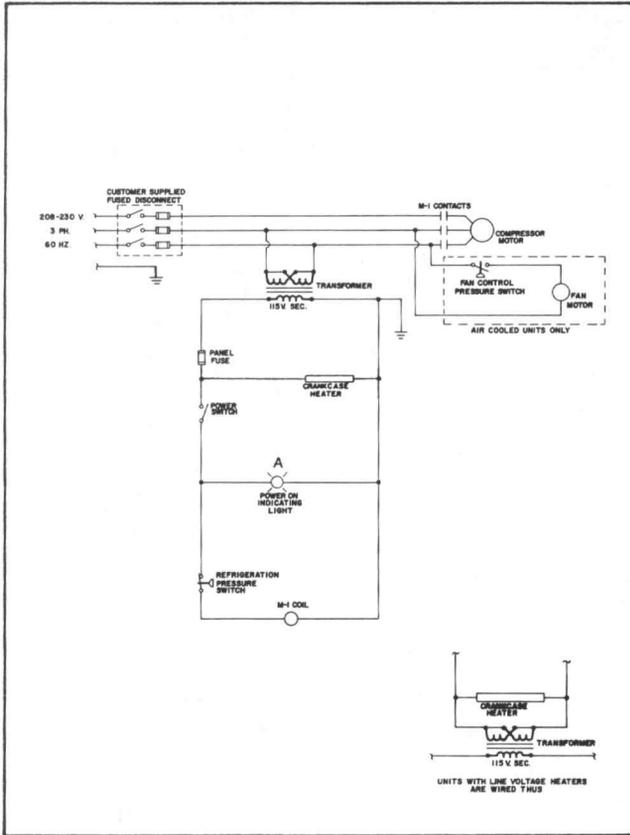
Models R5A, R10A 115/1/60



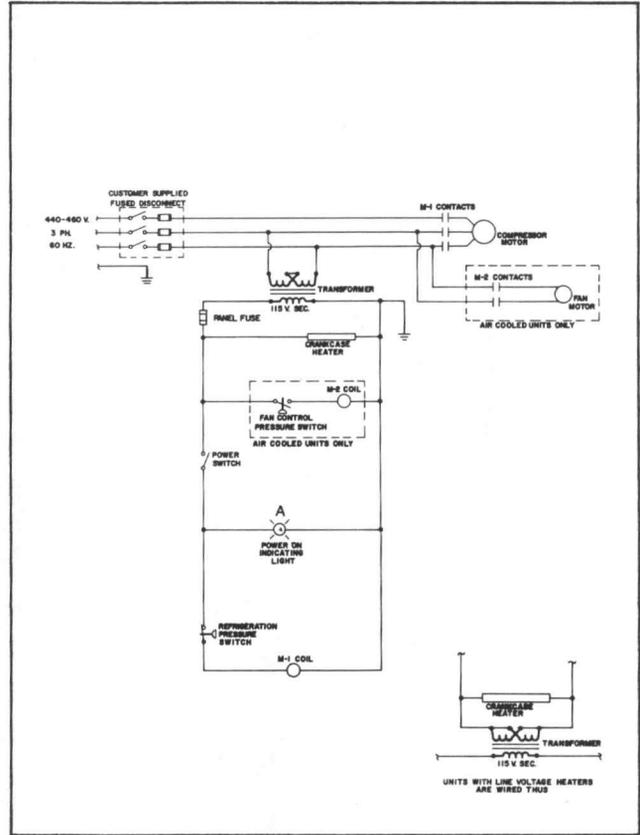
Models R15A thru R45W 115/1/60



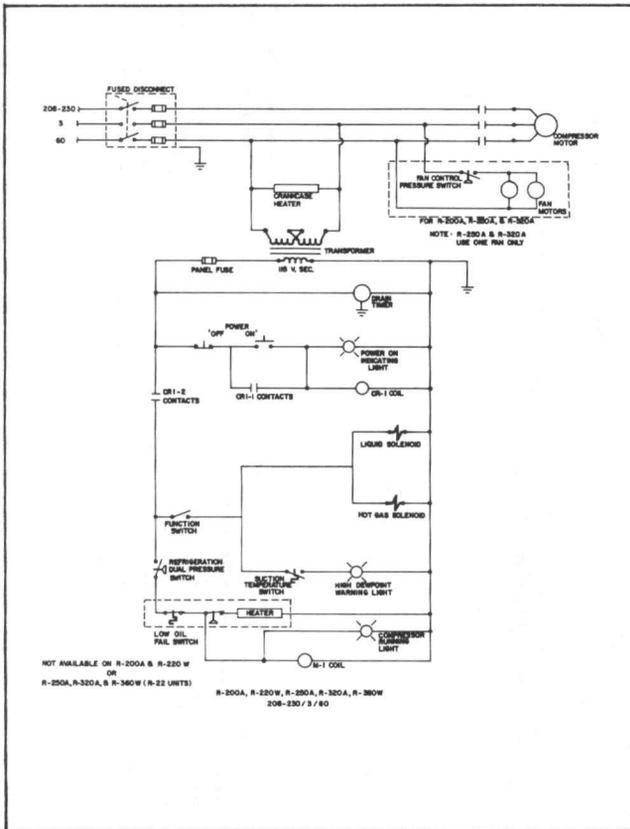
Models R15A thru R45W 230/1/60



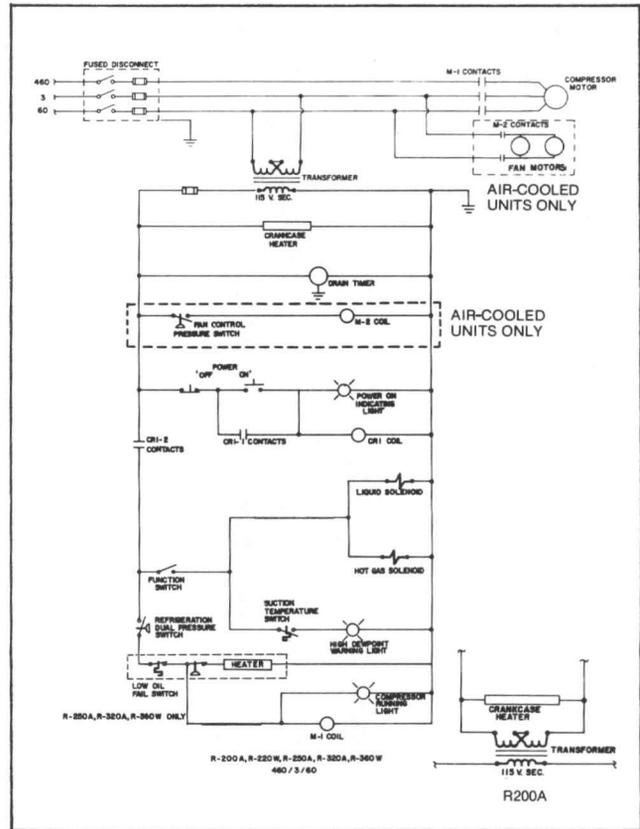
Models R15A thru R150W 208-230/3/60



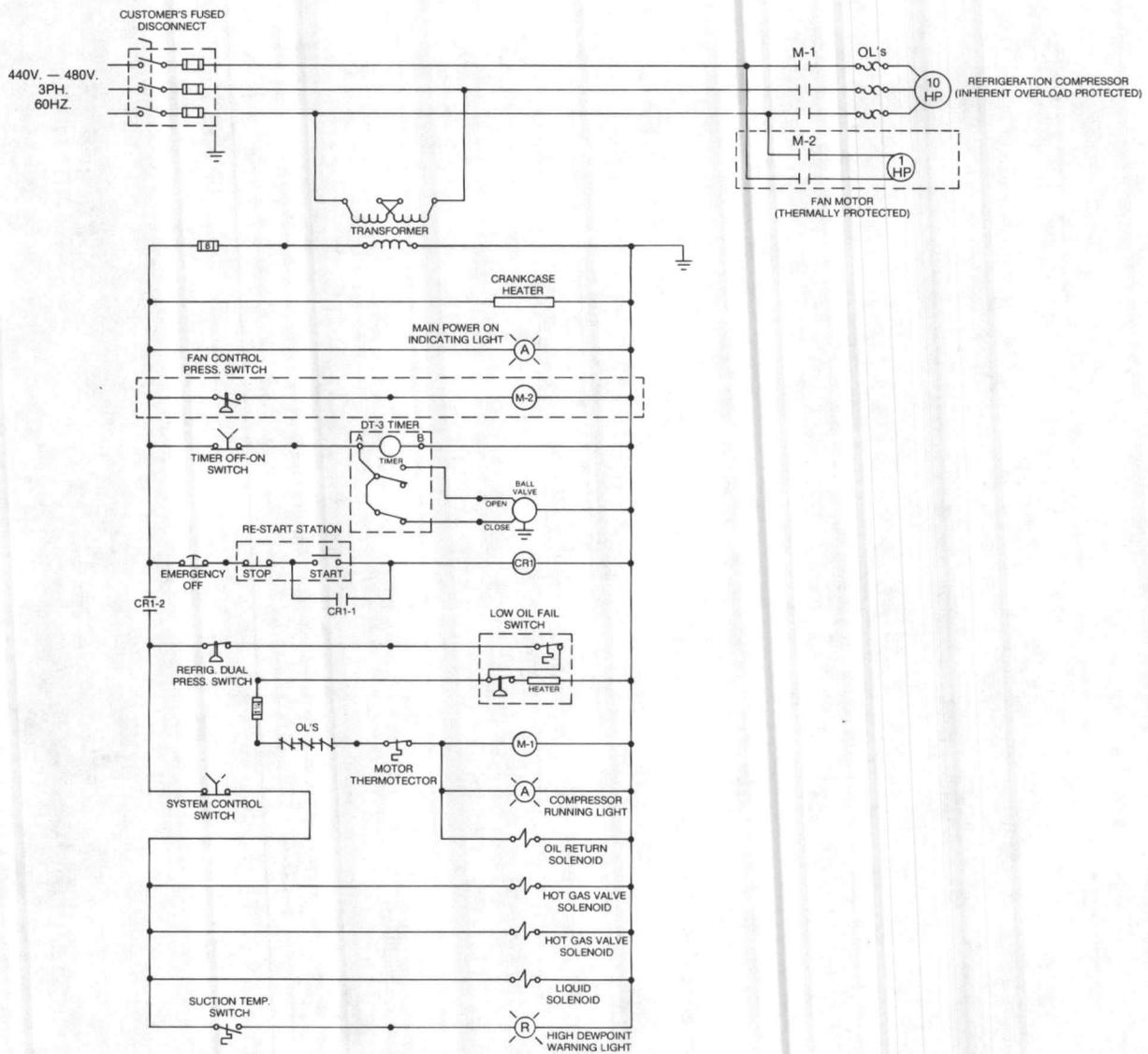
Models R20A thru R150W 440-460/3/60



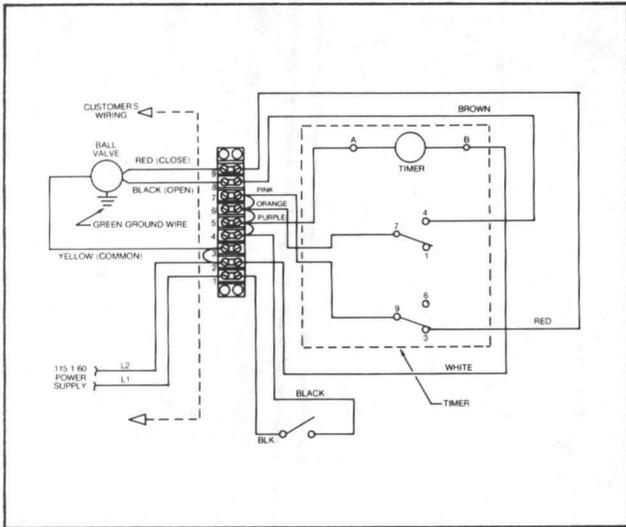
Models R200A thru R360W 208-230/3/60



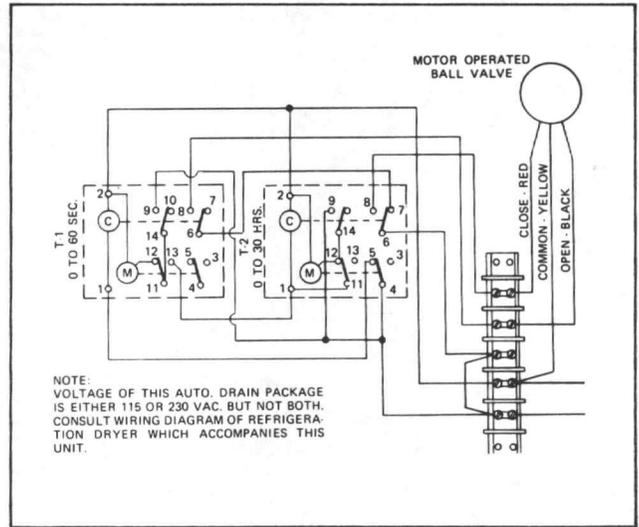
Models R200A thru R360W 440-460/3/60



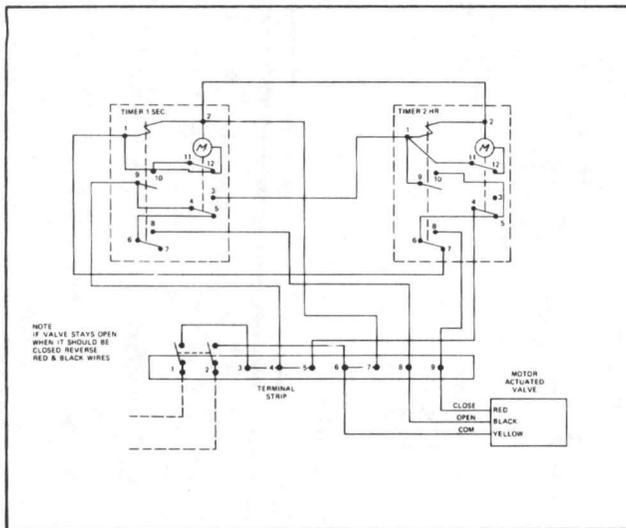
Models R440A thru R880W 460/3/60



Model DT-3 Automatic Timer Drain



Model DT-2A Automatic Timer Drain



Model DT-2EB Automatic Timer Drain

INSTRUCTIONS FOR ADDITION OF REFRIGERANT

Note: This is a flooded evaporator unit, with a critical charge. Over or under charge will damage the compressor, and void the warranty.

Use **only** the following procedure to add refrigerant:

Charge unit at **No Load**. Apply air pressure but do not flow air through Dryer.

For Single Valve Systems:

1. Do not change control settings.
2. Add the proper type of refrigerant slowly, in vapor form, at the suction service valve. Observe compressor crankcase temperature as follows:

hermetic compressors — The top of the can should be slightly warm. Only the area around the suction valve should be cool.

semi-hermetic compressors — Crankcase should be warm (110° - 120° F). Heads should be warmer.

3. Continue to add refrigerant, until the normally warm areas become cool. Use extreme care, as the compressor can be damaged by slugging.
4. Slowly withdraw refrigerant until the crankcase warms slightly. Be sure that evaporating pressure is set properly
35° dewpoint — R-12, 32 PSIG
R-22, 60 PSIG
50° dewpoint — R-12, 42 PSIG
R-22, 72 PSIG

For Three Valve Systems:

1. Do not change control settings.
2. Add refrigerant in vapor form, at suction service valve. Fill to full sight glass.
3. Note pressures as in (4) above.

IF THERE ARE ANY QUESTIONS REGARDING THIS UNIT, CALL THE FACTORY SERVICE DEPARTMENT AT 814/453-3651.

INSTRUCTIONS FOR MAINTENANCE OF AIR-COOLED REFRIGERANT CONDENSERS

Air-cooled condensers may be cleaned by:

1. Blowing clean with a compressed air blow gun.
2. Steam cleaning may be necessary for heavy deposits. **DO NOT** use wire brushes as they may bend fins and cause leaks.
3. Clean fan blades.
4. Check fan and fan blade tightness.
5. Straighten bent fins and fan blades.

Recommended service interval is 2,000 hours of operation. More frequent service may be required if dryer is in a dusty or dirty area.

INSTRUCTIONS FOR CLEANING WATER-COOLED REFRIGERANT CONDENSERS

There are three ways to clean the water tubes of a water-cooled refrigerant condenser, namely:

1. Descaling compound
2. Brush
3. Combination of 1 and 2 above (descaling compound and brush).

A complete description of the three methods follows:

1. Calgon Corporation, a division of Merck & Company, manufactures a scale dissolver which can be pumped through the water tubes. As this acid dissolves the scale, it bubbles. Once the bubbling stops, you know that all of the scale has been dissolved. This acid scale dissolver will not remove sediment that has collected in the water tubes.
2. Rifle or shotgun cleaning brushes can be used to remove the scale. The tube in tube water-cooled condensers used on Zurn Refrigerated Air Dryers have plugs at each end that can be removed for cleaning. Models having tube and shell condensers have heads on each end of the shell which can be removed thus exposing all the water tubes for cleaning. If the condenser is located in tight quarters, a sectionalized brush can be used adding extensions to the brush handle as need be.
3. Sometimes it is necessary to use a combination of both the acid scale dissolver and a brush. There may be certain types of scale that the acid dissolver does dissolve and there may be some sediment that will not be removed by simply circulating the scale dissolver. In such cases, it is recommended that both the scale dissolver be pumped through the water side and this followed up by a brush cleaning.

For proper operation of a Zurn water-cooled refrigerated air dryer, it is important that the water-cooled condenser be cleaned on a regular maintenance schedule, preferably every 2000 operating hours.

TROUBLE SHOOTING & SERVICE CHART

Complaint

Possible Cause & Repair

A. Compressor will not start. No hum.

1. Line disconnect switch open. Close switch.
2. Fuse removed or blown. Replace fuse.
3. Overload tripped.
Wait 5 to 20 minutes to reset. Check ambient & inlet air temperatures, operating pressure, and air flow rates against rated capacities listed, to determine cause of overload.
4. Loose or improper wiring.
Check connections against schematic. Tighten loose connections.
5. Safety controls tripped (Oil, air, temperature, refrigerant).
Test controls for malfunction by jumpering. Look for reason device tripped (High head, low suction, oil loss, low air). Correct any malfunctions such as dirty condenser, high ambient, overloads. Replace faulty controls.
6. Starter coils open or contacts burnt.
Replace coils and/or contacts.

B. Compressor will not start. Hums.
Trips over-load protector.

1. Loose or improper wiring. See A-4 above.
2. Low line voltage, (10% of name-plate rating).
Check line voltage with voltmeter. Correct condition.
3. Defective starting capacitor.
Check with capacitor tester or ohmmeter. Replace if defective.
4. Start winding open or shorted.
Check with ohmmeter, referring to motor schematic for correct value. Replace motor.
5. Models R2A & R3A re-starting too soon.
These models need 5-20 minutes for refrigerant pressures to equalize before re-starting.
6. Open or unbalanced phase (3 phase units).
Check phases for equal voltages ($\pm 10\%$). Correct unbalanced or open condition.
7. Relay or contactor not closing.
Examine contacts and coils for burning, opens, shorts or sticking. Correct conditions.
8. Compressor internal mechanical failure.
Loss of oil may have locked up compressor. If above steps do not apply, this may be the cause. Replace compressor.

C. Compressor starts, but will not get off start winding.
(single phase only)

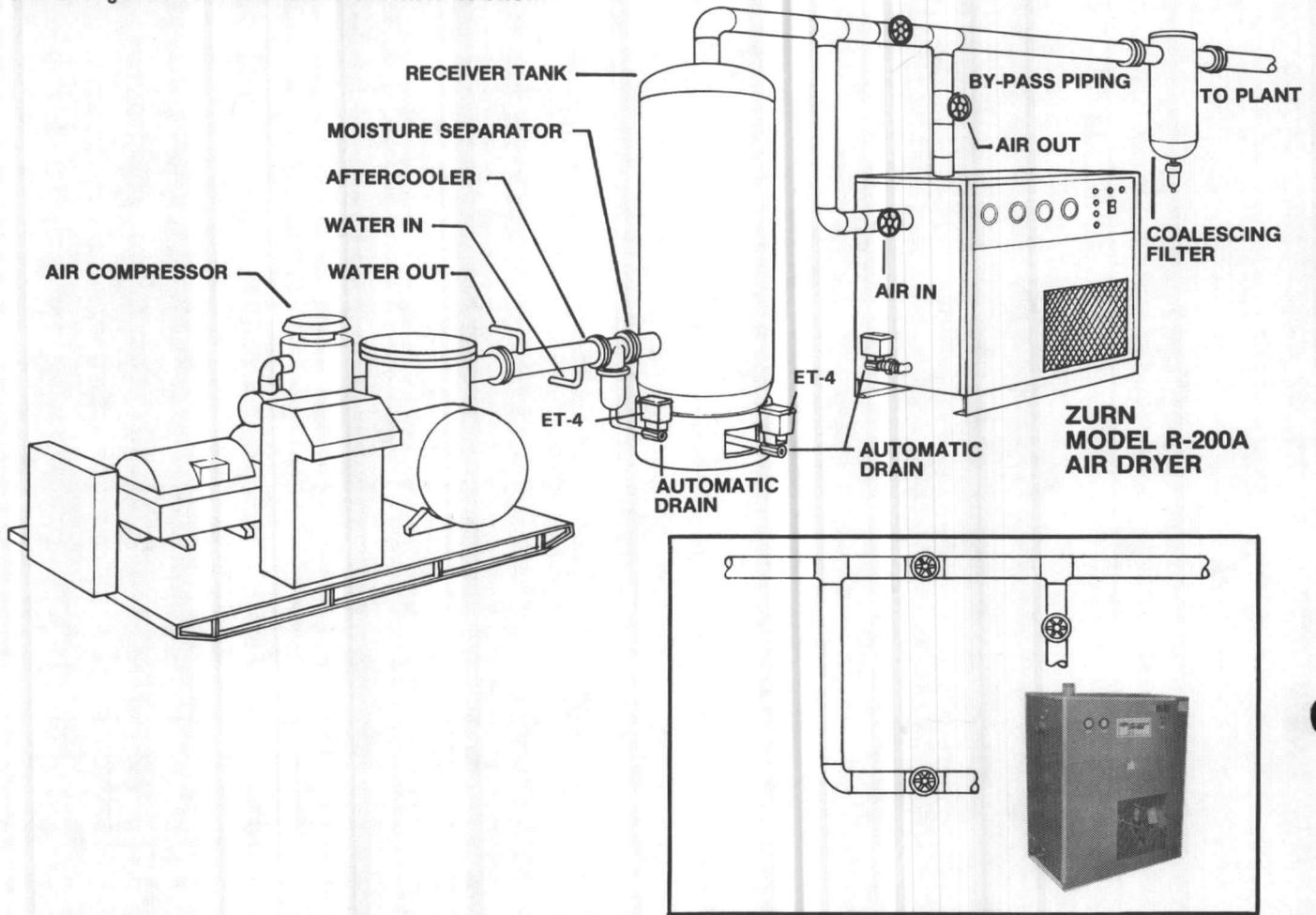
1. Low line voltage.
Measure line voltage. Must be within 10% of motor name-plate voltage rating. Correct condition if not within specifications.
2. Improper wiring. See A-4 above.
3. Defective relay. Check out & replace if necessary.
4. Weak or defective run capacitor.
Check with ohmmeter, replace if defective.
5. High discharge pressure.
Check for dirty or clogged condenser, partially closed service valve.
6. Open or shorted winding. See B-4 above.

	<p>7. Tight compressor. Low oil or flooding back can damage bearings & other internal parts. Compressor should be replaced.</p>
<p>D. Unit short-cycles.</p>	<ol style="list-style-type: none"> 1. Plant air compressor differential greater than dead air switch. Check pressures, adjust compressor and/or dead air switch settings. 2. Motor overload cutting out. Check circuitry against schematic. Look for electrical devices wired thru overload. Also check for high head pressure or air overload, high ambient, clogged condenser. 3. Defective overload protectors. Check currents. Replace if necessary. 4. Low voltage, or 3 phase unbalance. Voltages must be within 10% of nameplate rating. Correct off specification conditions. 5. Refrigerant shortage. Check for leaks. Repair & recharge. 6. Low suction pressure or sticking expansion valve. Check valve setting & operation. Adjust, repair, or replace. 7. Low water pressure Check water pressure & flow. Correct if either is insufficient. 8. Shorted motor winding. See B-4 above.
<p>E. Relays, start, or run capacitors burn out.</p>	<ol style="list-style-type: none"> 1. High or low line voltage. Adjust to within 10% of nameplate rating. 2. Relay not functioning properly. Check coils & contacts. Repair or replace. 3. Short cycling. Refer to Section "D" above. 4. Prolonged operation on start winding. See Section "C". 5. Incorrect capacitor or relay. Refer to motor schematic for proper value. Replace defective component.
<p>F. Noisy Unit.</p>	<ol style="list-style-type: none"> 1. Loose mountings on compressor. Check & tighten. 2. Loose or bent fan blade. Straighten tighten, or replace. 3. Worn bearings in motor or compressor. Replace, using recommended procedures. 4. Flood back. (Refrigerant overcharge) Check compressor crankcase. If cold, unit is overcharged. Carefully bleed off a little refrigerant until the crankcase warms to the touch, about 110°F to 120°F. Allow sufficient time for compressor to stabilize following each short bleed-off.
<p>G. High head pressure.</p>	<ol style="list-style-type: none"> 1. Refrigerant over-charge. Bleed to correct value. 2. Dirty condenser. Blow dirt out of fins with compressed air if air-cooled, clean tubes with brush & de-scaler if water-cooled. 3. Hot location. If ambient temperature is above 110°F, condenser will not function properly. Cool ambient, or relocate unit. 4. Fan or water control defective. Check operation of control. Adjust, repair, or replace as necessary.

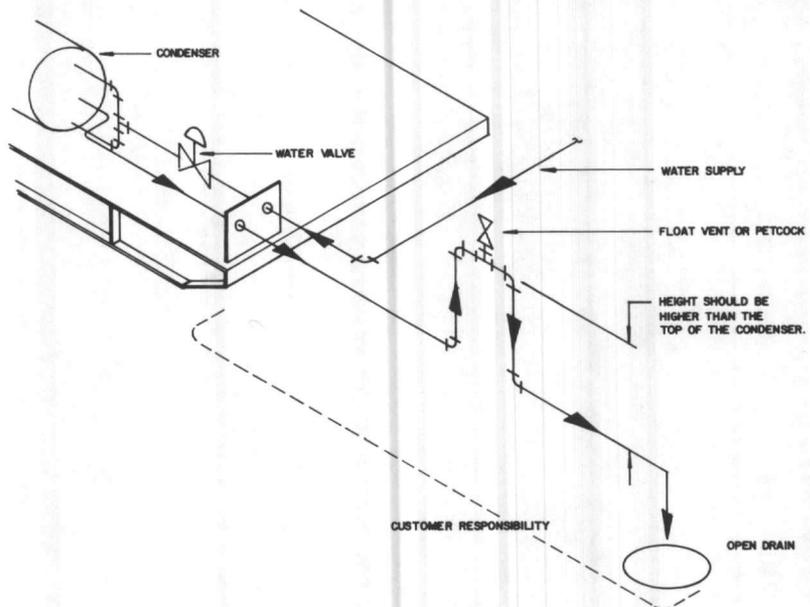
	<ol style="list-style-type: none"> 5. Defective fan motor. Replace or repair. 6. Air in refrigeration system. Determine reason & correct condition.
<p>H. Low head pressure.</p>	<ol style="list-style-type: none"> 1. Refrigerant shortage. Test for leaks. Repair and recharge. 2. Inefficient compressor. If suction or discharge valves, or fittings leak, compressor will not pump enough refrigerant. Repair or replace parts, or replace entire compressor if necessary. 3. Low inlet air temperature. If inlet air temperature is below +50°F, the unit should be shut down. Air may still be passed through unit.
<p>I. Exit air temperature high. High dew-point.</p>	<ol style="list-style-type: none"> 1. Air overload or too small a unit. Reduce flow through unit, add another unit, or replace with a larger unit. 2. High ambient or inlet air temperature. Move machine to cooler location, or otherwise reduce ambient, pre-cool inlet air. 3. Dirty condenser. See G-2 above. 4. Refrigerant shortage. Locate leak & repair. Recharge. 5. Filter-dryer or strainer clogged. Check pressure drop across filter, or if downstream side is colder, replace element. 6. Controls stuck or mis-adjusted. Examine expansion valve, hot gas by-pass valves, solenoid valves, and hand valves for functioning, Repair, replace, adjust as necessary.
<p>J. Low or no outlet air pressure.</p>	<ol style="list-style-type: none"> 1. Air overload or too small a unit. See I-1 above. 2. Incorrect or restricted piping. Look for restrictions in lines, or too small pipe sizes. Replace piping if needed. 3. Evaporator and/or pre-cooler clogged or frozen. Check suction temperature at evaporator outlet, or turn unit off to thaw. If clogged, reverse flush with mild detergent, if frozen, adjust controls at no load. Turn expansion valve screw clockwise one or more turns, as required to eliminate freeze-up.

BY-PASS PIPING REFRIGERATED AIR DRYERS:

It is mandatory that shut-off valves be placed at the inlet and outlet ports of the dryer, with a valved by-pass between the two, to permit isolation of the unit for servicing, and eliminate the need for shutting down the plant air system. Compressed air piping should be of equal size as furnished on the dryer. Larger pipe, reduced to the inlet/outlet pipe size may be used. Flexible connections or union joints are recommended to avoid piping stresses and vibration transmission. Suggested piping and valve arrangements are outlined on the sketches below:



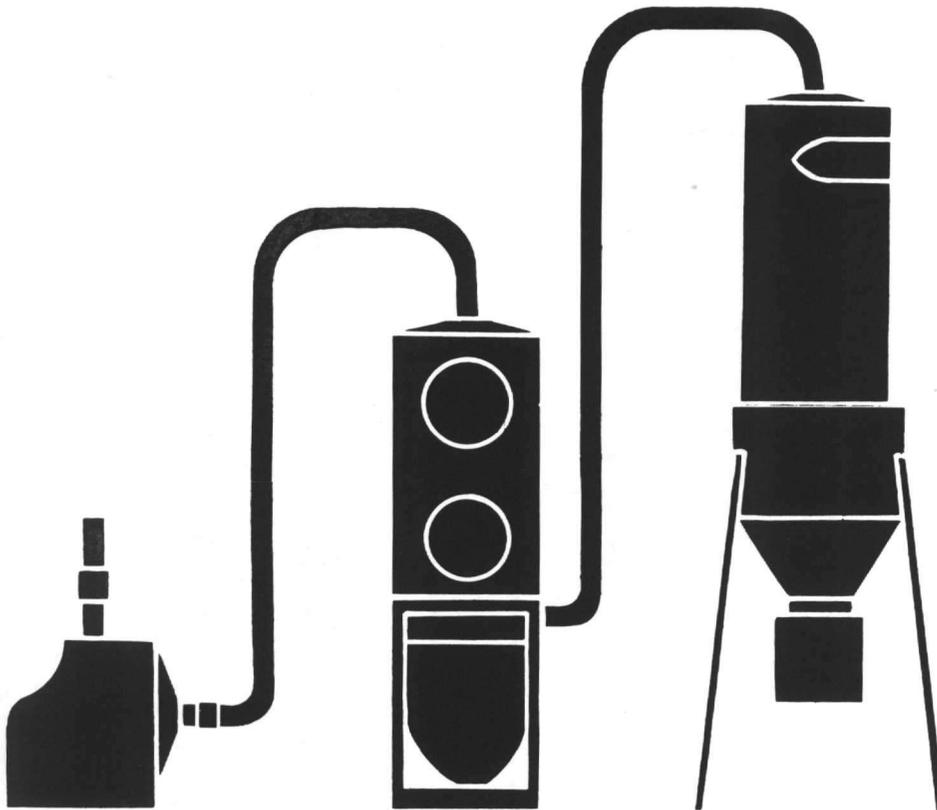
REQUIRED INSTALLATION WHERE AN OPEN DRAIN IS LOWER IN ELEVATION THAN THE CONDENSER.



ZURN INDUSTRIES, INC.
 GENERAL AIR DIV.
 1335 WEST 12TH ST.
 P.O. BOX 13801
 ERIE, PA, U.S.A. 16514

Spencer[®] Vacuum Cleaning Systems

Handling, Installing, Operating and Adjusting Instructions



Important

Do not operate machine in unstable, low-flow range (surge).

Read and become familiar with this manual prior to uncrating and installing your Spencer Vacuum Equipment. This precision equipment is capable of extended service and life span. Realization of this potential can best be achieved through proper handling and adherence to the following instructions. Damage resulting from failure to follow correct procedures will void warranty.

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I. General Instructions

Illustrations contained here apply to three types of Spencer Vacuum Producers. Use the illustrations or consult factory to determine which machine you have, then read instructions paying particular attention to those which are unique to your machine. When in doubt, consult Spencer.

Important

Read and become familiar with this manual prior to uncrating and installing or storing machinery — Spencer provides a precision piece of equipment capable of extraordinary service and life span. Realization of this potential can best be achieved through proper handling and adherence to the following instructions. Damage resulting from failure to follow correct procedures will void warranty.

Spencer service

Spencer service begins upon receipt of your request for equipment purchase. Our engineers welcome the opportunity to discuss your installation problems and will assist in determining specification requirements if so desired. To serve you promptly, we maintain a large inventory of electric motors and machine parts for the various types of equipment. Also, by combining under one roof the constantly supervised manufacturing, assembly, and test procedures, Spencer can assure you of a unit capable of optimum performance under the most severe service conditions. All Spencer machines are factory tested for load capacities and noise and vibrational characteristics. This guarantees long, trouble-free operation.

Warranty:

We warrant that this product will be free from defects in material and workmanship for a period of one year from date of shipment thereof. Within the warranty period, we shall repair or replace, F.O.B. our Factory, such products that are determined by us to be defective.

This warranty will not apply to any product which has been subjected to misuse, negligence, or accident or misapplied or improperly installed. This warranty will not apply to any product which has been disassembled, repaired or otherwise altered by any persons not authorized by our Service Department.

The guarantee of the motor and control manufacturers will govern the extent of our guarantee on such equipment.

Warranty work on motors and controls must be authorized by Spencer and must be performed in an authorized shop as designated by the motor and control manufacturers.

The Spencer Turbine Company reserves the right to invoice all expenses incurred when repairs are made in the field at the specific request of the customer.

Handling

Caution: Do not lift by the shaft end or bearing housing; use lift rings or slots in base.

This machine has been carefully balanced and tested at our factory. It is essential, therefore, that it be handled with care during installation in order that you may be assured satisfactory performance.

Storage

Caution:

If machine is to be stored for an extended period of time, it must be carefully protected from dampness and dirt and the shaft should be rotated a few times by hand, every week.

On Four bearing Overhung and/or Four Bearing Outboard type machines, bearings must be replaced at customer expense if start up occurs one year beyond date of shipment.

Failure to comply with any of the preceding will void warranty.

Location

Caution:

Do not locate unit in excessively hot area unless motor is designed for this condition.

Before placing the machine in its operating position, be sure that the Vacuum Producer and motor are readily accessible for servicing by **allowing several feet of clear space around the machine. Inaccessibility can prove costly in both time and labor.**

Foundation

Caution:

Vacuum Producers should not be bolted down or anchored in any way.

No special foundation is necessary for the Vacuum Producer. A level concrete floor or block is recommended, although any other substantial floor will prove satisfactory. The Vacuum Producer base should be placed on cork insulating pads furnished.

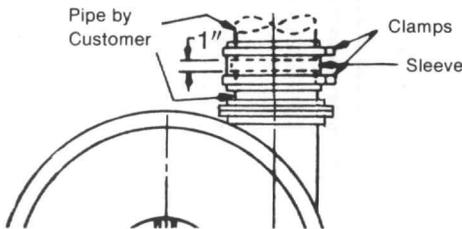
Separators to be installed on the floor may be bolted-down although they usually stand without support. Separators designed for I-beam mounting should be bolted to the I-beam.

Be sure separators are level and plumb.

Piping

Piping should be properly aligned and supported so as not to produce any stress or strain on the machine casing. It is necessary that the isolating sleeve supplied with the machine be used to connect it to the piping system. It is necessary that piping be restrained to prevent its movement away from the Vacuum Producer due to air pressure when it is operated. All piping should be of ample size to minimize frictional loss. It is absolutely essential that all joints be air-tight and that there are no leaks in the system. Leaky air pipes consume a surprising amount of power and impair the operating efficiency of the system.

Inlet and Outlet Sleeves



Designed for tubing, the rubber connecting sleeve supplied with the Vacuum Producer should be installed so that it covers a minimum piping gap of approximately 1" as illustrated. The mounting clamps supplied with the sleeve should be adequately tightened to effect and air-tight connection.

It is important that the tubing or piping not touch or butt the Vacuum Producer; there must be a gap between the machine and piping or tubing.

Electrical

Caution:

Be sure motor, starter and other electrical equipment is the proper type suitable for the application and environment.

Be sure that the motor furnished with this machine is rated for the same type of voltage available at the installation site. In making the electrical connections, follow the wiring instructions furnished. Wire and fuses should be of ample capacity to insure that proper voltage is maintained at the motor terminals while starting and running. It is important that proper starting equipment be used. All AC machines should be equipped with a magnetic contactor or a manual or automatic compensator depending on the machine size and the installation regulations of the local power company. The starters should have thermal overload protection as well as low-voltage protection.

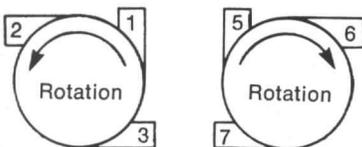
Start-Up

Coupling-equipped Machines (4BOH/4BOB)

Caution: Before start-up the coupling must be aligned in accordance with the information contained in Section II, Coupling Alignment, or with the manufacturer's instructions accompanying each coupling.

The following procedures apply to start-up of all Spencer Vacuum Producers.

Caution: The Vacuum Producer must be electrically wired with regard to the correct direction-of-rotation. A direction-of-rotation arrow is affixed to the Vacuum Producer casing. To check rotation direction, depress start button, immediately depress stop button and observe that the motor drive shaft rotation coincides with the arrow attached to the casing. Available discharge positions, (viewed from intake end) and the correct relationship of the discharge position to rotation are shown in the following diagram.



Under no circumstances should the Vacuum Producer be operated without being connected to the pipe system with which it is to be used. The outlet should discharge preferably outdoors or into a room having ample volume and proper

ventilation in order to permit the air to escape and at the same time keep the Vacuum Producer at a reasonable temperature.

When starting up a Vacuum Producer, a blast gate, or other control device should be closed. When first starting the installation, an ammeter should be connected to the motor circuit and the control valve opened until full load current is reached. At this point, the unit is delivering the full rated volume of air for which it was designed and the control device should be adjusted to prevent opening beyond this point. (See following paragraphs.)

Periodic Operation

Caution:

All Vacuum Producers in a multiple machine operation should be operated periodically. This can be accomplished through bi-weekly, alternate operation of the machines.

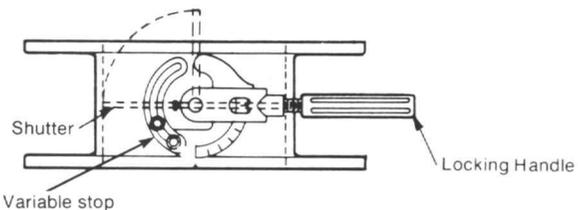
Parallel Operation

Caution: Check valves must be installed in the discharge of each Vacuum Producer operating in parallel to prevent blow-back through the unit not in operation. When operating two or more Vacuum Producers in parallel it is necessary to be sure that each machine carries its respective share of the load.

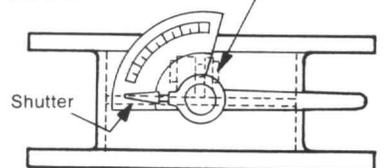
After accomplishing start-up of each machine, proceed as follows. Check the current reading at each motor to be sure they are the same. If current readings are approximately the same it indicates Vacuum Producers are sharing the system load. It may be necessary to re-adjust the control device (variable stop) to attain similar readings on the ammeters.

In most cases the low flow protection for the equipment is required.

View A



View B



Surge (Unstable Low Flow)

Caution: Do not operate machine in "Surge" (i.e. in unstable low flow range). Damage done to the Vacuum Producer because of operating in surge will not be covered by our warranty.

A unit in surge can produce a breathing or pulsating discharge noise. It may also be detected by movement on an ammeter scale or manometer. Increasing the volume flow sufficiently should eliminate this condition. This may be accomplished by bleeding air or recirculating the gas.

II. Coupling Alignment

Caution: The coupling on this machine was carefully aligned at the factory and the coupling halves and shell(s) marked to indicate relative position. However, transportation may have caused coupling misalignment. It is essential, therefore, that the motor and turbo shafts be checked for misalignment after installation and before start up, as misalignment can cause destructive vibration.

Coupling alignment should be rechecked again after an hour's operation. Final alignment should be made at average operating temperature. After each alignment check, add lubricant per instructions and replace coupling guard.

On certain vacuum producers, the coupling is disassembled after factory alignment and marking. The coupling halves are specially protected against the elements and the machine is shipped. Prior to start-up it is necessary on these machines, to assemble, align using factory markings, and lubricate in accordance with the instructions supplied with the machine contained here.

Coupling alignment provides for aligning, in the horizontal and vertical plane, the coupling motor half with the coupling turbo drive half, and insuring adequate clearance (gap) between the two. Only qualified maintenance personnel should attempt to align a coupling. If doubt exists as to competency, or if problems arise contact The Spencer Turbine Company.

Sier Bath Coupling (See accompanying illustration.)

Sier Bath couplings are manufactured to Spencer's rigid specifications. To align this coupling Spencer recommends the following procedure.

Remove one snap ring and slide the sleeve off the hub halves. (This operation will force one sleeve seal out of position.) Remove the old lubricant and clean the hub teeth.

Determine the correct dimension for the gap on the accompanying list and set a feeler gauge to that dimension. Lay a machine shop quality straight edge (maximum edge thickness 1/32 inch) across root diameter gear teeth as shown in the diagram. Adjust the motor side as necessary so that the straight edge is evenly supported by both gear teeth. (It may be necessary to re-shim or shift the motor). Check this even support in the four places as indicated.

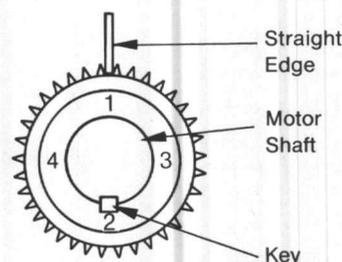
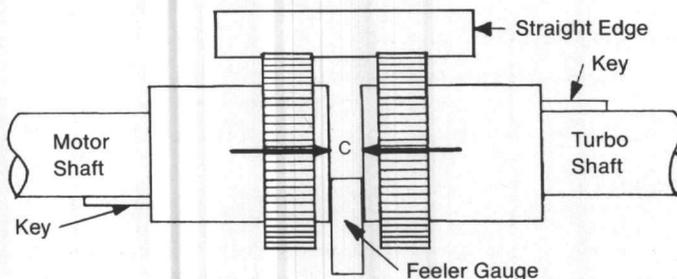
Sier Bath

Shaft Size	Dimension "C"
7/8	1/8
1 1/2	1/8
2	1/8
2 1/2	1/4
3	1/4
3 1/2	1/4
4	1/4

Place the previously preset feeler gauge between the two coupling faces, and in the four places indicated in the diagram, check to be sure the gap is consistent.

Caution: Be careful because some motor shafts are spring-loaded axially and when using feeler gauge take care not to compress shaft and disturb normal at-rest position.

When, at these four places, the feeler gauge indicates consistent spacing and the straight edge is evenly supported by both gear teeth, alignment of 0.002-inch or better has been achieved and the coupling is aligned.



Caution: Be sure to relubricate coupling after alignment and before operating. Refer to Section III for Lubricating Instructions.

Coupling Alignment with Sleeve Bearing Motors

Caution: Where sleeve bearing motors are used, it is necessary to accomplish the following procedures before coupling alignment is attempted.

Unless otherwise specified by the customer, a flange type gear coupling should be used for both 1800 and 3600 RPM applications. Do not use a sleeve type coupling.

Sleeve bearing motors have a specified end play. End play limits and the magnetic center (where motor will run) should be scribed on the shaft by the manufacturer.

When aligning a sleeve bearing motor with a machine, use the following procedure:

1. The motor shaft must be level.
2. Position the motor so that when the rotor is pushed toward the machine as far as it will go there will be 0.030-inch clearance between the ends of the machine and motor shafts (or the alignment faces on the coupling hubs.)
3. Proceed with the coupling alignment in accordance with applicable instructions.

III. Lubrication Instructions

Caution: Recommended grease Chevron SRI, Number 2. Alternate compatible greases are Shell Dolium, American Rykon-K. Use of other greases will void warranty. Chevron SRI Number 2 is available from Spencer.

General

Proper lubrication procedure is important to Vacuum Producer maintenance. These instructions should be closely followed to assure trouble-free operation of the equipment.

Standard Overhung Lubrication

Spencer Standard Overhung Vacuum Producers do not require lubrication except for possible motor bearing lube when required by the motor manufacturer. See paragraph titled **Motor Bearing Lubrication**.

Four Bearing Overhung and Four Bearing Outboard Bearing Lubrication

Spencer Four Bearing Overhung and Outboard Vacuum Producers, are equipped with deep-groove radial ball bearings designed to be self-aligning and still carry thrust and radial loads. These bearings are packed with the proper amount and grade of lubricant before the unit is shipped from the factory. For this reason, **lubrication prior to first operation is not recommended and should not be attempted**. Spencer machines are shipped from the factory without high-pressure lube fittings to discourage the use of a grease gun in bearing lubrication. **Many bearing failures are caused by excess grease applications which result in over-heating and consequent bearing failure.**

Bearing Lubrication Procedure and Frequency Guide

Lubrication is required based on operating frequency and conditions.

The Vacuum Producer bearings, as lubricated at the factory, carry an adequate amount and proper grade of grease for 1500 to 8000 hours of continuous operation prior to lubrication, depending upon atmospheric conditions and size. An average lubrication interval therefore should be established based on existing conditions. Several factors contribute to frequency of lubrication:

1. Operating temperatures (bearing)
2. Indoor or outdoor operation
3. Dusty or clean atmosphere
4. Ambient temperature
5. Predicted duty cycle
6. Bearing size and speed

Assuming an ideal 8000 hour lubrication interval, reduce the time factor by applying the above conditions as follows:

Operating Condition	Lubrication Interval Vacuum Producer Bearings
I. 1. 120° F to 170° F bearing temperature 2. Indoor installation 3. Clean atmosphere 4. 40° F to 100° F ambient temperature 5. Continuous operation	4000—6000 average operating hours
II. Same conditions as "I", above except: Intermittent operation	6000—8000 average operating hours

Operating Condition	* Lubrication Interval Vacuum Producer Bearings
III. 1. 120° F to 170° F bearing temperature 2. Outdoor installation 3. All atmospheric conditions 4. 0° F to + 120° F ambient temperature 5. Continuous operation	3000—5000 average operating hours
IV. Same conditions as "III", above except: Intermittent operation	5000—7000 average operating hours

***Note:** Higher limits apply to smaller bearings, (# 308 and smaller). Lower limits apply to larger bearings.

An extremely dirty atmosphere, in addition to the above factors, could decrease the lubrication period as much as 50%. The above chart serves only as a guide.

To lubricate Vacuum Producer bearings, proceed as follows:

1. Shut down machine.
2. Remove guards as necessary.
3. Carefully insert and remove a clean metal probe into each plug opening (approximately 1½ inches) to ensure adequate grease reaches the bearing.
4. Fill grease cups with recommended grease (Chevron SRI, Number 2) and turn down each ½ ounce grease cup three (3) or four (4) times.
5. Reinstall guards and restart the Vacuum Producer.

Caution: Do not run Vacuum Producer unless guards are properly installed.

Recommended Bearing Lubricant Type

The bearings of Four Bearing Outboard and Four Bearing Overhung Vacuum Producers are packed at the factory with Chevron SRI, Number 2 grease. The general specifications are:

Grade or consistency	# 2
Thickener	Polyurea
ASTM Dropping Point	480°F
Work Penetration	270
Base Oil Viscosity	600 SUS @ 100°F
Color	Blue-Green

Motor Bearing Lubrication (Applicable to all)

Follow motor manufacturer's recommendations. Some motors equipped with sealed bearings are not intended to be re-lubricated. There are, therefore, no grease or drain plugs on motors of this type.

Flexible Coupling Lubrication

Gear type couplings must contain lubricant at all times. Lubricate after checking alignment. Follow the coupling manufacturer's recommendations. Lubricate coupling every 6 months; check alignment if vibrations exist.

Couplings on machines shipped from Spencer have been serviced with Texaco Marfax # 1 grease. All couplings should be re-lubricated prior to start-up.

To lubricate without disassembling coupling, remove both lube plugs and position lube holes at 45° to horizontal. Force grease into top hole until clean grease flows out of opposite lower hole. Reinstall both plugs and wipe off all excess grease. Lubricate every six (6) months.

IV. Standard Overhung Machine

Instructions for Disassembly and Reassembly

Caution:

Parts must be reassembled in exactly the same relative positions. Therefore, it is recommended that each part be tagged as it is removed from the machine to facilitate later reassembly. It is especially important that the location of each impeller, as well as its position on the shaft, be marked.

When ordering replacement impellers and deflector heads, refer to the Notes on accompanying illustration.

General Configuration

The most common Spencer machine (overhung type construction) have the impellers mounted directly on the extended motor shaft and are available as either single-stage or multi-stage units. The multi-stage units are provided with deflectors to channel the air efficiently from one impeller to the next. The single-stage units are equipped with one impeller mounted between the end head and division head of the machine housing. The motor bearings support the shaft and impeller assembly. Besides the customary motor maintenance, no additional attention is required by the unit.

The motor base on the single stage adjustable and multi-stage adjustable discharge unit is made of fabricated steel.

Disassembly

It is suggested that the disassembly and reassembly procedures be read through carefully before starting disassembly efforts. If at all in doubt contact Spencer for help.

If it becomes necessary to disassemble a machine in the field, the following suggestions are offered for your assistance. Begin at intake and remove in turn, end head 6, impeller 8, spacer 14, packing 4, deflector head 7, impeller 8, and so on until all impellers are removed. Note: *Division head 3 cannot be removed.*

Remove packing plate 2 and slide back on shaft. If for any reason this packing has become damaged, new packing should be installed before motor is put into position.

Run motor to check for mechanical or electrical defects. To dismount motor, remove bolts 20, and slide motor straight back being careful not to injure packing, 2, around shaft nor disturb shims (if present) under each motor attach-point.

Reassembly

Bolt motor down tightly in its original position with shaft in the exact center of Vacuum Producer casing. Be sure shims (if removed) are replaced in exact position on the same motor attach-point as when removed. See that packing 2, is in place and tight around shaft. Place first impeller, 8, on shaft but do not tighten if center plate, 9, is removable. Place deflector head, 7, back **tightly against the stops**, and with suitable tool, calk packing, 4, (Felt on Multi-stage adjustable-discharge type) firmly back into the grooves. Remove center plate, 9, and set impeller midway in its chamber in such a position that the marks on hub and shaft coincide. Tighten impeller bolts firmly and replace the plate.

9. Tighten screws securely, but evenly, taking only a few turns on each screw in succession. Place second impeller 8, on shaft but do **not** tighten. Place spacer, 14, into deflector head, 7, and put both together into position in casing as shown. If center plate, 9, is not removable, push each impeller toward the motor until it bottoms. Back off approximately 1/8-inch and tighten impeller. Install first deflector and repeat procedure as necessary.

Note: Make sure spacer and deflector are pressed back tightly and at a uniform distance from the end of casing at all points. Calk in packing 4 (Felt on Multi-stage adjustable discharge type) and remove center plate, 9. Tighten impeller bolts and proceed in a like manner with remainder of the impellers, spacers, and heads.

Balancing

Each machine is fully tested before leaving the Spencer factory to be sure vibrations, if any, are well within specifications for the particular machine. However, rough handling during shipment or improper disassembly/reassembly of a machine can upset its balance and result in excess vibrations.

When a machine is being disassembled for repairs, mark the parts as they are removed. If this is done, no trouble should be expected from vibration when they are reassembled in the same order.

However, if the impellers are being replaced or there is any vibration due to an unbalanced condition after assembly, use the following procedure.

After running at operating speed and when at rest mark position of end impeller hub on shaft. Loosen bolts or screws holding impeller on shaft. Rotate impeller 90° on shaft. Run machine again at operating speed, and check vibration. Repeat this process until the best position is located for the impeller on the shaft so that there is no vibration or unbalance in the machine.

Note:

In the event of trouble, notify The Spencer Turbine Company, Windsor, Connecticut, or the nearest Spencer representative, describing in detail the nature of the difficulty before attempting to disassemble the machine.

Instructions for disassembly and reassembly of a Spencer Single Stage Adjustable Discharge Machine.

Disassembly

1. Block up casing on bottom. Remove end head.
2. Measure or mark position of impeller (8) on shaft, loosen three (or six) Allen socket screws three full turns, tap heads of screws. This will loosen impeller from tapered bushing allowing removal of impeller.
3. Remove bolts holding motor in place. Remove motor leaving block and shims in their original place. Motor can now be overhauled.

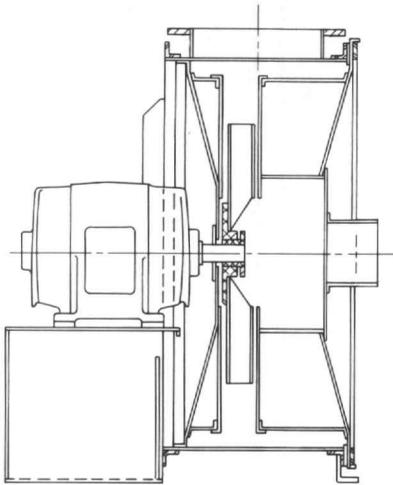
Reassembly

Replace motor in original position on blocking and shims, making sure shaft is centered in hole in division head and is perpendicular to head. Bolt motor down solidly, tighten nuts on packing plate, replace fan in original position, tighten up Allen socket screws with socket wrench.

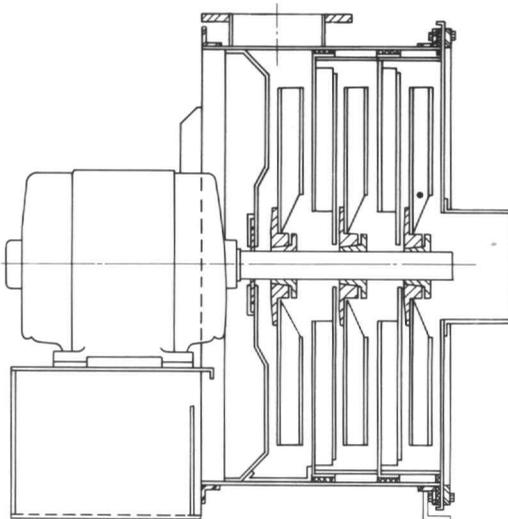
Replace end head in proper position, insert all bolts. Then tighten them all uniformly.

Make sure motor leads are properly connected and motor is rotating in the right direction. Machine is ready to run.

Typical Single-Stage Adjustable Discharge Type (IAD)



Typical Multi-Stage Adjustable Discharge Type (MAD)



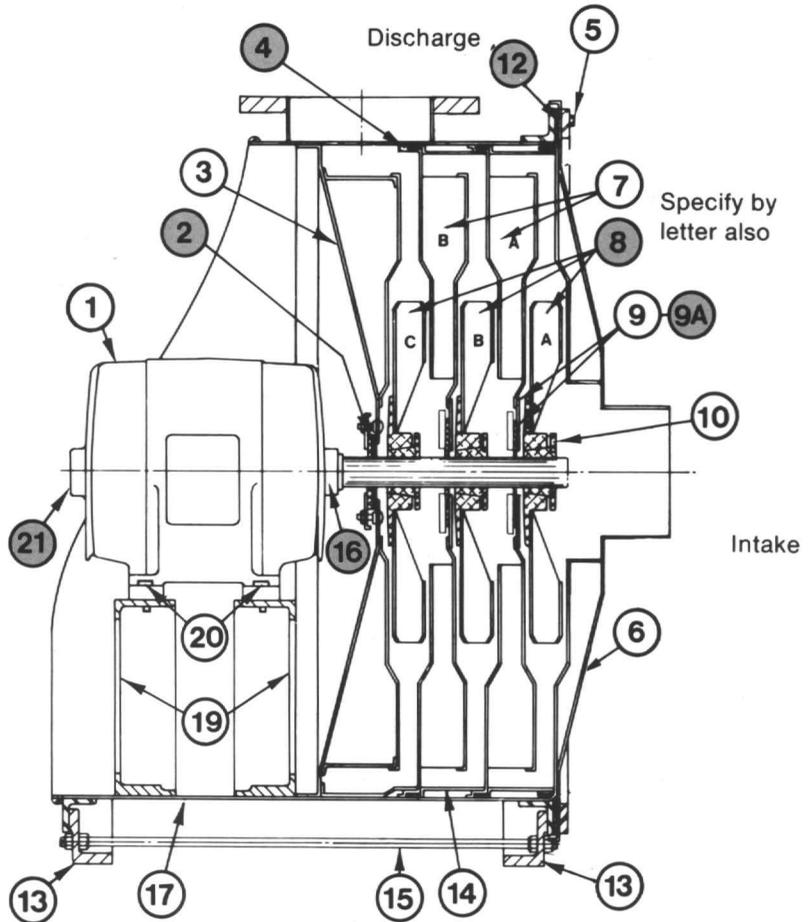
Notes:

1. Although three impellers and two deflectors are shown in this typical drawing, the number, in each machine, will vary dependent on the specific machine's design criteria. To determine the number of impellers and deflectors in a specific machine, consult the factory. Be sure to include machine serial number and appropriate impeller/deflector letter designation.

2. When ordering replacement parts, refer to Section XIV.

3. The impellers are equipped with tapered bushing hubs as illustrated (Item 10), or split clamped hubs. The former is tightened on the shaft with three or six Allen socket screws.

Typical Multi-Stage Standard Overhung Type (SOH)



Depending on volume and pressure, this type of Vacuum Producer is built with 1 to 9 impellers.

 Screened items are recommended spare parts

- 1 — Motor and shaft assembly
- 2 — Division Head Packing
- 3 — Division Head (Not available as separate item)
- 4 — Rope Packing For Deflector
- 5 — End Head Bolts
- 6 — End Head
- 7 — Deflector Head (A, B, Etc.)
- 8 — Impellers [Fans] (A, B, Etc.)
- 9 — Center Deflector Plates
(Normally Not furnished on 30" or Smaller Machines)
- 9A — Inter-Stage Deflector Packing
- 10 — Split Clamped Hub or Taper Bushing Clamp (Part of fan assembly)

- 12 — End Head Gasket
- 13 — Rear Head Foot
- 14 — Spacers
- 15 — Tie Rods (when required)
- 16 — Rear Motor Bearing
- 17 — Housing or Casing
- 18 — Front Foot
- 19 — Motor Base
- 20 — Motor Bolts
- 21 — Front Motor Bearing

V. Four-Bearing Overhung Machine

Instructions for Disassembly and Reassembly

Caution: Be sure all electrical power is disconnected prior to performing Vacuum Producer maintenance.

Caution: Parts must be reassembled in exactly the same relative positions. Therefore, it is recommended that each part be tagged as it is removed from the machine to facilitate later reassembly. It is especially important that the location of each impeller, as well as its position on the shaft, be marked.

When ordering replacement impellers and deflector heads, refer to the Notes on accompanying illustrations.

General Configuration

The four-bearing unit employs the overhung impeller construction with the rotating element supported by a rigid ball bearing bracket and shaft. A flexible coupling is mounted between this bearing bracket and the motor. The entire assembly is rigidly supported on a cast iron and steel channel which distributes the load evenly, thus assuring smooth, quiet operation.

Disassembly

If it becomes necessary to disassemble a machine in the field, the following suggestions are offered for your assistance. Refer to drawing on page 9.

Begin at intake and remove in turn end head 11, impeller 10, spacer 15, packing 18, deflector head 9, impeller 10, and so on until all impellers are removed. Note: Division head 4 cannot be removed.

Run motor with bracket installed and check for vibration.

Disassemble coupling. Remove motor bolts and slide motor straight back. Remove packing plate 6 and slide back on shaft. If for any reason this packing has become damaged, new packing should be installed before bearing bracket is put into position. Remove bearing bracket bolts and slide bearing bracket and shaft assembly out of the casing, exercising care so as not to injure packing, 6, around shaft.

Reassembly

Bolt bearing bracket down tightly *in its original* position with shaft in the exact center of blower casing. See that the packing, 6, is in place and tight around shaft.

Place first impeller, 10, on shaft but do not tighten. Place deflector head, 9 back *tightly against the stops*, and with a suitable tool, caulk packing, 18, firmly back into grooves. Remove center plate, 14, (if any) and set impeller midway in its chamber in such a position that the marks on hub and shaft coincide. Tighten impeller firmly, securely, and evenly, taking only a few turns on each bolt (screw) 12 in succession. Replace plate 14. Place second impeller, 10, on shaft but do *not* tighten. Place spacer 15 into deflector head 9 and put both together into position in casing as shown.

Note:

Make sure spacer and deflector are pressed back tightly and at a uniform distance from the end of the casing at all points. Caulk in packing 18, and remove center plate, 14. Tighten impeller bolts 12, and proceed in a like manner with remaining impellers, spacers, and deflector heads.

Balancing

Each machine is fully tested before leaving the Spencer factory to be sure vibrations, if any, are well within specifications for the particular machine. However, rough handling during shipment or improper disassembly/reassembly of a machine can upset its balance and result in excess vibrations.

When a machine is being disassembled for repairs, mark the parts as they are removed. If this is done, no trouble should be expected from vibration when they are re-assembled in the same order.

However, if the impellers are being replaced or there is any vibration due to an unbalanced condition after assembly, use the following procedure:

1. If there is any vibration or imbalance, coupling should be checked first for misalignment. If realignment does not correct the imbalance, rotate coupling hubs or machine shaft and motor shaft 90° or until opposite each other at 180°. This should take care of any imbalance in the machine.
2. If imbalance persists, run at operating speed then shut down. When at rest mark the position of end impeller hub on the shaft. Loosen bolts or screws holding the impeller on shaft. Rotate impeller 90° on shaft. Retighten impeller. Run machine again at operating speed, and check for vibration. Repeat this process until the best position is located for impeller on shaft so that there is no vibration or imbalance in the machine.

Note:

In case of trouble notify The Spencer Turbine Company, Windsor, Connecticut, or the nearest Spencer representative, describing in detail the nature of the difficulty before attempting to disassemble the machine.

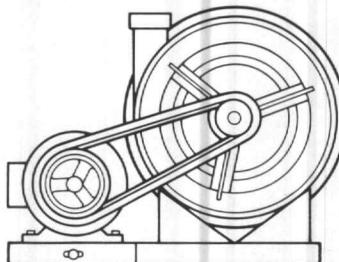
To Change the Back Bearing on the Motor End of the Machine:

1. Remove bolts (or spring) holding coupling together.
2. Check gap on coupling hubs.
3. Loosen and remove motor bolts, and slide motor back.
4. Remove coupling hub from machine shaft.
5. Remove locknut, washers, and bearing.
6. Replace bearing and parts in their proper order.

Realign coupling and check hub gap before and after bolting motor in place.

VI. Belt-Driven Machine

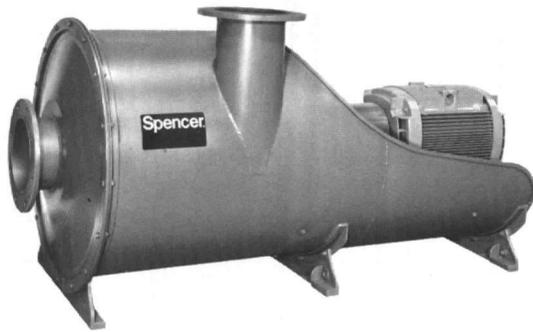
Belt-driven units are similar in construction to the four bearing overhung or the four bearing outboard direct drive machines except for the relative positions of the Vacuum Producer and drive motor. Care should be exercised to maintain proper belt tension.



Shown with belt guard removed.

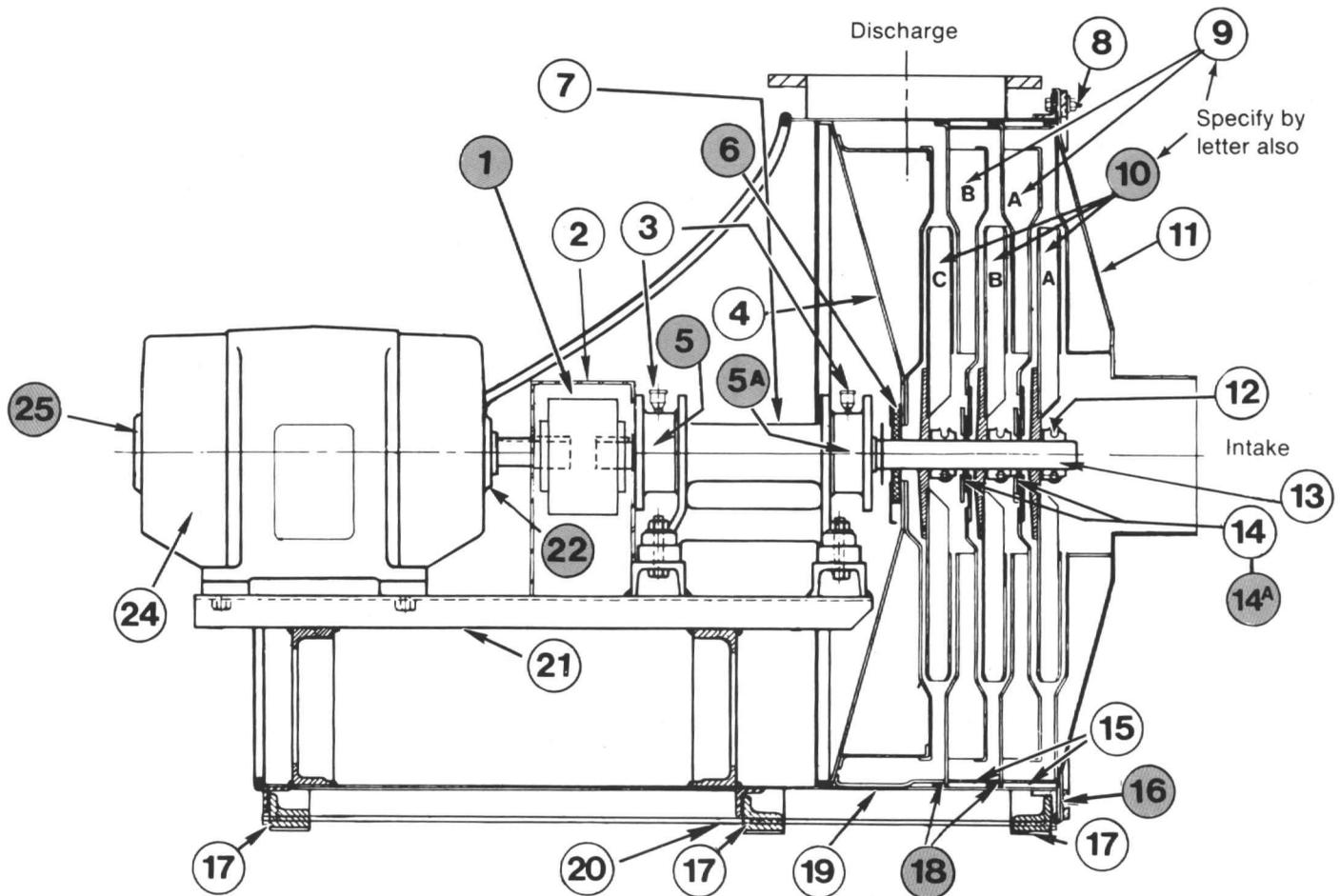
Caution: Be sure belt guard is installed before starting and operating machine.

Typical Four-Bearing Overhung Type



Notes:

1. Although three impellers and two deflectors are shown in this typical drawing, the number, in each machine, will vary dependent on the specific machine's design criteria. To determine the number of impellers and deflectors in a specific machine, consult the factory. Be sure to include machine serial number and appropriate impeller/deflector letter designation.
2. When ordering replacement parts, refer to Section XIV.
3. The impellers are equipped with a split clamped hub as illustrated or tapered bushing hubs. The latter is tightened on the shaft with Allen socket screws.



Screened items are recommended spare parts

- | | | |
|--------------------------------------|--|---|
| 1 - Flexible Coupling | 10 - Impellers (A,B,C, Etc.) | 18 - Rope Packing for Deflector |
| 2 - Coupling Guard | 11 - End Head Assembly | 19 - Casing |
| 3 - Bearing Bracket Lubrication Cups | 12 - Impeller Bolts (or Screws) | 20 - Tie Rod |
| *4 - Division Head | 13 - Shaft | 21 - Base for Bearing Bracket and Motor |
| 5 - Inboard Bearing | 14 - Center Deflector Plates (Normally not furnished on 30" or smaller machines) | 22 - Rear Motor Bearing |
| 5A - Outboard Bearing | 14A - Inter-stage Deflector Packing | 24 - Motor |
| 6 - Division Head Packing | 15 - Spacers | 25 - Front Motor Bearing |
| 7 - Bearing Bracket | 16 - End Head Gasket | |
| 8 - End Head Bolts | 17 - Feet | |
| 9 - Deflectors (A,B, Etc.) | | |

* Not available as separate item

VII. Four-Bearing Outboard Machine

Instructions for Disassembly and Reassembly

Caution: Be sure all electrical power is disconnected prior to performing Vacuum Producer maintenance.

Caution: Parts must be reassembled in exactly the same relative positions. Therefore, it is recommended that each part be tagged as it is removed from the machine to facilitate later reassembly. It is especially important that the location of each impeller, as well as its position on the shaft, be marked.

When ordering replacement impellers and deflector heads, refer to the Notes on accompanying illustrations.

General Configuration

In four-bearing unit of the outboard type, the impellers are mounted between two supporting bearings of the Vacuum Producer. The equipment is driven by means of a flexible coupling, and although most standard makes of couplings can be used, a gear type is normally furnished unless otherwise specified. Standard sleeve bearing or ball bearing motors with standard shaft dimensions are included, and the entire assembly is mounted as shown.

Caution:

Some four-bearing outboard machines have a duplex (tandem) bearing assembly. These bearings are available only from Spencer as a custom-matched set of two: one bearing for thrust and one bearing for radial load. These bearings are not interchangeable with bearings carrying the same part number; they can only be used in matched sets as furnished by The Spencer Turbine Company. For best results, follow instructions enclosed with each matched set of bearings.

Disassembly & Reassembly

1. Remove packing plate nuts from packing plate (32 and 20) on each end of machine. Slide both packing plates and packing (32 and 20) on shaft away from heads. Remove all packing from packing box when applicable.
2. Remove bolts (or spring) holding coupling (3) together, and break coupling apart. Check gap between coupling hubs.
3. Measure distance "B" from spider to outside edge of cap. Remove bolts in thrust assembly housing cap.
4. Remove lock nut (15) and washer from end of shaft, and loosen bolt (21) binding housing in spider.
5. Remove bracket bolts (19A). Using puller remove complete thrust assembly and bearings.
6. Remove bolts on end head, holding flat ring and end head to casing. (Use a chain hoist if available to hold head while removing bolts). After removal of end head, keep shaft supported while removing internal parts.
7. Remove spiral (13), or baffle, after marking position to insure correct reassembly. See Note (B) in following paragraphs.
8. Remove rope packing (10) and half deflector (26).
9. On other than keyed construction measure distance from fan hub to any step or shoulder on shaft, and mark for reassembly. On stacked and keyed construction, remove nuts and washers (24A) and shaft sleeves (24B). Remove impeller (29) and its hub spacer, number

or mark them for replacement in their proper position. See Note (A) following paragraphs.

10. Check axial position of each deflector at 4 radial points with reference to end of casing and record.
11. Remove spacer (27) holding rope packing in place. Number or mark for replacement.
12. Remove packing plate. Remove rope packing holding deflector in place. Then pull or work deflector (11) out of casing. Number or mark for replacement.
13. Proceed to remove the remaining stages in the same way, numbering or marking all fans, spacers, deflectors, etc., to insure proper replacement.
14. Check deflector stops for damage.
15. Reassemble in reverse order.

To change the back bearing on the motor end of the machine

1. Remove bolts (or spring) holding coupling together.
2. Check gap on coupling hubs.
3. Loosen and remove motor bolts, and slide motor back.
4. Remove coupling hub from machine shaft.
5. Remove packing plate nuts from packing plate (32 and 20) on each end of machine. Slide both the packing plates and packing (32 and 20) on the shaft away from the heads. Remove all packing from packing box where applicable.
6. Remove bolts on both caps (8 and 8A) on three-arm bearing bracket (33).
7. Slide front cap off shaft, and push back cap away from bracket.
8. Remove bolts holding three-arm bracket in position while supporting end of shaft.
9. Slide three-arm bracket off bearing.
10. Remove locknut, washers, and bearing.
11. Replace bearing and parts in their proper order.

Realign coupling and check the hub gap before and after bolting motor in place.

Notes:

- (A) Upon reassembly, with all internal parts installed, the intake spiral edge should project slightly beyond end of casing so that end head will hold all stationary parts in position.
- (B) On stacked fans and keyed construction, the first nut installed is tightened with a spanner wrench, then loosened one full turn to allow for fan hub expansion. The second nut is brought up to the first nut with the lock-washer in between. Lock nut in position with washer tabs.

Balancing

Each machine is fully tested before leaving the Spencer factory to be sure vibrations, if any, are well within specifications for the particular machine. However, rough handling during shipment or improper disassembly/reassembly of a machine can upset its balance and result in excess vibrations.

When a machine is being disassembled for repairs, mark the parts as they are removed. If this is done, no trouble should be expected from vibration when they are re-assembled in the same order.

However, if the impellers are being replaced or there is any vibration due to an unbalanced condition after assembly, use the following procedure:

1. If there is any vibration or unbalance, the coupling should be checked first for misalignment. If realignment does not correct imbalance, rotate coupling hubs or machine shaft and motor shaft 90° or until opposite each other at 180°. This should take care of any unbalance in the machine.

Typical Four-Bearing Outboard Type (4BOB)

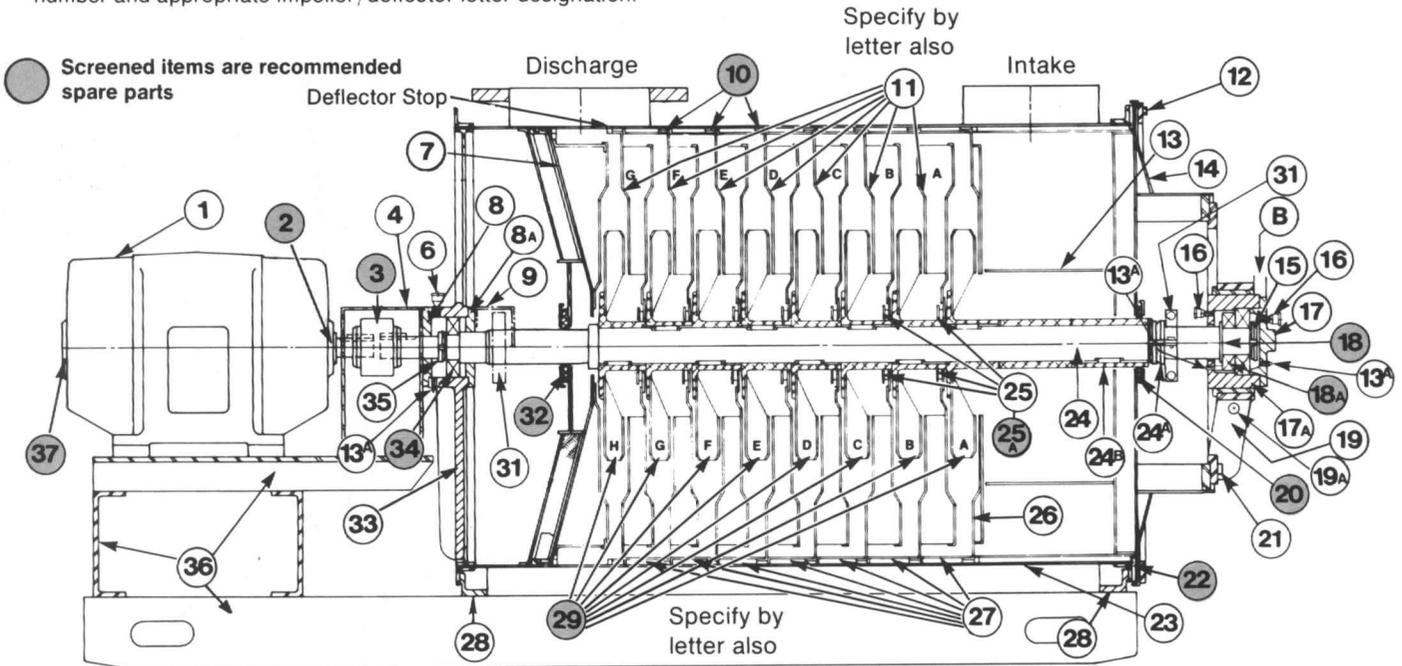
Notes:

1. Although eight impellers and seven deflectors are shown in this typical drawing, the number, in each machine, will vary dependent on the specific machine's design criteria.

To determine the number of impellers and deflectors in a specific machine, consult the factory. Be sure to include machine serial number and appropriate impeller/deflector letter designation.

2. When ordering replacement parts, refer to Section XIV.

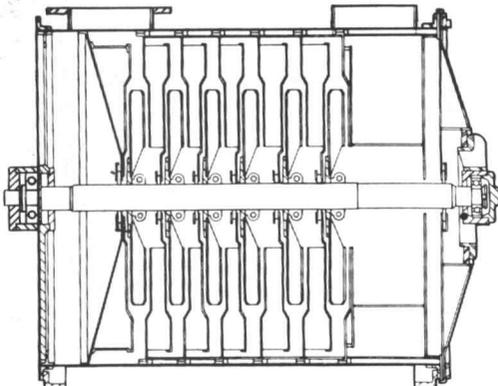
3. The impellers are equipped with keyed hubs as illustrated or split clamped hubs shown below.



- | | | |
|-------------------------------------|--|---|
| 1 - Motor | 15 - Outboard Bearing Nut and Washer | 25 - Center Deflector Plates |
| 2 - Rear Motor Bearing | 16 - Outboard Bearing Lubrication Cup | 25A - Inter-Stage Deflector Packing |
| 3 - Flexible Coupling | 17 - Outboard Bearing Cap | 26 - Half Deflector |
| 4 - Coupling Guard | 17A - Outboard Bearing Housing | 27 - Spacers |
| 6 - Inboard Bearing Lubrication Cup | 18 - Thrust Washer (where applicable) | 28 - Feet |
| *7 - Division Head | 18A - Outboard Bearing(s) | 29 - Impellers (A,B,C, etc.) |
| 8 - Inboard Bearing Cap Front | 19 - Outboard Bearing Bracket | 31 - Heat Fan |
| 8A - Inboard Bearing Cap Rear | 19A - Housing Locking Bolt and Nut | 32 - Division Head Packing |
| 9 - Heat Fan Guard | 20 - End Head Packing (where applicable) | 33 - Inboard Bearing Bracket |
| 10 - Rope Packing for Deflectors | 21 - Bracket Bolts | 34 - Inboard Bearing |
| 11 - Deflectors (A,B, C, Etc.) | 22 - End Head Gasket | 35 - Inboard Shaft Locking Nut and Washer |
| 12 - End Head Bolt | 23 - Casing | 36 - Common Base |
| 13 - Intake Spiral | 24 - Shaft and Keys | 37 - Front Motor Bearing |
| 13A - Grease Drain | 24A - Fan Assembly Lock Nuts(2) and Washer (1) | |
| 14 - End Head Assembly | 24B - Shaft Sleeves (Two; one keyed) | |

* Not available as a separate item

Alternate internal construction of a Four Bearing Outboard Vacuum Producer with split clamped hubs

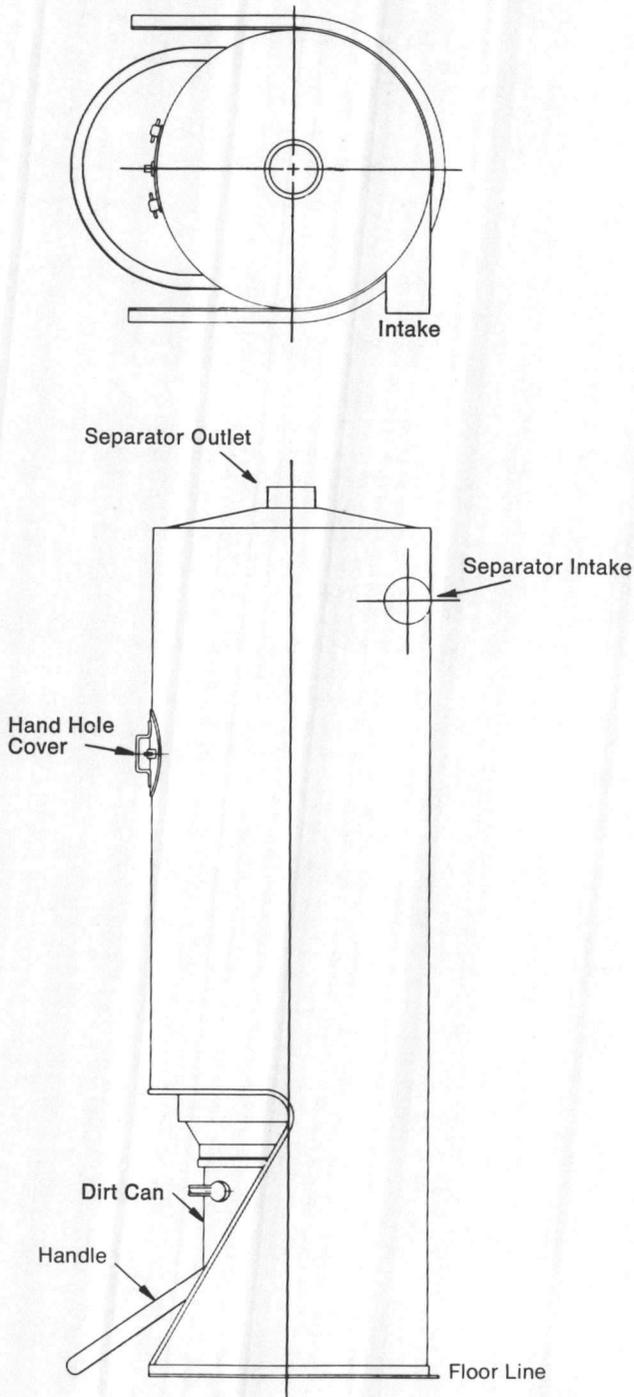


VIII. Centrifugal Separator

To assure efficient operation the separator must be sealed properly to prevent leakage. The access doors, dirt can, discharge valve, intake and outlet should be checked as the most common places for leakage.

The separator should not be allowed to become so full that the accumulated litter interferes with its efficiency. The separator should be emptied at regular intervals. After each cleaning period the wire screen over the baffle inside the separator should be brushed to remove accumulated litter. The screen can be reached through the hand hole at the front of the separator.

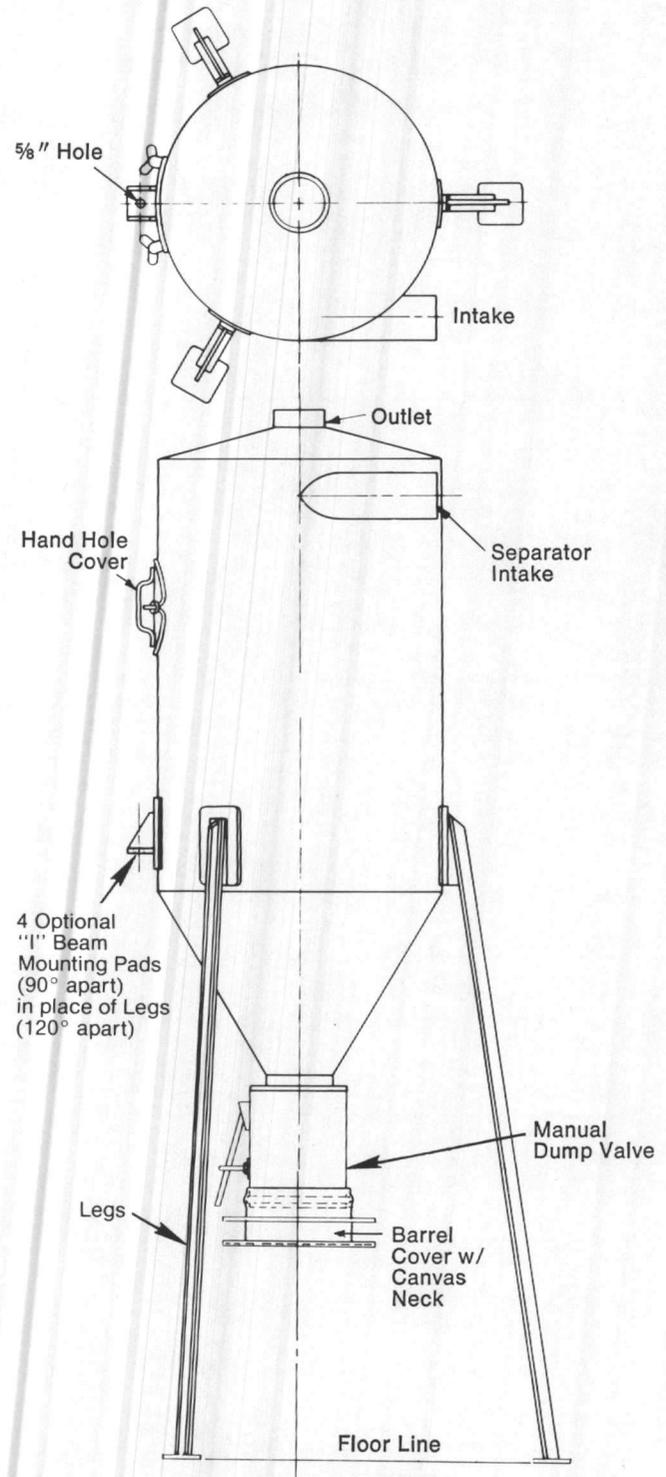
Centrifugal Separator with Removable Dirt Can



The dirt can type separator is cleaned by removing and dumping the dirt can. Be sure the dirt can is properly seated when it is replaced.

The hopper bottom separator is cleaned by opening the discharge valve in the cone of the separator and allowing the material to drop into a container or discharge line.

Centrifugal Separator with Hopper Bottom



IX. Tubular Bag Separator

To assure efficient operation the separator must be sealed properly to prevent leakage. The access doors, dirt can, discharge valve, intake and outlet should be checked as the most common places for leakage.

After each cleaning period the bags should be thoroughly shaken. Bags should also be checked for wear periodically and replaced if needed. See bag installation instructions.

The dirt can type separator is cleaned by removing and dumping the dirt can. Be sure the dirt can is properly seated when it is replaced.

The hopper bottom separator is cleaned by opening the discharge valve in the cone of the separator and allowing the material to drop into a container or discharge line.

Caution: Be sure to shut down the system before attempting to clean.

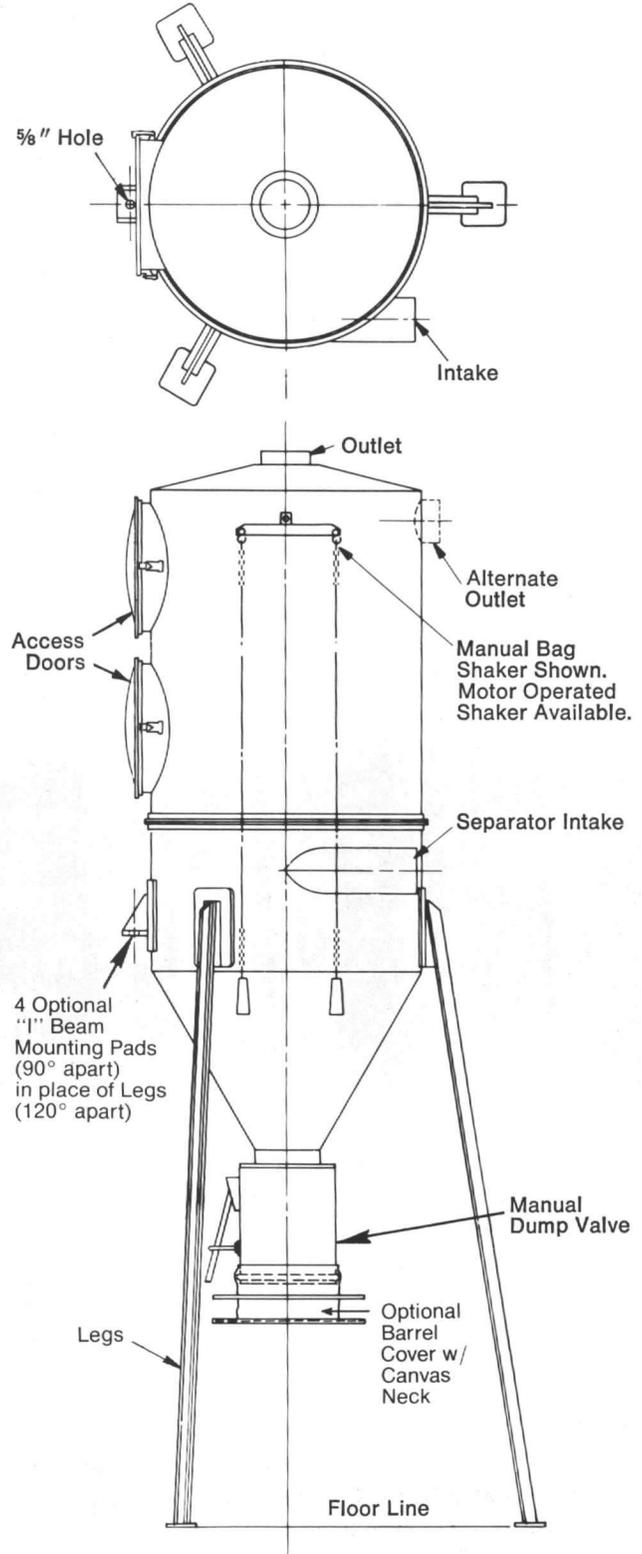
Motorized Bag Shaker

Caution:

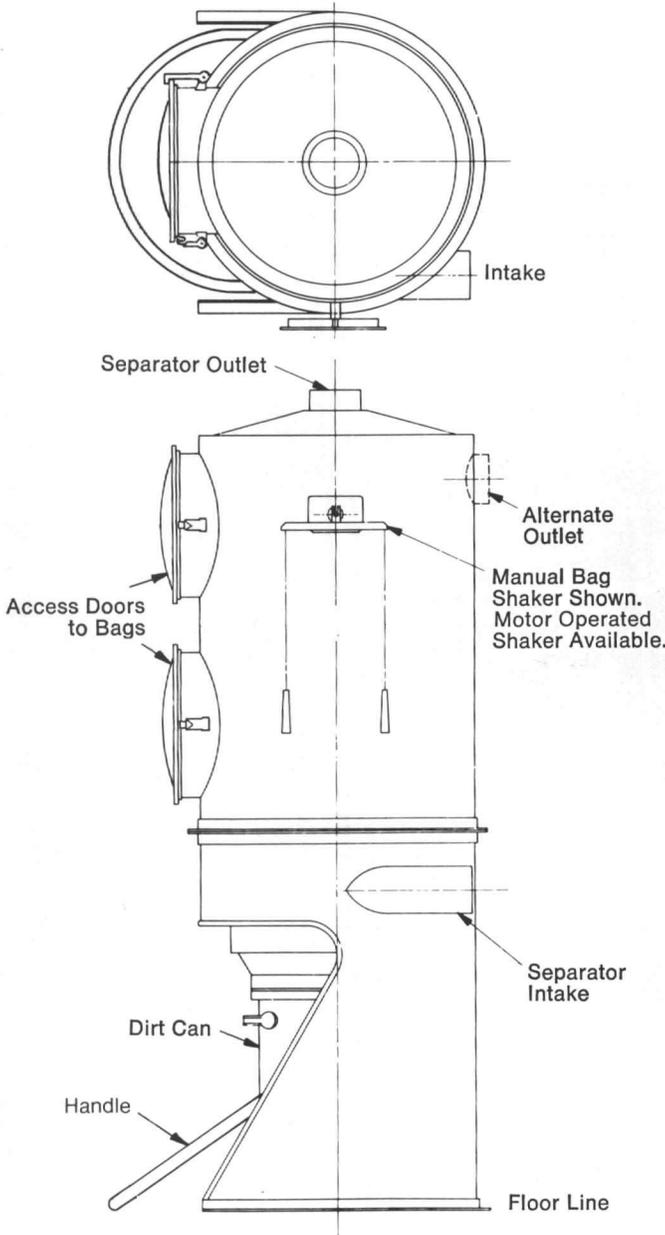
The motorized bag shaker gearbox has been shipped with gearbox lubricant. The gearbox must be serviced prior to start-up in accordance with the manufacturer's instructions regarding type of lubricant used and servicing interval.

Motorized bag shaker linkage rod end bearings have been lubricated at the factory and should be re-lubricated every three months.

Tubular Bag Separator with Hopper Bottom



Tubular Bag Separator with Removable Dirt Can



X. Filter Bag Information

Attaching Bag Clamp

Top (Closed) End
Important!

Proper filtration will be obtained with filter bag clamp attached. **One way only.** Please follow instructions **exactly.**

Pay particular attention to installing the first filtration loop and bag. If care is exercised, remainder of bag loops will not require adjustment after installation. Install and adjust the first filtration bag; carefully measure and note dimensions A. Prefold each subsequent bag end to dimension A before installing into separator. Record dimension A (Step 3) for future bag installation efforts.

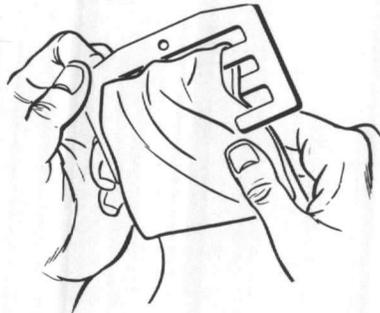
1

Fold narrow (closed) end of bag forward on itself. Holding top (closed) end of bag clamp in left hand, insert loop of bag (formed by folding forward) on lugs on each side between two solid bars.

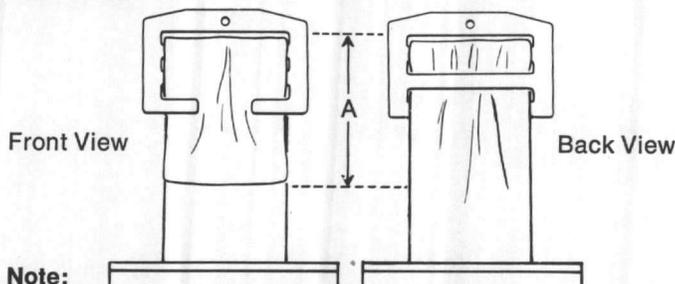


2

Holding together the two thicknesses of bag, insert under lugs at each side of open end of clamp.



3 Clamp is now securely in position and should look like this:



Note:

Before attaching additional bag clamps, determine (by actually installing in separator) whether amount of fold is correct. If not, adjust accordingly and use as guide when attaching clamps to other bags.

Caution:

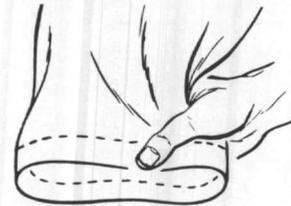
Serious malfunction of system will develop unless filter bag clamp is attached EXACTLY as shown. Please follow instructions precisely as given above.

Mounting Filter Bags

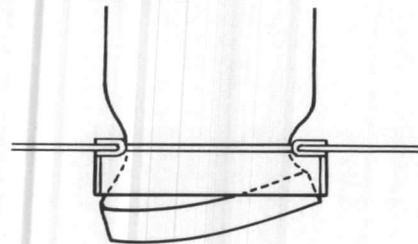
Bottom (open) End

After attaching bag clamps, suspend all filter bags from hooks in the top head of separator. Then:

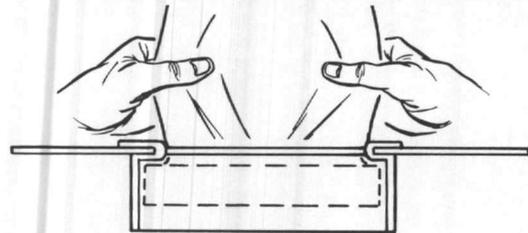
1 Compress spring at bottom of bag into an oval.



2 Tilt to a suitable angle and slip past bead on inside of collar.



3 Allow ring to resume circular shape and bring it up snugly against the under side of the bead. Accomplish this by grasping bag and pulling up gently.



Notes:

1. If filter bag is loose, slack should be taken up by readjusting bag clamp at top of bag (see instructions).
2. It is best to install first the bags farthest from the access door.

Bag Materials

Several types of bags are available. A partial list of these types and recommended application are shown:

Type Filter Bag	Recommended Filter Application
Cotton Sateen	Average dirt encountered in general cleaning
Nomex	Hot materials (Consult Factory)
Cotton Twill	Extra fine material
Nylon	Certain chemical resistance
Dacron	Certain chemical resistance

Consult factory for specific recommendations.

XI. Hospital Separator

The separator is used for general hospital cleaning with provision to flush with liquid disinfectants. Unless equipped with the Ball Float Level protection (typical view shown in XIII Portable Wet Separator), the system should not be used as a wet pickup because damage could result due to overfilling of separator with liquids.

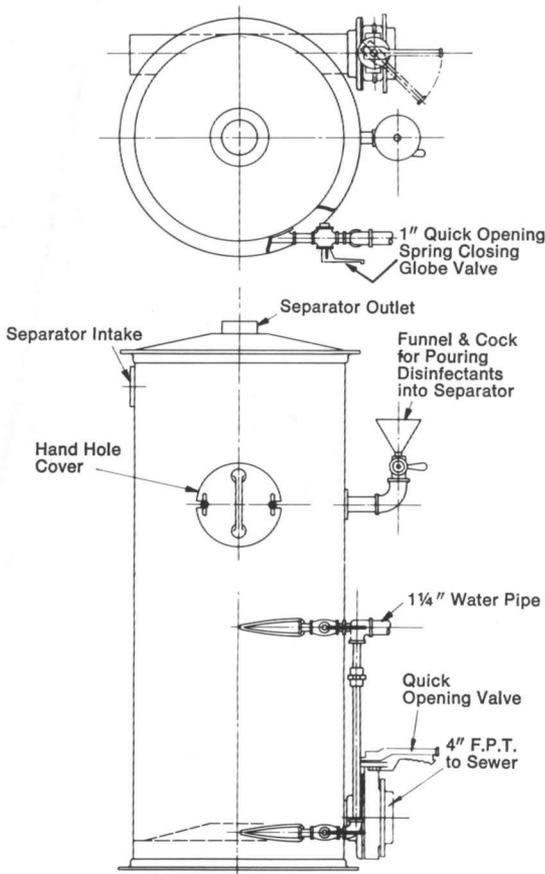
To insure proper operation of the separator check all connections and inspection door to be sure they are properly sealed and do not leak air into the system.

The separator should not be allowed to become so full that the accumulated material interferes with its efficiency.

After each cleaning period the separator should be cleaned according to the following procedure.

1. Pour required disinfectants into funnel.
2. Open lower water tap, so slurry of dirt in solution will form.
3. Open upper water tap to aid in filling separator.
4. Close upper water tap after approximately:
 - 1 minute for 24" separator
 - 2 minutes for 30" separator
 - 3 minutes for 36" separator
5. With lower water tap open to continue whirlpool action of solution, open discharge valve to sewer, to flush out separator.
6. Proceed with flushing action until discharge water becomes clean.
7. Close lower water tap and let separator drain-out.
8. Close discharge valve to sewer.
9. System can now be used for vacuuming.

Note: Water should not be left in the separator while dirt is being picked up.



XII. Wet Separator

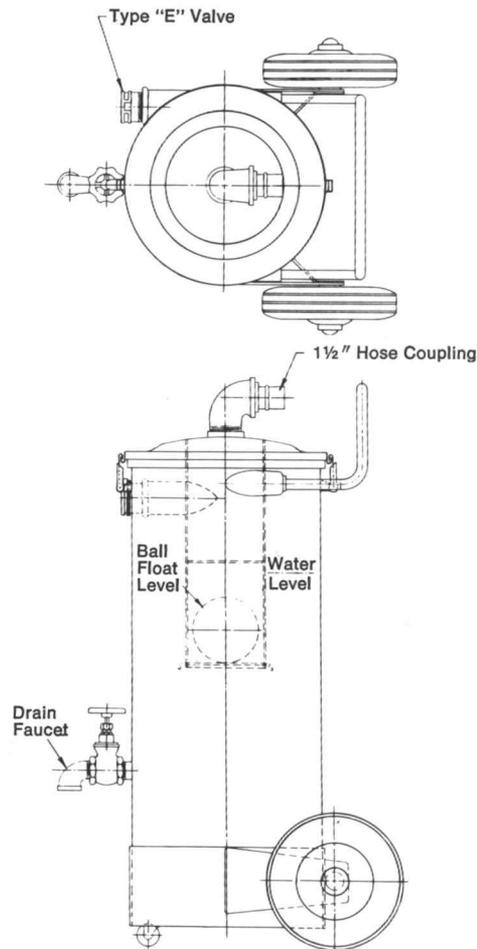
The Wet Separator will be supplied for wet material pickup and water flushing. This separator will have all the standard features of the Hospital Separator plus a ball float shutoff, a float switch flange, and a 1 1/2" FPT pump connection. The standard float switch flange is for pump operation, and when an overflow control is required a special float switch flange will have to be added above the standard one. When a pumping arrangement is not required the 1 1/2" FPT pump connection will be plugged and the float switch flange will be capped.

XIII. Portable Wet Separator

The separator is used for picking up wet solutions and is not intended for general cleaning.

It is connected to the system by the use of a short length of hose. The male end of the hose is plugged into an inlet valve of the main system. The female end of the hose is attached to the 1 1/2" hose coupling at the top of the separator.

The separator should be drained and flushed after each use. It is flushed by removing the cover assembly and pouring in clean water while the faucet on the separator is open and draining.



XIV. Replacement Parts

How to order replacement parts

When ordering replacement parts, it is important that the information you furnish to Spencer is correct and complete. Be sure when reading nameplates that you obtain the correct information. Record nameplate information on the typical nameplate shown here to use as a reference when ordering parts. Remember, the more complete the information, the quicker the order will be processed; incomplete information will result in unnecessary delays and expense through call-backs. When in doubt, consult the factory for further information.

To order replacement parts, furnish the following:

1. Record machine serial number and catalog number from machine nameplate.
2. Record motor horsepower from motor nameplate.
3. Measure and record the casing diameter.
4. Refer to applicable illustration in the instruction manual and locate needed item by its circled call-out number. Refer to call-out list for nomenclature and record.
5. When ordering impellers and deflector heads be sure to include the letter designation shown on the applicable illustration. An alternate method would be to count the number of fans from the end of the casing.
6. Include the form number from which you have extracted the nomenclature. The form number will read AA, EE, etc.

Spencer®			Serial No.
Vacuum Producer			
			Cat. No.
	H.P.		C.F.M.
	R.P.M.		Vac. Inches Hg

Manufactured under some or all of the following United States patents: 2,932,444; 2,984,856; 3,025,894; 3,042,765; 3,097,673; 3,565,103; 3,672,616; 3,685,530; 3,874,857.

Read instruction manual before starting.

The Spencer Turbine Company
Windsor, Connecticut 06095

Plate 201 Made in U.S.A.

Recommended Spare Parts

Standard Overhung (refer to drawing)

Item number	Nomenclature
2.	Division head packing
4.	Rope Packing
8.	Impellers (fans)
9A.	Interstage packing
12.	End head gasket
16.	Rear motor bearing
21.	Front motor bearing

Typical Four-Bearing Overhung (refer to drawing)

Item	Nomenclature
1.	Flexible coupling
5.	Ball bearings
6.	Division head packing and plate
10.	Impellers (fans)
14A.	Interstage deflector packing
16.	End head gasket
18.	Rope packing for deflector
22.	Rear motor bearing
25.	Front motor bearing

Typical Four-Bearing Outboard (refer to drawing)

Item	Nomenclature
2.	Rear motor bearing
3.	Flexible coupling
10.	Rope packing
18.	Thrust washer
18A.	Outboard bearing(s)
20.	End head packing
22.	End head gasket
25A.	Interstage deflector packing.
29.	Impellers (fans)
32.	Division head packing
34.	Inboard bearing
37.	Front motor bearing

XV. Trouble Shooting Guide -Separators

Trouble	Probable Cause	Corrective Action
Centrifugal Separators		
Vacuum Producer Motor Overload	— Leaks.	Check access doors for tightness. Check dirt can or discharge valve sealing. Check for holes worn in separator (when handling abrasive materials).
Low Vacuum in System	— Leaks. — Screen Clogged.	See above. Clean screen (access through clean-out door in side of Separator).
Majority of Material Not Being Collected	— Leaks.	See above. A small leak will greatly affect separation efficiency.

Tubular Bag Separators

Vacuum Producer Motor Overloaded	— Leaks.	See above.
Low Vacuum in System	— Leaks. — System Overloaded. — Bags clogged.	See above. See vacuum producer Trouble Shooting Guide. Shake bags at more frequent intervals (only shake bags when system is not running).
Dirt Passing Through Separator and Clogging Vacuum Producer or Being Exhausted	— Loose bag. — Holes in bags.	Check bags and re-install per instructions. Carefully examine bags for holes and replace defective bags.

XVI. Trouble Shooting Guide-Vacuum Producers

Trouble	Probable Cause	Corrective Action
Insufficient Air Through System	Low vacuum as determined by measurement with a manometer:	
	— Incorrect rotation.	Change motor leads to correct rotation.
	— Customer has reassembled machine incorrectly.	Refer to instructions in this book and to assembly print; disassemble machine and reassemble properly.
	— Machine sized for requirements given, but air lines too small causing excessive frictional loss.	Increase line sizes or install machine providing higher vacuum.
	— Usage over and above designed rate.	Too many operators use the system at one time or shorter hoses are used causing too much air to enter the system. Use tools as supplied; do not use open end hoses.
	— High inlet temperature, i.e., higher than designed inlet temperature.	Direct inlet line to a cooler area; replace machine with one designed for correct temperature.
	— Machine not running at designed speed.	Refer to motor manufacturer's instructions; check motor speed; check voltage connections.
	— Machine air passages clogged with material.	Disassemble, clean and inspect all parts.
	— Fans worn out due to explosion, abrasion, or vibration.	Replace fan(s).
	— Inlet spiral has rotated, partially blocking inlet (4-bearing outboard machines only).	Rotate spiral to correct position and pin or clamp in position.
	— Vacuum gauge inaccurate — applies but to gauge reading only, not machine performance.	Calibrate gauge; always use a "U" tube manometer for checking vacuum.
	Machine design capacity too small for the system:	
	— System requirements incorrectly calculated; volume must be throttled in order to maintain full load on motor and to prevent overload.	Install larger volume Vacuum Producer machine to handle correct system requirements.
— Too much leakage and/or openings.	Eliminate all leakage; also refer to Separator Trouble Shooting Guide.	
Machine Noisy	External machine malfunction — bearing whining or growling:	
	— Too much grease — bearings hot.	Remove excess grease. Check bearing temperature (refer to lubrication instructions in this manual).
	— Too little grease — bearings dry.	Grease according to instructions.
	— Bearing(s) failure.	Replace bearing(s).
	— Bearing retainers worn.	Replace bearing(s).
	— Bearing turning on shaft — retaining nut loose.	Tighten nut, check for damage.
	— Bearing turning in housing — housing worn.	Replace housing and bearing.
	— Bearings replaced incorrectly — particularly in tandem assembly, i.e., angled, cramped or put in backwards.	Install bearings correctly according to instructions; check bearing, shaft and housing dimensions.
	Internal machine malfunction:	
	— Fan(s) hitting after customer reassembly and/or fans slipping shaft due to heat or excessive inlet pressure.	Reassemble according to instructions, tighten fans. Bleed air at low flow to reduce heat. Change inlet conditions if necessary.
	— Fan(s) coming apart due to age or wear from dirty air.	Replace fan(s). Too much material passing through separator. If system has a tubular bag separator, check bags for holes. If system has a centrifugal separator, check with Spencer Agent for recommendations on a bag separator.
	— Deflector coming apart due to age or wear from dirty air.	Repair or replace deflector.
	— Machine operating in surge or unbalanced flow range.	Increase air flow to stop surge condition.
	— Keyed hubs rattle on start up.	Normal. These will be loose when machine is cold — they will tighten as machine reaches operating temperature.
	— Machine out of balance; running rough.	Rebalance and/or clean machine. (Refer to — "Machine Vibrating.")
	— Deflector packings rubbing on shaft or fan hub (will seat themselves if new).	Ignore if audible only when machine turned by hand. If otherwise audible, replace packings.
	— Motor not aligned in casing (Standard Overhung) causing fans to hit.	Reassemble and carefully align shaft and motor properly.
	— Four-bearing machines — coupling misaligned and/or dry of grease.	Check alignment; check coupling for wear and replace if necessary. Relubricate according to instructions.
	— Foreign material in machine.	Disassemble machine, inspect and clean. Reassemble and refer to Separator Trouble Shooting Guide to prevent further clogging.

Trouble	Probable Cause	Corrective Action
Machine Noisy (Continued)	<ul style="list-style-type: none"> — Foreign material in machine. <li style="text-align: center;">Motor malfunctions: — Electrical hum or whine (above normal level). — Wrong voltage — low voltage motor not up to speed; high voltage will burn out motor and also cause noticeably more noise. — Bearings (see External Machine Malfunction). — Motor rebuilt improperly — thrust taken on wrong end in Standard Overhung Machine. — Loose part in motor. — Low frequency. 	<p>Too much material passing through separator. If system has a tubular bag separator, check bags for holes. If system has a centrifugal separator, check with Spencer Agent for recommendations on a bag separator.</p> <p>Check motor manufacturer's instructions. Check voltage supply and connections. Check for proper voltage at motor and correct.</p> <p>Rebuild motor properly and correct end play.</p> <p>Tighten, repair, or replace (check with motor manufacturer). Separate power supply; correct frequency.</p>
Machine Vibrating	<ul style="list-style-type: none"> <li style="text-align: center;">Imbalance: — Material build-up on fan(s). — Shaft bent — possibly in shipment—(.001 maximum shaft run out per 10" of length). Standard and 4-Bearing Overhung Machines. — Bearing(s) failure. — Faulty replacement motor installed and/or machine reassembled incorrectly. — Fan(s) failure. <li style="text-align: center;">Mechanical: — Motor not aligned in casing (standard overhung & 4-bearing overhung); fans rubbing. — Coupling misaligned (4-bearing machines). — Inlet and/or outlet piping connected to machine without flexible connector causing torque or strain on casing. — Machine bolted down causing change in alignment. — Bearing(s) cramped due to improper fit. — Piping not properly supported. — Improper voltage on motor causing assembly to operate at different speed. — Solids or liquids in, or passing through machine. — Machine operating in surge or unbalanced flow range. — Overtightened fan hub nuts. — Belts on belt drive machine loose(slapping). — Harmonic pulsation from gas engine driver. — Machine not mounted on solid foundation, i.e., on unstable catwalk, etc. 	<p>Clean fan(s). Too much material passing through separator. If system has a tubular bag separator, check bags for holes. If system has a centrifugal separator, check with Spencer Agent for recommendations on a bag separator. Replace shaft.</p> <p>Replace bearing(s). Disassemble machine, balance motor, reassemble according to the illustration and instructions in this manual. Replace fan(s).</p> <p>Align motor, realign shaft.</p> <p>Align coupling. Install flexible connection at inlet and outlet.</p> <p>Remove bolts; use dowel pins or set in guide channels. Check bearings, shaft and housing, correct bearing fit. Properly support or anchor piping beyond flexible connector. Check voltage and wiring connections; correct voltage. Disassemble, inspect and clean machine; install filter to prevent further contamination. Increase air flow to stop surge condition.</p> <p>Loosen hub nuts 1/2 turn. Tighten belts to proper tension. Do not operate at this speed! Change motor speed to remove harmonic pulsation. Re-inforce foundation.</p>
Motor Hot (Can Be Checked With Putty And Thermometer, Should Be Referred To Factory For Decision As To Whether Or Not It Is Too Hot).	<ul style="list-style-type: none"> <li style="text-align: center;">Incorrect motor selection: — Ambient temperature too high for insulation class. — Incorrect voltage. — Incorrect cycle. — Electrical short-circuit; insulation failure. — Motor overloaded — Vacuum Producer too small for system. — Leaks in system. <li style="text-align: center;">Unbalanced voltage supply: 	<p>Cool motor or replace with motor having proper insulation. Change to correct voltage. Change to correct cycle. Repair or replace motor. Install larger motor and/or Vacuum Producer. See also separator trouble shooting . Check all joints, valves, cleanouts or caps for sealing. Also see separator trouble shooting guide. Check with power company for correction.</p>



For the name and telephone number of your local Spencer Representative see your Yellow Pages under Vacuum Cleaners Industrial or Blowers and Blower Systems.

The Spencer Turbine Company

Windsor, Connecticut 06095 (203) 688-8361

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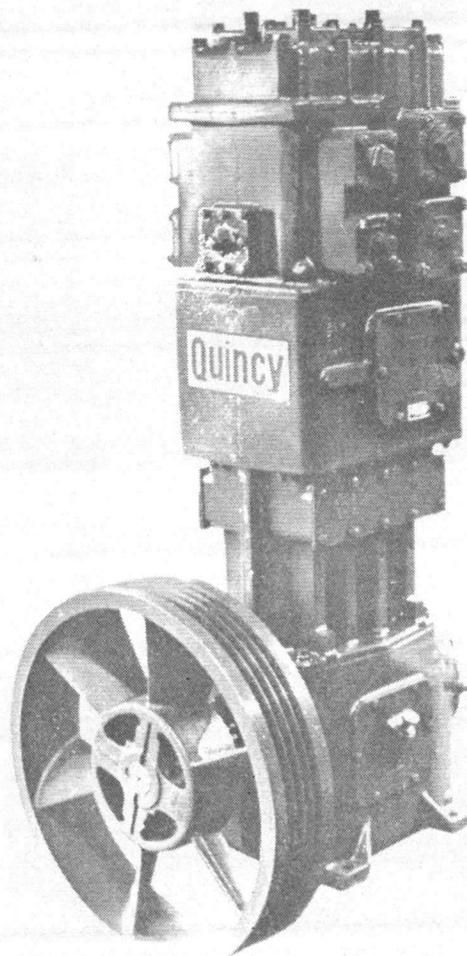
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QDD-QGD

Instruction Manual



CAUTION

**BEFORE INSTALLING THIS COMPRESSOR
READ AND UNDERSTAND THE SAFETY PRECAUTIONS
CONTAINED WITHIN THIS MANUAL.**



WARNING

Failure to heed any of the following warnings may be injurious to your health or result in serious injury or death, property damage and/or mechanical failure.

Air from this compressor must not be used for food processing or breathing without adequate filtering. Breathing air must comply with all federal, state and local laws, such as, but not limited to, OSHA 29 CFR 1910.34, Compressed Gas Association Commodity Specification G-7.1-1979 or ANSI Z86.1-1973, Grade "D" Breathing Air, and/or Canadian Standards Association.

Alterations must not be made to this compressor without Quincy Compressor approval. Use of parts other than those approved by Quincy Compressor for alterations, repair or servicing may create hazardous conditions.

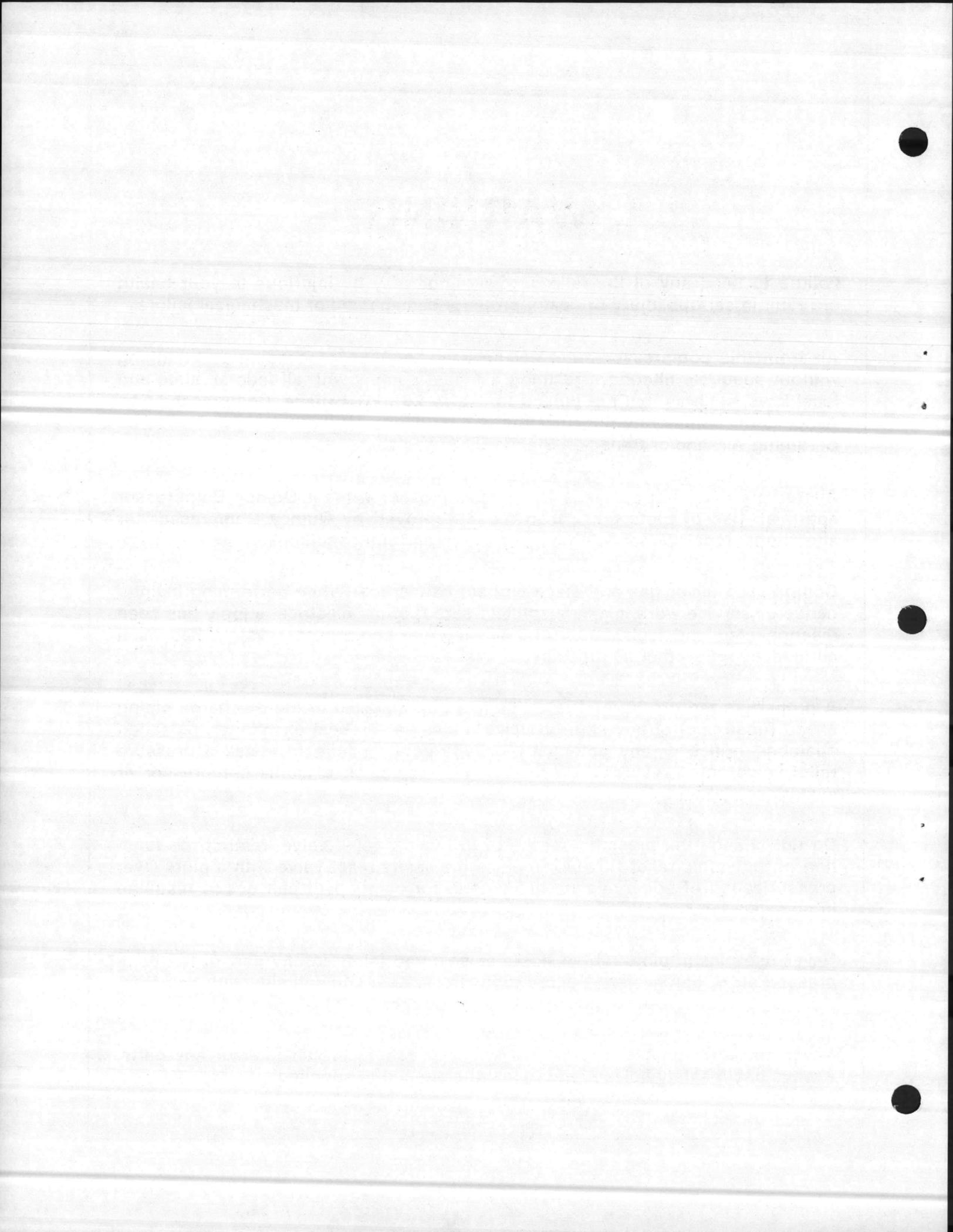
Compressed air or gas and electricity are dangerous. When performing maintenance or service work, make absolutely sure that the electrical supply has been disconnected and locked out, and the internal compressor system has been completely relieved of all pressure.

A properly sized pressure relief valve must be installed in the discharge piping ahead (upstream) of any shut-off valve (block valve), heat exchanger, pulsation chamber, orifice or any potential blockage point. Failure to install a pressure relief valve could result in the rupturing or explosion of some compressor or system component.

Do not change the pressure setting of the safety relief valve, restrict the function of the safety relief valve, or replace the safety relief valve with a plug. Over pressurization of some system or compressor component can occur, resulting in an explosion.

Never use plastic pipe, rubber hose, or soldered joints in any part of the compressed air or gas system. Failure to insure system compatibility with compressor piping is dangerously unsound.

Never use a flammable or toxic solvent for cleaning the air filter or any parts. Always use a safety solvent and follow the directions supplied.



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SECTION I DESCRIPTION

General—Quincy Compressor's QDD and QDG are heavy duty, two stage, double acting, water cooled, oil free compression chamber compressors.

Principles of Compression—Air or gas is drawn into the low pressure cylinder on both the up and down strokes of the piston, compressed on both strokes, and discharged from the low pressure cylinder on both strokes. The compressed air passes through an externally mounted intercooler (if used) and then into the high pressure cylinder where, like the low pressure cylinder, air is drawn in, compressed and discharged on both strokes of the piston.

Description of Lubrication—Oil lubrication is restricted to the running gear in the crankcase and the crosshead group. Wiper rings located at the top of the crosshead guide group prevents oil from reaching the compression cylinder. If a trace of oil should pass through the wiper rings and move along the piston rod shaft toward the cylinder it would be thrown off by the collars attached to the piston rod shafts. A positive displacement oil pump circulates oil through the crankshaft to the main bearings and crankpin bearings and up through the connecting rods to the crosshead and crosshead pin.

Specification

QGD-30W		Low Pressure Cylinder	High Pressure Cylinder
Size (inches)	4" Stroke	6	3.5
Maximum Discharge Pressure—PSIG		400	600
Maximum Rod Load Rating (400-900 RPM) Tension/Compression (Pounds)		2,000/2,000	2,000/2,000
Maximum Differential Pressure—PSI		71	208
Piston Displacement, CFD at 900 RPM	Head End	84,823	28,863
	Crankend	82,467	26,507
	Total	167,290	55,370
Piston Rod Displacement, CFD @ 900 RPM		Crankend	2,356
% Inherent Cylinder Clearance Volume	Head End	8.48	6.94
	Crankend	12.57	16.17
	Average	9.52	12.56
Average Valve Gas Velocity (per APT-618) FT/MIN.		2,770	2,080
Frame Power Rating (BHP)		30	
Piston Speed at 900 RPM, FT/MIN.		600	
Piston Ring Material		Teflon	

QDD-25W PERFORMANCE TABULATION

Stroke 4", L.P. Bore 6", H.P. Bore 3½"

Motor H.P.	PSIG Discharge Pressure	PSIG Discharge Pressure				
		100	125	150	175	200
10	RPM	460	460	400		
	CFM Displacement	59.38	59.38	51.65		
	CFM Free Air	44.50	44.00	37.60		
15	RPM	723	645	645	570	508
	CFM Displacement	93.33	83.25	83.25	73.58	65.57
	CFM Free Air	71.20	62.50	61.70	54.30	47.20
20	RPM	893	893	846	800	723
	CFM Displacement	115.27	115.27	109.20	103.31	93.33
	CFM Free Air	85.50	84.90	80.20	75.20	68.00
25	RPM			893	893	893
	CFM Displacement			115.27	115.27	115.27
	CFM Free Air			84.00	83.40	82.40

SECTION II BEFORE UNCRATING

Procedure—Before uncrating the following steps should be taken:

1. Immediately upon receipt of the equipment, it should be inspected for damage that may have occurred during shipment. If any damage is found, demand an inspection immediately by an inspector from the carrier. Refer to appendix "A" for complete details.
2. Insure that adequate lifting equipment is available for moving the machinery.
3. Read the compressor nameplate to be sure the compressor is the model and size ordered.

SECTION III INSTALLATION

Location—Locate the compressor in an area that is clean, well lighted, and well ventilated with sufficient space for safe and proper inspection, cleaning, maintenance, and the necessary dismantling required. Outline drawings may be obtained from the factory showing the required service clearances, or found in the parts book.

The maximum ambient temperature the compressor is capable of operating in is dependant upon the temperature of the coolant supplied to the compressor, the final discharge pressure, and the gas being compressed. Under no circumstances should the final discharge temperature exceed 380° F (193° C).

Mounting—Mount the compressor on a sturdy steel base or concrete floor or pad and bolt solidly in place. The foundation must support the weight of the compressor and absorb the unbalanced forces and couples generated by the compressor. The small extra cost of a heavy duty foundation will be well justified. When bolting solidly in place make certain that the tie down bolts don't distort the crankcase of the compressor. If the floor or base is uneven at the point of mounting, it may be necessary to shim the feet.

Induction System—QDD—Avoid locating the air compressor inlet system where it can ingest toxic, volatile or corrosive vapors, water, or extremely dirty air. Fine airborne dust, such as cement or rock dust requires special filtration equipment which is not furnished as standard equipment with this compressor. If it is necessary to remotely install the air filters make the inlet piping as short and direct as possible and as large or larger than the inlet connection to the compressor, for every eight feet of piping or ninety degree bend increase the pipe diameter by one pipe size. The inlet piping must be thoroughly clean inside, remove all weld slag or beads, rust or dirt. Galvanized pipe with screwed or flanged fittings is preferred.

—QGD— On closed systems the suction piping must be thoroughly clean as described for the QDD and must also include the necessary filters and scrubbers to eliminate liquid or solid carryover to the compressor.

Noise—Noise is a potential health hazard that must be considered. There are local and federal laws specifying maximum acceptable noise levels that must not be exceeded. Most of the noise from the compressor emanates from the air inlet point and therefore may require a silencer. Other methods of reducing noise to a listener may be achieved, but not necessarily, by total enclosures, walls, or by moving and/or rotating the noise source. Care must

be taken when erecting total enclosures or walls because if not properly done could contribute to the noise level and/or overheating. Consult your authorized Quincy Distributor if assistance is required.

Soldering—Never join pipes or fittings by soldering, lead-tin solder alloys melt in the range of the compressor discharge temperature. Silver soldering and hard soldering are forms of brazing and should not be confused with lead-tin soldering. Silver soldering and hard soldering is brazing with silver-alloy types of filler material and melt in the range of 1145° F (618° C) to 1800° F (982° C).

SECTION IV SYSTEM AND COMPONENT SELECTION

Pressure Pulsations—Total pipe length either to or from the basic compressor resulting in near resonant conditions can create serious problems. Near resonant conditions occur when the pulsating flow of air in and out of the compressor cylinders is close to being in tune with the natural frequency of the pipework, the compressor framework, and/or the surrounding structure (walls, windows, etc.). Problems created by near resonant conditions are:

1. Overloading the compressor drive unit.
2. Compressor valve breakage.
3. Damage to the surrounding structure.
4. Objectionable noise.
5. Loss of air capacity.
6. Aftercooler damage.
7. Fatigue failure of pipework and structural supports.

Methods of correcting near resonant conditions but not limited to are:

1. Change the developed length of the piping.
2. Strategically locate orifices or choke tubes in the piping system being careful not to create any excessive pressure drops.
3. Add a commercial pulsation dampening device.
4. Add a volume chamber.
5. Change the compressor speed.

Piping Fitup—Care must be taken to avoid assembling the piping in a strain with the compressor, it should line up without having to spring or twist it into position. Adequate expansion loops or bends should be installed to prevent undue stresses at the compressor resulting from the changes between hot and cold conditions. Pipe supports should be mounted independently of the compressor and anchored as necessary to limit vibration and prevent expansion strains.

Water Piping—Water piping must be of adequate size to flow the required amount of coolant at minimum head conditions, maximum coolant temperature and maximum compressor operating conditions. Failure to adequately cool can result in short valve life and short piston ring life.

Cooling Water—Cooling water should be clean and cool. Scale forming or corrosive water will shorten the life of watered cooled coolers. If there is any doubt about the condition of the water have it analyzed. It may be necessary to add a water treatment system and/or revise the cooling system. Under some conditions the life of the water cooled cooler can be extended by changing to a water cooled cooler of different material, consult with your local authorized Quincy Distributor.

The flow of cooling water must be controlled by a valve or water temperature regulator in the inlet line to the cylinder. No restrictions such as valves, temperature regulators, etc. should be placed in the cylinder water outlet in an open flow system. Restrictions can cause the cylinder bore to fill with water due to possible cylinder head gasket seepage when unit is stopped and cools.

Sight-flow indicators are recommended for the cylinder water outlet in a closed system. In a closed system, to prevent any cylinder head gasket seepage, the compressor and water circulating pump must be stopped simultaneously so the water pressure decreases to a negligible value at compressor shut down.

A thermometer with a 0-200° F range is recommended for the cylinder water outlet line in both the opened and closed systems so accurate temperature readings can be obtained.

The maximum allowable water pressure for cylinder heads, jackets, and intercooler is 75 PSIG. A pressure reducing valve must be used if the water pressure exceeds 75 PSIG.

It is not practical to list exact rates of flow since too many variables such as pressure, capacity, ambient and discharge temperatures, water temperature, and method of piping the many different applications are encountered. The following formulae can be used for determining the rate of water flow required by the compressor.

Two stage air compressor with aftercooler.

$$\frac{HP \times 42.4}{(140 - C) 8.33} = \text{GPM of water required}$$

HP—Horsepower input to the compressor

C—Water supply temperature in °F.

Note—For closed circuit cooling systems figure the water supply temperature (C) to be 15° F above the maximum ambient temperature.

Two stage air compressors without aftercooler.

$$\frac{HP \times 42.4}{(140 - C) 8.33} \times 0.57 = \text{GPM of water required}$$

Water Cooled Heat Exchangers—Water cooled heat exchangers must be sized and maintained to hold the design operating temperature of the compressor during maximum power input to the compressor and at maximum supply water temperature to the heat exchanger. A reserve capacity for removing heat should be built into the cooler for fouling. Provisions must be made for draining the coolant from the heat exchanger to prevent freeze-up when

not operational. Failure to adequately cool the compressor can result in short valve life and short ring life.

Air Cooled Heat Exchangers—Air cooled heat exchangers like water cooled heat exchangers must be sized to provide adequate cooling under the most severe conditions which means providing for the maximum ambient temperature the compressor may operate in. Once the cooler is in place and working, precautions must be taken to prevent restriction of the cooling air flow to and from the cooler and recirculation of the cooling air.

Drives—The compressor is supplied with a 4 groove, B section, statically balanced sheave. It is important that the compressor and drive sheaves are aligned properly and the V belts are correctly tensioned. Improper pulley alignment and belt tension are causes for motor overloading, excessive vibration, and premature belt and/or bearing failure. Important points to be followed are:

1. Check compressor and drive sheaves for oil, grease, nicks and burrs and remove if found.
2. Make sure compressor and drive sheaves are tight on shaft.
3. Align the compressor sheave with the drive sheave making sure the compressor shaft and the drive shaft are parallel with one another.
4. Use matched belt sets for maximum belt life.
5. New belts stretch and must be adjusted several times before they will stay tight.

The recommended procedure for tightening V belts is as follows:

2.1 RECOMMENDED V-BELT TENSIONING METHOD

- STEP 1. A. Measure the span length (1) of your drive (see figure 4-1).
- B. At the center of the span (2), measure the force required to deflect one belt on the drive $\frac{1}{64}$ " per inch of span length from its normal position (see figure 3-3). Be sure to apply the force perpendicular to the belt.
- C. For multiple V-belt installations, measure the force required to deflect a band of belts $\frac{1}{64}$ " per inch of span length as discussed above. Divide the value by the number of individual belts in the band to find the deflection force per belt.

NOTE: Lay a steel bar or a narrow block of wood across the multiple V-belt section and apply the deflection force to the bar so that all of the individual belts in the band are deflected the same amount. Lay a straight edge or stretch a string from sheave to sheave to use as a reference for measuring deflection. Lay the straight edge or string across the back of the multiple V-belt section on the sheaves.

- STEP 2. COMPARE THIS DEFLECTION FORCE WITH THE RANGE OF FORCES GIVEN IN TABLE 4-1
- A. If it is less than the minimum recommended force, the belts should be retensioned.
 - B. If it is more than the maximum recommended force, the drive is tighter than it needs to be.
 - C. The belts on a new drive can be tensioned until the deflection force for one belt is $\frac{1}{3}$ greater than the maximum recommended force, since the tension drops rapidly during the V-belt run-in period.

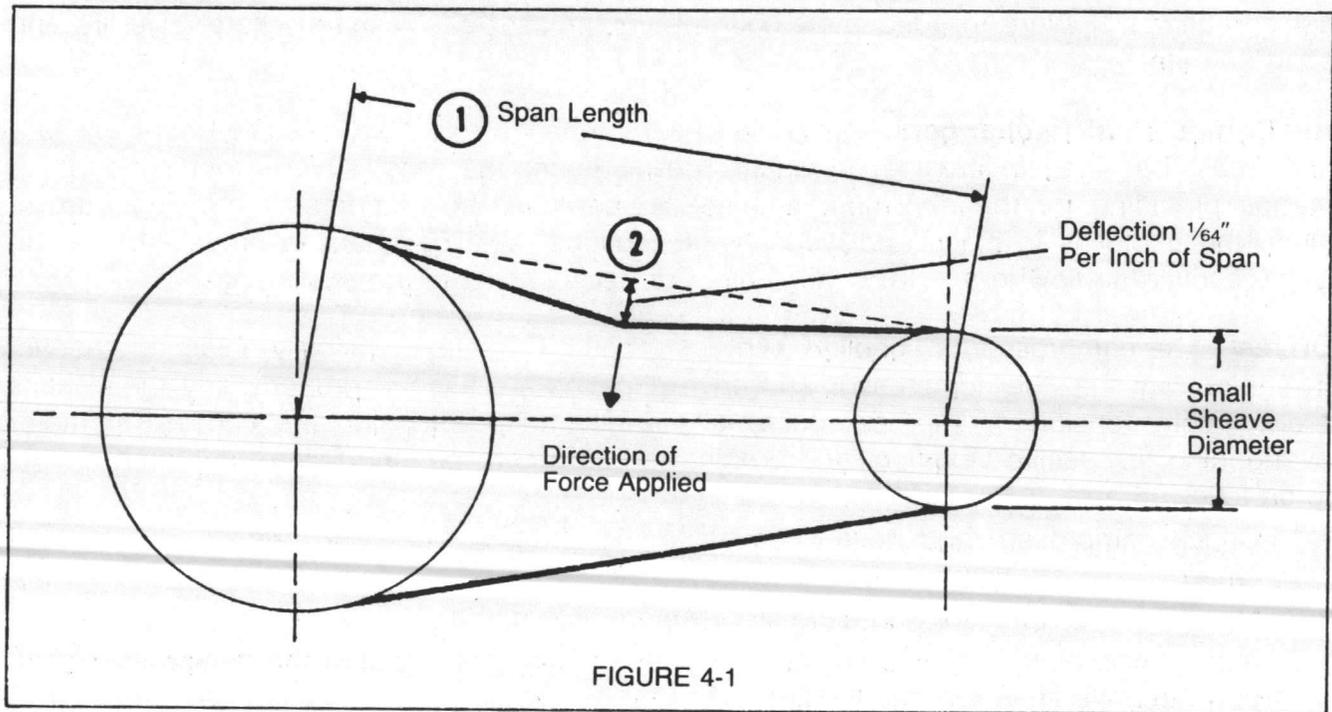


FIGURE 4-1

RECOMMENDED DEFLECTION FORCES

Belt Cross Section	Small Sheave Diameter Range	Recommended Deflection Force, Lbs.	
		Minimum	Maximum
A	3.0"-3.2"	2.3	3.2
	3.4"-3.6"	2.5	3.6
	3.8"-4.2"	2.9	4.2
	4.6"-7.0"	3.5	5.1
B	4.6"	4.0	5.9
	5.0"-5.4"	4.5	6.7
	5.6"-6.4 "	5.0	7.4
	6.8"-9.4 "	5.8	8.6
C	7.0"	7.1	10
	7.5"-8.0"	7.9	11
	8.5"-10.0"	9.3	13
	10.5"-16.0"	11	16

TABLE 4-1

Safety Valves—Safety valves are pressure relief valves and should be sized and purchased with a pressure setting to protect the weakest link in the system. Never change the pressure setting, only the safety valve manufacturer or an approved representative is qualified to make a change.

Safety valves are to be placed ahead of any potential blockage point which includes but not limited to, shut-off valves, heat exchangers, pulsation dampeners, and discharge silencers. Ideally the safety valve should be inserted directly into the pressure point it is sensing, not connected with tubing or pipe, and pointed away from any chance bystander.

The safety valve shall prevent pressure in the weakest component from exceeding 110% of the maximum allowable working pressure during maximum flow conditions but must not be set higher than the maximum working pressure of the weakest link. FAILURE TO PROPERLY SIZE, SET AND INSTALL PRESSURE RELIEF VALVES CAN BE FATAL. It is important to use the gas temperature when sizing a safety valve.

Pressure Vessels—Air receiver tanks and other pressure containing vessels such as, but not limited to, pulsation bottles, heat exchangers, moisture separators and traps, shall be in accordance with ASME Boiler and Pressure Vessel Code Section VIII. FAILURE TO ADHERE TO THE ASME CODE CAN BE FATAL.

The purpose of the air receiver is to stabilize the pulsations from the compressor so that a steady flow of air is delivered to the distribution line. It also serves as a storage tank and helps condense out any moisture which may be present in the air.

It is important that the receiver be of proper size. Generally the minimum cubic content of the air receiver is $\frac{1}{3}$ of the free air delivery of the compressor. For compressors equipped with automatic start and stop controls, the cubic content of the receiver must be determined to prevent excessive starting.

The discharge line from the compressor should enter the receiver at its lowest point. The air distribution line from the air receiver to the plant system should be near the top of the receiver. Pipe the drain in the bottom of the receiver to a convenient and safe location for removing the condensate, an automatic drain valve is a good investment.

If the air receiver is located outside or in an unheated area where temperatures of 32 deg. F. and below may be encountered, provisions must be made to keep the safety valves, pressure gauge, and drain from freezing.

Air Distribution Lines—The air distribution lines should be sized so the pressure drop at any point in the system does not exceed 10% of the air receiver pressure. Generally the discharge piping from the receiver should be the same size as the compressor discharge connection.

All piping should either be sloped to the receiver or a drop leg or moisture trap insuring the removal of any moisture present.

All service line outlets should be installed at the top of the headers. This will prevent moisture from entering the tool or device using the gas.

Shutoff valves protected by safety relief valves in the system, should be installed at all service line outlets to eliminate leakage when the tools are not in use.

Install auxiliary air receivers near heavy loads or at the far end of a long system. This will insure sufficient pressure if the usage is intermittent.

Guards—All mechanical action or motion is hazardous in varying degrees and needs to be guarded. Guarding shall be in compliance with OSHA SAFETY & HEALTH STANDARDS 29 CFR 1910.219 in OSHA manual 2206 revised November 7, 1978, and any state or local codes.

Manual Relief and Shutoff Valves—Install a manual relief valve to vent the compressor and the compressor discharge line to atmosphere. In those instances where the air receiver tank services a single air compressor, such as a tank mounted unit, the manual relief valve can be installed in the receiver. Where a manual shutoff valve (block valve) is used, the manual relief valve shall be installed upstream from the shutoff valve (block valve), and a safety relief valve installed upstream from the manual relief valve. These valves should be certified for the capacity, gas, pressure and temperature to which they will be applied and installed as to permit maintenance to be performed in a safe manner. NEVER substitute a check valve for a manual shutoff valve (block valve) if its the purpose of the manual shutoff valve to isolate the compressor unit from a system for servicing.

Warnings—Warning signs and labels shall be provided with enough light to read, conspicuously located, and maintained for legibility.

Controls—QGD, Plain valves are standard with the compressor. QDD, Suction valve unloading mechanisms are standard with the compressor.

QGD & QDD—Optional controls are available for constant speed, load—unload operation and stop—start operation.

SECTION V PREPARATION FOR STARTING

The following check list shall be adhered to before putting the compressor into operation. FAILURE TO PERFORM THE CHECKS MAY RESULT IN SERIOUS INJURY OR DEATH, PROPERTY DAMAGE AND/OR MECHANICAL FAILURE.

1. Remove all loose pieces and tools around the compressor installation.
2. Check oil level in crankcase.
3. Check drive and compressor pulley for alignment and tightness on shaft.
4. Manually rotate the compressor through enough revolutions to be certain there are no mechanical interferences.
5. Check air filter installation, oil bath air filters are not to be used.
6. Check belt tension, see recommended procedure for tightening belts.
7. Check all pressure connections for tightness.
8. Check to make sure all safety relief valves are in place.
9. Check to be sure all guards are in place and securely mounted.
10. Check fuses, circuit breakers and thermal overloads for proper size.
11. Open all manual shutoff valves (block valves) at and beyond the compressor discharge.
12. Turn on cooling water, fill system and check for leaks.
 - a. When manual water control is used, adjust water valve in the inlet line to maintain a small flow of water.
 - b. When a water temperature regulator valve is used, there must always be a small bypass to allow water to circulate around the sensing bulb at all times.

- c. When a solenoid water shutoff valve is used, there must be a manual bypass valve installed for filling. The manual bypass valve is to be closed for normal operation.
13. After all of the above conditions have been satisfied, jog the starter switch to check the rotational direction of the compressor it must agree with the directional arrow on the oil pump.

SECTION IV STARTING AND OPERATING

The following procedure should be followed for; startup of a new installation, startup after changes have been made to an existing installation, and startup after service repair work has been performed.

1. Instructions in addition to those contained within this manual, supplied by manufacturers of supporting equipment, must also be read and understood before startup.
2. Start compressor and watch for excessive vibration or strange noises. If either is observed, stop the compressor and correct. See stopping instructions.
3. Observe temperature and pressure gauges closely for the first hour of operation and then frequently for the next seven hours. After the first day, temperature, pressure and general compressor operation should be monitored at least once every eight hours. If any abnormal conditions are witnessed, stop the compressor and correct the problem.

Maximum Discharge Temperature, Air—380° F

Oil Pressure @ Operating Speed & Temp. — 18 — 20 psig

4. After two days of operation check belt tension, oil level, and oil & water piping for leaks.
5. Daily starting Routine;
 - a. Check oil level in crankcase.
 - b. Drain all moisture separators.
 - c. Turn on cooling water supply.
 - d. Start compressor per packagers instructions.
 - e. Check oil pressure.
 - f. Check system and/or air receiver pressure.
 - g. Check safety relief devices.
 - h. Check control system for proper operation.
6. Daily check list;
 - a. Oil level and oil pressure of crankcase.
 - b. Air discharge temperature.
 - c. Cooling water outlet temperature.
 - d. Manually blow safety valve.
 - e. Air receiver or system pressure.
 - f. Intercooler pressure.
 - g. Operation of controls.
 - h. Drain moisture separators and traps.

- i. Operation of scrubber (if used), including high liquid level.
- j. Check for abnormal temperature.
- k. Check for abnormal noise and/or vibration.

The above items should be checked at least every eight hours and preferably more often. It is not good practice to allow a machine to operate unattended over prolonged periods of time.

7. Cooling water;

- a. Maintain the cylinder outlet water temperature at 120-140° F. Set water temperature shutdown or alarm switch at 160° F.

Running the cylinders too cold may result in condensation and rust which would result in cylinder pitting and short ring life. Insufficient water causes excessive heat and results in reduced running clearance, short ring life and the Teflon rings may swell enough to stall the unit.

8. Stopping unit;

- a. Unload the compressor before stopping. If the unit is to stand idle, the cooling water must be turned off, allowing water to run through the cylinder will cause condensate and rust.

Note: Compressor must be operated at least one hour every two or three days to prevent a rust film from forming on the cylinder walls. If the unit must stand idle for a prolonged period of time, adequate protection against rust formation must be provided.

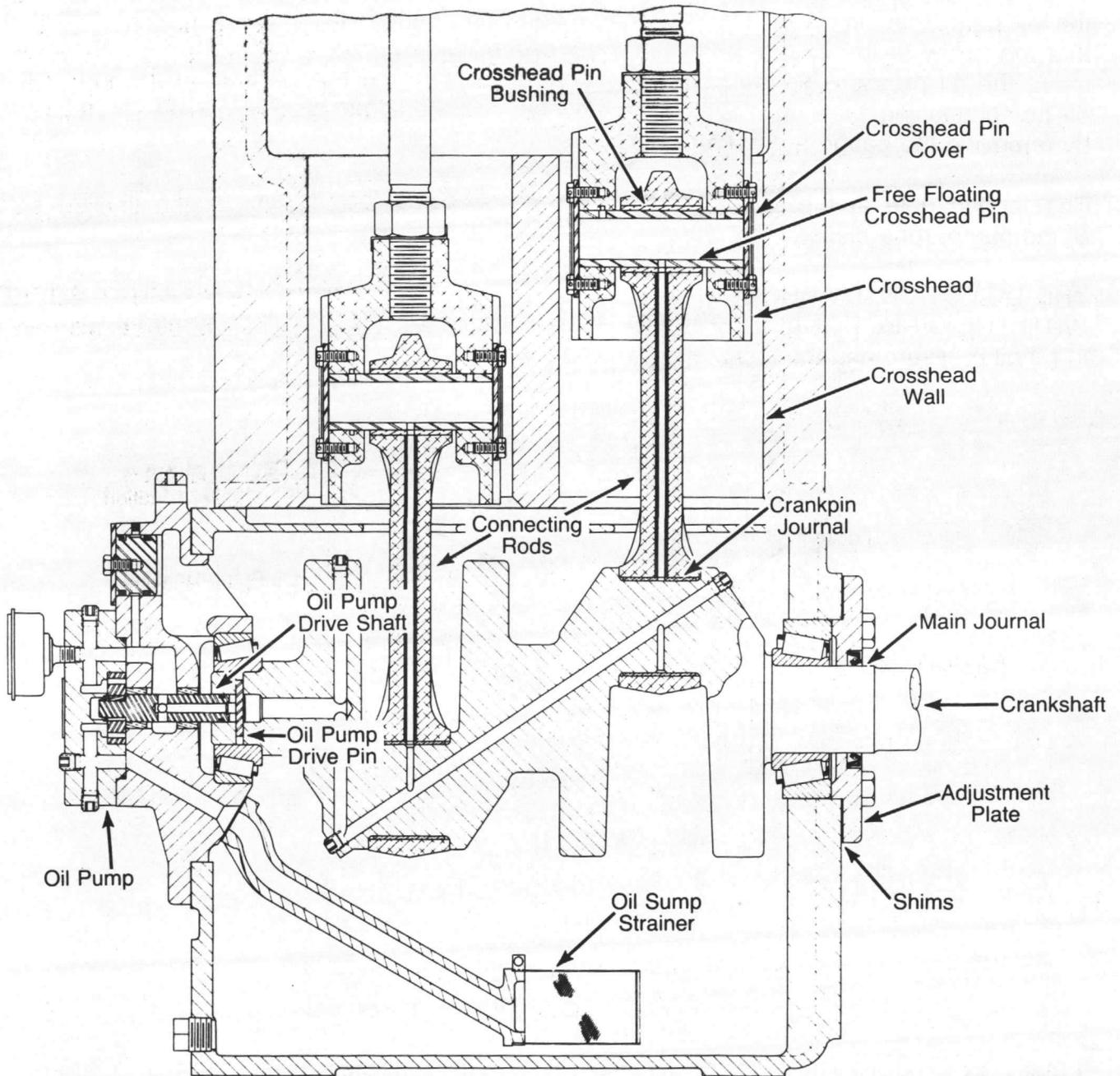
SECTION VII LUBRICATION

Crankcase Lubrication System (Fig. 7-1)—The crankcase rotating and reciprocating parts are lubricated by means of a positive displacement rotary gear type oil pump. Oil is drawn up from the crankcase oil sump through an oil strainer, to the oil pump. From the oil pump the oil is forced under pressure through the crankshaft and connecting rods to lubricate the crankpin journals, the main journals, the crosshead pin bushings and the crosshead walls.

Normal oil pressure is between 18 and 20 PSIG at rated speed and operating temperature.

Oil Sump Strainer (Fig. 7-1)—The screen type oil sump strainer filters out small particles of dirt and sludge which may be present in the crankcase. At every oil change, the oil sump strainer should be thoroughly cleaned in a safety solvent. If an appreciable sludge build-up exists, thoroughly clean the entire crankcase. Never use a flammable or toxic solvent for cleaning, always use a safety solvent and follow the directions supplied.

Oil Pump (Fig. 7-1 & 7-2)—The oil pump is an internal gear type pump with an adjustable pressure relief valve. It is flange mounted and piloted to the oil pump housing and driven directly by the crankshaft. Normally no adjustment is required to the oil pump. If necessary the relief valve can be adjusted to regulate the oil pressure. Refer to fig. 7-2 this section. Loosen locknut—increase oil pressure by turning adjusting screw clockwise—decrease oil pressure by turning adjusting screw counterclockwise. After adjustment tighten the locknut. The oil pump is NOT self reversing! It must be manually reversed.



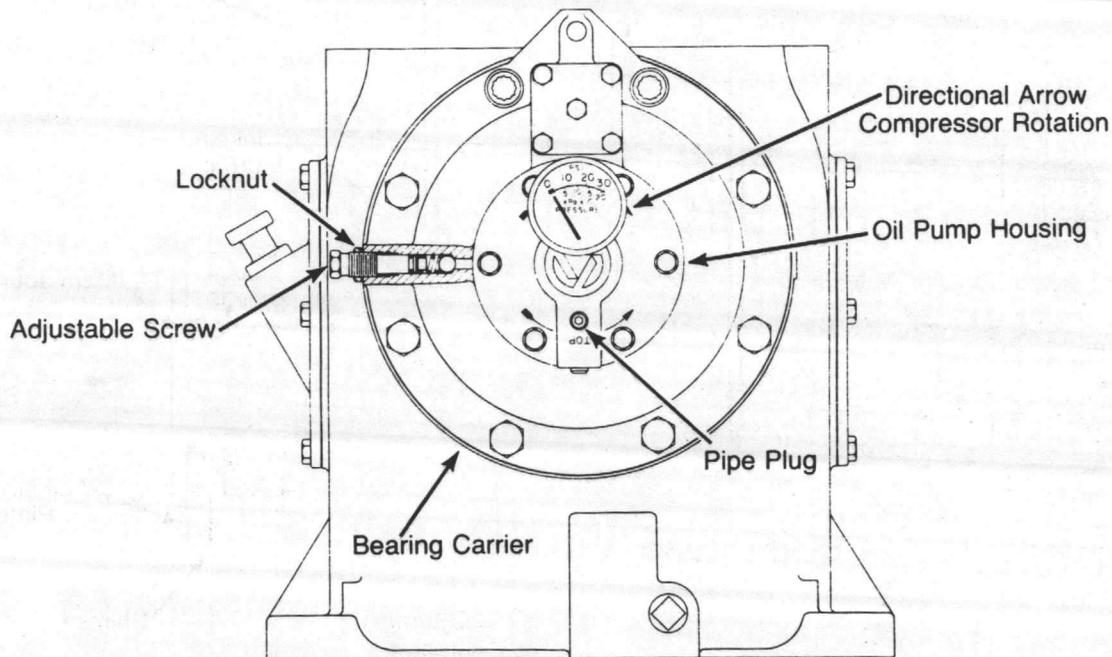
CRANKCASE LUBRICATION SYSTEM
FIGURE 7-1

The proper rotation of the compressor is shown by the directional arrow at the top of the oil pump housing, see fig. 7-2.

To reverse compressor rotation; remove the six capscrews from the oil pump housing, rotate the oil pump housing 180 degrees without removing it from the bearing carrier and such that the arrow at the bottom becomes the top directional arrow, reinstall the six capscrews, move the oil pressure gauge from its original position to the tapped hole at the top of the oil pump housing face and using the pipe plug removed from this hole plug the hole left by removing the gauge at the bottom.

The tapped hole at the bottom of the oil pump housing face is always the suction side of the pump, regardless of the pump direction.

THE DIRECTIONAL ARROW AT THE TOP OF THE OIL PUMP HOUSING MUST AGREE WITH THE DIRECTIONAL ROTATION OF THE COMPRESSOR. Failure to agree will result in no oil pressure and the compressor running gear seizing.



OIL PUMP & CRANKCASE

Figure 7-2

Lubricant—CAUTION!!! THE CRANKCASE OF THIS MACHINE WAS DRAINED BEFORE SHIPPING. FILL THE COMPRESSOR CRANKCASE WITH THE RECOMMENDED GRADE AND VISCOSITY OF OIL.

Before starting this compressor, be sure to fill the crankcase to the full mark on the bayonet oil level gauge. The oil level must be maintained between the two marks on the gauge. Never allow it to fall below the lower mark.

The type of oil depends on operating conditions and ambient temperature at the point of installation. A high quality turbine or compressor type paraffinic based oil or an oil with an

(API) American Petroleum Institute service "SC" classification is recommended. For proper viscosity refer to the chart below.

AMBIENT TEMPERATURE AT POINT OF INSTALLATION	SAE VISCOSITY OR EQUIVALENT
BELOW 0 DEG. F.	SAE 5W
0 DEG. F. to 32 DEG. F.	SAE 10W
32 DEG. F. to 80 DEG. F.	SAE 20W
ABOVE 80 DEG. F.	SAE 30W

Crankcase Oil Capacity

- 4½ Quarts to add mark
- 7 Quarts to full mark

Change oil after first 500 hours and every 2000 operating hours after that, unless the condition of the oil dictates more frequent changes.

Synthetic Lubricants—Kits are available through the Service Department for most Diester and Phosphate Ester synthetic lubricants. Use of a synthetic lubricant without the proper kit will cause gaskets and "O" rings to deteriorate.

SECTION VIII MAINTENANCE

Safety Precautions

WARNING!!! – NEVER ASSUME THE COMPRESSOR IS READY FOR MAINTENANCE OR SERVICE BECAUSE IT IS STOPPED. THE AUTOMATIC STOP-START CONTROL MAY START THE COMPRESSOR AT ANY TIME!

The following procedure should be followed to maximize safety when preparing for maintenance or service.

1. Disconnect and lockout the main power switch and hang a sign at the switch stating the unit is being serviced.
2. Close shutoff valve between receiver and compressor, or receiver and plant air system, to prevent any back-up of air flow into the area being serviced.
3. Shut off water and depressurize system.
4. Lock open manual vent valve and wait for the pressure in the system to be completely relieved before starting service. Do not close manual vent valve at any time while the system is disassembled.
5. Open all manual drain valves within the system being serviced.
6. Wait for the unit to cool before starting service, (Temperatures of 125° F can burn the skin). Some surface temperatures exceed 350 °F when the compressor is working.

The following safety procedures should be followed while performing service.

1. Loosen, but do not remove, flange or component bolting and carefully pry apart to be sure there is no residual pressure before removing the bolting.

2. Clean up all oil spills immediately to prevent slipping.
3. Capscrews, bolts and nuts should be tightened with a torque wrench in accordance with the torque values shown in the parts list, or this manual.
4. NEVER use a flammable solvent such as gasoline or kerosene for cleaning air filters or compressor parts. Safety solvents are available and should be used in accordance with their instructions.

Air Filters—Never install an oil bath or oil wetted filter on this compressor.

Servicing of the filter should be done in accordance with the filter manufacturer's service instructions. Frequency of service is dependant upon atmospheric conditions and should be established by checking at regular intervals until a pattern for servicing is found. Daily maintenance of the filter is not uncommon in dirty conditions.

Always make sure all seals, gaskets, clamps and hose connections on the filter and suction line are absolutely air tight. Each time the filter is serviced, inspect the interior of the cylinder or suction line for dirt. If dirt is found, determine the cause and correct.

Valves—The suction and discharge valves are of the frictionless plate design tailored for the QDD and QGD non lubricated compressors. Except for the valve seat and bumper all parts in the standard valve are stainless steel. Optional valves are available from Quincy with stainless steel seats and cadmium plated alloy steel bumpers.

Service intervals for the valves should be established by experience with the application. Atmospheric conditions or the gas being compressed, maintenance of suction filter or scrubber (if used), compressor rpm and pressure, and operating temperatures all have an effect on valve life. Valve malfunctions can best be noted by monitoring the compressor performance while it is operating. Abnormal performance that may be valve related is as follows:

1. Low gas delivery.
2. Low discharge pressure.
3. High or low interstage pressure.
4. Excessive discharge temperatures.
5. Excessive power input.

A. Valve Assembly Removal From Head or Cylinder

WARNING!!! DISCONNECT AND LOCK OUT THE POWER TO THE COMPRESSOR. RELEASE GAS PRESSURE FROM THE CYLINDER BEFORE REMOVING THE VALVES. NEVER REACH HAND INTO THE CYLINDER UNTIL A VALVE HAS BEEN REMOVED FROM EACH END OF THE CYLINDER AND THE CRANKSHAFT HAS BEEN BLOCKED SO THAT IT CAN NOT MOVE DUE TO POSITION OF COUNTERWEIGHTS OR OTHER ACCIDENTAL CAUSES.

1. Remove special lock nut or unloader assembly on valve cover plate and back out set screw or threaded sleeve.
2. Remove valve cover plate.
3. Lift out valve retainer.
4. Lift out valve assembly and gasket.

B. Installation of Valve Assembly into Head or Cylinder

1. Inspect and clean the valve seating surface in the head or cylinder.
2. Install a new valve seat gasket.
3. Check valve plate cover gasket and replace if necessary.
4. For valve assembly installation into the cylinder head, reverse steps listed under "Valve Assembly Removal From Head or Cylinder".

For valve assembly installation into the cylinder it is necessary to insert a rod through the valve retainer, set the valve assembly in place making sure the valve seat gasket is on the seat, and then while holding the valve assembly in place, with the rod, slide the valve retainer along the rod until it contacts the valve assembly. The valve retainer will hold the valve assembly in place and the rod can be removed.

5. Replace the valve cover plate by inserting the four capscrews in the corners and tightening to the torque specifications shown in the chart below.
6. Install and/or snug up set screw or threaded sleeve in center of valve plate and torque to specifications shown in chart below.
7. If valve plate has set screw, assemble lock nut over top and torque to specification shown in table below.
8. If valve plate has a valve unloader assembly, insert the unloader pin and spring through the threaded sleeve and install valve unloader assembly over threaded sleeve. Tighten valve unloader assembly.

DESCRIPTION	TORQUE, DRY
Cover plate capscrews 1/2—13 x 2.00	75 FT. LBS.
Set screw 3/4—16 x 3.00	75 FT. LBS.
Set screw 3/4—16 x 1.75	75 FT. LBS.
Special nut 3/4—16 UNF	200 FT. LBS.
Threaded sleeve, L.P.	75 FT. LBS.
Threaded sleeve, H.P.	75 FT. LBS.

Note: For relative positioning of valve parts see Parts List Book.

Unloading Mechanism, Suction Valve—The suction valve unloader assembly is standard equipment with the QDD and is a diaphragm operated plunger that when pressurized holds the suction valve off its seat. A minimum pressure of 35 psig is required to unload the valve.

Piston and Piston Rod Assembly—The piston is guided in the cylinder bore by one Teflon rider ring which prevents the piston from contacting the cylinder wall. On either side of the

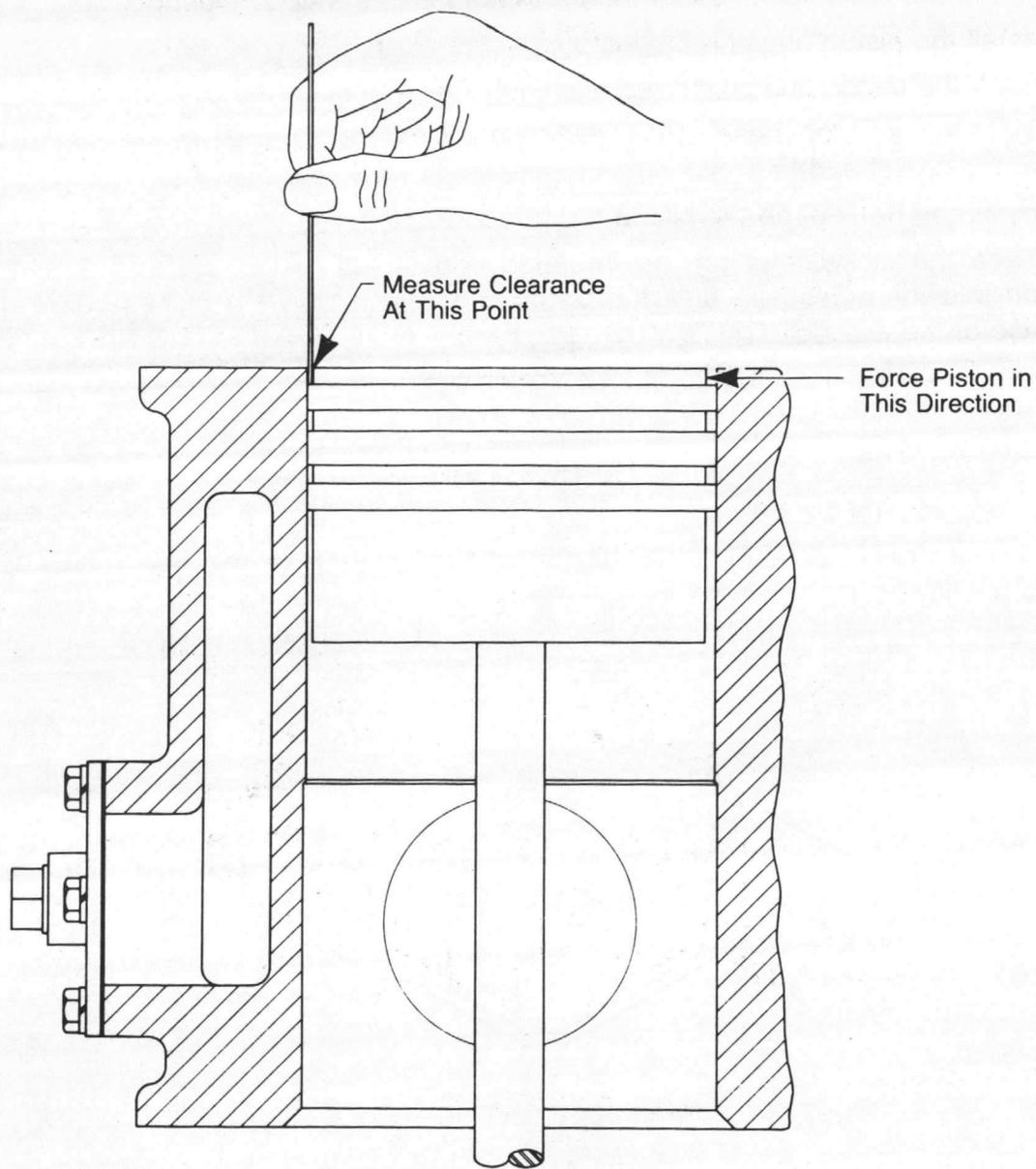
Teflon rider ring is a Teflon compression ring which prevents the compressed gas from leaking from one compression chamber to the other. Owing to the fact that conditions and gases vary greatly in their influence on the life of Teflon rings, it is recommended that ring wear be checked every 500 hours until a wear rate is established for your particular application.

A. Checking Piston Ring Wear (Fig. 8-1).

1. Remove the cylinder head.
2. Force piston to one side and measure the clearance between the top edge of the piston wall (not the piston ring) and the cylinder wall at the piston's nearest point to the cylinder wall. Repeat this procedure for several points around the piston, each time forcing the piston toward the point to be measured. If the clearance is 0.015 inches or less replace the piston rings.

B. Removing Piston and Piston Rod Assembly.

1. Remove the cylinder head.
2. Remove hand hole plate from distance piece.
3. Remove oil slinger from piston rod.
4. Remove oil stop head screws.
5. Rotate crankshaft until the three piece wiper ring set is exposed.
6. Unhook the garter springs and remove with the three piece wiper rings. **NEVER SLIDE THE WIPER RINGS OVER THE THREADS ON THE PISTON ROD.** If rings are to be reused they must be installed in the same order and segmental position as when they were last removed.
7. Remove the two $\frac{1}{2}$ —13 hex head packing flange bolts holding the packing cases in place.
8. Rotate the crankshaft until the packing rings and cases are exposed.
9. Slide the packing ring cups out of the way and remove the packing rings by unhooking the garter springs and removing with the three piece packing ring sets. **NEVER SLIDE THE PACKING RINGS OVER THE THREADS ON THE PISTON ROD.** If rings are to be reused they must be installed in the same order and segmental position as when they were last removed.
10. Remove a hand hole plate from the crosshead guide.
11. Loosen the hex nut on the piston rod next to the crosshead.
12. Grasp the piston rod by hand or with a strap wrench and unscrew the complete assembly from the crosshead. **DO NOT MAR THE PISTON ROD.**
13. Remove the lockwasher and hex nut from the piston rod and slide off the stop head cover, the packing flange and packing cups, as the piston and piston rod assembly are pushed up through the cylinder.



CHECKING PISTON RING WEAR
FIGURE 8-1

C. Replacing Piston on Piston Rod

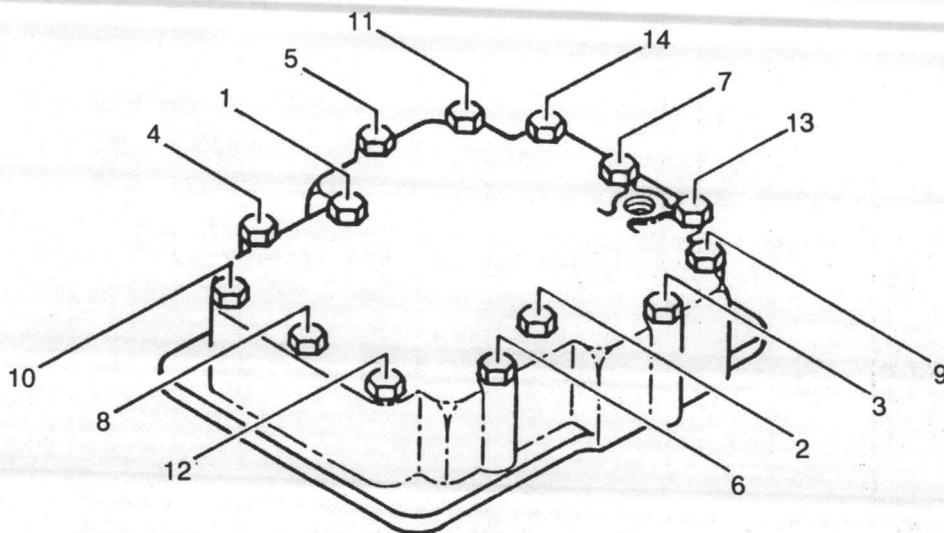
1. Remove special nut holding piston to piston rod with special spanning tool (160150).
2. Remove old piston and install new one. Torque the special nut with the spanning tool to; 85 Lb. Ft. for the first stage piston and 110 Lb. Ft. for the second stage piston.

D. Replacing Piston and Piston Rod Assembly

1. Assemble the packing ring cups on the packing ring flange with cup AB on top, CD in the middle, and EF next to the flange. **DO NOT INSERT THE PACKING RINGS.**
2. Lightly fasten the packing flange and cups in place.

3. Rotate the crankshaft so that the crosshead is in the uppermost position.
4. Install the piston rings on the piston.
5. Insert the piston and piston rod assembly down through the cylinder and packing cups.
6. Slide the oil stop head cover over the piston rod and allow the piston rod to rest on the crosshead.
7. Install the hex nut on the piston rod and run to the end of the threads.
8. Place the lockwasher on the threaded end of the piston rod and thread the piston rod into the crosshead until the piston is approximately $\frac{1}{16}$ inches below the top surface of the cylinder. CARE MUST BE TAKEN NOT TO MAR THE PISTON ROD.
9. Install cylinder head and torque as shown below.

Proper Head Bolt
Torque Sequence

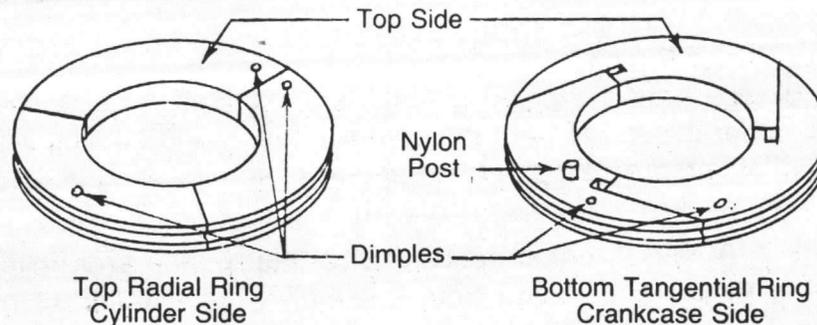


HEAD BOLT TORQUE—150 FT. LBS.
DRY THREADS

10. Remove one crank end valve from the cylinder.
11. Rotate crankshaft until piston is at top dead center.
12. Back piston rod out of crankcase by hand or with strap wrench until the piston just touches the cylinder head.
13. Insert $\frac{1}{8}$ inch diameter soft lead wire ($\frac{1}{2}$ to 1 inch long) into the crank end valve opening and rotate crankshaft one complete revolution so bottom of piston crushes soft lead wire. If wire does not crush, lap two thicknesses of wire over one another and crush.
14. Measure thickness of crushed wire or wires with micrometer, this is total clearance.
15. Turn piston rod into the crosshead so that $\frac{2}{3}$ of the total clearance (from step 14) will be at the cylinder head end of the piston and $\frac{1}{3}$ at the crankshaft end.

Note: Piston will move up or down approximately 0.125 inches for each revolution of the piston rod in the crosshead.

16. Snug hex nut on piston rod against crosshead piston and crush a new piece of wire in the cylinder and measure.
17. Repeat until setting is ± 0.010 of calculated value.
18. Torque hex nut on piston rod against crosshead to 200 FT. LBS., DRY THREADS.
19. Recheck clearance by crushing another piece of wire to be certain nothing moved.
20. Remove loosely threaded capscrews from packing ring flange and separate packing ring cups.
21. Two packing rings, each of a different style, are to be installed in each cup. It is extremely important that the packing rings are installed exactly as explained below.



PACKING RINGS

- a. Dimpled side of both style packing rings must be installed with the dimples facing the top outer cylinder head.
 - b. Segments of the packing ring must be assembled with the dimples in the positions shown. For the radial segmented ring the dimples close to the split must be assembled next to each other and for the tangential segmented ring the same holds true.
 - c. The nylon plug in the bottom tangential packing ring locates in the hole on the under side of the top radial packing ring.
 - d. Hook garter spring around the piston rod.
 - e. Put two sections of the segmented packing ring on the piston rod and slip spring into position.
 - f. Stretch spring and insert third segment of packing ring.
- Note: Before reinstalling old packing rings read section titled "Packing Rings and Wiper Rings".
22. Slide packing cups, packing rings, and packing flange into position and fasten flange in place. Dry torque flange capscrews to 75 Ft. Lbs.
 23. Install wiper ring set (3 rings) in place on piston rod as explained for the packing rings in step 21—d. e. and f. The smooth side of the ring must face the cylinder and the notched side of each ring must face the crankcase. Because all three rings are alike no particular stacking order is required nor is any particular positioning of the three segments of each ring relative to each other required, however, it is always a good practice when replacing used rings to install them in the exact same positions from which they were removed.
 24. Slide the wiper rings and oil stop head cover in place and incrementally dry torque the four capscrews to 8 Ft. Lbs. by moving back and forth across the bolt pattern.

25. Install the oil slinger (collar) on the piston rod, with "O" rings, as follows:
 - a. Move piston to top dead center.
 - b. Position oil slinger 2 inches below packing flange on piston rod.
 - c. Tighten Allen head screws evenly by alternating back and forth until a dry torque reading of 6 Ft. Lbs. is reached. Failure to draw up evenly will result in a cracked oil slinger.
26. Assemble the hand hole cover on the distance piece by evenly dry torquing the capscrews to 12 Ft. Lbs. while alternating across the bolt pattern.
27. Repeat step 26. For the crosshead guide hand hole cover plate and dry torque to 30 Ft. Lbs.

Packing Rings and Wiper Rings

Packing Rings—If blowby past the packing rings is suspected a quick check can be made by removing the breather assembly from the distance piece and holding ones hand 6 inches away. When pulses of air are felt a further check of the packing rings should be made as follows:

1. Follow steps 2, 7, 8, and 9, under section "B" of the "Piston and Piston Rod Assembly" titled "Removing Piston and Piston Rod Assembly", for instructions on how to remove the packing rings.
2. Assemble the packing rings around a 1.000 inch diameter rod to determine if the packing rings are worn out. If no radial gap exists between the segments of the top radial packing rings the packing ring is worn out. If no radial gap exists at the inner most point of the I.D. of the bottom tangential packing ring segments (Do not confuse the small $\frac{1}{16}$ inch relief or the tangential parting line with the point to look for the gap) the packing ring is worn out.

Note: If any one packing ring is worn out the complete set should be replaced.

Wiper Rings—When excessive oil is passing the wiper rings the following procedure should be followed:

1. When removing the wiper rings follow steps 2, 4, 5, and 6, in section "B" titled "Removing Piston and Piston Rod Assembly" which in turn can be found under the main heading of "Piston and Piston Rod Assembly".
2. Assemble the wiper rings around a 1.000 inch diameter rod to determine if the wiper rings are worn out. If no radial gap exists between the segments of the wiper rings they are worn out.

Note: If any one wiper ring is worn out the complete set should be replaced.

Installation of the packing rings and wiper rings should be done as explained in steps 21, 22, 23, 24, and 26, in section "D" titled "Replacing Piston & Piston Rod Assembly" which can be found under the main title of "Piston and Piston Rod Assembly".

Crosshead and Connecting Rod Assembly (Fig. 7-1)—The crosshead and connecting rod are aluminum with positive lubrication supplied through the connecting rod to a free floating crosshead pin. The crosshead pin is hollow and carries oil to matching oil holes and grooves in the crosshead to provide lubrication to the thrust faces of the crosshead. The crosshead

pin bushing in the connecting rod is bronze and the bearing inserts at the crankshaft end are a steel backed tin based babbit. Note: 0.010 undersize bearing shells are available from Quincy.

A. Removal of Crosshead and Connecting Rod Assembly

WARNING!!! DISCONNECT AND LOCK OUT THE POWER TO THE COMPRESSOR AND RELEASE THE GAS PRESSURE FROM THE CYLINDERS

1. Drain the water from the cylinder, cylinder head, and intercooler (if provided).
2. Remove piston and piston rod assembly as explained in section "B" under the main heading of "Piston and Piston Rod Assembly".
3. Remove cylinder and distance piece.
4. Remove hand hole plate from crankcase.
5. Remove connecting rod cap from connecting rod.
6. Push crosshead and connecting rod assembly up through the crosshead guide.

B. Installation of Crosshead and Connecting Rod Assembly

1. Reverse Steps 3, 4, 5, & 6 of "A" above and torque capscrews and connecting rod bolts as follows:
 - a. All screws, bolts and nuts are to be tightened by crossing back and forth across the bolt hole pattern and gradually increasing the torque until the desired specification is reached.
 - b. The torque specifications are as follows:
 - C'bore screw, distance piece to crosshead guide. Dry 75 Ft. Lbs.
 - Hex screw, crankcase hand hole cover plate. Dry 12 Ft. Lbs.
 - Hex nut, connecting rod. Dry 60 Ft. Lbs.
2. Complete the reassembly by referring to section "D" of the "Piston and Piston Rod Assembly".

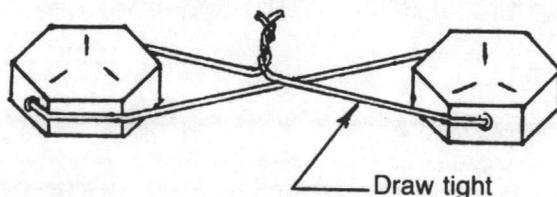
C. Removal of Crosshead from Connecting Rod

1. Remove crosshead pin covers to expose crosshead pin.
2. Heat crosshead with hot water to remove crosshead pin. DO NOT push out the crosshead pin from a cold crosshead, it will gall the bearing surfaces in the crosshead.

D. Reassembly of Crosshead to Connecting Rod

1. Heat the crosshead with hot water.
2. Insert the connecting rod in the crosshead and palm press the crosshead pin in place.
3. Assemble crosshead pin cover and gasket.
Torque capscrews dry to 6 Ft. Lbs.

4. Install screw retainer wire as shown to prevent screws from backing out.



Connecting Rod Bearing Shells—Replacement of the connecting rod bearing shells does not require the removal of any compressor parts above the crankcase. The following procedure can be used for replacing the bearing shells:

WARNING!!! DISCONNECT AND LOCK OUT THE POWER TO THE COMPRESSOR AND BE CERTAIN THAT THE COMPRESSOR ASSEMBLY IS SECURED SUCH THAT IT CAN NOT TIP OVER.

1. Remove a hand hole cover plate from the crankcase and any plumbing and/or ancillary equipment that may be in the way.
2. Remove the connecting rod cap.
3. Rotate the crankshaft away from the connecting rod and remove the bearing shells. DO NOT allow the connecting rod to drag on the crankshaft bearing journal.
4. Install the new bearing shells being certain that the projection on the bearing shell fits into the recess in the connecting rod. Do the same with the connecting rod cap.
Note: The bearing shell extends slightly beyond the cap. DO NOT file this. This overlap provides the bearing clearance when it is crushed.
5. Apply crankcase lubricating oil with finger to the bearing surface of the bearing that rides on the crankshaft journal.
6. Position the connecting rod with its bearing shell on the crankshaft.
7. Install the connecting rod cap with the pip mark on the same side as the connecting rod.
8. Install the hex nuts and washers on the connecting rod bolts. Dry torque incrementally while alternating between locknuts until 60 Ft. Lbs. is reached.
9. Rock pulley back and forth to be sure connecting rod is free on shaft. If connecting rod is in a bind pulley will be difficult to move, remove connecting rod and correct problem.

Crankshaft and Main Bearings (Fig. 7-1)—The crankshaft material is ductile iron. Counterweights are located at each connecting rod journal for optimum balancing. Tapered roller bearings support the two main journals. Positive lubrication is provided to all bearings on the crankshaft by rifle drilled holes through the crankshaft.

A. Removal of Crankshaft

1. Drain the water from the cylinder, cylinder head, and intercooler, if used.
2. Remove hand hole cover plate from the crankcase and any plumbing and/or ancillary equipment that may be in the way.

3. Remove the connecting rod caps and bearing shells. See instructions under connecting rod bearings.
4. Attach sling or chain to cylinder assembly and remove slack from sling or chain with hoist. Retain only enough tension to prevent the top assembly from tipping over when step 5, is completed.
5. Remove counterbore screws holding crosshead guide to crankcase.
6. Lift crosshead guide, cylinder, distance piece, and head assembly from crankcase as one unit.
7. Remove pulley from crankshaft by removing hex screws at hub of pulley.
8. Remove adjustment plate assembly with shims from pulley end of crankcase.
9. Remove 6 hex screws and 2 counterbore screws holding the bearing carrier assembly to the crankcase. Support crankshaft so that it does not drop and remove bearing carrier assembly. Be careful not to damage oil pickup screen.
10. Remove crankshaft with care.

B. Replacement of Crankshaft

1. Before starting inspect all gaskets and replace any damaged ones.
2. Place crankshaft in crankcase with care, locating bearing cone into bearing cup on pulley end and supporting and centering the oil pump end.
3. Install bearing carrier assembly by aligning slot in oil pump drive shaft with drive pin in crankshaft hole. It may be necessary to rock crankshaft or bearing carrier assembly until pump drive pin drops into pump drive shaft. NEVER force the bearing carrier into place, a damaged oil pump will result.
4. Torque bearing carrier hex screws by gradually tightening back and forth across the bolt hole pattern until a dry torque of 75 Ft. Lbs. is reached.
5. Install adjustment plate assembly with shims if no parts affecting the crankshaft end play were replaced, see Fig. 7-1. Dry torque hex screws by criss crossing the bolt hole pattern and gradually increasing the torque until 75 Ft. Lbs. is reached.

Crankshaft end play should be 0.002 to 0.0035 inches, if not within tolerance the end play should be adjusted as follows:

- a. With bearing carrier assembly torqued in place, assembly adjustment plate less shim pack removed with old crankshaft and torque in place.
- b. Install dial indicator to read end play of crankshaft.
- c. Rock crankshaft while laterally pushing the crankshaft as far as it will go in one direction.
- d. Set dial indicator to read zero at this point. Note exact point of where dial indicator tip is reading on the crankshaft because you must return to this point.
- e. Rock crankshaft and push crankshaft as far as it will go in the opposite direction making certain that the dial indicator tip is reading the exact same point as stated in "d".
- f. Read total end play of crankshaft and select proper shim combination to obtain 0.002 to 0.0035 inches of end play.

- g. Install shims, retorque adjustment plate, and determine resulting end clearance as stated in b, c, d, e, f above.
- h. Repeat until proper end clearance is achieved.
6. Replace top compressor assembly (crosshead guide, cylinder, distance piece, and head assembly) taking care to position connecting rods as they are lowered into the crankcase.
7. Replace bearing shells and connecting rod caps as explained under "Connecting Rod Bearings".
8. Replace the hand hole cover plates and tighten gradually moving back and forth across the bolt hole pattern until 12 Ft. Lbs. dry torque is reached.
9. Mount pulley and torque bolts gradually to 150 Ft. Lbs. dry torque.
10. See lubrication chart and add 7 quarts of oil.

Oil Pump Fig. 7-2

- A. Reversing Direction—Arrow on top of pump body must point in the same direction the compressor is going to rotate, it is not a self reversing oil pump.

Reversing the direction of the oil pump is done as follows:

1. Remove the six capscrews holding the oil pump to the bearing carrier.
2. Without removing the oil pump from the bearing carrier, rotate the oil pump 180 degrees (such that the bottom arrow becomes the top arrow).
3. Dry torque the 6 capscrews to 6 Ft. Lbs. by gradually increasing torque while moving back and forth across the bolt hole pattern.
4. Move the oil pressure gauge from the bottom hole to the top hole, and plug the bottom hole.

B. Removal and Reinstallation of the Oil Pump

1. Remove the 6 capscrews holding the oil pump to the bearing carrier and remove the oil pump.
2. Examine the "O" rings for damage and replace if necessary.
3. If there is trouble with the oil pump it should only be necessary to replace the pump elements.
4. When reinstalling the oil pump, FIRST install the large "O" ring into the bearing carrier cavity, NOT over the pump housing shoulder.
5. Mount the oil pump assembly taking care to align the slot in the oil pump driveshaft with the drive pin in the crankshaft.
6. Rotate the pump so that the top arrow is pointing in the direction the compressor will be run.
7. Dry torque the 6 capscrews by criss crossing the bolt hole pattern and gradually tightening until 6 Ft. Lbs. is reached.
8. Mount oil pressure gauge in top hole.
9. Loosen the locknut on the oil pressure adjustment screw and with the compressor running and the oil warm, adjust the screw to hold 18 to 20 psig.

SECTION IX TROUBLE SHOOTING

Possible Causes	TROUBLE									
	Low Discharge Pressure	Low Capacity	Compressor Overheats	Compressor Knocks	Excessive Vibration	Abnormal Intercooler Pressure	High Receiver Pressure	High Gas Discharge or Water Outlet Temperature	Overload Motor	Compressor Loads, Unloads Excessively
Restricted Filter or Suction Line	X	X				X				
Defective Valves Or Unloaders	X	X	X	X	X	X	X	X	X	X
Defective Control	X	X				X	X	X	X	X
Excessive System Leakage	X	X								X
Incorrect Speed	X	X	X	X	X				X	X
Worn Piston Rings	X	X	X	X		X		X		
Leaky Head Gaskets	X	X	X			X				
Demand Exceeds Capacity	X	X								
Drain Valve Open	X	X				X				X
V Belt Slipping	X	X								
Defective Pressure Gauge	X					X	X		X	
Leaky or Loose Packing	X	X	X	X		X				
Inadequate Cooling Water			X					X	X	
Excessive Cooling Water Temperature			X					X	X	
Excessive Discharge Pressure		X	X	X	X	X		X	X	
Inadequate Crankcase Lubrication			X	X					X	
Excessive Belt Tension									X	
Loose Pulley (Sheave)				X	X					
Excessive Running Clearances	X	X		X				X		
Insufficient Running Clearances			X	X	X			X	X	
Loose Crosshead				X						
Insufficient Head Clearances				X						
Excessively Expanded Teflon Rings				X					X	
Loose Piston Rod Nut				X						
Inadequate Foundation					X					
Improper Grouting Shimming or Bolting					X					
Piping Improperly Supported					X					
One End of Cylinder Inoperative	X	X		X	X	X				
Defective Safety Valve	X	X				X	X			
Clogged Intercooler	X	X	X			X		X	X	
Clogged Cylinder Jackets			X					X		
Incorrect Electrical Characteristics									X	
Motor Too Small									X	
Carrier Ring Excessively Worn				X						

SECTION X TORQUE CHART

CRANKCASE GROUP

Seal Adjustment Plate Hex Screws (4)	75 Ft. Lbs.
and Hole Plate Hex Screws (6 each side)	12 Ft. Lbs.

BEARING CARRIER GROUP

Bearing Carrier Assembly Counter Bore Screws (2)	75 Ft. Lbs.
Bearing Carrier Assembly Hex Screws (6)	75 Ft. Lbs.
Oil Pump Housing Sem Screws (6)	6 Ft. Lbs.
Oil Inlet Bracket Counter Bore Screws (2)	30 Ft. Lbs.

CRANKSHAFT GROUP

Pulley Hex Screws (2)	150 Ft. Lbs.
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CROSSHEAD CONNECTING ROD GROUP

Connecting Rod Nuts (2)	60 Ft. Lbs.
Crosshead Pin Cover Screw (2 each side)	6 Ft. Lbs.

CROSSHEAD GUIDE GROUP

Crosshead Guide to Crankcase Counter Bore Screws (7)	150 Ft. Lbs.
Crosshead Guide Hand Hole Plate Hex Screws (20)	30 Ft. Lbs.
Distance Piece to Crosshead Guide C'Bore Screws (12)	75 Ft. Lbs.
Oil Stop Head Hex Screws (8)	8 Ft. Lbs.
Oil Stop Head Cover Hex Screws (8)	8 Ft. Lbs.
Distance Piece Hand Hole Plate Hex Screws (12)	12 Ft. Lbs.
Packing Case Hex Screws (2 each assembly)	75 Ft. Lbs.
Inner Head Hex Screws (11 total, 5 H.P. 6 L.P.)	75 Ft. Lbs.
Cylinder to Distance Piece C'Bore Screws (6)	200 Ft. Lbs.

CYLINDER GROUP

Discharge Valve Cover Hex Screws (4 L.P. & 4 H.P.)	75 Ft. Lbs.
Suction Valve Cover Hex Screws (4 L.P. & 4 H.P.)	75 Ft. Lbs.
Intake Flange Hex Screws (4)	75 Ft. Lbs.
Discharge Valve Retainer Set Screw (2)	75 Ft. Lbs.
Valve Retainer Set Screw Special Locknut (2)	200 Ft. Lbs.
Companion Flange Hex Screw (12 total, 4 each flange)	50 Ft. Lbs.
Suction Valve Hold Down Screw (1)	75 Ft. Lbs.
Suction Valve Hold Down Sleeve (1)	75 Ft. Lbs.
Water Inlet Plate Hex Screws (8 each side)	30 Ft. Lbs.

PISTON GROUP, LOW PRESSURE

Piston Rod to Crosshead Hex Locknut (1)	200 Ft. Lbs.
Piston Rod Collar Allen Head Screws (2)	6 Ft. Lbs.
Special Piston Nut (1)	85 Ft. Lbs.

PISTON GROUP, HIGH PRESSURE

Piston Rod to Crosshead Hex Locknut (1)	200 Ft. Lbs.
Piston Rod Collar Allen Head Screws (2)	6 Ft. Lbs.
Special Piston Nut (1)	110 Ft. Lbs.

SECTION IX TROUBLE SHOOTING

Possible Causes	TROUBLE									
	Low Discharge Pressure	Low Capacity	Compressor Overheats	Compressor Knocks	Excessive Vibration	Abnormal Intercooler Pressure	High Receiver Pressure	High Gas Discharge or Water Outlet Temperature	Overload Motor	Compressor Loads, Unloads Excessively
Restricted Filter or Suction Line	X	X				X				
Defective Valves Or Unloaders	X	X	X	X	X	X	X	X	X	X
Defective Control	X	X				X	X	X	X	X
Excessive System Leakage	X	X								X
Incorrect Speed	X	X	X	X	X				X	X
Worn Piston Rings	X	X	X	X		X		X		
Leaky Head Gaskets	X	X	X			X				
Demand Exceeds Capacity	X	X								
Drain Valve Open	X	X				X				X
V Belt Slipping	X	X								
Defective Pressure Gauge	X					X	X		X	
Leaky or Loose Packing	X	X	X	X		X				
Inadequate Cooling Water			X					X	X	
Excessive Cooling Water Temperature			X					X	X	
Excessive Discharge Pressure		X	X	X	X	X		X	X	
Inadequate Crankcase Lubrication			X	X					X	
Excessive Belt Tension									X	
Loose Pulley (Sheave)				X	X					
Excessive Running Clearances	X	X		X				X		
Insufficient Running Clearances			X	X	X			X	X	
Loose Crosshead				X						
Insufficient Head Clearances				X						
Excessively Expanded Teflon Rings				X					X	
Loose Piston Rod Nut				X						
Inadequate Foundation					X					
Improper Grouting Shimming or Bolting					X					
Piping Improperly Supported					X					
One End of Cylinder Inoperative	X	X		X	X	X				
Defective Safety Valve	X	X				X	X			
Clogged Intercooler	X	X	X			X		X	X	
Clogged Cylinder Jackets			X					X		
Incorrect Electrical Characteristics									X	
Motor Too Small									X	
Carrier Ring Excessively Worn				X						

SECTION X TORQUE CHART

CRANKCASE GROUP

Seal Adjustment Plate Hex Screws (4)	75 Ft. Lbs.
and Hole Plate Hex Screws (6 each side)	12 Ft. Lbs.

BEARING CARRIER GROUP

Bearing Carrier Assembly Counter Bore Screws (2)	75 Ft. Lbs.
Bearing Carrier Assembly Hex Screws (6)	75 Ft. Lbs.
Oil Pump Housing Sem Screws (6)	6 Ft. Lbs.
Oil Inlet Bracket Counter Bore Screws (2)	30 Ft. Lbs.

CRANKSHAFT GROUP

Pulley Hex Screws (2)	150 Ft. Lbs.
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CROSSHEAD CONNECTING ROD GROUP

Connecting Rod Nuts (2)	60 Ft. Lbs.
Crosshead Pin Cover Screw (2 each side)	6 Ft. Lbs.

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Crosshead Guide to Crankcase Counter Bore Screws (7)	150 Ft. Lbs.
Crosshead Guide Hand Hole Plate Hex Screws (20)	30 Ft. Lbs.
Distance Piece to Crosshead Guide C'Bore Screws (12)	75 Ft. Lbs.
Oil Stop Head Hex Screws (8)	8 Ft. Lbs.
Oil Stop Head Cover Hex Screws (8)	8 Ft. Lbs.
Distance Piece Hand Hole Plate Hex Screws (12)	12 Ft. Lbs.
Packing Case Hex Screws (2 each assembly)	75 Ft. Lbs.
Inner Head Hex Screws (11 total, 5 H.P. 6 L.P.)	75 Ft. Lbs.
Cylinder to Distance Piece C'Bore Screws (6)	200 Ft. Lbs.

CYLINDER GROUP

Discharge Valve Cover Hex Screws (4 L.P. & 4 H.P.)	75 Ft. Lbs.
Suction Valve Cover Hex Screws (4 L.P. & 4 H.P.)	75 Ft. Lbs.
Intake Flange Hex Screws (4)	75 Ft. Lbs.
Discharge Valve Retainer Set Screw (2)	75 Ft. Lbs.
Valve Retainer Set Screw Special Locknut (2)	200 Ft. Lbs.
Companion Flange Hex Screw (12 total, 4 each flange)	50 Ft. Lbs.
Suction Valve Hold Down Screw (1)	75 Ft. Lbs.
Suction Valve Hold Down Sleeve (1)	75 Ft. Lbs.
Water Inlet Plate Hex Screws (8 each side)	30 Ft. Lbs.

PISTON GROUP, LOW PRESSURE

Piston Rod to Crosshead Hex Locknut (1)	200 Ft. Lbs.
Piston Rod Collar Allen Head Screws (2)	6 Ft. Lbs.
Special Piston Nut (1)	85 Ft. Lbs.

PISTON GROUP, HIGH PRESSURE

Piston Rod to Crosshead Hex Locknut (1)	200 Ft. Lbs.
Piston Rod Collar Allen Head Screws (2)	6 Ft. Lbs.
Special Piston Nut (1)	110 Ft. Lbs.

CYLINDER HEAD GROUP

Discharge Valve Cover Hex Screws (4 each cover)	75 Ft. Lbs.
Suction Valve Cover Hex Screws (4 each cover)	75 Ft. Lbs.
Discharge Valve Retainer Set Screw (2)	75 Ft. Lbs.
Valve Retainer Set Screw Special Locknut (2)	200 Ft. Lbs.
Suction Valve Hold Down Sleeve (2)	75 Ft. Lbs.
Cylinder Head to Cylinder Hex Screws (14)	150 Ft. Lbs.

CONTROL PIPING GROUP

Hydraulic Unloader Assembly Hex Screws (4)	8 Ft. Lbs.
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SECTION XI LUBRICATION

CAUTION!!! THE CRANKCASE OF THIS COMPRESSOR WAS DRAINED BEFORE SHIPPING. FILL THE COMPRESSOR CRANKCASE WITH THE RECOMMENDED GRADE AND VISCOSITY OF LUBRICATING OIL.

Before starting this compressor, be sure to fill the crankcase to the full mark on the bayonet oil level gauge. The oil level must be maintained between the two marks on the gauge. NEVER allow it to fall below the lower mark.

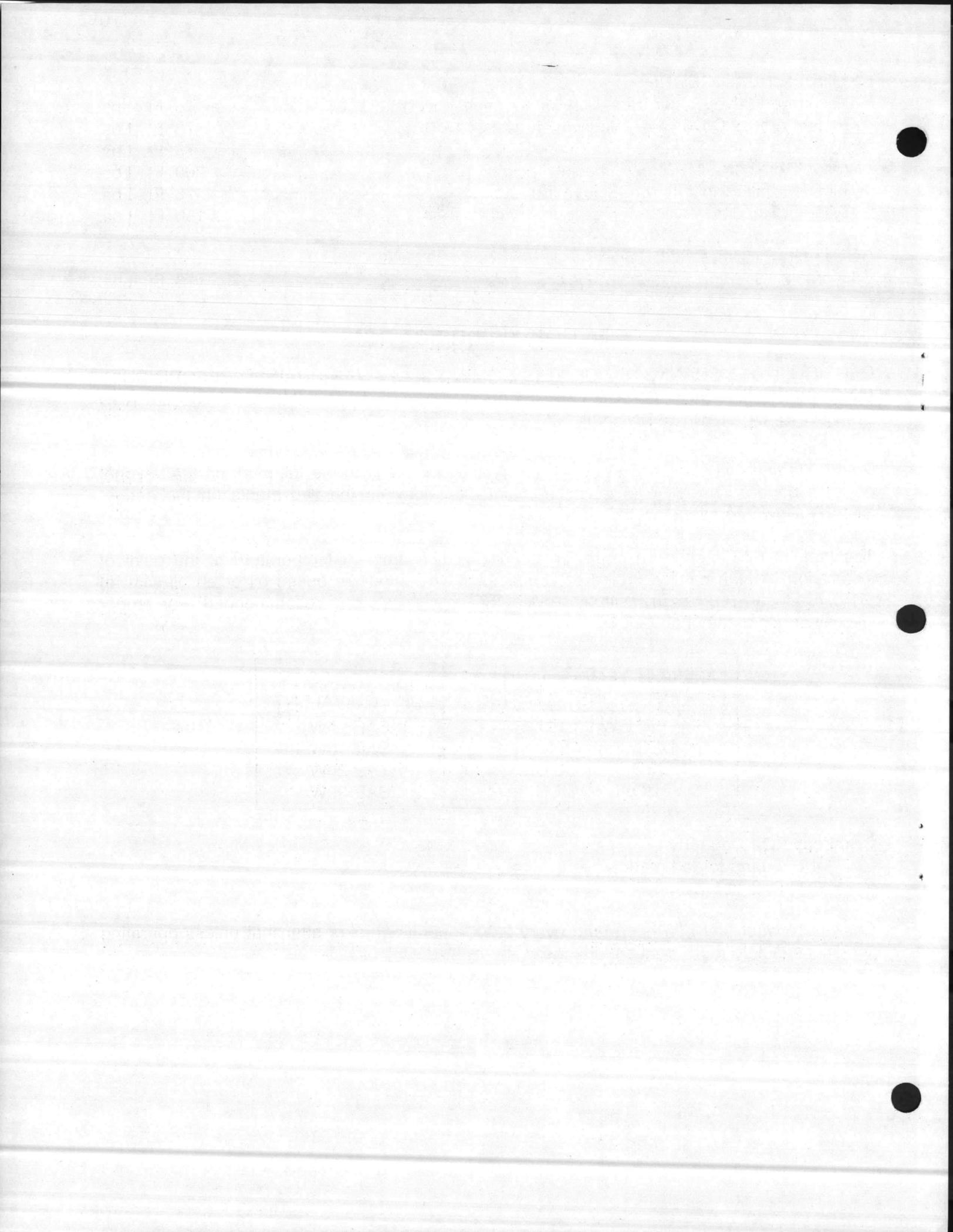
The type of oil depends on operating conditions and ambient temperature at the point of installation. A high quality turbine or compressor type paraffinic based oil or an oil with an (API) American Petroleum Institute service "SC" classification is recommended. For proper viscosity refer to the chart below.

AMBIENT TEMPERATURE AT POINT OF INSTALLATION	SAE VISCOSITY OR EQUIVALENT
BELOW 0 DEG. F.	SAE 5W
0 DEG. F. to 32 DEG. F.	SAE 10W
32 DEG. F. to 80 DEG. F.	SAE 20W
ABOVE 80 DEG. F.	SAE 30W

Crankcase Oil Capacity

- 4½ Quarts to add mark
- 7 Quarts to full mark

Change oil after first 500 hours and every 2,000 operating hours after that unless operating conditions dictate more frequent changes.





**For Prompt Compressor Service
Anywhere**

Quincy
COMPRESSORS

Quincy
Compressor Division

Colt Industries



Quincy

QDD-25

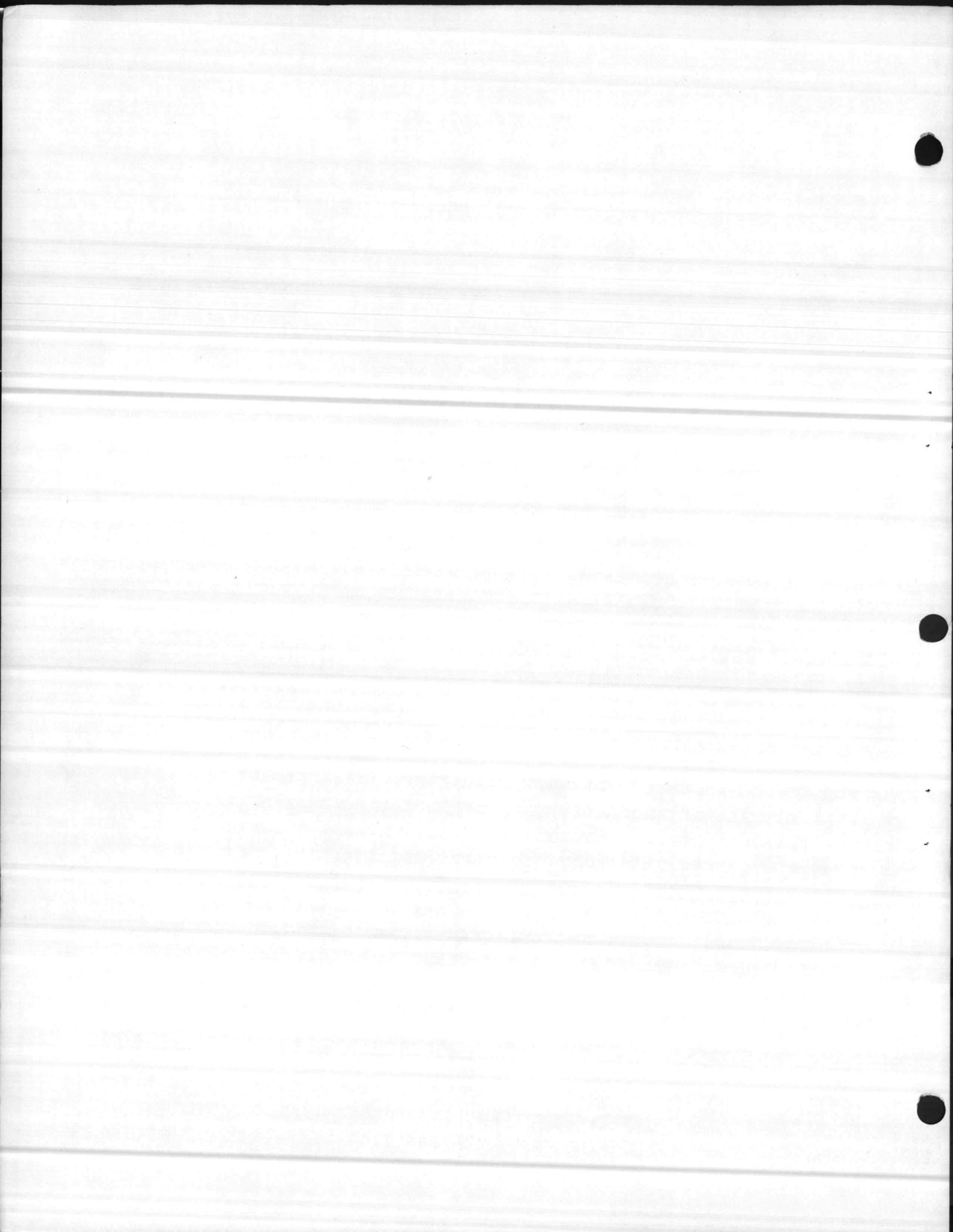
AIRCOOLED &
WATERCOOLED
MODELS

PARTS
MANUAL

50155-101



FEBRUARY, 1987



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PERFORMANCE TABULATIONS

QDD-25A PERFORMANCE TABULATION						QDD-25W PERFORMANCE TABULATION						
STROKE 4", L.P. BORE 6", H.P. BORE 3-1/2"						STROKE 4", L.P. BORE 6", H.P. BORE 3-1/2"						
MOTOR	P.S.I.G. DISCHARGE					MOTOR	P.S.I.G. DISCHARGE					
H.P.	PRESSURE	80	100	110	125	H.P.	PRESSURE	100	125	150	175	200
10	RPM	454	454			10	RPM	454	454	408		
	CFM DISPLCMNT	58.6	58.6				CFM DISPLCMNT	58.6	58.6	52.7		
	CFM FREE AIR	42.5	42				CFM FREE AIR	43.9	43.4	38.4		
15	RPM	711	650	650	650	15	RPM	711	650	559	559	499
	CFM DISPLCMNT	91.8	83.9	83.9	83.9		CFM DISPLCMNT	91.8	83.9	72.2	72.2	64.4
	CFM FREE AIR	70	62.5	62.5	62		CFM FREE AIR	70	63	53.5	53.3	46.4
20	RPM	877	832	771	771	20	RPM	877	877	832	771	711
	CFM DISPLCMNT	113.2	107.4	99.5	99.5		CFM DISPLCMNT	113.2	113.2	107.4	99.5	91.8
	CFM FREE AIR	87	81.5	75	74.5		CFM FREE AIR	84	83.4	78.9	72.4	66.9
25	RPM		877	877	877	25	RPM			877	877	877
	CFM DISPLCMNT		113.2	113.2	113.2		CFM DISPLCMNT			113.2	113.2	113.2
	CFM FREE AIR		86.5	86	85.5		CFM FREE AIR			82.5	81.9	80.9

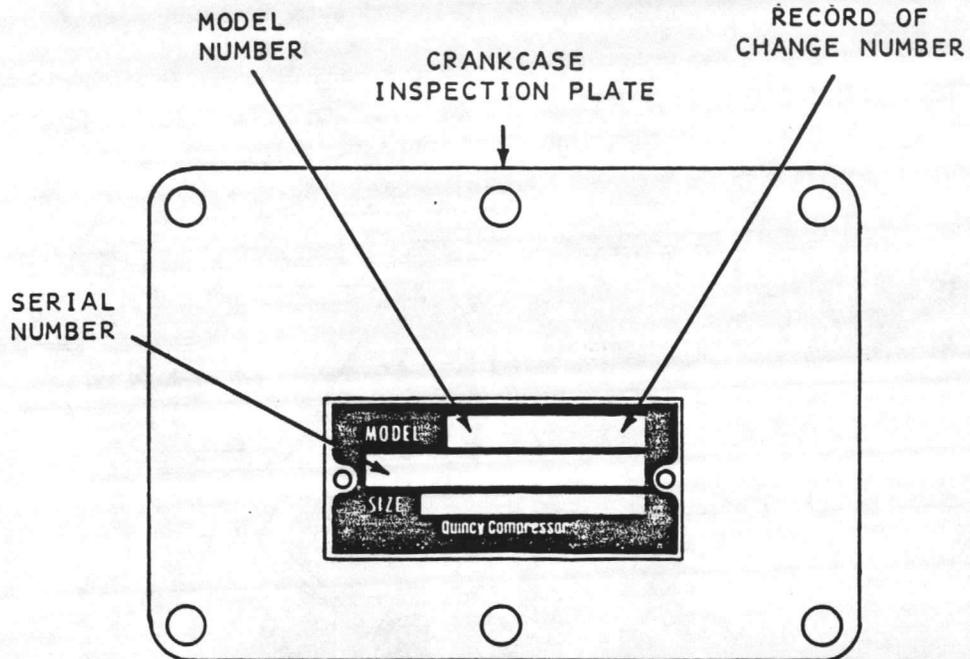
BASED ON 1750 R.P.M. MOTOR

ASSEMBLY CLEARANCES

- 1.) CLEARANCES TO BE SET AT ASSEMBLY
 - A.) Crankshaft end play
.002 - .0035 In.
 - B.) Piston-to-head clearance
 - 1.) Measure total clearance
 - 2.) Set 2/3 of total on head end
1/3 of total on crank end

- 2.) CLEARANCES TO BE CHECKED AT ASSEMBLY
 - A.) All those in "1" above
 - B.) Crosshead guide-to-crosshead
.012/.017 total
 - C.) Piston to cylinder wall clearance with rider ring
in place (Pull piston to side before measuring. Measure close side.)
 - 1.) 1st. Stage cylinder .063/.073
 - 2.) 2nd. Stage cylinder .053/.062

SERIAL NUMBER IDENTIFICATION



Prompt service can be rendered on repair parts orders if the following information is given:

1. The code number, as stamped in the raised boss on the bayonet oil gage side of the crankcase, must be given when ordering repair parts.
2. State the exact part number needed. Do not order by index numbers, as index numbers are repeated throughout this manual, and if used for ordering repair parts, will necessitate time consuming correspondence.
3. State the exact quantity needed.
4. State the preferred type of transportation.

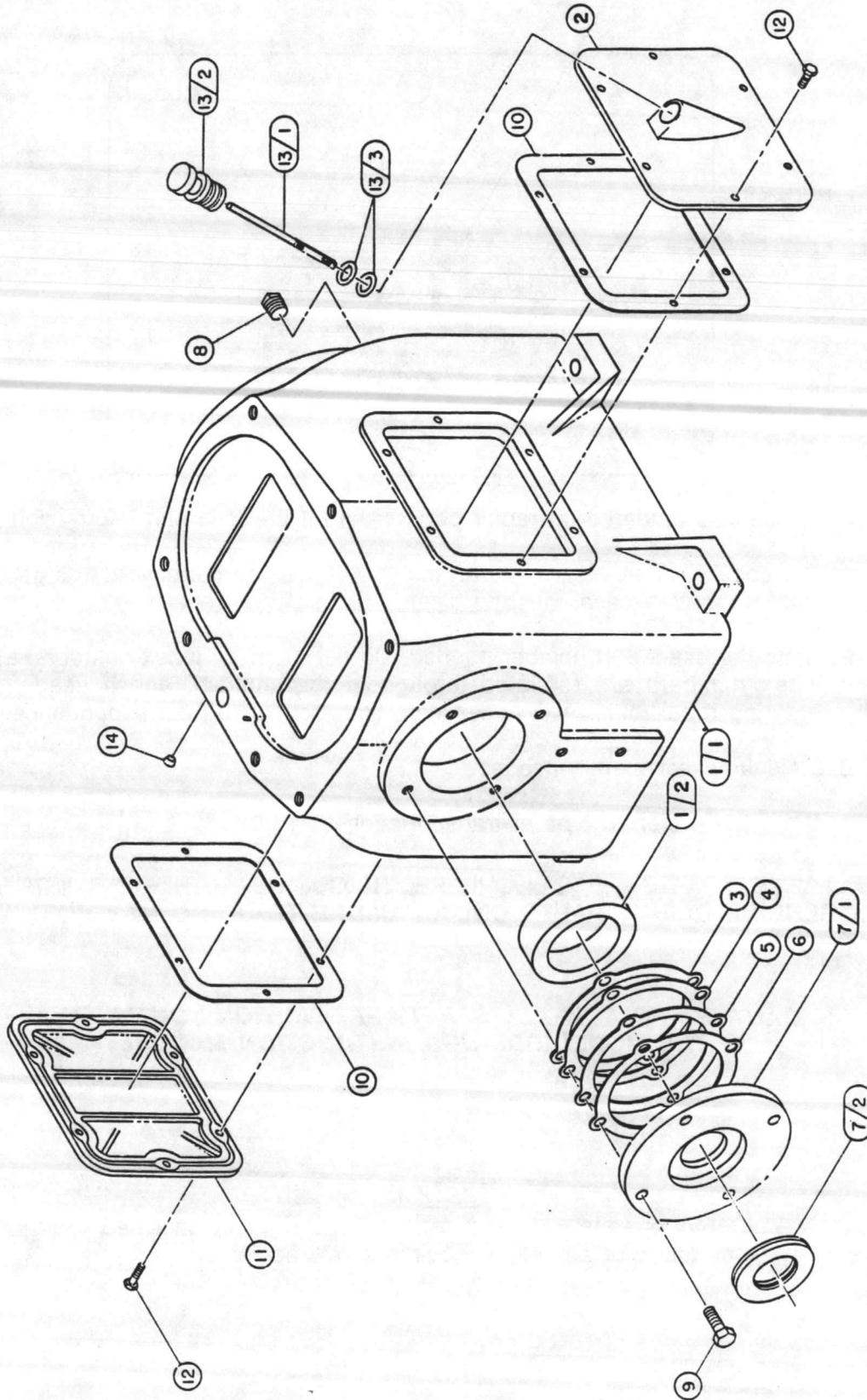
**ALL REPLACEMENT PARTS ARE TO BE ORDERED THROUGH AN AUTHORIZED DISTRIBUTOR.
INSIST ON GENUINE QUINCY PARTS ONLY! FAILURE TO DO SO MAY VOID WARRANTY**

***CAUTION: FOLLOW ALL SAFETY PRECAUTIONS OUTLINED
IN THE MODEL QDD-QGD INSTRUCTION MANUAL***

NOTICE:

Do not operate this compressor without a totally enclosed belt guard or any other required safety equipment.

CRANKCASE GROUP 160097



CRANKCASE GROUP 160097

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	6946X	CRANKCASE ASSEMBLY
1/1	1	6946	CRANKCASE
1/2	1	4357	CUP-BEARING
2	1	6849	PLATE-INSPECTION
3	*	1498	SHIM-BEARING, .005
4	*	1498A	SHIM-BEARING, .007
5	*	1498B	SHIM-BEARING, .020
6	*	1498C	SHIM-BEARING, .002
7	1	6643-1X1	ADJUSTMENT PLATE ASSEMBLY
7/1	1	6643-1	PLATE-ADJUSTMENT
7/2	1	8966-001	SEAL-ADJUSTMENT PLATE
8	1	2057	PLUG-PIPE, 1/2 NPT
9	4	123478-N14	SCREW-HEX. ,1/2-13 UNC X 1.25, GRADE 5 (@ 75FT. -LBS.)
10	2	1315	GASKET-INSPECTION PLATE
11	1	1249	PLATE-INSPECTION
12	12	123478-K10	SCREW-HEX. ,5/16-18 UNC X .75, GRADE 5 (@ 12FT. -LBS.)
13	1	6726X001	OIL GAUGE ASSEMBLY
13/1	1	5488-001	ROD-OIL GAUGE (NOT SOLD SEPARATELY)
13/2	1	6726	KNOB-OIL GAUGE (NOT SOLD SEPARATELY)
13/3	2	123157-210	"O"RING-1/8 WIDE X 1.00 O.D.
14	1	6564	PLUG-HOLE

* AS REQUIRED

MAINTENANCE PARTS

13/3	1	22749-210	"O"RING-1/8 WIDE X 1.00 O.D. (FOR USE WITH SYNTHETIC LUBRICANTS)
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@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

LUBRICATION

Caution!! The crankcase of this machine was drained before shipping. Fill the compressor crankcase with the recommended grade and viscosity of oil.

Before starting this compressor, be sure to fill the crankcase to the full mark on the bayonet oil level gauge. The oil level must be maintained between the two marks on the gauge. Never allow it to fall below the lower mark.

The type of oil depends on operating conditions and ambient temperature at the point of installation. A high quality turbine or compressor type paraffinic based oil or an oil with an (API) American Petroleum Institute Service "SC" classification is recommended. For proper viscosity refer to the chart below.

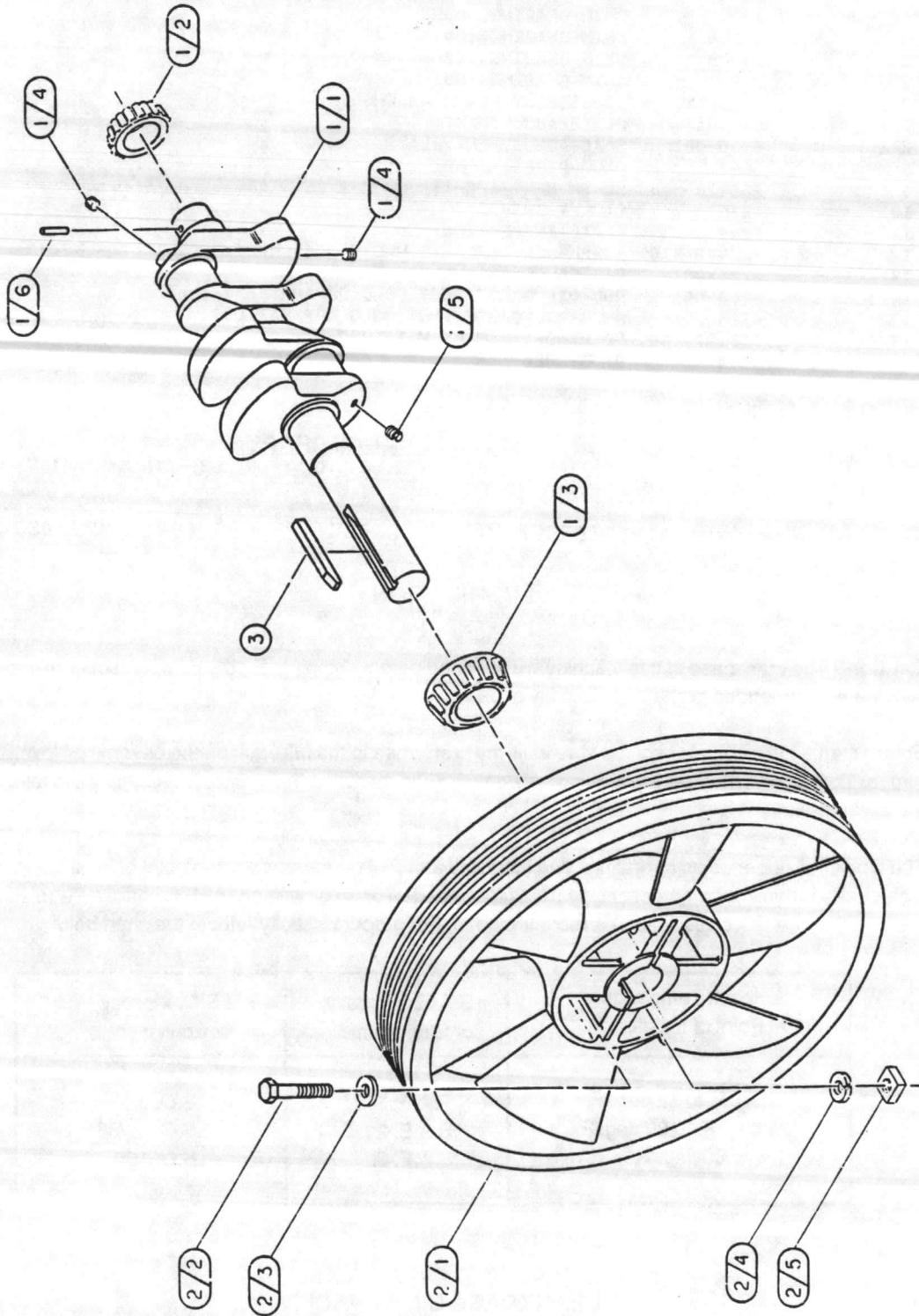
Ambient Temperature at Point of Installation	S.A.E. Viscosity or Equivalent	I.S.O. Viscosity or Equivalent
0 deg. F. to 32 deg. F.	S.A.E. 10W	I.S.O. 32
32 deg. F. to 80 deg. F.	S.A.E. 20W	I.S.O. 46/68
above 80 deg. F.	S.A.E. 30	I.S.O. 100

CRANKCASE OIL CAPACITY

6 quarts & 3 pints to add mark
9 quarts & 1 pint to full mark

Change oil filter after first 500 hours and every 2,000 operating hours after that unless operating conditions dictate more frequent changes.

CRANKSHAFT GROUP 160098

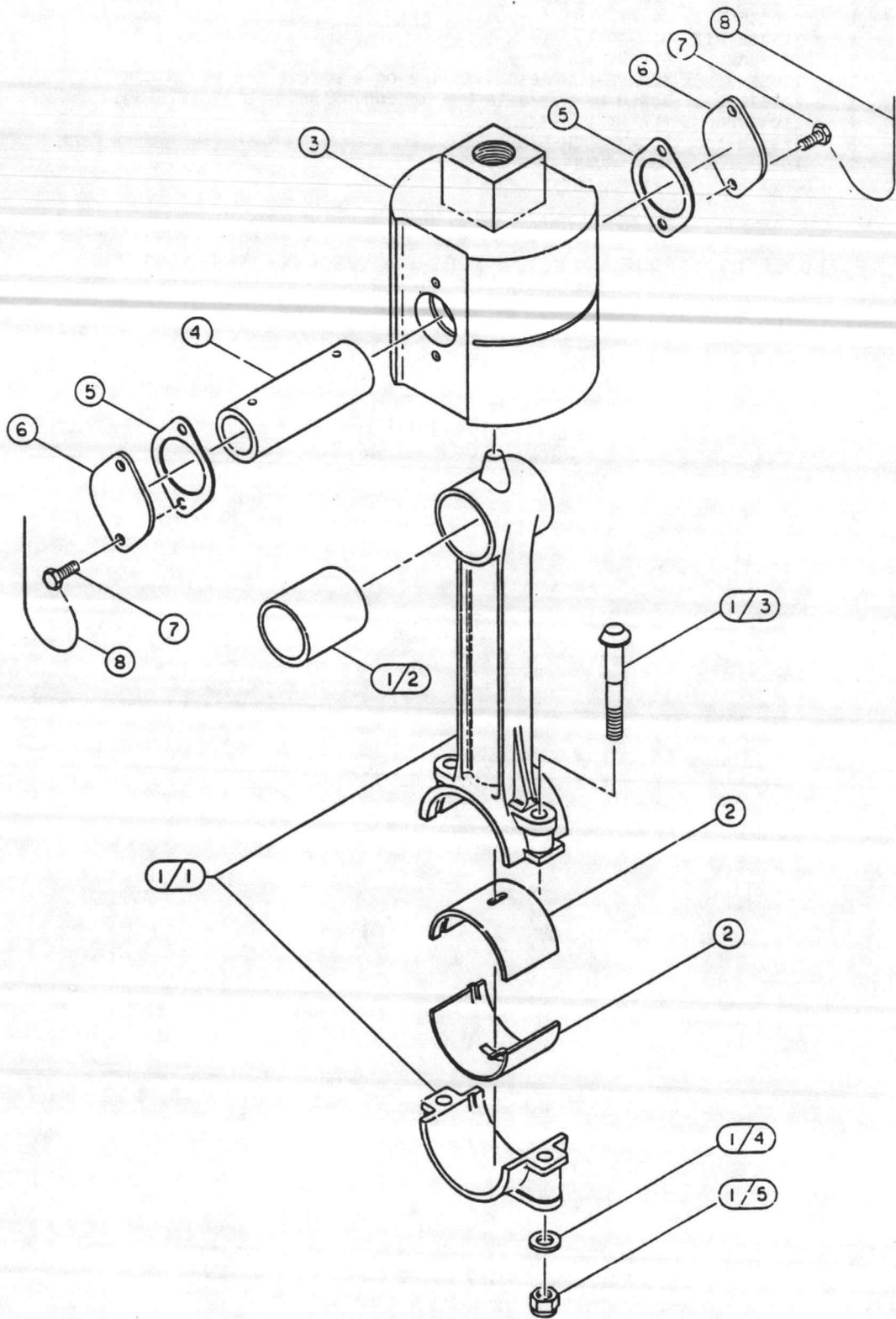


CRANKSHAFT GROUP 160098

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	110225-002	CRANKSHAFT ASSEMBLY
1/1	1	110224-002	CRANKSHAFT (NOT SOLD SEPARATELY;MUST BE PURCHASED AS 110225-002 ASSY)
1/2	1	3776	CONE-BEARING
1/3	1	6651	CONE-BEARING
1/4	2	2755S	PLUG-PIPE,1/8 NPT
1/5	1	110234	ORIFICE-PIPE PLUG,1/8 NPT
1/6	1	110705-F17	PIN-ROLL,3/16 X 1.38
2	1	110558X	SHEAVE ASSEMBLY
2/1	1	110558	SHEAVE-COMPRESSOR,23-1/2"OD,4 GROOVE,B SECTION,CCW
2/2	2	124571-Q21	SCREW-HEX.,5/8-18 UNF X 3.00,GRADE 5 (⊕ 150FT.-LBS.)
2/3	2	110428W062	FLATWASHER-5/8
2/4	2	123115-10C	LOCKWASHER-5/8
2/5	2	1883	NUT-SQUARE,5/8-18 UNF
3	1	2851	KEY-PULLEY

⊕ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

CROSSHEAD/CONNECTING ROD GROUP 160100



CROSSHEAD/CONNECTING ROD GROUP 160100

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160099	CONNECTING ROD ASSEMBLY
1/1	1	160021	ROD-CONNECTING (NOT SOLD SEPARATELY,ORDER 160099X CON-ROD ASSEMBLY)
1/2	1	160022	BUSHING-BRONZE
1/3	2	1344	BOLT-CONNECTING ROD,7/16-20 UNC X 3.25
1/4	2	1319	WASHER-CONNECTING ROD
1/5	2	124471-M08	LOCKNUT-7/16-20 UNF (@ 60 FT.-LBS.)
2	2	2819	INSERT-CONNECTING ROD BEARING (SOLD IN PAIRS ONLY)
3	1	160007	CROSSHEAD-5.00 DIA.
4	1	160023	PIN-CROSSHEAD
5	2	160031	GASKET-CROSSHEAD PIN
6	2	160024	COVER-CROSSHEAD PIN
7	4	160059-J09	SCREW-HEX 1/4-20 UNC X .62,GRADE 5 (@6FT.-LBS.)
8	2	2830	LOCKWIRE-#19 GAGE,24" LONG

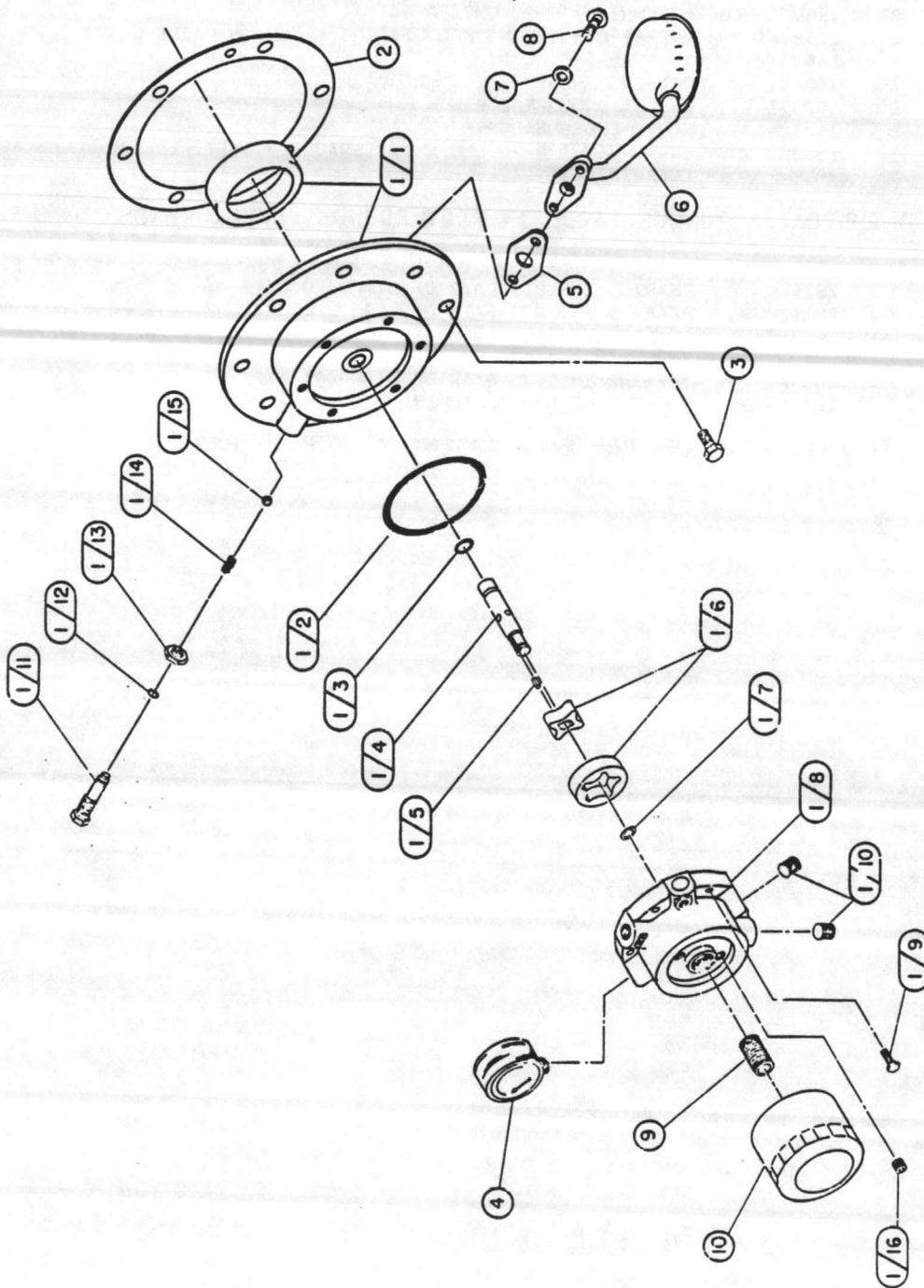
@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

MAINTENANCE PARTS

1	2819PR	BEARING INSERTS-PAIR OF STANDARD SIZE *
1	2819PRUS 160099X	BEARING INSERTS-PAIR OF .010 UNDERSIZE * CONNECTING ROD ASSEMBLY
		INCLUDES:
1	2819PR	BEARING INSERTS-PAIR OF STANDARD SIZE *
1	160099	CONNECTING ROD ASSEMBLY

* 1 PAIR REQUIRED FOR EACH ASSEMBLY--2 PAIR PER UNIT

BEARING CARRIER GROUP 110818-001
(WITH OIL FILTER)



**BEARING CARRIER GROUP 110818-001
(WITH OIL FILTER)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	110811-003	BEARING CARRIER ASSEMBLY
1/1	1	110811	BEARING CARRIER INCLUDES:
	1	3720	CUP-BEARING
	2	160005	BUSHING-BRONZE
1/2	1	123157-152	"O"RING-3/32 WIDE X 3.44 O.D.
1/3	1	123157-112	"O"RING-3/32 WIDE X .69 O.D.
1/4	1	160002-001	DRIVESHAFT-BEARING CARRIER
1/5	1	160075-001	KEY-DRIVESHAFT
1/6	1	160003	GEROTOR-PUMP
1/7	1	6285	RING-RETAINING
1/8	1	110813-001	HOUSING-OIL PUMP
1/9	6	160077-J14	SCREW-HEX., 1/4-20 UNC X 1.25, W/TOOTH WASHER (@ 6 FT.-LBS.)
1/10	2	2719	PLUG-PIPE, 1/4 NPT
1/11	1	5489	SCREW-ADJUSTMENT
1/12	1	123157-011	"O"RING-1/16 WIDE X .44 O.D.
1/13	1	124369-P02	JAMNUT-9/16-18 UNF
1/14	1	1160	SPRING
1/15	1	1281	BALL
1/16	1	121160	PLUG-PIPE, 1/8 NPT
2	1	5494	GASKET-BEARING CARRIER
3	8	123478-N14	SCREW-HEX., 1/2-13 UNC X 1.25, GRADE 5 (@ 75 FT.-LBS)
4	1	110822	GAUGE-PRESSURE
5	1	6679	GASKET-OIL INLET BRACKET
6	1	110660	TUBE-OIL PICKUP
7	2	123115-06C	LOCKWASHER-3/8
8	2	123478-L11	SCREW-HEX., 3/8-16 UNC X .88, GRADE 5 (@ 45 FT.-LBS.)
9	1	110825	STUD-OIL FILTER

@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

MAINTENANCE PARTS

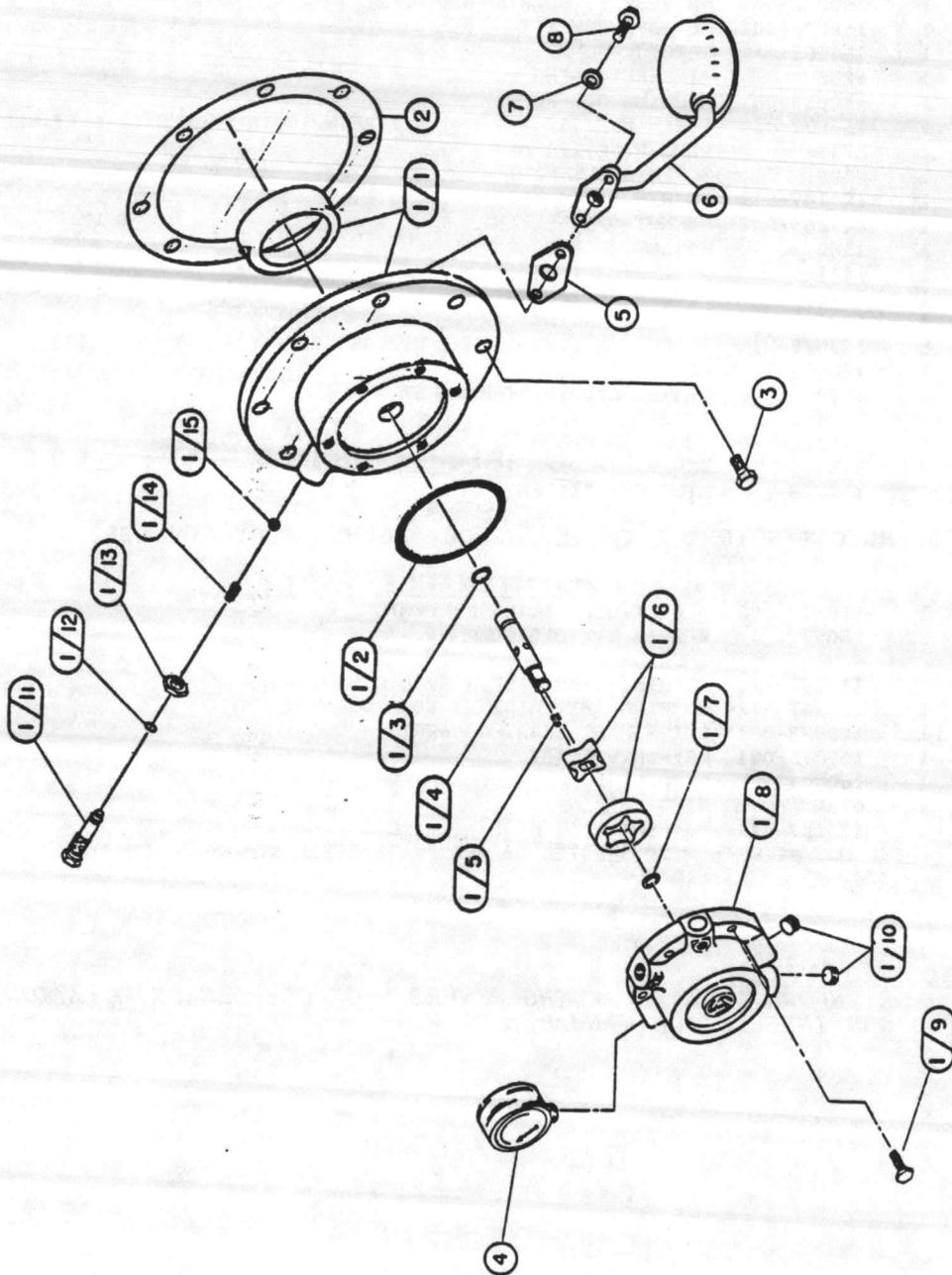
10	* 1	110814-001	6 PACK-OIL FILTER ELEMENTS
		160079	REPAIR KIT-OIL PUMP INCLUDES:
	1	123157-152	"O"RING-3/32 WIDE X 3.44 O.D.
	1	123157-112	"O"RING-3/32 WIDE X .69 O.D.
	1	160002-001	DRIVESHAFT-BEARING CARRIER
	1	160075-001	KEY-DRIVESHAFT
	1	160003	GEROTOR-PUMP
	1	6285	RING-RETAINING
	1	123157-011	"O"RING-1/16 WIDE X .44 O.D.

* CAN NOT BE USED WITH DIESTER OR PHOSPHATE ESTER SYNTHETIC LUBRICANTS

COMPRESSOR ROTATION

FOR INFORMATION REGARDING REVERSAL OF COMPRESSOR ROTATION, SEE THE QDD-QGD INSTRUCTION MANUAL.

BEARING CARRIER GROUP 110818
(LESS OIL FILTER)



**BEARING CARRIER GROUP 110818
(LESS OIL FILTER)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	110811-002	BEARING CARRIER ASSEMBLY
1/1	1	110811	BEARING CARRIER INCLUDES:
	1	3720	CUP-BEARING
	2	160005	BUSHING-BRONZE
1/2	1	123157-152	"O"RING-3/32 WIDE X 3.44 O.D.
1/3	1	123157-112	"O"RING-3/32 WIDE X .69 O.D.
1/4	1	160002-001	DRIVESHAFT-BEARING CARRIER
1/5	1	160075-001	KEY-DRIVESHAFT
1/6	1	160003	GEROTOR-PUMP
1/7	1	6285	RING-RETAINING
1/8	1	110813	HOUSING-OIL PUMP
1/9	6	160077-J14	SCREW-HEX., 1/4-20 UNC X 1.25, W/TOOTH WASHER (6 FT.-LBS.)
1/10	2	2719	PLUG-PIPE, 1/4 NPT
1/11	1	5489	SCREW-ADJUSTMENT
1/12	1	123157-011	"O"RING-1/16 WIDE X .44 O.D.
1/13	1	124369-P02	JAMNUT-9/16-18 UNF
1/14	1	1160	SPRING
1/15	1	1281	BALL
2	1	5494	GASKET-BEARING CARRIER
3	8	123478-N14	SCREW-HEX., 1/2-13 UNC X 1.25, GRADE 5 (@ 75 FT.-LBS.)
4	1	110822	GAUGE-PRESSURE
5	1	6679	GASKET-OIL INLET BRACKET
6	1	110660	TUBE-OIL PICKUP
7	2	123115-06C	LOCKWASHER-3/8
8	2	123478-L11	SCREW-HEX., 3/8-16 UNC X .88, GRADE 5 (@ 45 FT.-LBS.)

@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

MAINTENANCE PARTS

	160079	REPAIR KIT-OIL PUMP
		INCLUDES:
1	123157-152	"O"RING-3/32 WIDE X 3.44 O.D.
1	123157-112	"O"RING-3/32 WIDE X .69 O.D.
1	160002-001	DRIVESHAFT-BEARING CARRIER
1	160075-001	KEY-DRIVESHAFT
1	160003	GEROTOR-PUMP
1	6285	RING-RETAINING
1	123157-011	"O"RING-1/16 WIDE X .44 O.D.

PARTS FOR SPECIAL APPLICATIONS

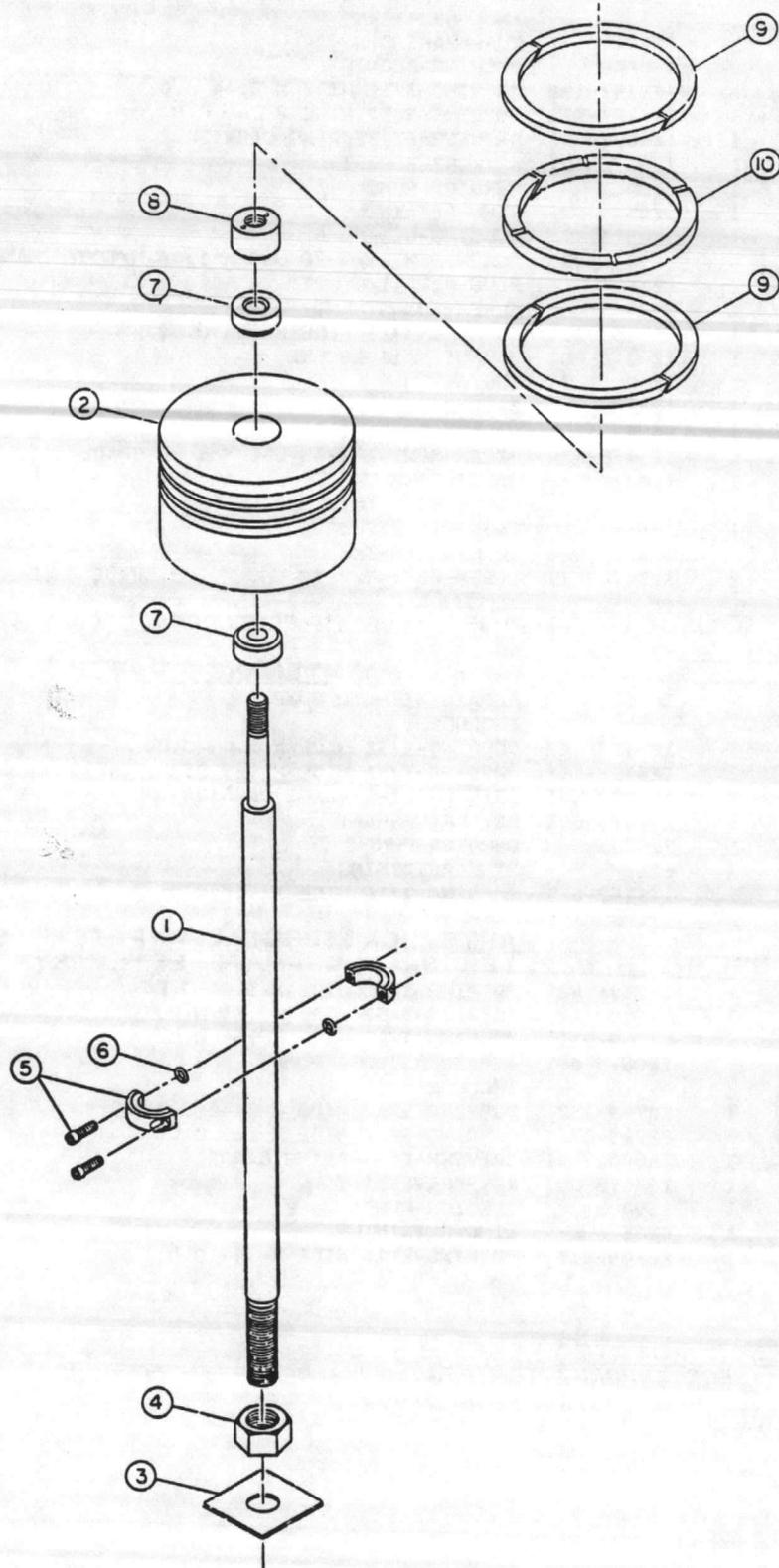
(FOR USE WITH DIESTER OR PHOSPHATE ESTER SYNTHETIC LUBRICANTS)

1/2	1	22749-152	"O"RING-3/32 WIDE X 3.44 O.D.
1/3	1	22749-112	"O"RING-3/32 WIDE X .69 O.D.
1/12	1	22749-011	"O"RING-1/16 WIDE X .44 O.D.
		160079-001	REPAIR KIT-OIL PUMP
			INCLUDES:
1	1	22749-152	"O"RING-3/32 WIDE X 3.44 O.D.
1	1	22749-112	"O"RING-3/32 WIDE X .69 O.D.
1	1	160002-001	DRIVESHAFT-BEARING CARRIER
1	1	160075-001	KEY-DRIVESHAFT
1	1	160003	GEROTOR-PUMP
1	1	6285	RING-RETAINING
1	1	22749-011	"O"RING-1/16 WIDE X .44 O.D.

COMPRESSOR ROTATION

FOR INFORMATION REGARDING REVERSAL OF COMPRESSOR ROTATION, SEE THE QDD-QGD INSTRUCTION MANUAL.

LOW PRESSURE PISTON GROUP 160102



LOW PRESSURE PISTON GROUP 160102

INDEX NUMBER	Q T Y	PART NUMBER	DESCRIPTION
1	1	160032	ROD-PISTON
2	1	160008	PISTON-LOW PRESSURE
3	1	160057	LOCKWASHER
4	1	160170	NUT-PISTON ROD (@ 200FT.-LBS.)
5	1	160060	COLLAR-SHAFT (INCLUDES 2 SCREWS @ 6 FT.-LBS.)
6	2	123157-010	"O"RING-1/16 WIDE X .38 O.D.
7	2	160011	WASHER-SPECIAL, PISTON
8	1	160010	NUT-SPECIAL,PISTON (@ 85 FT.-LBS.)
9	2	160028-001	RING-COMPRESSION
10	1	160029-001	RING-RIDER

@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

MAINTENANCE PARTS

1	160135	RING SET-LOW PRESSURE INCLUDES:
2	160028-001	RING-COMPRESSION
1	160029-001	RING-RIDER
1	160139	PISTON ASSEMBLY-L.P. INCLUDES:
1	160008	PISTON-LOW PRESSURE
1	160010	NUT-SPECIAL,PISTON (@ 85 FT.-LBS.)
2	160011	WASHER-SPECIAL, PISTON
1	160135	RING SET-LOW PRESSURE

PARTS FOR SPECIAL APPLICATIONS

(FOR USE WITH DIESTER OR PHOSPHATE ESTER SYNTHETIC LUBRICANTS)

6	2	22749-010	"O"RING-1/16 WIDE X .38 O.D.
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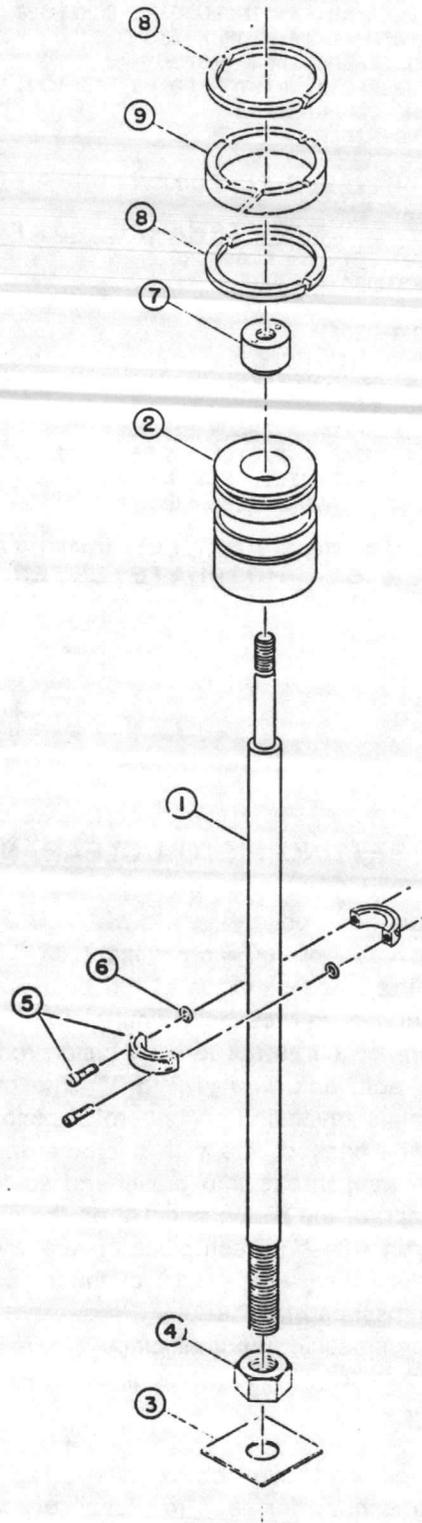
SETTING PISTON CLEARANCE

- 1.) Install head and torque head bolts.
- 2.) Leave one crank-end valve out of each cylinder.
- 3.) Turn crankshaft so first stage piston is at top dead center.
- 4.) Turn piston rod on threads in crosshead until piston just touches head at the top. Turn by hand or use strap wrench so as not to scuff piston rod.
- 5.) Insert 1/8" diameter soft lead wire (1/2" to 1") into crank-end valve opening and turn crankshaft one complete revolution so bottom of piston smashes wire.
- 6.) Measure thickness of smashed wire with micrometer. This is total clearance.
- 7.) Turn piston rod, screwing thread into crosshead so that 2/3 of this total (from step #6) will be on the head end of the piston and 1/3 on the crank-end.
- 8.) Snug locknut and again smash a fresh piece of wire and measure.
- 9.) Repeat until setting is within + or - .010 of theoretical correct value.
- 10.) Tighten and torque crosshead locknut.
- 11.) Recheck clearance by smashing another piece of wire to be certain piston did not move.
- 12.) Repeat above procedure for second stage piston.

NOTE

The piston will move approximately .125" into or out of crosshead for each revolution of the piston.

HIGH PRESSURE PISTON GROUP 160101



HIGH PRESSURE PISTON GROUP 160101

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160032	ROD-PISTON
2	1	160009	PISTON-HIGH PRESSURE
3	1	160057	LOCKWASHER
4	1	160170	NUT-PISTON ROD (@ 200FT.-LBS.)
5	1	160060	COLLAR-SHAFT (INCLUDES 2 SCREWS @ 6 FT.-LBS.)
6	2	123157-010	"O"RING-1/16 WIDE X .38 O.D.
7	1	160010	NUT-SPECIAL,PISTON (@ 85 FT.-LBS.)
8	2	160028-002	RING-COMPRESSION
9	1	160029-002	RING-RIDER

@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

MAINTENANCE PARTS

1	160136	RING SET-HIGH PRESSURE INCLUDES:
2	160028-002	RING-COMPRESSION
1	160029-002	RING-RIDER
1	160140	PISTON ASSEMBLY INCLUDES:
1	160009	PISTON-HIGH PRESSURE
1	160010	NUT-SPECIAL,PISTON (@ 85 FT.-LBS.)
1	160136	RING SET-HIGH PRESSURE

PARTS FOR SPECIAL APPLICATIONS

(FOR USE WITH DIESTER OR PHOSPHATE ESTER SYNTHETIC LUBRICANTS)

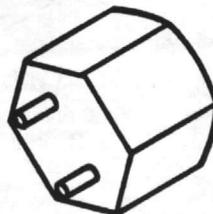
6	2	22749-010	"O"RING-1/16 WIDE X .38 O.D.
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SETTING PISTON CLEARANCE

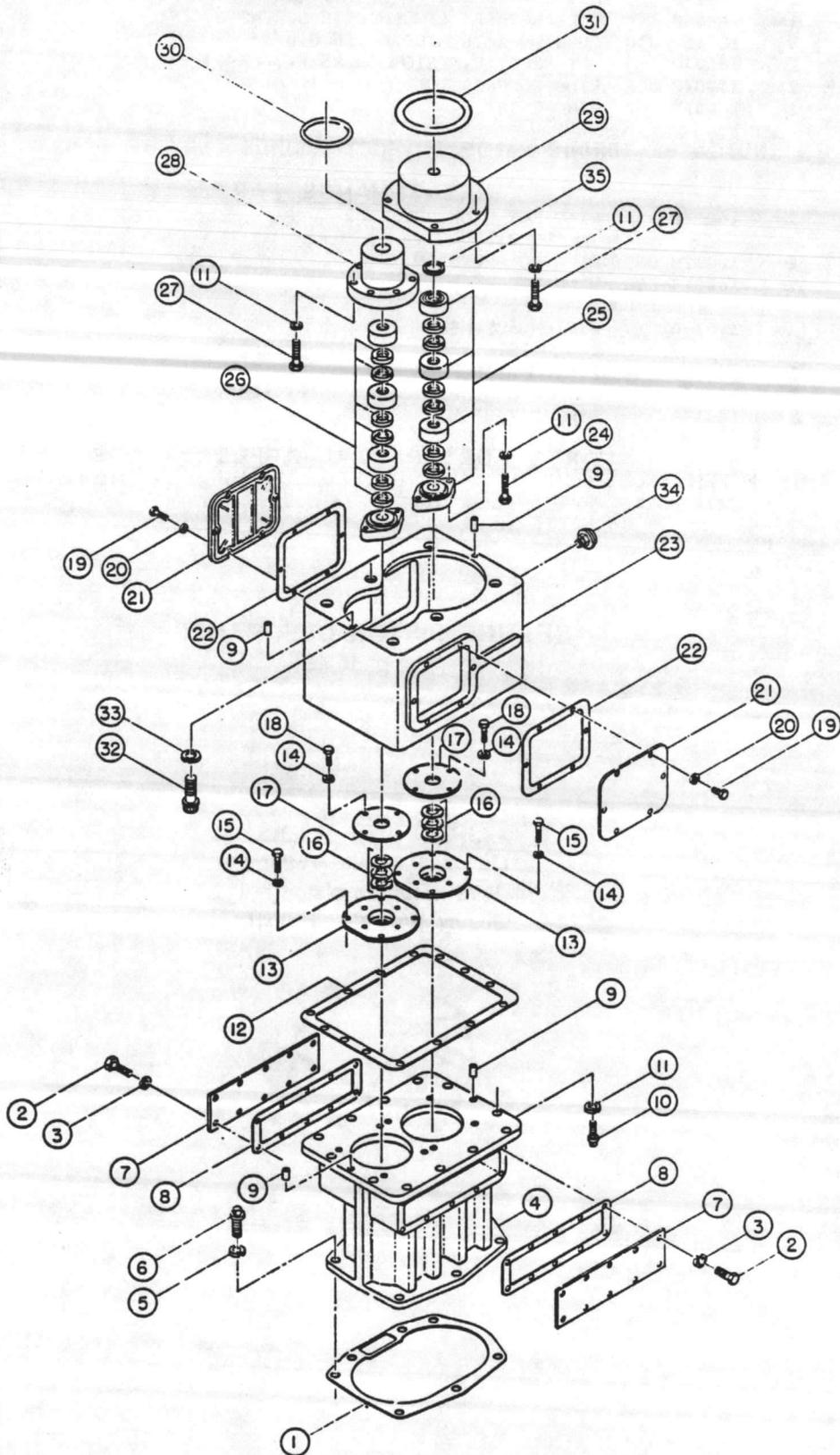
(See page 15)

SPANNING TOOL

Quincy Part No. 160150
Used to torque piston nut
(Quincy Part No. 160010)



CROSSHEAD GUIDE GROUP 160103



CROSSHEAD GUIDE GROUP 160103

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	2344	GASKET-CYLINDER TO CRANKCASE
2	20	123478-L11	SCREW-HEX.,3/8-16 UNC X .88,GRADE 5 (@ 30 FT.-LBS.)
3	20	123115-06C	LOCKWASHER-3/8
4	1	160012	GUIDE-CROSSHEAD
5	7	123115-10C	LOCKWASHER-5/8
6	7	90386-Q16	SCREW-COUNTERBORE,5/8-11 UNC X 1.75,GRADE 8 (@ 220 FT.-LBS.)
7	2	160053	PLATE-HANDHOLE, CROSSHEAD GUIDE
8	2	160054	GASKET,HANDHOLE
9	4	124145-002	PIN-DOWEL
10	12	90386-N15	SCREW-COUNTERBORE,1/2-13 UNC X 1.50,GRADE 8 (@ 110 FT.-LBS.)
11	27	123115-08C	LOCKWASHER-1/2
12	1	160020	GASKET-DISTANCE PIECE TO CROSSHEAD GUIDE
13	2	160025	HEAD-OIL STOP
14	16	123115-04C	LOCKWASHER-1/4
15	8	123478-J10	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5 (@ 8 FT.-LBS.)
16	2	160030	SET-RING WIPER (MUST BE PURCHASED AS COMPLETE SET)
17	2	160026	COVER-HEAD,OIL STOP
18	8	123478-J09	SCREW-HEX.,1/4-20 UNC X .62,GRADE 5 (@ 8 FT.-LBS.)
19	12	123478-K10	SCREW-HEX.,5/16-18 UNC X .75,GRADE 5 (@ 12 FT.-LBS.)
20	12	123115-05C	LOCKWASHER-5/16
21	2	1249	PLATE-INSPECTION
22	2	1315	GASKET-INSPECTION PLATE
23	1	160014	DISTANCE PIECE
24	4	123478-N17	SCREW-HEX.,1/2-13 UNC X 2.00,GRADE 5 (@ 75 FT.-LBS.)
25	2	160027-001	CASE-PACKING
26	2	160081-001	SET-RING PACKING (MUST BE PURCHASED AS A COMPLETE SET)
27	11	123478-N18	SCREW-HEX.,1/2-13 UNC X 2.25,GRADE 5 (@ 75 FT.-LBS.)
28	1	160018	HEAD-INNER,HIGH PRESSURE
29	1	160017	HEAD-INNER,LOW PRESSURE
30	1	22749-341	"O"RING-3/16 WIDE X 3.88 O.D.
31	1	22749-361	"O"RING-3/16 WIDE X 6.38 O.D.
32	6	90386-R16	SCREW-COUNTERBORE,3/4-10 UNC X 1.75,GRADE 8 (@ 350 FT.-LBS.)
33	6	123115-12C	LOCKWASHER-3/4
34	1	160122	BREATHER-1/4 NPT

@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

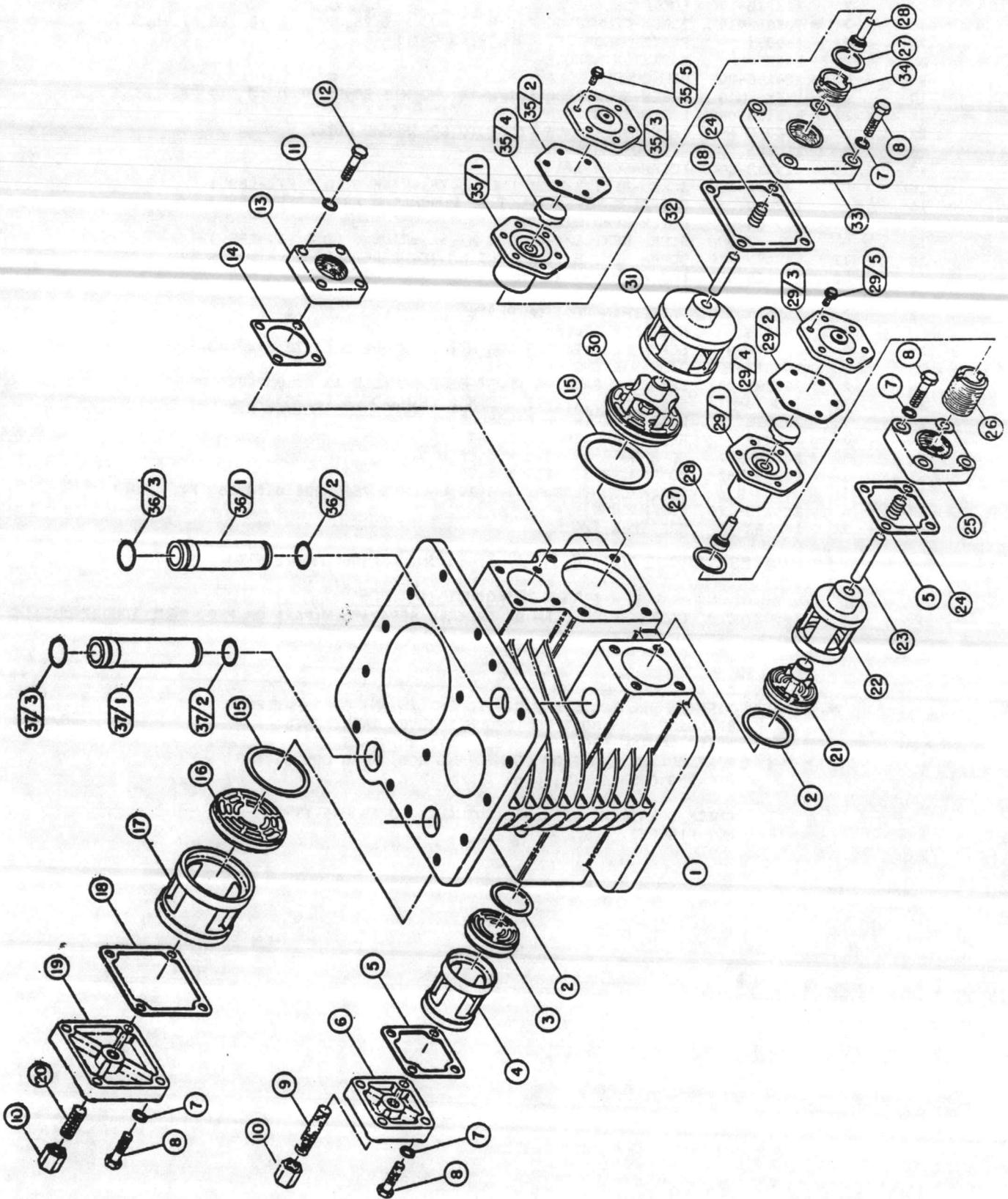
MAINTENANCE PARTS

35	2	160027-003	GASKET-WIRE (CAN BE ORDERED SEPARATELY;PART OF PKG. CASE 160027-001)
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NOTE: 1. TIGHTEN ALL BOLTS AND CAP SCREWS IN ANY BOLT PATTERN BRINGING EACH BOLT TO TORQUE IN EVEN INCREMENTS WHILE MOVING ABOUT THE BOLT PATTERN. THIS IS PARTICULARLY TRUE OF CONNECTING ROD, HEAD BOLTS, AND PACKING CASE BOLTS, e.g. ITEMS 18 & 24.

2. CHECK BREATHER (#34) PERIODICALLY TO ASSURE IT IS NOT PLUGGED.

CYLINDER GROUP 160175
(FOR AIRCOOLED MODELS)



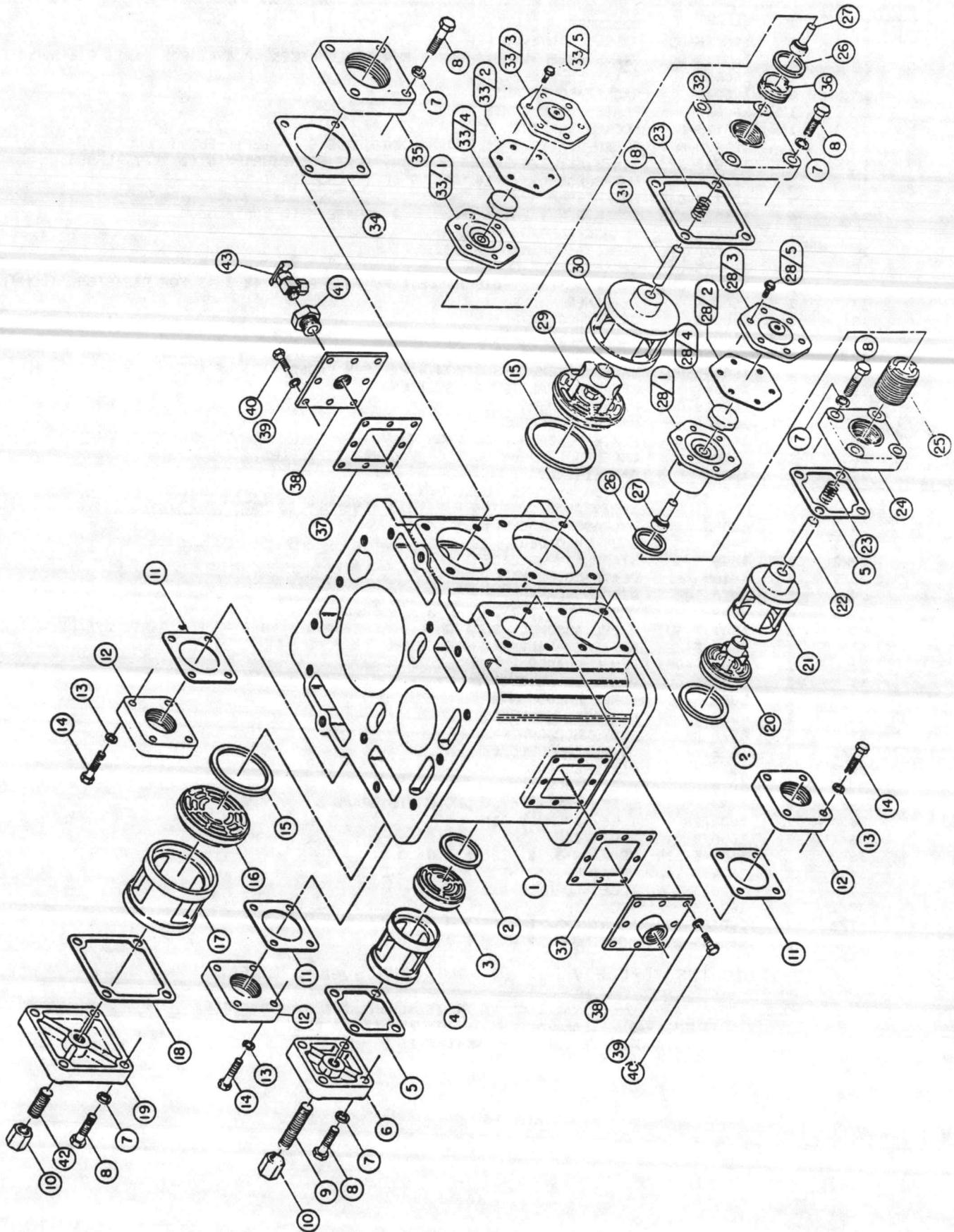
**CYLINDER GROUP 160175
(FOR AIRCOOLED MODELS)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160089	CYLINDER
2	2	160035-002	GASKET-VALVE,COPPER
3	1	160134-D01	VALVE ASSEMBLY-DISCHARGE,H.P. (SEE PAGES 40 & 41 FOR PARTS BREAKDOWN)
4	1	160042	RETAINER-VALVE,H.P.
5	2	160040	GASKET-COVER PLATE
6	1	160036	PLATE-VALVE COVER
7	16	123115-08C	LOCKWASHER-1/2
8	16	123478-N17	SCREW-HEX.,1/2-13 UNC X 2.00,GRADE 5 (@ 75FT.-LBS.)
9	1	160048-R21	SCREW-SET,3/4-16 UNF X 3.00, FLAT POINT,GRADE 5 (@ 75FT.-LBS.)
10	2	2623	NUT-SPECIAL,3/4-16 UNF (@ 90FT.-LBS.)
11	4	123115-06C	LOCKWASHER-3/8
12	4	123478-L16	SCREW-HEX.,3/8-16 UNC X 1.75,GRADE 5 (@ 30FT.-LBS.)
13	1	160087	FLANGE-COMPANION
14	1	160076	GASKET-COMPANION FLANGE
15	2	160035-001	GASKET-VALVE,COPPER
16	1	160133-D01	VALVE ASSEMBLY-DISCHARGE,L.P. (SEE PAGES 42 & 43 FOR PARTS BREAKDOWN)
17	1	160044	RETAINER-VALVE
18	2	160041	GASKET-COVER PLATE
19	1	160038	PLATE-COVER,VALVE
20	1	160048-R15	SCREW-SET,3/4-16 X 1.75(@ 75FT.-LBS.)
21	1	160134-SU1	VALVE ASSEMBLY-SUCTION,H.P. (SEE PAGES 44 & 45 FOR PARTS BREAKDOWN)
22	1	160043	RETAINER-VALVE,H.P.,SUCTION
23	1	160049-002	PIN-UNLOADER
24	2	160006	SPRING-COMPRESSION
25	1	160037	PLATE-COVER,H.P.SUCTION VALVE
26	1	160046	SCREW-HOLD DOWN,SUCTION VALVE(@ 75FT.-LBS.)
27	2	1556	GASKET-VALVE
28	2	110753X	PISTON ASSEMBLY-UNLOADER <u>INDIVIDUAL "O"RING FOR THIS ASSEMBLY IS PART NO. 110663-113</u>
29	1	40055	UNLOADER ASSEMBLY
29/1	1	7483	BODY-UNLOADER
29/2	1	1855	DIAPHRAGM-UNLOADER
29/3	1	1818B	PLATE-COVER
29/4	1	5910	DISC-DIAPHRAGM
29/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
30	1	160133-SU1	VALVE ASSEMBLY-SUCTION,L.P. (SEE PAGES 46 & 47 FOR PARTS BREAKDOWN)
31	1	160045	RETAINER-VALVE,L.P.,SUCTION
32	1	160049-003	PIN-UNLOADER
33	1	160039	PLATE-COVER,SUCTION VALVE,L.P.
34	1	3008	SCREW-HOLDDOWN
35	1	40192	UNLOADER ASSEMBLY
35/1	1	8272	BODY-UNLOADER
35/2	1	1855	DIAPHRAGM-UNLOADER
35/3	1	1818B	PLATE-COVER
35/4	1	5910	DISC-DIAPHRAGM
35/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
36	2	160072X	TUBE ASSEMBLY-AIR
36/1	1	160072	TUBE-AIR
36/2	1	160663-124	"O"RING-3/32 WIDE X 1.44 O.D.
36/3	1	160663-125	"O"RING-3/32 WIDE X 1.50 O.D.
37	1	160073X	TUBE ASSEMBLY-AIR
37/1	1	160073	TUBE-AIR
37/2	1	160663-124	"O"RING-3/32 WIDE X 1.44 O.D.
37/3	1	160663-125	"O"RING-3/32 WIDE X 1.50 O.D.

@ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

NOTE:TIGHTEN AND TORQUE VALVE COVER PLATE SCREWS (ITEM 8) BEFORE TIGHTENING VALVE CLAMP SCREWS. A MINIMUM OF 45 PSIG IS REQUIRED TO OPERATE THE VALVE UNLOADERS.

CYLINDER GROUP 160104
(FOR WATERCOOLED MODELS)



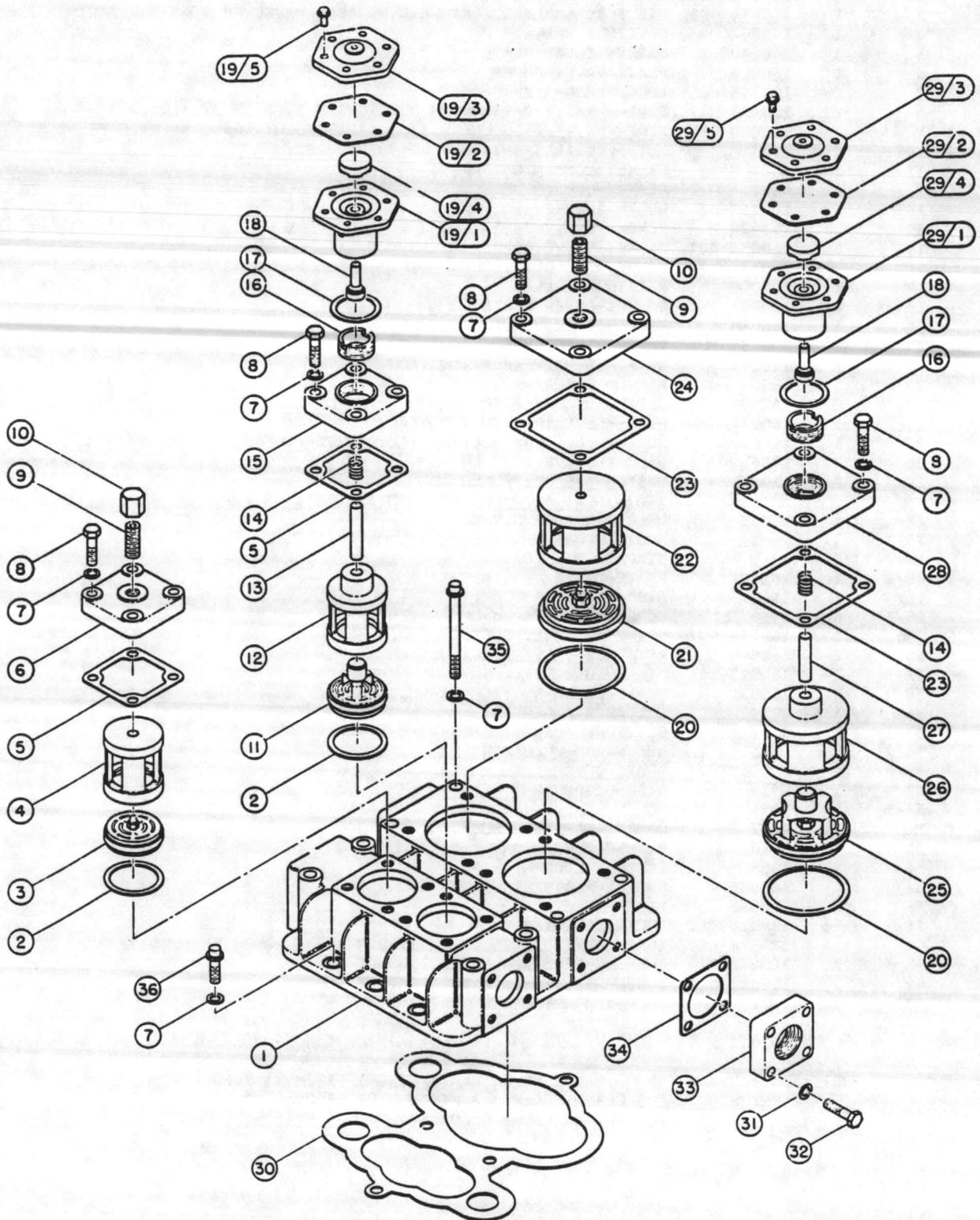
**CYLINDER GROUP 160104
(FOR WATERCOOLED MODELS)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160013	CYLINDER
2	2	160035-002	GASKET-VALVE,COPPER
3	1	160134-D01	VALVE ASSEMBLY-DISCHARGE,H.P. (SEE PAGES 40 & 41 FOR PARTS BREAKDOWN)
4	1	160042	RETAINER-VALVE,H.P.
5	2	160040	GASKET-COVER PLATE
6	1	160036	PLATE-VALVE COVER
7	20	123115-08C	LOCKWASHER-1/2
8	20	123478-N17	SCREW-HEX.,1/2-13 UNC X 2.00,GRADE 5 (⊗ 75 FT.-LBS.)
9	1	160048-R21	SCREW-SET,3/4-16 UNF X 3.00, FLAT POINT,GRADE 5 (⊗ 75 FT.-LBS.)
10	2	2623	NUT-SPECIAL,3/4-16 UNF (⊗ 90 FT.-LBS.)
11	3	5828	GASKET-COMPANION FLANGE
12	3	6977	FLANGE-COMPANION
13	12	123115-07C	LOCKWASHER-7/16
14	12	123478-M16	SCREW-HEX.,7/16-14 UNC X 1.75,GRADE 5
15	2	160035-001	GASKET-VALVE,COPPER
16	1	160133-D01	VALVE ASSEMBLY-DISCHARGE,L.P. (SEE PAGES 42 & 43 FOR PARTS BREAKDOWN)
17	1	160044	RETAINER-VALVE
18	2	160041	GASKET-COVER PLATE
19	1	160038	PLATE-COVER,VALVE
20	1	160134-SU1	VALVE ASSEMBLY-SUCTION,H.P. (SEE PAGES 44 & 45 FOR PARTS BREAKDOWN)
21	1	160043	RETAINER-VALVE,H.P.,SUCTION
22	1	160049-002	PIN-UNLOADER
23	2	160006	SPRING-COMPRESSION
24	1	160037	PLATE-COVER,H.P.SUCTION VALVE
25	1	160046	SCREW-HOLD DOWN,SUCTION VALVE(⊗ 75FT.-LBS.)
26	2	1556	GASKET-VALVE
27	2	110753X	PISTON ASSEMBLY-UNLOADER <u>INDIVIDUAL "O"RING FOR THIS ASSEMBLY IS PART NO. 110663-113</u>
28	1	40055	UNLOADER ASSEMBLY
28/1	1	7483	BODY-UNLOADER
28/2	1	1855	DIAPHRAGM-UNLOADER
28/3	1	1818B	PLATE-COVER
28/4	1	5910	DISC-DIAPHRAGM
28/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
29	1	160133-SU1	VALVE ASSEMBLY-SUCTION,L.P. (SEE PAGES 46 & 47 FOR PARTS BREAKDOWN)
30	1	160045	RETAINER-VALVE,L.P.,SUCTION
31	1	160049-003	PIN-UNLOADER
32	1	160039	PLATE-COVER,SUCTION VALVE,L.P.
33	1	40192	UNLOADER ASSEMBLY
33/1	1	8272	BODY-UNLOADER
33/2	1	1855	DIAPHRAGM-UNLOADER
33/3	1	1818B	PLATE-COVER
33/4	1	5910	DISC-DIAPHRAGM
33/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
34	1	9073	GASKET-MANIFOLD,SUCTION
35	1	9070	FLANGE-COMPANION
36	1	3008	SCREW-HOLDDOWN
37	2	160056	GASKET-PLATE
38	2	160055	PLATE-INLET
39	16	123115-06C	LOCKWASHER-3/8
40	16	123478-L12	SCREW-HEX.,3/8-16 UNC X 1.00,GRADE 5 (⊗ 30 FT.-LBS.)
41	1	125868-010	BUSHING-PIPE,3/4 NPT X 1/8 NPT
42	1	160048-R15	SCREW-SET,3/4-16 X 1.75(⊗ 75FT.-LBS.)
43	1	7572	COCK-1/8"NPT DRAIN

⊗ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

NOTE:TIGHTEN AND TORQUE VALVE COVER PLATE SCREWS (ITEM 8) BEFORE TIGHTENING VALVE CLAMP SCREWS. A MINIMUM OF 45 PSIG IS REQUIRED TO OPERATE THE VALVE UNLOADERS.

HEAD GROUP 160174
(FOR AIRCOOLED MODELS)



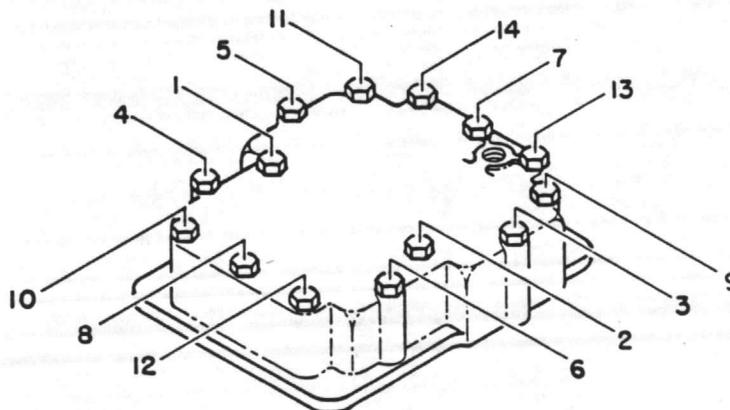
**HEAD GROUP 160174
(FOR AIRCOOLED MODELS)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160088	HEAD-CYLINDER
2	2	160035-002	GASKET-VALVE,COPPER
3	1	160134-D01	VALVE ASSEMBLY-DISCHARGE,H.P. (SEE PAGES 40 & 41 FOR PARTS BREAKDOWN)
4	1	160042	RETAINER-VALVE,H.P.
5	2	160040	GASKET-COVER PLATE
6	1	160036	PLATE-VALVE COVER
7	32	123115-08C	LOCKWASHER-1/2
8	16	123478-N17	SCREW-HEX.,1/2-13 UNC X 2.00,GRADE 5 (⊗ 75 FT.-LBS.)
9	2	160048-R15	SCREW-SET,3/4-16 X 1.75(⊗ 75FT.-LBS.)
10	2	2623	NUT-SPECIAL,3/4-16 UNF (⊗ 90 FT.-LBS.)
11	1	160134-SU1	VALVE ASSEMBLY-SUCTION,H.P. (SEE PAGES 44 & 45 FOR PARTS BREAKDOWN)
12	1	160043	RETAINER-VALVE,H.P.,SUCTION
13	1	160049-001	PIN-UNLOADER
14	2	160006	SPRING-COMPRESSION
15	1	160037	PLATE-COVER,H.P.SUCTION VALVE
16	2	3008	SCREW-HOLDDOWN (⊗ 75 FT.-LBS.)
17	2	1556	GASKET-VALVE
18	2	110753X	PISTON-ASSEMBLY <u>INDIVIDUAL "O"RING FOR THIS ASSEMBLY IS PART NO. 110663-113</u>
19	1	40055	UNLOADER ASSEMBLY
19/1	1	7483	BODY-UNLOADER
19/2	1	1855	DIAPHRAGM-UNLOADER
19/3	1	18188	PLATE-COVER
19/4	1	5910	DISC-DIAPHRAGM
19/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
20	2	160035-001	GASKET-VALVE,COPPER
21	1	160133-D01	VALVE ASSEMBLY-DISCHARGE,L.P. (SEE PAGES 42 & 43 FOR PARTS BREAKDOWN)
22	1	160044	RETAINER-VALVE
23	2	160041	GASKET-COVER PLATE
24	1	160038	PLATE-COVER,VALVE
25	1	160133-SU1	VALVE ASSEMBLY-SUCTION,L.P. (SEE PAGES 46 & 47 FOR PARTS BREAKDOWN)
26	1	160045	RETAINER-VALVE,L.P.,SUCTION
27	1	160049-003	PIN-UNLOADER
28	1	160039	PLATE-COVER,SUCTION VALVE,L.P.
29	1	40192	UNLOADER ASSEMBLY
29/1	1	8272	BODY-UNLOADER
29/2	1	1855	DIAPHRAGM-UNLOADER
29/3	1	18188	PLATE-COVER
29/4	1	5910	DISC-DIAPHRAGM
29/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
30	1	160074	GASKET-CYLINDER HEAD
31	16	123115-06C	LOCKWASHER-3/8
32	16	123478-L16	SCREW-HEX.,3/8-16 UNC X 1.75,GRADE 5 (⊗ 30 FT.-LBS)
33	4	160087	FLANGE-COMPANION
34	4	160076	GASKET-COMPANION FLANGE
35	8	90386-N27	SCREW-COUNTERBORE,1/2-13 UNC X 5.00,GRADE 8 (⊗ 110 FT.-LBS.)
36	8	90386-N15	SCREW-COUNTERBORE,1/2-13 UNC X 1.50,GRADE 8 (⊗ 110 FT.-LBS.)

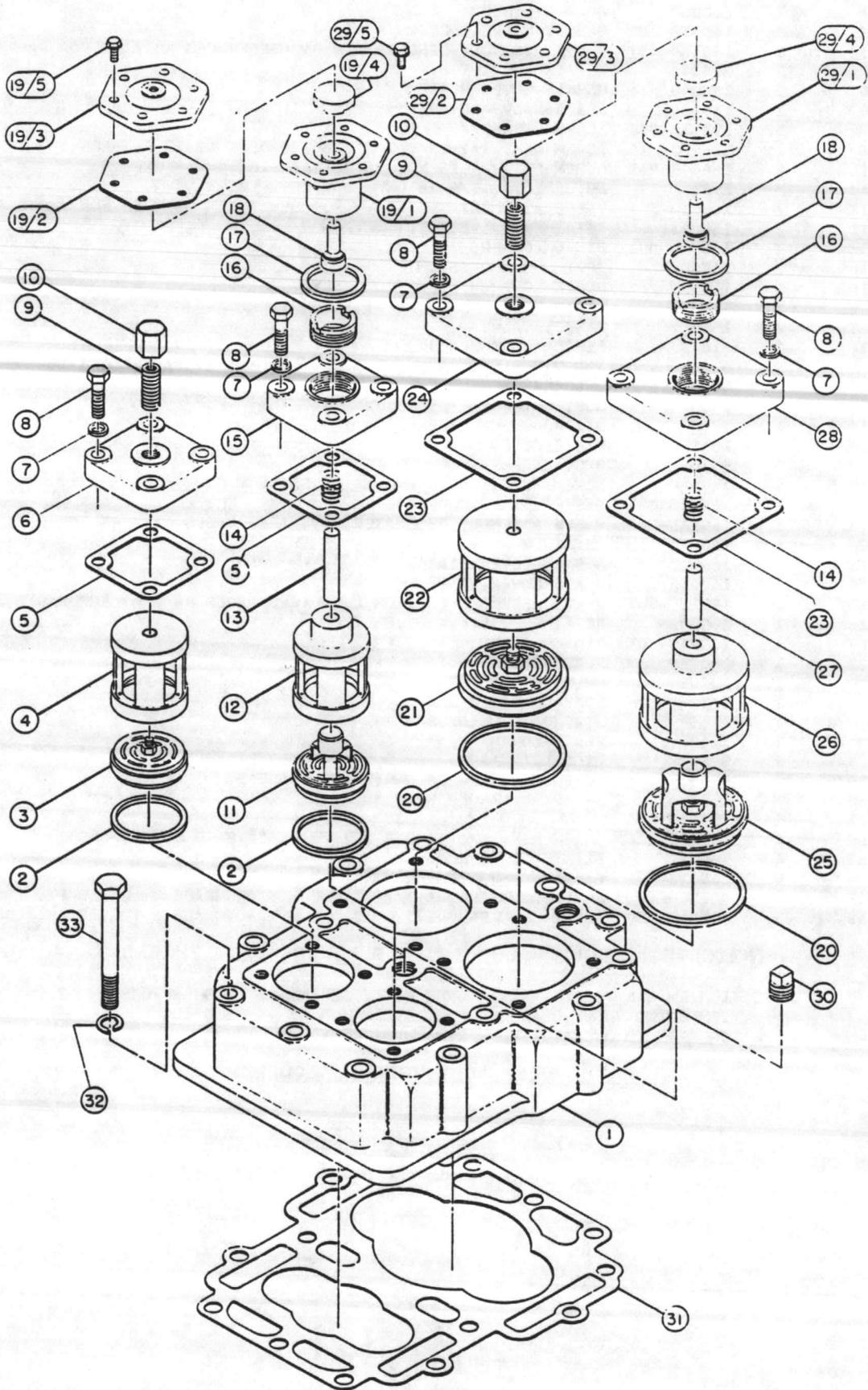
⊗ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

NOTE:TIGHTEN AND TORQUE VALVE COVER PLATE SCREWS (ITEM 8) BEFORE TIGHTENING VALVE CLAMP SCREWS. A MINIMUM OF 45 PSIG IS REQUIRED TO OPERATE THE VALVE UNLOADERS.

PROPER HEAD BOLT TORQUE SEQUENCE



HEAD GROUP 160106
(FOR WATERCOOLED MODELS)



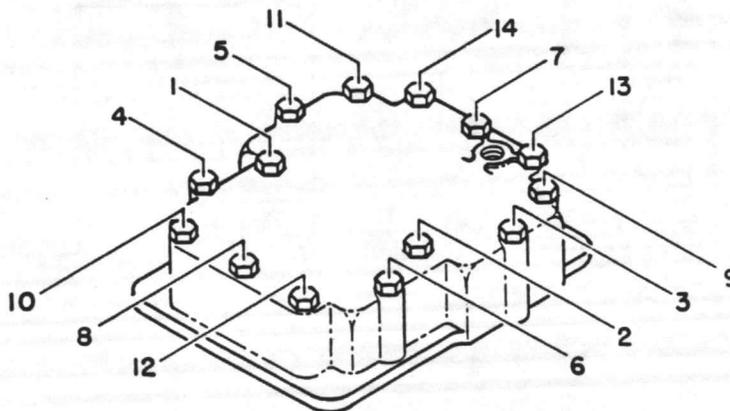
**HEAD GROUP 160106
(FOR WATERCOOLED MODELS)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160015	HEAD-CYLINDER
2	2	160035-002	GASKET-VALVE,COPPER
3	1	160134-001	VALVE ASSEMBLY-DISCHARGE,H.P. (SEE PAGES 40 & 41 FOR PARTS BREAKDOWN)
4	1	160042	RETAINER-VALVE,H.P.
5	2	160040	GASKET-COVER PLATE
6	1	160036	PLATE-VALVE COVER
7	16	123115-08C	LOCKWASHER-1/2
8	16	123478-N17	SCREW-HEX.,1/2-13 UNC X 2.00,GRADE 5 (⊗ 75 FT.-LBS)
9	2	160048-R15	SCREW-SET,3/4-16 X 1.75(⊗ 75FT.-LBS.)
10	2	2623	NUT-SPECIAL,3/4-16 UNF (⊗ 90 FT.-LBS.)
11	1	160134-SU1	VALVE ASSEMBLY-SUCTION,H.P. (SEE PAGES 44 & 45 FOR PARTS BREAKDOWN)
12	1	160043	RETAINER-VALVE,H.P.,SUCTION
13	1	160049-001	PIN-UNLOADER
14	2	160006	SPRING-COMPRESSION
15	1	160037	PLATE-COVER,H.P.SUCTION VALVE
16	2	3008	SCREW-HOLDDOWN (⊗ 75 FT.-LBS.)
17	2	1556	GASKET-VALVE
18	2	110753X	PISTON-ASSEMBLY <u>INDIVIDUAL "O"RING FOR THIS ASSEMBLY IS PART NO. 110663-113</u>
19	1	40055	UNLOADER ASSEMBLY
19/1	1	7483	BODY-UNLOADER
19/2	1	1855	DIAPHRAGM-UNLOADER
19/3	1	1818B	PLATE-COVER
19/4	1	5910	DISC-DIAPHRAGM
19/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
20	2	160035-001	GASKET-VALVE,COPPER
21	1	160133-001	VALVE ASSEMBLY-DISCHARGE,L.P. (SEE PAGES 42 & 43 FOR PARTS BREAKDOWN)
22	1	160044	RETAINER-VALVE
23	2	160041	GASKET-COVER PLATE
24	1	160038	PLATE-COVER,VALVE
25	1	160133-SU1	VALVE ASSEMBLY-SUCTION,L.P. (SEE PAGES 46 & 47 FOR PARTS BREAKDOWN)
26	1	160045	RETAINER-VALVE,L.P.,SUCTION
27	1	160049-003	PIN-UNLOADER
28	1	160039	PLATE-COVER,SUCTION VALVE,L.P.
29	1	40192	UNLOADER ASSEMBLY
29/1	1	8272	BODY-UNLOADER
29/2	1	1855	DIAPHRAGM-UNLOADER
29/3	1	1818B	PLATE-COVER
29/4	1	5910	DISC-DIAPHRAGM
29/5	6	7499	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
30	1	2058	PLUG-PIPE,3/4 NPT
31	1	160019	GASKET-CYLINDER HEAD
32	14	123115-10C	LOCKWASHER-5/8
33	14	123478-Q27	SCREW-HEX.,5/8-11 UNC X 5.00,GRADE 5 (⊗ 150 FT.-LBS.)

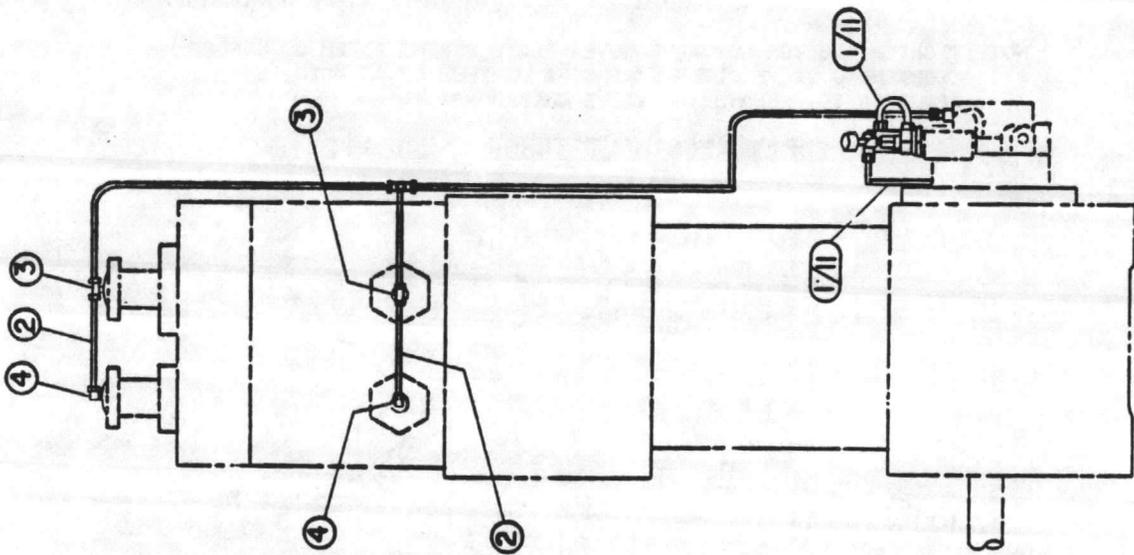
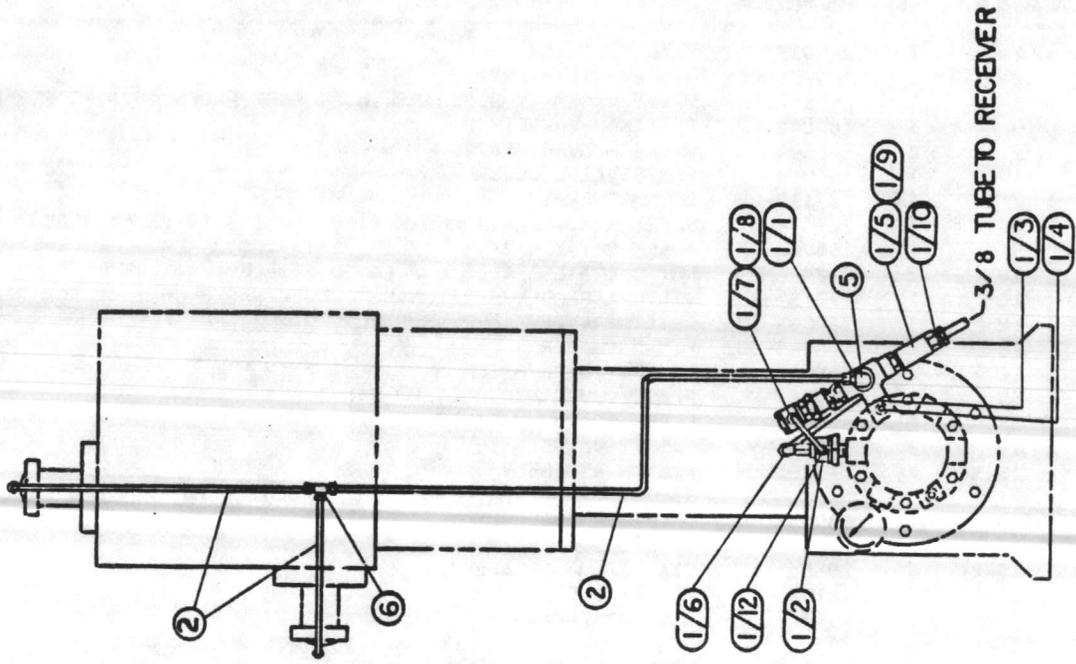
⊗ INDICATES TORQUE VALUE IN FOOT POUNDS (DRY THREADS)

NOTE:TIGHTEN AND TORQUE VALVE COVER PLATE SCREWS (ITEM 8) BEFORE TIGHTENING VALVE CLAMP SCREWS. A MINIMUM OF 45 PSIG IS REQUIRED TO OPERATE THE VALVE UNLOADERS.

PROPER HEAD BOLT TORQUE SEQUENCE



CONTROL PIPING GROUP 110865
(DUAL CONTROL MODELS)

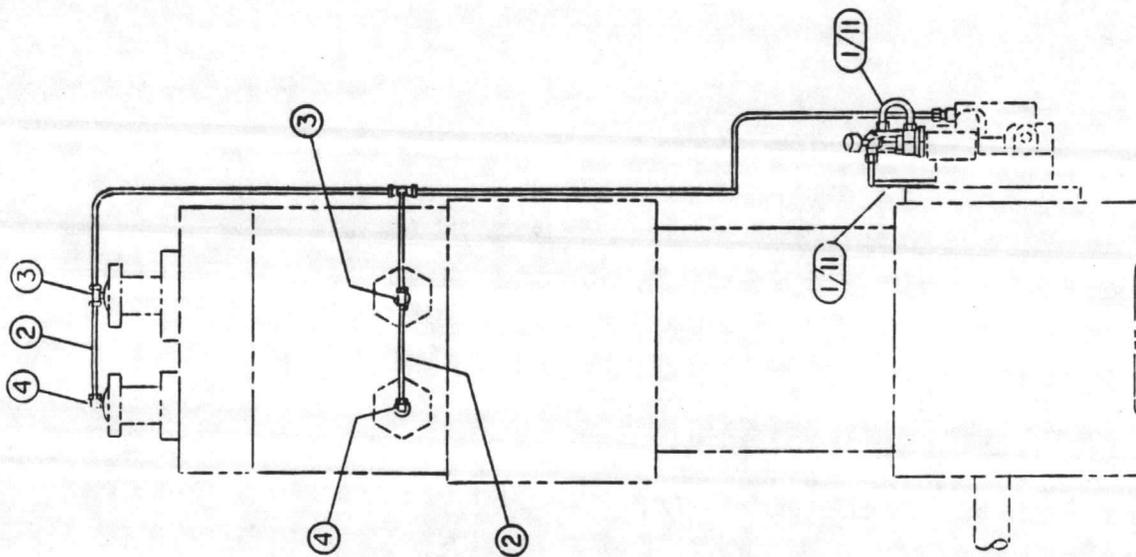
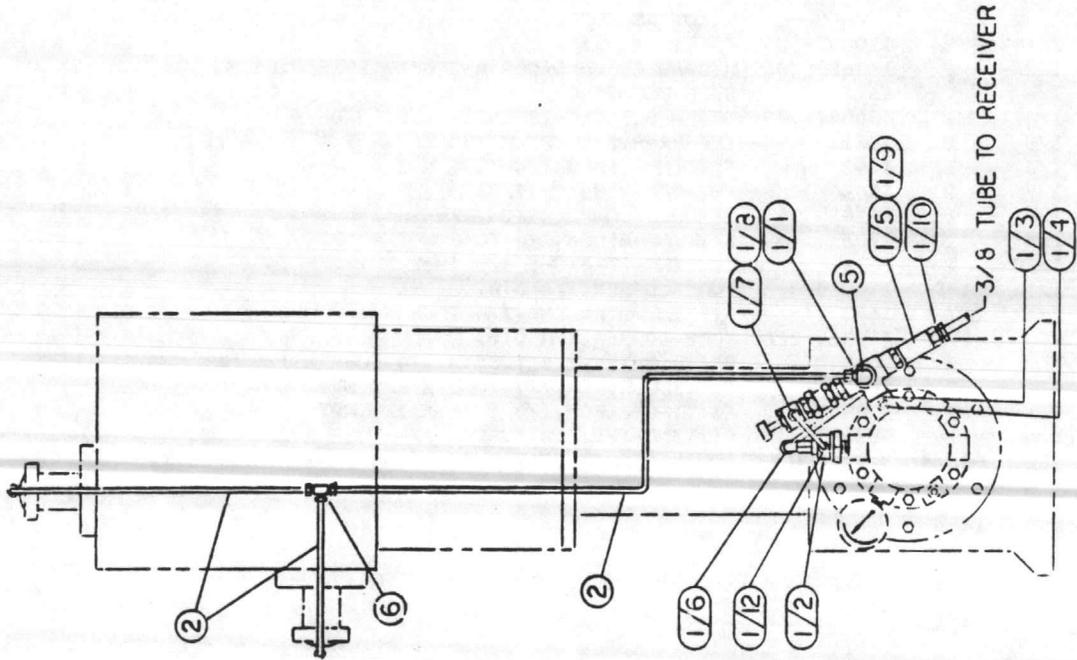


**CONTROL PIPING GROUP 110865
(DUAL CONTROL MODELS)**

INDEX NUMBER	Q T Y	PART NUMBER	DESCRIPTION
1	1	110842	PILOT ASSEMBLY
* 1/1	1	110833-100	PILOT
1/2	1	110827-001	HYDRAULIC UNLOADER ASSEMBLY (SEE PAGE 35)
1/3	1	6317	STUD-MOUNTING
1/4	1	160047-J05	SCREW-SET,1/4-28 UNF X .38,GRADE 5
1/5	1	7361	TEE-PIPE,1/4 NPT X 1/4 NPT X 1/4 NPT,BRASS
1/6	1	1642	FITTING-ELBOW,1/4 TUBE X 1/8 NPT
1/7	1	3455	NUT-COMPRESSION,1/4
1/8	1	3454	FERRULE-COMPRESSION,1/4
1/9	1	2708	FITTING-ELBOW,1/4 TUBE X 1/4 NPT
1/10	1	2616	FITTING-STRAIGHT,3/8 TUBE X 1/4 NPT
1/11	1FT	110515-025	TUBE-COPPER,1/4 O.D.
1/12	1	1643	FITTING-STRAIGHT,1/4 TUBE X 1/8 NPT
2	6FT	110515-025	TUBE-COPPER,1/4 O.D.
3	2	1665	FITTING-TEE,1/4 TUBE X 1/4 TUBE X 1/8 NPT
4	2	1642	FITTING-ELBOW,1/4 TUBE X 1/8 NPT
5	1	2708	FITTING-ELBOW,1/4 TUBE X 1/4 NPT
6	1	4836	FITTING-TEE,1/4 TUBE X 1/4 TUBE X 1/4 TUBE

* SEE PAGES 32 & 33 FOR OPTIONAL PILOTS THAT MUST BE USED WITH RESPECTIVE PRESSURE RANGES.

**CONTROL PIPING GROUP 110866
(DUAL CONTROL MODELS WITH PILOT LOCKOUT)**

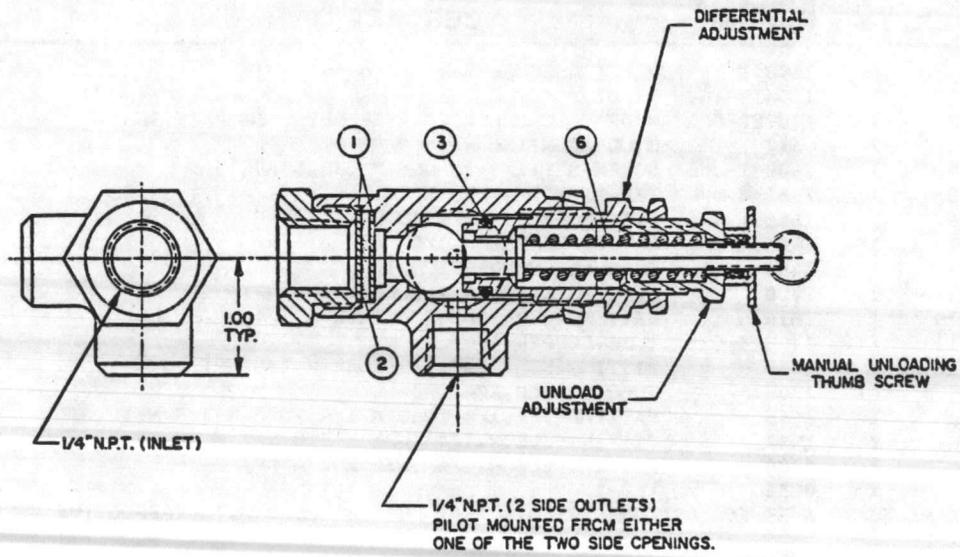


**CONTROL PIPING GROUP 110866
(DUAL CONTROL MODELS WITH PILOT LOCKOUT)**

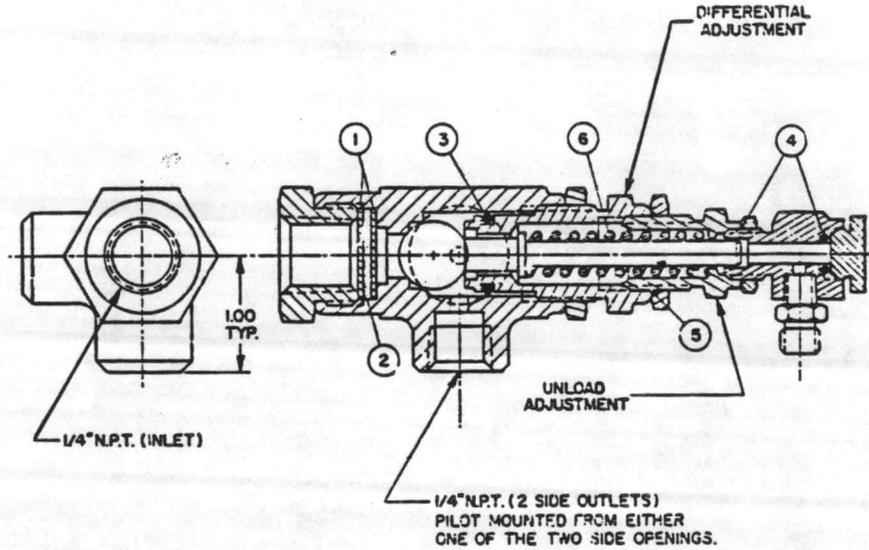
INDEX NUMBER	Q T Y	PART NUMBER	DESCRIPTION
1	1	110843	PILOT ASSEMBLY
* 1/1	1	110834-100	PILOT
1/2	1	110827-001	HYDRAULIC UNLOADER ASSEMBLY (SEE PAGE 35)
1/3	1	6317	STUD-MOUNTING
1/4	1	160047-J05	SCREW-SET,1/4-28 UNF X .38,GRADE 5
1/5	1	7361	TEE-PIPE,1/4 NPT X 1/4 NPT X 1/4 NPT,BRASS
1/6	1	1642	FITTING-ELBOW,1/4 TUBE X 1/8 NPT
1/7	1	3455	NUT-COMPRESSION,1/4
1/8	1	3454	FERRULE-COMPRESSION,1/4
1/9	1	2708	FITTING-ELBOW,1/4 TUBE X 1/4 NPT
1/10	1	2616	FITTING-STRAIGHT,3/8 TUBE X 1/4 NPT
1/11	1FT	110515-025	TUBE-COPPER,1/4
1/12	1	1643	FITTING-STRAIGHT,1/4 TUBE X 1/8 NPT
2	6FT	110515-025	TUBE-COPPER,1/4
3	2	1665	FITTING-TEE,1/4 TUBE X 1/4 TUBE X 1/8 NPT
4	2	1642	FITTING-ELBOW,1/4 TUBE X 1/8 NPT
5	1	2708	FITTING-ELBOW,1/4 TUBE X 1/4 NPT
6	1	4836	TEE-1/4"

* SEE PAGES 32 & 33 FOR OPTIONAL PILOTS THAT MUST BE USED WITH RESPECTIVE PRESSURE RANGES.

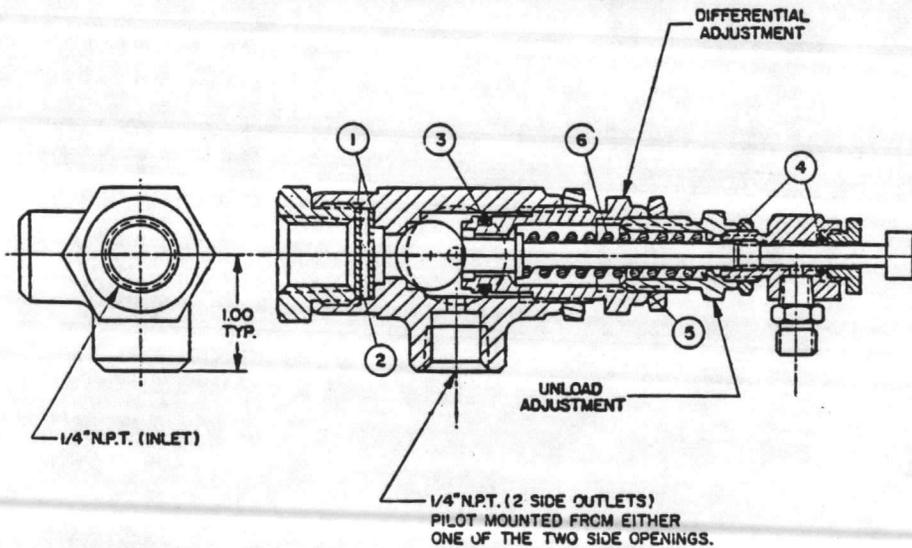
**PILOT ASSEMBLIES
FOR COMPRESSORS WITH PILOT CONTROL
PART NUMBER 110832-__**



**FOR COMPRESSORS WITH DUAL CONTROL
PART NUMBER 110833-__**



**FOR COMPRESSORS WITH DUAL CONTROL WITH PILOT LOCKOUT
PART NUMBER 110834-__**



PILOT ASSEMBLIES

DASH NO.

PRESSURE SETTING

-080	FACTORY PRESET 70 P.S.I. LOAD TO 80 P.S.I. UNLOAD
-100	FACTORY PRESET 90 P.S.I. LOAD TO 100 P.S.I. UNLOAD
-110	FACTORY PRESET 100 P.S.I. LOAD TO 110 P.S.I. UNLOAD
-140	FACTORY PRESET 130 P.S.I. LOAD TO 140 P.S.I. UNLOAD
-150	FACTORY PRESET 135 P.S.I. LOAD TO 150 P.S.I. UNLOAD
-165	FACTORY PRESET 150 P.S.I. LOAD TO 165 P.S.I. UNLOAD
-175	FACTORY PRESET 165 P.S.I. LOAD TO 175 P.S.I. UNLOAD
-997	** 30 TO 70 P.S.I. ADJUSTABLE UNLOAD PRESSURE
-998	** 71 TO 150 P.S.I. ADJUSTABLE UNLOAD PRESSURE
-999	** 151 TO 200 P.S.I. ADJUSTABLE UNLOAD PRESSURE
	** CUSTOMER TO SET- SEE DIFFERENTIAL SETTING CHART BELOW

WARNING: NOT ALL PILOTS ARE FOR USE WITH ALL COMPRESSOR SYSTEMS. MAKE SURE THAT THE PILOT YOU ORDER IS SET WITHIN THE SAFE OPERATING LIMITS OF YOUR SYSTEM. FAILURE TO HEED THIS WARNING COULD RESULT IN AN EXPLOSION!

PILOT REPAIR KIT 110832-051

ITEM NO.	QTY	DESCRIPTION
1	2	SCREEN
2	1	FILTER
3	1	"O"RING
4	1	"O"RING
5	1	"O"RING

PILOT REPLACEMENT SPRINGS (ITEM NO. 6 ON DRAWING)

SPRING NO.	UNLOAD P.S.I. RANGE	COLOR CODE
110832-052	30-70	RED
110832-053	71-150	YELLOW
110832-054	151-200	GREEN

DIFFERENTIAL SETTING CHART

SPRING NO.	UNLOAD P.S.I.	MINIMUM DIFFERENTIAL P.S.I.	MAXIMUM DIFFERENTIAL P.S.I.
110832-052	30	2	4
"	40	5	8
"	50	5	8
"	60	5	8
"	70	5	10
110832-053	80	5	10
"	90	5	12
"	100	5	13
"	110	5	15
"	120	5	15
"	130	5	18
"	140	5	18
"	150	5	20
110832-054	160	5	15
"	170	5	20
"	175	5	23
"	200	5	25

PILOT ASSEMBLIES

INSTRUCTIONS

**QUINCY BALL TYPE UNLOADER PILOT
PART NO.S 110832, 110833, & 110834
MAXIMUM OPERATING PRESSURE 200 LBS.**

APPLICATION

Suction valve unloaders are recommended for use on Quincy compressors where the compressor is to run continuously and a constant pressure is to be maintained. The purpose is to automatically unseat the suction valve of the compressor when the air supply is greater than the demand.

The Quincy suction unloader consists of unloading arrangements on the suction valves, having a plunger to contact the suction valve disc and an unloader pilot to automatically regulate the passing of receiver pressure to the unloading arrangement.

OPERATION

Unloading occurs when receiver pressure is sufficient to overcome pilot spring pressure. The check ball is then unseated allowing receiver pressure to pass to the unloading arrangements. The compressor will then run unloaded until the receiver pressure drops to a predetermined level. At this time the action of the ball is reversed, shutting off receiver pressure to the unloader arrangement and venting the unloader to atmosphere. This allows the compressor to load. The drive, either electric motor or gasoline engine, runs continuously and must be started and stopped manually.

Pilot (#110834) for dual control models has a shut off feature built in. The knurled knob at the top of the pilot is turned clockwise all the way to lock out the pilot. In this mode, a pressure switch is required to stop the motor. **CAUTION!** Do not use this pilot without a pressure switch. If the pilot is locked out without another device to control the compressor, pressure could rise to an unsafe level causing an explosion. With the knob turned counterclockwise all the way, the pilot functions as shown as above.

INSTALLATION

The unloader pilot is to be connected to the air receiver using a minimum of 3/8" O.D. copper tube. Plain machines in field service can be converted to constant speed by installing valve unloaders and an unloader pilot.

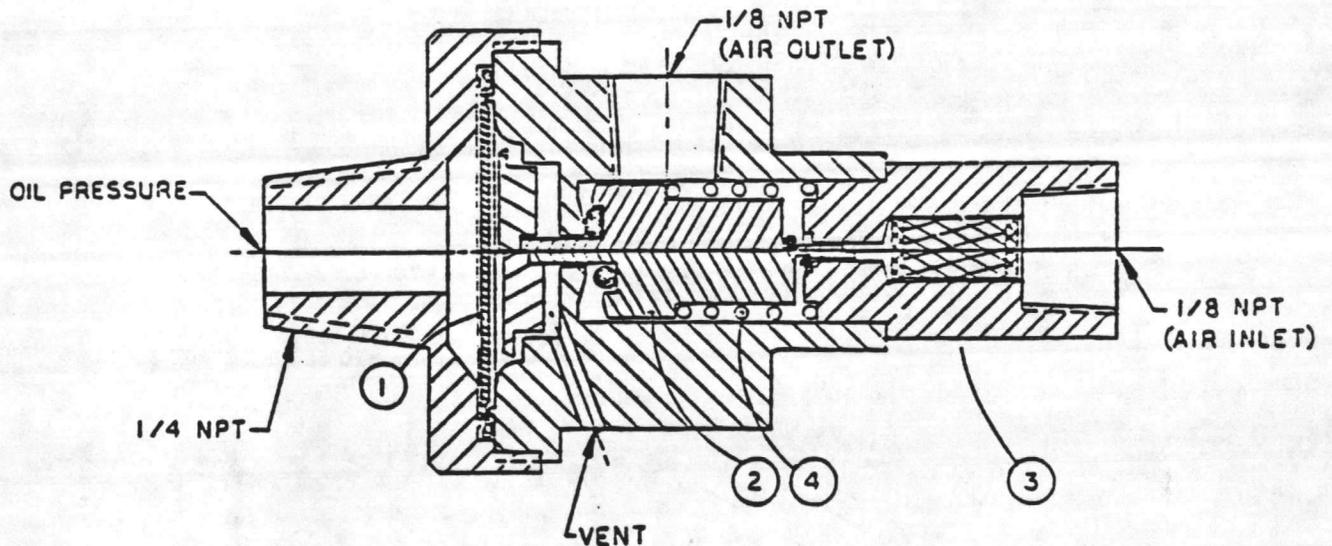
SERVICE

The unloader ball is the only vital moving part in the Quincy ball type unloader pilot and should run for a long period without servicing, providing the inlet filter is kept clean and the pilot is clean inside.

The unloading pressure is adjustable and is regulated by the screw (see cross sectional illustrations of pilot valves) marked "UNLOAD ADJ." (turn clockwise to increase and counterclockwise to decrease). **WARNING: DO NOT SET THE PILOT HIGHER THAN THE SAFE OPERATING LIMITS OF YOUR SYSTEM. FAILURE TO HEED THIS WARNING COULD RESULT IN AN EXPLOSION!**

The differential (difference between unloading and loading pressure) is set by an adjusting screw marked "DIFFERENTIAL ADJ." (see cross section illustration of pilot valve) increase by turning clockwise, decrease by turning counterclockwise. Tighten locknuts after adjustment.

HYDRAULIC UNLOADER ASSEMBLY



<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>PRESSURE RANGE</u>
110827-001	HYDRAULIC UNLOADER ASSEMBLY	0-200 P.S.I.
* 110827-003	HYDRAULIC UNLOADER ASSEMBLY	0-200 P.S.I.

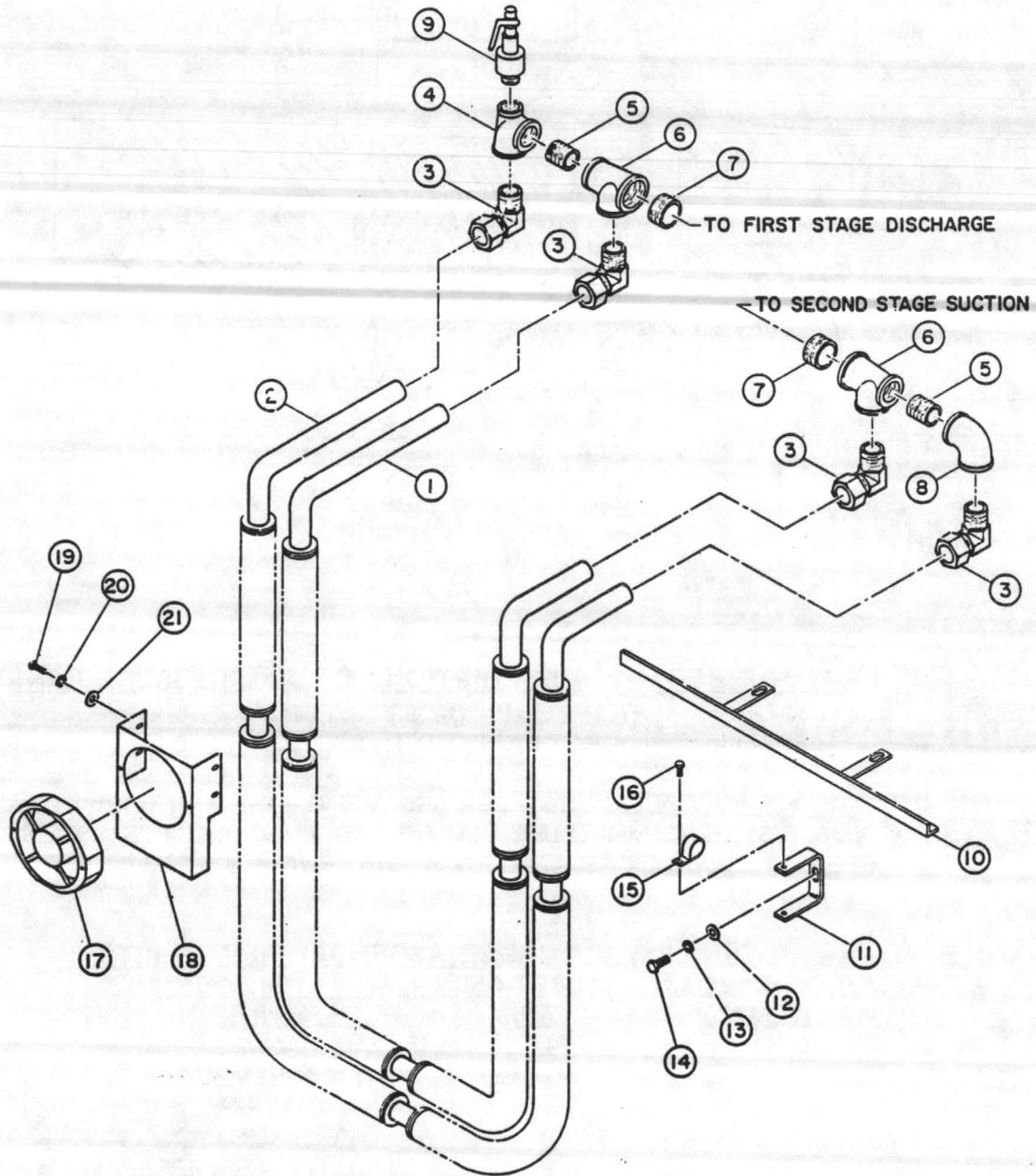
NOTE: NOT ALL HYDRAULIC UNLOADER ASSEMBLIES ARE FOR USE WITH ALL COMPRESSOR SYSTEMS. MAKE SURE THAT THE HYDRAULIC UNLOADER ASSEMBLY YOU ORDER IS WITHIN THE OPERATING P.S.I. LIMITS OF YOUR SYSTEM.

HYDRAULIC UNLOADER ASSEMBLY REPAIR KITS NO.S 110827-050 OR *110827-051

<u>ITEM NO.</u>	<u>QTY.</u>	<u>DESCRIPTION</u>
1	1	DIAPHRAGM
2	1	STEM ASSEMBLY
	2	INCLUDES: "O"RINGS
3	1	FILTER ASSEMBLY
		INCLUDES: FITTING & SCREENS
4	1	SPRING

* NOTE: FOR USE WITH DIESTER OR PHOSPHATE ESTER SYNTHETIC LUBRICANTS

INTERCOOLER GROUP 160183
(AIRCOOLED MODELS)



**INTERCOOLER GROUP 160183
(AIRCOOLED MODELS)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160176	INTERCOOLER
2	1	160177	INTERCOOLER
3	4	110419-022	FITTING-ELBOW,1-1/4 TUBE X 1-1/4 NPT
4	1	20398	TEE-PIPE,1-1/4 NPT X 3/4 NPT X 1-1/4 NPT
5	2	125938-001	NIPPLE-PIPE,1-1/4 NPT X CLOSE
6	2	23716	TEE-PIPE,1-1/2 NPT X 1-1/4 NPT X 1-1/4 NPT
7	2	125939-001	NIPPLE-PIPE,1-1/2 NPT X CLOSE
8	1	4715	ELBOW-PIPE,1-1/4 NPT
9	1	9158-60	VALVE-SAFETY
10	1	160179	BRACKET-INTERCOOLER
11	1	160178	BRACKET-INTERCOOLER
12	1	110428W050	FLATWASHER-1/2
13	1	123115-08C	LOCKWASHER-1/2
14	1	123478-N12	SCREW-HEX.,1/2-13 UNC X 1.00,GRADE 5
15	6	160182	CLAMP-TUBE
16	6	110257	SCREW-HEX.,#8-32 UNC X 5/16,THREAD FORMING
17	1	160180	FAN ASSEMBLY
18	1	160181	SHROUD-FAN
19	4	123478-J10	SCREW-HEX.,1/4-20 UNC X .75,GRADE 5
20	4	123115-04C	LOCKWASHER-1/4
21	4	110428W025	FLATWASHER-1/4

MAINTENANCE PARTS

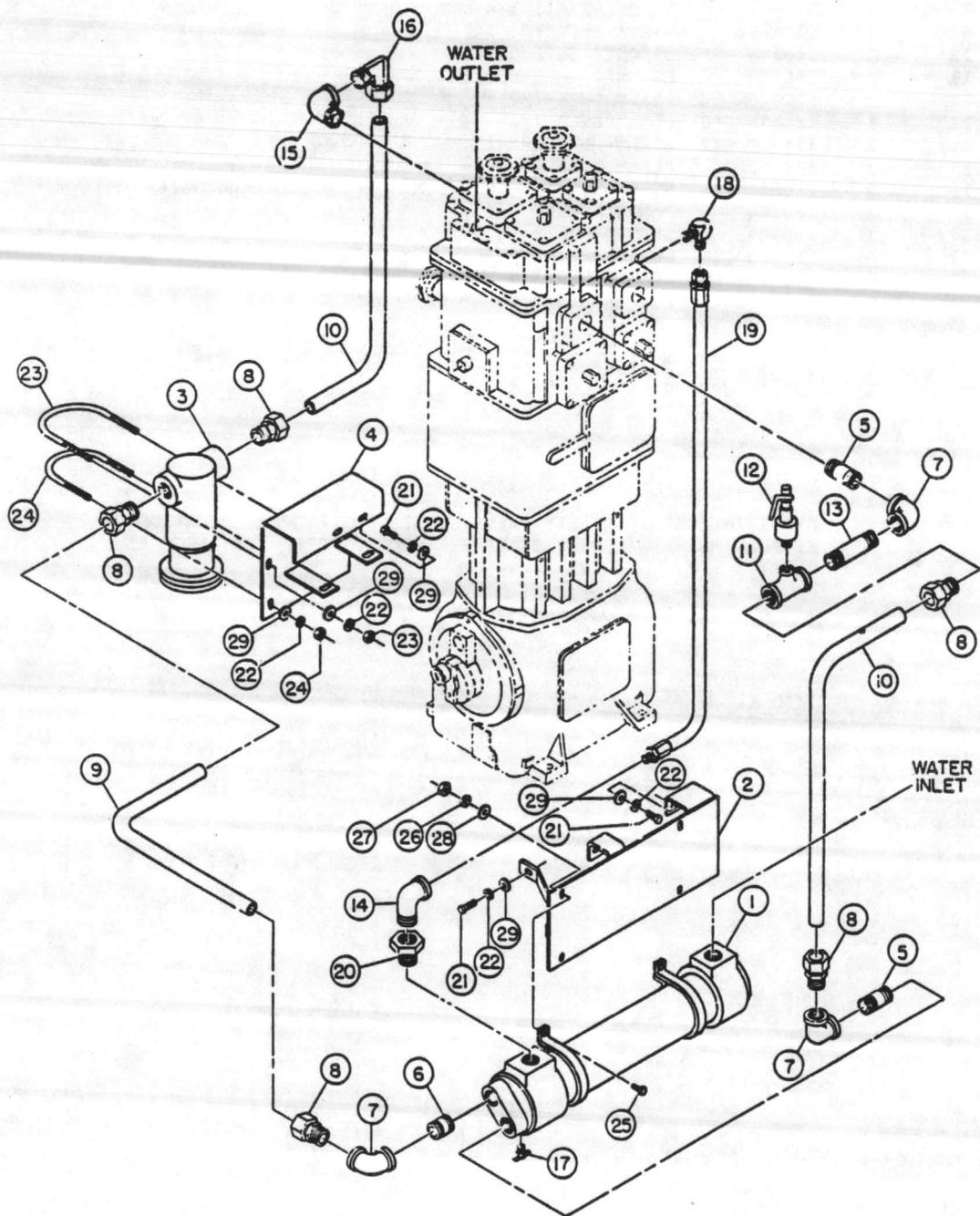
*	1	160180-002	GUARD-FAN
*	1	160180-003	PLUG & CORD SET-FAN,36" LONG

* NOT SHOWN

NOTE:

CHECK INTERSTAGE SAFETY VALVE WEEKLY FOR PROPER OPERATION
BY PULLING MANUAL RELEASE LEVER. PROTECT EYES ETC. FROM AIR
BLAST.

INTERCOOLER GROUP 160108
(WATERCOOLED MODELS)



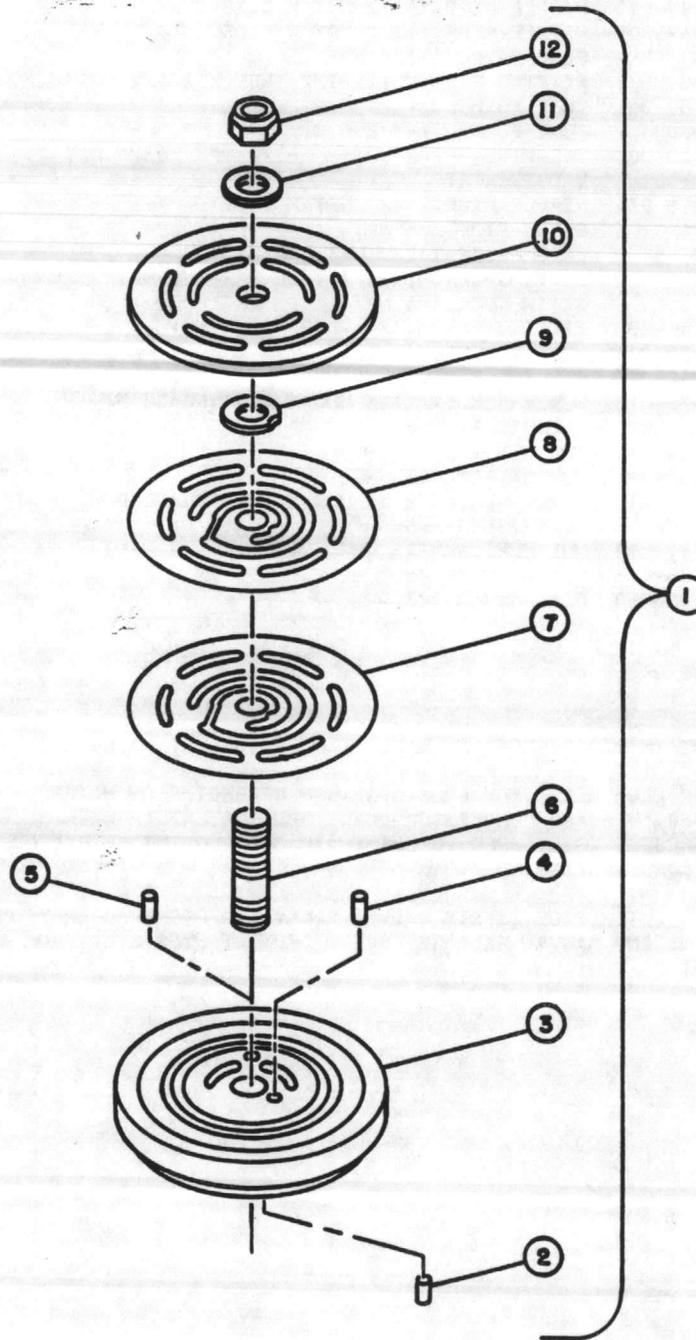
**INTERCOOLER GROUP 160108
(WATERCOOLED MODELS)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160058	INTERCOOLER(INCLUDES MOUNTING CLAMPS)
2	1	160071	BRACKET-INTERCOOLER SUPPORT
3	1	110382A150	SEPARATOR-MOISTURE
4	1	160069	BRACKET-MOISTURE SEPARATOR
5	2	125939-020	NIPPLE-PIPE,1-1/2 NPT X 3.25
6	1	125939-001	NIPPLE-PIPE,1-1/2 NPT X CLOSE
7	3	4718	ELBOW-PIPE,1-1/2 NPT
8	5	23240	FITTING-STRAIGHT,1-1/2 TUBE X 1-1/2 NPT
9	1	160080-001	TUBE-FORMED,1-1/2 O.D.
10	2	160080	TUBE-FORMED,1-1/2 O.D.
11	1	124420-003	TEE-PIPE,1-1/2 NPT X 1-1/2 NPT X 3/4 NPT
12	1	9158-60	VALVE-SAFETY
13	1	125939-034	NIPPLE-PIPE,1-1/2 NPT X 5.00
14	1	21794	ELBOW-PIPE,3/4 NPT
15	1	4512	ELBOW-PIPE,1-1/2 NPT,STREET
16	1	110419-023	FITTING-ELBOW,1-1/2 TUBE X 1-1/2 NPT
17	1	2713	DRAIN-COCK,1/4 NPT
18	1	123167-18	FITTING-ELBOW,3/4 TUBE X 3/4 NPT
19	1	123329-046	HOSE ASSEMBLY
20	1	125868-023	BUSHING-PIPE,1-1/2 NPT X 3/4 NPT
21	5	123478-N12	SCREW-HEX.,1/2-13 UNC X 1.00,GRADE 5
22	9	123115-08C	LOCKWASHER-1/2
23	1	122560-03	"U"BOLT-1/2-13 UNC
24	1	23256	"U"BOLT-1/2-13 UNC
25	4	123478-L14	SCREW-HEX.,3/8-16 UNC X 1.25,GRADE 5
26	4	123115-06C	LOCKWASHER-3/8
27	4	124364-L02	NUT-HEX.,3/8-16 UNC
28	4	110428W038	FLATWASHER-3/8
29	9	110428W050	FLATWASHER-1/2

NOTE:

1. MAINTAIN 110 DEGREES F. WATER TEMPERATURE AT WATER OUTLET.
2. WATER FLOW WILL VARY FROM 1-12 GPM DEPENDING ON WATER TEMPERATURE AND COMPRESSOR LOAD. SHUT WATER OFF WHEN COMPRESSOR IS STOPPED TO ELIMINATE SUB COOLING OF CYLINDERS AND CONDENSATION.
3. CHECK INTERSTAGE SAFETY VALVE WEEKLY FOR PROPER OPERATION BY PULLING MANUAL RELEASE LEVER. PROTECT EYES ETC. FROM AIR BLAST.

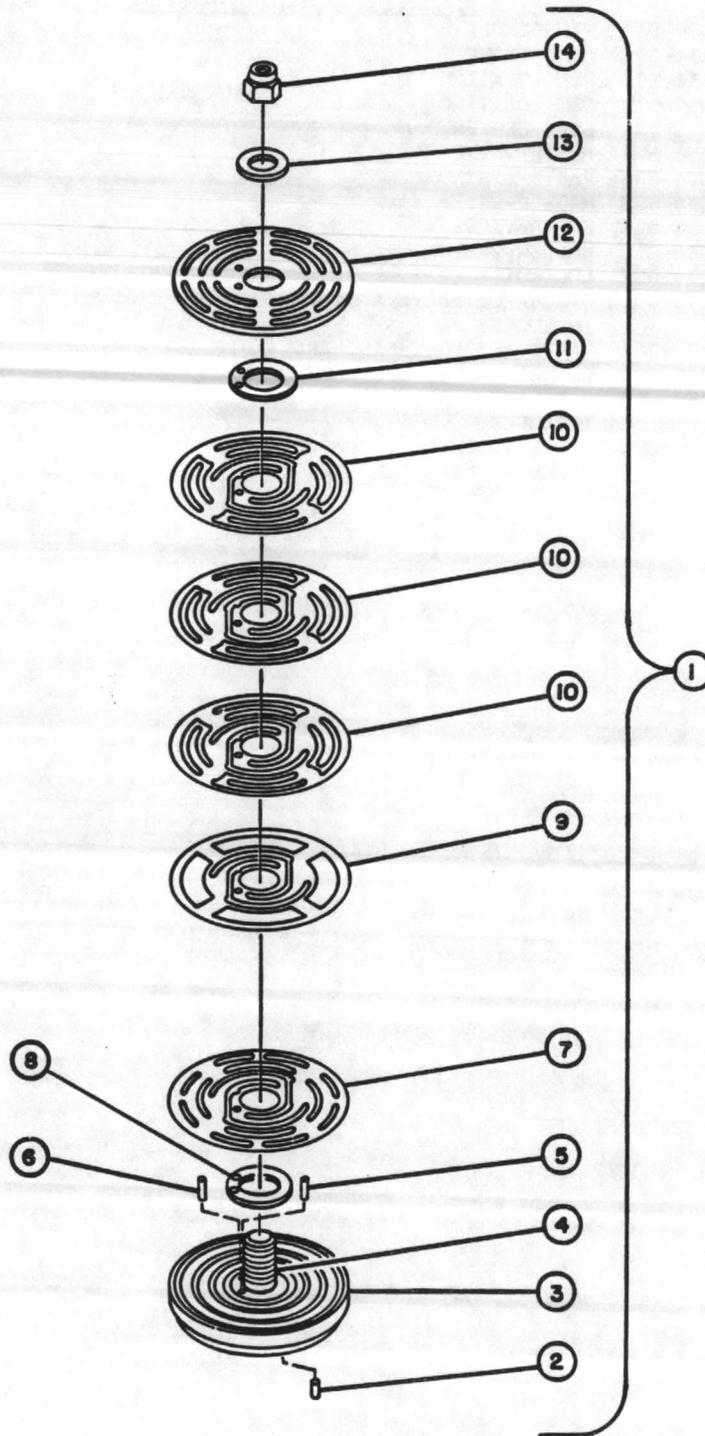
DISCHARGE VALVE ASSEMBLY 160134-D01
(HIGH PRESSURE)



**DISCHARGE VALVE ASSEMBLY 160134-D01
(HIGH PRESSURE)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160134-D01	VALVE ASSEMBLY-DISCHARGE, H.P. (* NOT SOLD SEPARATELY;ORDER FROM MAINTENANCE PARTS LISTED BELOW)
<u>MAINTENANCE PARTS</u>			
2	1	160034-D12	PIN-DOWELL
3	1	160134-D02	SEAT-VALVE
4	1	160034-S09	PIN-LOCATING
5	1	160034-S10	PIN-LOCATING
6	1	160034-D06	BOLT-CENTER
7	1	160034-S04	PLATE-VALVE
8	1	160034-D05	PLATE-SPRING
9	1	160034-S08	WASHER-LIFT
10	1	160134-D03	GUARD-VALVE
11	1	160034-S11	WASHER-VALVE
12	1	160034-S07	LOCKNUT
*		160134-GD1	DISCHARGE VALVE ASSEMBLY INCLUDES:
	1	160134-D01	VALVE ASSEMBLY-DISCHARGE, H.P.
	1	160035-002	GASKET-VALVE,COPPER
*	1	160134-GD2	DISCHARGE VALVE ASSEMBLY INCLUDES:
	1	160134-D01	VALVE ASSEMBLY-DISCHARGE, H.P.
	1	160092-002	GASKET-VALVE,ALUMINUM

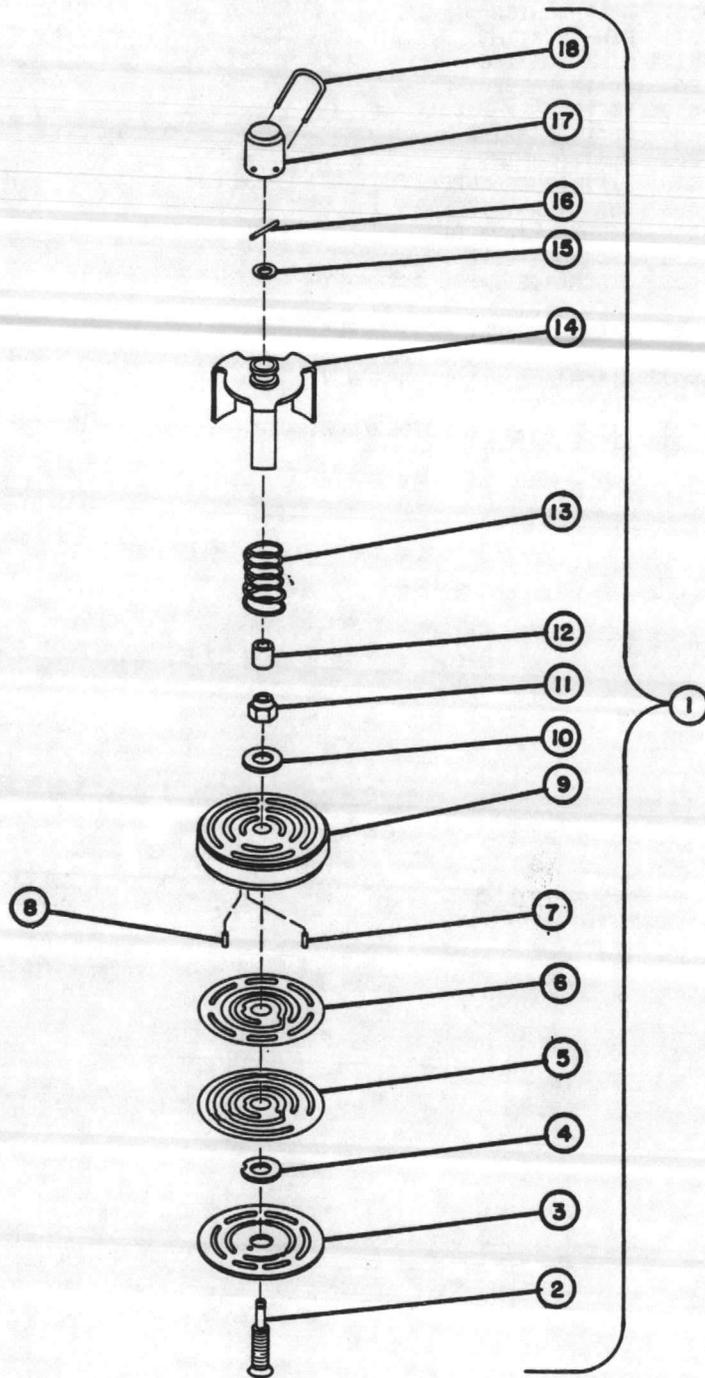
DISCHARGE VALVE ASSEMBLY 160133-D01
(LOW PRESSURE)



**DISCHARGE VALVE ASSEMBLY 160133-D01
(LOW PRESSURE)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160133-D01	VALVE ASSEMBLY-DISCHARGE, L.P.(* NOT SOLD SEPARATELY;ORDER FROM MAINTENANCE PARTS LISTED BELOW)
<u>MAINTENANCE PARTS</u>			
2	1	160033-D13	LOCK-BOLT
3	1	160133-D02	SEAT-VALVE
4	1	160033-D07	BOLT-CENTER
5	1	160033-S11	PIN-LOCATING
6	1	160033-S12	PIN-LOCATING
7	1	160033-S04	PLATE-VALVE
8	1	160033-S09	LIFTWASHER-MIDDLE
9	1	160033-S06	PLATE-DAMPING
10	3	160033-S05	PLATE-SPRING
11	1	160033-S10	LIFTWASHER-UPPER
12	1	160133-D03	GUARD-VALVE
13	1	160033-D14	WASHER-VALVE
14	1	160033-S08	LOCKNUT-VALVE
*		160133-GD1	DISCHARGE VALVE ASSEMBLY INCLUDES:
	1	160133-D01	VALVE ASSEMBLY-DISCHARGE, L.P.
	1	160035-001	GASKET-VALVE,COPPER
*	1	160133-GD2	DISCHARGE VALVE ASSEMBLY INCLUDES:
	1	160133-D01	VALVE ASSEMBLY-DISCHARGE, L.P.
	1	160092-001	GASKET-VALVE,ALUMINUM

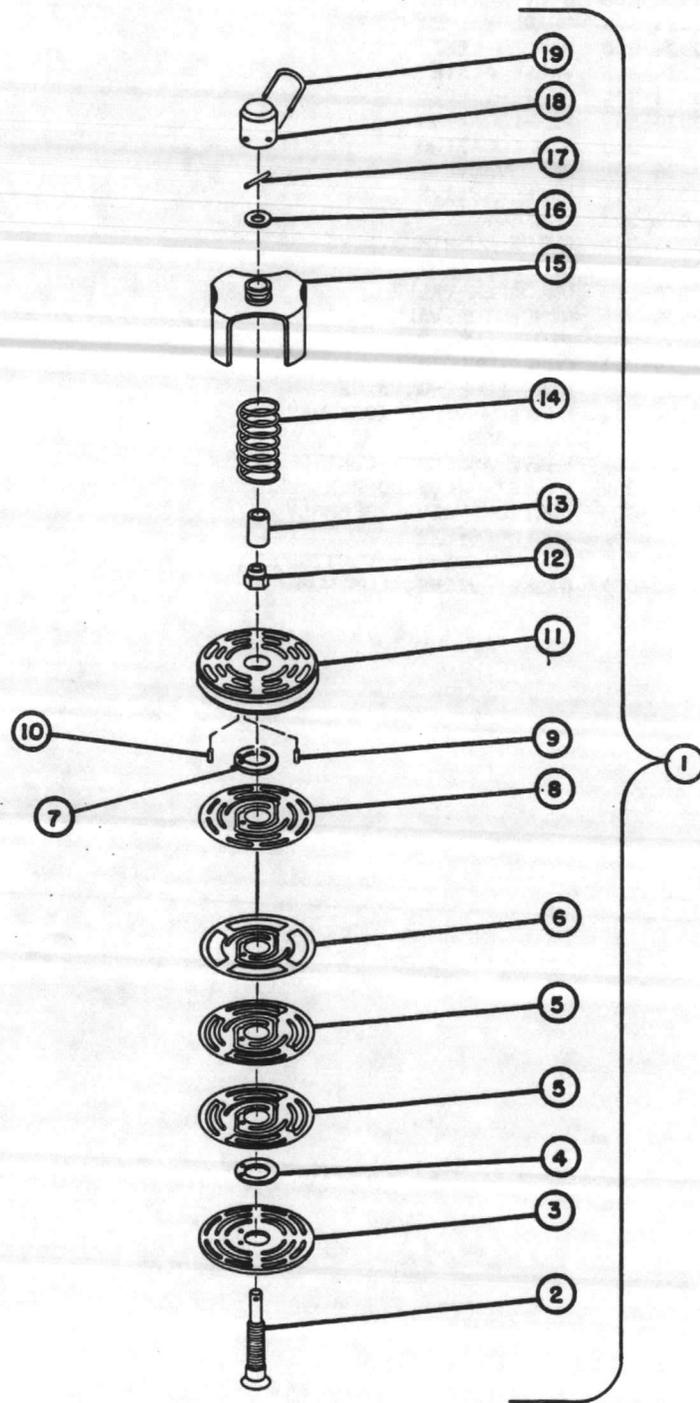
SUCTION VALVE ASSEMBLY 160134-SU1
(HIGH PRESSURE)



**SUCTION VALVE ASSEMBLY 160134-SU1
(HIGH PRESSURE)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160134-SU1	VALVE ASSEMBLY-SUCTION, H.P.(* NOT SOLD SEPARATELY,ORDER FROM MAINTENANCE PARTS LISTED BELOW)
MAINTENANCE PARTS			
2	1	160034-S06	BOLT-CENTER
3	1	160134-S03	GUARD-VALVE
4	1	160034-S08	WASHER-LIFT
5	1	160034-S05	VALVE PLATE
6	1	160034-S04	PLATE-VALVE
7	1	160034-S09	PIN-LOCATING
8	1	160034-S10	PIN-LOCATING
9	1	160134-S02	SEAT-VALVE
10	1	160034-S11	WASHER-VALVE
11	1	160034-S07	LOCKNUT
12	1	160034-U08	GUIDE-BUSHING,VALVE
13	1	160034-U04	SPRING-VALVE
14	1	160034-U10	UNLOADER-VALVE
15	1	160034-U06	RING-STOP,VALVE
16	1	160033-U05	PIN-VALVE
17	1	160034-U02	COVER-UNLOADER,VALVE
18	1	160033-U09	WIRE-LOCKING,VALVE
*		160134-GS1	SUCTION VALVE ASSEMBLY INCLUDES:
	1	160134-SU1	VALVE ASSEMBLY-SUCTION,H.P.
	1	160035-002	GASKET-VALVE,COPPER
*	1	160134-GS3	SUCTION VALVE ASSEMBLY INCLUDES:
	1	160134-SU1	VALVE ASSEMBLY-SUCTION,H.P.
	1	160092-002	GASKET-VALVE,ALUMINUM

SUCTION VALVE ASSEMBLY 160133-SU1
(LOW PRESSURE)



**SUCTION VALVE ASSEMBLY 160133-SU1
(LOW PRESSURE)**

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
1	1	160133-SU1	VALVE ASSEMBLY-SUCTION, L.P. (* NOT SOLD SEPARATELY;ORDER FROM MAINTENANCE PARTS LISTED BELOW)
<u>MAINTENANCE PARTS</u>			
2	1	160033-S07	BOLT-CENTER, VALVE
3	1	160133-S03	GUARD-VALVE
4	1	160033-S10	LIFTWASHER-UPPER
5	2	160033-S05	PLATE-SPRING
6	1	160033-S06	PLATE-DAMPING
7	1	160033-S09	LIFTWASHER-MIDDLE
8	1	160033-S04	PLATE-VALVE
9	1	160033-S11	PIN-LOCATING
10	1	160033-S12	PIN-LOCATING
11	1	160133-S02	SEAT-VALVE
12	1	160033-S08	LOCKNUT-VALVE
13	1	160033-U08	GUIDE-BUSHING, VALVE
14	1	160033-U04	SPRING-VALVE
15	1	160033-U10	UNLOADER-VALVE
16	1	160033-U06	RING-STOP, VALVE
17	1	160033-U05	PIN-VALVE
18	1	160033-U02	COVER-UNLOADER, VALVE
19	1	160033-U09	WIRE-LOCKING, VALVE
*		160133-GS1	SUCTION VALVE ASSEMBLY INCLUDES:
	1	160133-SU1	VALVE ASSEMBLY-SUCTION, L.P.
	1	160035-001	GASKET-VALVE, COPPER
*	1	160133-GS3	SUCTION VALVE ASSEMBLY INCLUDES:
	1	160133-SU1	VALVE ASSEMBLY-SUCTION, L.P.
	1	160092-001	GASKET-VALVE, ALUMINUM

GASKET SETS & "O"RING KITS

INDEX NUMBER	PART QTY NUMBER	PART QTY NUMBER	DESCRIPTION	
	AIRCOOLED	WATERCOOLED		
	160189	160131	GASKET SET - COMPLETE COMPRESSOR OVERHAUL	
4	1315	4	1315	GASKET - HAND HOLE PLATE
4	1556	4	1556	GASKET - UNLOADER ASSEMBLY
1	160074	1	160019	GASKET - HEAD TO CYLINDER
1	160020	1	160020	GASKET - DISTANCE PIECE
4	160031	4	160031	GASKET - CROSSHEAD TO PIN
4	160035-001	4	160035-001	GASKET - VALVE, L.P.
4	160035-002	4	160035-002	GASKET - VALVE, H.P.
4	160040	4	160040	GASKET - PLATE, VALVE COVER
4	160041	4	160041	GASKET - PLATE, VALVE COVER
2	160054	2	160054	GASKET - HANDHOLE PLATE
	N/A	2	160056	GASKET - PLATE, WATER INLET
1	2344	1	2344	GASKET - CYLINDER TO CRANKCASE
1	5494	1	5494	GASKET - BEARING CARRIER
5	160076	3	5828	GASKET - COMPANION FLANGE
1	6679	1	6679	GASKET - OIL INLET BRACKET
	N/A	1	9073	GASKET - COMPANION FLANGE
3	1498	3	1498	SHIM - BEARING ADJUSTMENT, .005
3	1498A	3	1498A	SHIM - BEARING ADJUSTMENT, .020
1	1498B	1	1498B	SHIM - BEARING ADJUSTMENT, .007
2	1498C	2	1498C	SHIM - BEARING ADJUSTMENT, .002
	160190	160143-001	"O"RING KIT - PETROLEUM LUBRICATED	
2	123157-210	2	123157-210	"O"RING - 1/8 WIDE X 1.00 O.D.
1	123157-152	1	123157-152	"O"RING - 3/32 WIDE X 3.44 O.D.
1	123157-112	1	123157-112	"O"RING - 3/32 WIDE X .69 O.D.
1	123157-011	1	123157-011	"O"RING - 1/16 WIDE X .44 O.D.
4	123157-010	4	123157-010	"O"RING - 1/16 WIDE X .38 O.D.
1	22749-341	1	22749-341	"O"RING - 3/16 WIDE X 3.88 O.D.
1	22749-361	1	22749-361	"O"RING - 3/16 WIDE X 6.38 O.D.
1	110832-051	1	110832-051	"O"RING REPAIR KIT FOR PILOT ASSEMBLY
1	110827-050	1	110827-050	REPAIR KIT FOR HYDRAULIC UNLOADER
3	160663-124	N/A		"O"RING - 3/32 WIDE X 1.44 O.D.
3	160663-125	N/A		"O"RING - 3/32 WIDE X 1.50 O.D.
	160191	160144-001	"O"RING KIT - SYNTHETIC LUBRICATED	
2	22749-210	2	22749-210	"O"RING - 1/8 WIDE X 1.00 O.D.
1	22749-152	1	22749-152	"O"RING - 3/32 WIDE X 3.44 O.D.
1	22749-112	1	22749-112	"O"RING - 3/32 WIDE X .69 O.D.
1	22749-011	1	22749-011	"O"RING - 1/16 WIDE X .44 O.D.
4	22749-010	4	22749-010	"O"RING - 1/16 WIDE X .38 O.D.
1	22749-341	1	22749-341	"O"RING - 3/16 WIDE X 3.88 O.D.
1	22749-361	1	22749-361	"O"RING - 3/16 WIDE X 6.38 O.D.
1	110832-051	1	110832-051	"O"RING REPAIR KIT FOR PILOT ASSEMBLY
1	110827-051	1	110827-051	REPAIR KIT FOR HYDRAULIC UNLOADER
3	160663-124	N/A		"O"RING - 3/32 WIDE X 1.44 O.D.
3	160663-125	N/A		"O"RING - 3/32 WIDE X 1.50 O.D.

N/A: NOT APPLICABLE

RECOMMENDED SPARE PARTS

INDEX NUMBER	QTY	PART NUMBER	DESCRIPTION
	1	110822	GAUGE-PRESSURE
	2	160030	SET-RING WIPER (MUST BE PURCHASED AS COMPLETE SET)
	1	160133-D01	VALVE ASSEMBLY-DISCHARGE, L.P.
	1	160133-SU1	VALVE ASSEMBLY-SUCTION,L.P.
	1	160134-D01	VALVE ASSEMBLY-DISCHARGE, H.P.
	1	160134-SU1	VALVE ASSEMBLY-SUCTION,H.P.
	2	160081-001	SET-RING PACKING (MUST BE PURCHASED AS A COMPLETE SET)
	1	160189	GASKET SET-AIRCOOLED MODELS
	1	160131	GASKET SET-WATERCOOLED MODELS
	1	160135	RING SET-LOW PRESSURE
	1	160136	RING SET-HIGH PRESSURE
	4	1855	DIAPHRAGM-UNLOADER
	1	110832-051	PILOT REPAIR KIT
	1	160079	REPAIR KIT-OIL PUMP
	OR		
*	1	160079-001	REPAIR KIT-OIL PUMP
	1	8966-001	SEAL-ADJUSTMENT PLATE
	1	160190	"O"RING KIT-AIRCOOLED COMPRESSOR OVERHAUL
	OR		
*	1	160191	"O"RING KIT-AIRCOOLED COMPRESSOR OVERHAUL
	1	160143-001	"O"RING KIT-WATERCOOLED COMPRESSOR OVERHAUL
	OR		
*	1	160144-001	"O"RING KIT-WATERCOOLED COMPRESSOR OVERHAUL

* FOR SYNTHETIC LUBRICATED MODELS

NATIONWIDE SALES/SERVICE

Quincy Service is always near. There are Authorized Quincy Distributors located throughout the United States and Canada. They stock genuine Quincy replacement parts and accessories for a wide range of Quincy products. Service specialists are factory trained and experienced. Quincy service will help keep you in business. Call for Authorized Quincy Service.

Quincy
Compressor Division

Colt Industries



TAB PLACEMENT HERE

DESCRIPTION:

8.

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5214 15501-2.2.1p, 6.3.9

HEAT TRANSFER SALES, INC.901-G NORWALK ST.
GREENSBORO, N.C. 27407
PHONE 919-294-3838

03-02-03

CONTRACTOR:SNEEDEN
BOX 3548
WILMINGTON, NC 28406

SUBMITTAL NO. S1360-3256

DATE: SEPTEMBER 15, 1987

JOB: MEDICAL/DENTAL CLINIC
CAMP LEJEUNE, NC
05-85-5214-15501-21ENGINEER: SIX ASSOCIATES
ASHEVILLE, NC

THIS ORDER IS BEING HELD FOR APPROVAL AND WILL NOT BE RELEASED UNTIL APPROVED.

H.W. AIR CONTROL SYSTEM

- 6.3.9. 1-TACO CAX-84 ASME DIAPHRAGM TANK
1-TACO 418 VENT
- 6.3.10 1-AC-2.5F 2 1/2" ASME AIR SEPARATOR WITH STRAINER
1- 335 3/4" BRONZE PRV

05-85 5214 15501-113.7.1 INLINE PUMPS P-1&P-2

- 2-TACO 1615C 2" SLEEVE BEARING OIL LUBRICATED INLINE PUMPS.
39 GPM @ 34 FT.HD. 6.1" DIAMETER IMPELLER 1 HP 1750 RPM
208/3/60

05-85-5214 15501-113.7.2. DUPLEX CONDENSATE PUMP UNITSP-3

- 1-WEINMAN D45C-4ACV7 DUPLEX CONDENSATE PUMP. 45 GALLON C.I.
RECEIVER. 15 GPM @ 25 PSI DISCHARGE. 3/4 HP 3500 RPM
208/3/60 WITH MECHANICAL ALTERNATOR.

05-85-5214 15501-103.6 HOT WATER CONVERTORC-1

- 1-TACO G6206-S 150 PSI ASME HEAT EXCHANGER. 39 GPM 160' TO
180' WITH 10 PSI STEAM. 390 LBS/HR .83 FT.PD. 2.87 FPS
TUBE VELOCITY. .0005 FOULING FACTOR

05-85-5214 15400-122.5 DOMESTIC WATER HEATERS2.5.1 SEMI INSTANTANEOUS TYPE PACKAGES

- 2-TACO PACKAGE HEATERS

(15) SETS OF SUBMITTAL DATA FOR YOUR APPROVAL.

SUBMITTAL NO: S1360-3256

PAGE 1



5214

15460 - 1.4.1c

15400 - 2.5.1

03-02-03

SUBMITTAL NO. S1360-3256P

DATE: SEPTEMBER 15, 1987

CONTRACTOR:

JOB: MEDICAL/DENTAL CLINIC
CAMP LEJEUNE, NC
05-85-5214-15501-21

SNEEDEN
BOX 3548
WILMINGTON, NC 28406

ENGINEER: SIX ASSOCIATES
ASHEVILLE, NC

THIS ORDER IS BEING HELD FOR APPROVAL AND WILL NOT BE RELEASED UNTIL APPROVED.

05-85-5214 15400-12
2.5 DOMESTIC WATER HEATERS
2.5.1 SEMI INSTANTANEOUS TYPE PACKAGES
2-TACO PACKAGE HEATERS
INCLUDING:

-G8408-S HEAT EXCHANGER 40 GPM 40'-120' 5 PSI STEAM
.001 FF BRONZE HEAD, BRONZE TUBE SHEET

-120 GALLON GLASSLINED STORAGE TANK 150 PSI W.P. ASME
INSULATED WITH METAL JACKET

-TACO 1600B 1 1/2" ALL BRONZE INLINE PUMP 1/4 HP 1750 RPM
115/1/60.

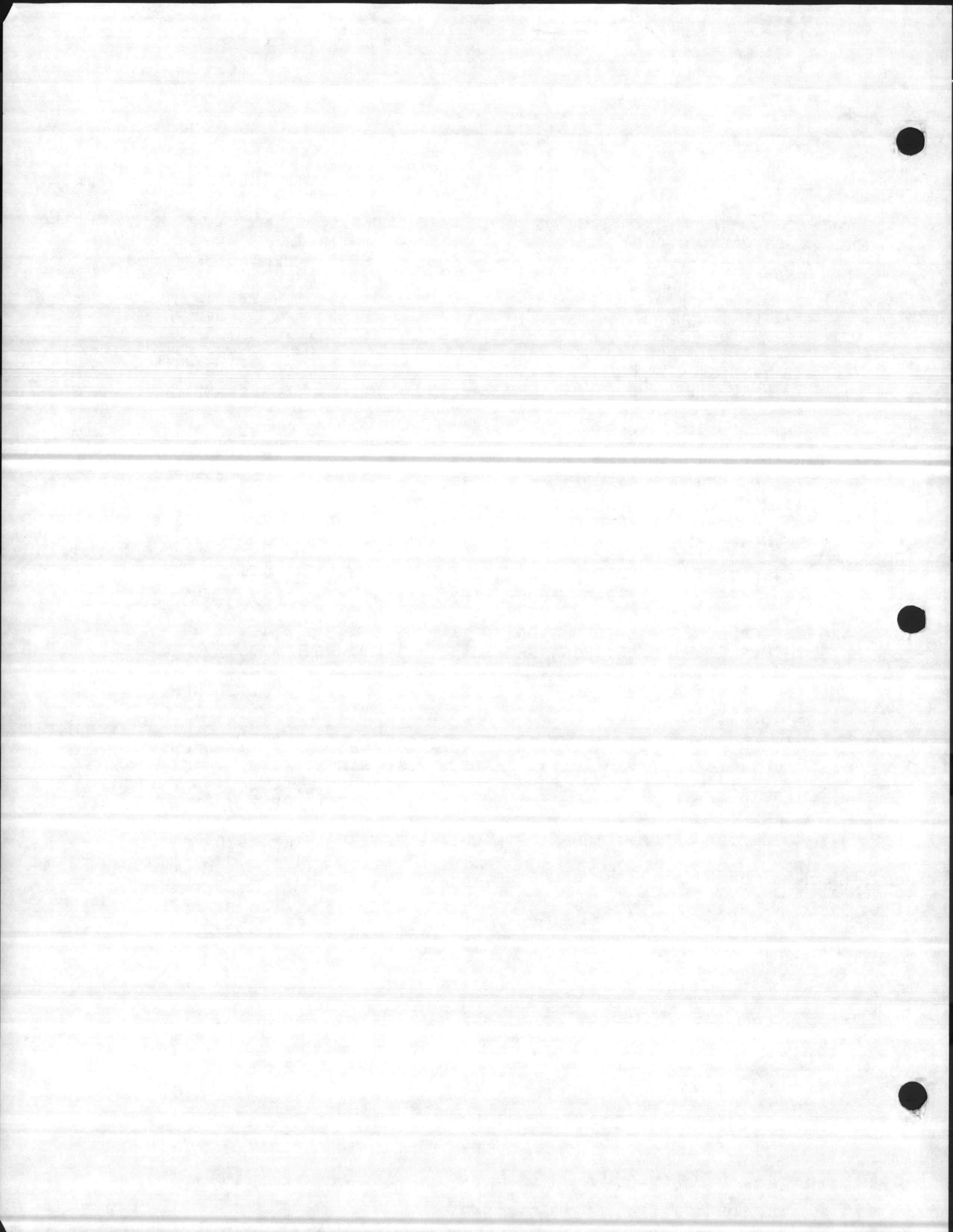
-WATSON MCDANIEL SERIES 175 TEMPERATURE REGULATOR. 1600 LBS/HR
5 PSI STEAM 100'F TO 140'F ADJUSTABLE RANGE. WITH BYPASS

-WATSON MCDANIEL FT-7 1 1/2" 15 PSI F & T TRAP

-ANGLE IRON FRAME, COPPER PIPING ALL TESTED AFTER FABRICATION.

-1" TEMPERATURE & PRESSURE RELIEF VALVE.

(15) SETS OF SUBMITTAL DATA FOR YOUR APPROVAL.



CA & CAX Expansion Tanks

Plant I.D. No. 001-398

1. Note location on the tank of the system connection, charging valve enclosure, and the drain plug. Note labels on the tank or refer to Diagram #1 - Location of Tank Fittings.
2. Carefully start to unscrew the shipping pipe-plug in the system connection coupling located at the center of the cover flange. Pause before completely removing to allow any trapped air to escape without "popping" the plug. There should not be much, if any, air pressure under this plug.
3. Remove the 1½" pipe plug covering the charging valve enclosure.

CAUTION: DO NOT REMOVE THE PIPE PLUGS LOCATED ON THE SIDE AND BOTTOM OF THE TANK (TANK DRAINS). THESE PLUGS SHOULD NEVER BE REMOVED UNLESS NECESSARY AND THEN ONLY AFTER THE AIR PRESSURE IN THE TANK HAS BEEN BLEDED OFF TO ZERO GAUGE PRESSURE. BEFORE BLEEDING OFF ANY OF THE AIR CHARGE ALWAYS ISOLATE THE TANK FROM THE SYSTEM WITH A SHUT-OFF VALVE.

CA Tanks

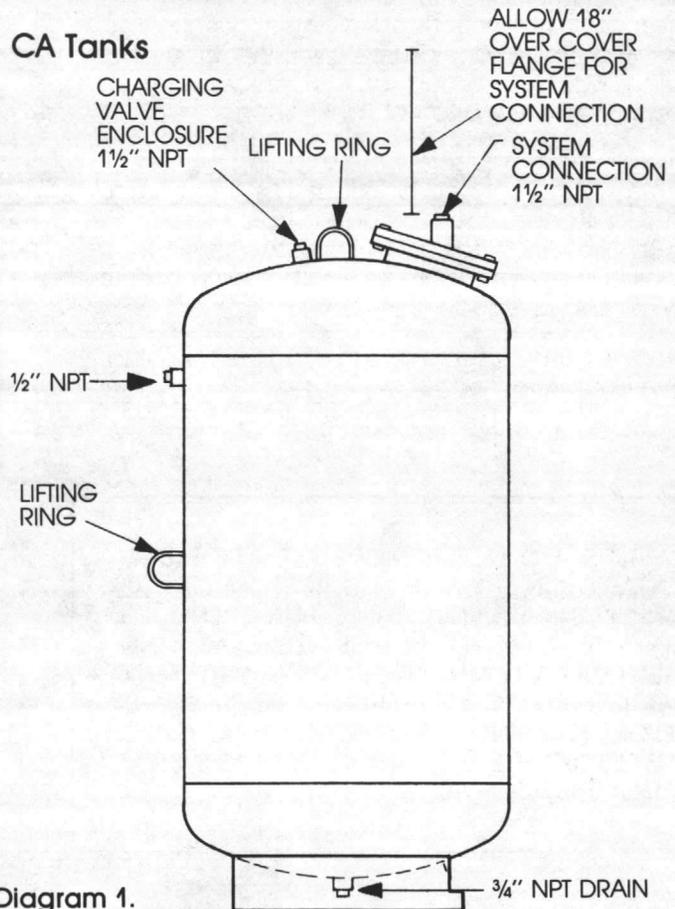


Diagram 1.

4. Before making any connections to the tank, check the tank air charge. Use an accurate automotive or similar type gauge on the air valve located under the pipe plug in step #3. The air charge pressure must be equal to the pre-charge pressure specified for the system. Refer to the label on the tank for the specified tank pre-charge pressure. In most cases the specified tank pre-charge pressure is equal to the system fill pressure at the tank location. Use Diagram #3 Air Charge Check Chart to correct the value read on the pressure gauge for the ambient temperature at the tank location.
5. After making sure that the air charge pressure is correct, replace the pipe plug over the charging valve for protection.
6. The pipe connection to the system may now be made. The piping requirements for captive air tanks are different from those of plain steel expansion tanks, note the Captive Air Tank Piping Diagrams. Piping and air elimination devices should be arranged so that air will not be trapped in the tank, above the tank, or in the nozzle. Pitch the piping connection up away from the tank and use automatic air vents where necessary, note the piping diagram.
7. Locate the CA tank connection as close as possible to the suction side of the pump. This ensures that the pressures realized from the pump head will be additive in the system. A combination shut-off and drain valve should be located in the connection piping to provide for tank isolation during the initial hydrostatic test.

Quality Through Design — COMPARE.

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

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CAX TANKS

1. Note location of the tank of the system connection, charging valve enclosure, coupling and the drain plug. Note labels on the tank or refer to Diagram #2 – Location of Tank Fittings.
2. Carefully start to unscrew the shipping pipe-cap on the system connection located in the center of the tank head. Pause before completely removing to allow any trapped air to escape without "popping" the cap. There should not be much, if any, air pressure under this cap.
3. Remove the 1/2" pipe plug covering the charging valve enclosure.

CAUTION: DO NOT REMOVE THE PIPE PLUGS LOCATED ON THE SIDE AND BOTTOM ON THE TANK (TANK DRAINS). THESE PLUGS SHOULD NEVER BE REMOVED UNLESS NECESSARY AND THEN ONLY AFTER THE AIR PRESSURE IN THE TANK HAS BEEN BLED OFF TO ZERO GAUGE PRESSURE. BEFORE BLEEDING OFF ANY OF THE AIR CHARGE ALWAYS ISOLATE THE TANK FROM THE SYSTEM WITH A SHUT-OFF VALVE.

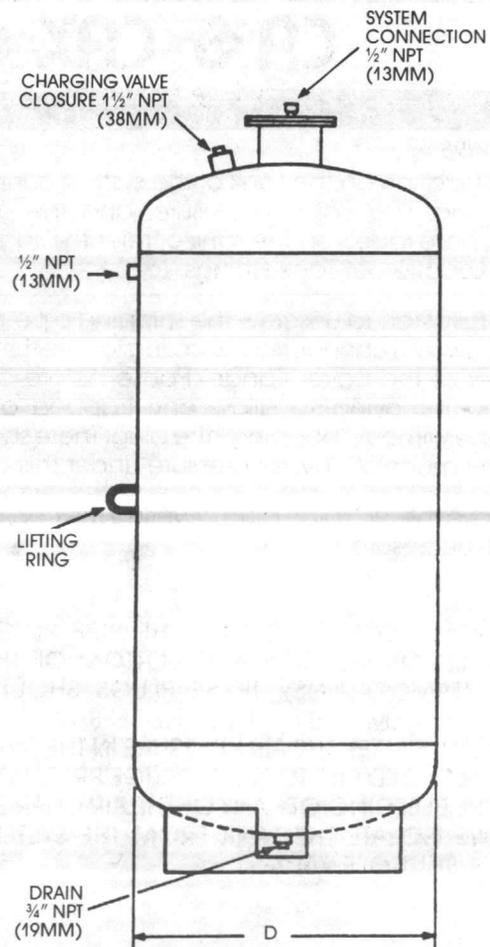


Diagram 2.

4. Before making any connections to the tank, check the tank air charge. Use an accurate automotive or similar type gauge on the air valve located under the pipe plug in step #3. The air charge pressure must be equal to the pre-charge pressure specified for the system. Refer to the label on the tank for the specified pre-charge pressure. In most cases the specified tank pre-charge pressure is equal to the system fill pressure at the tank location. Use diagram #2 Air Charge Check Chart to correct, value read on the pressure gauge for the ambient temperature at the tank location.
5. After making sure that the air charge pressure is correct, replace the pipe plug over the charging valve for protection.
6. The pipe connection to the system may now be made. The piping requirements for captive air tanks are different from those of plain steel expansion tanks, note the Captive Air Tank Piping Diagrams. Piping and air elimination devices should be arranged so that air will not be trapped in the tank, above the tank, or in the nozzle. Pitch the piping connection up away from the tank and use automatic air vents where necessary, note the piping diagram.
7. Locate the CA tank connection as close as practicable to the suction side of the pump. This ensures that the pressures realized from the pump head will be additive in the system. A combination shut-off and drain valve should be located in the connection piping to provide for tank isolation during the initial hydrostatic test.

AIR CHARGE CHECK CHART

AMBIENT TEMPERATURE, °F									
Specified Pre Charge Pressure, P.S.I. (at 68°F)	36	44	52	60	68	76	84	92	100
12	10.4	10.8	11.2	11.6	12.0	12.4	12.8	13.2	13.6
20	17.9	18.4	18.9	19.5	20.0	20.5	21.1	21.6	22.1
30	27.3	28.0	28.6	29.3	30.0	30.7	31.4	32.0	32.7
40	36.7	37.5	38.2	39.2	40.0	40.8	41.6	42.5	43.3
50	46.1	47.1	48.0	49.0	50.0	51.0	52.0	52.9	53.9
60	55.5	56.6	57.7	58.9	60.0	61.1	62.3	63.4	64.5
70	64.9	66.1	67.4	68.7	70.0	71.3	72.6	73.9	75.1

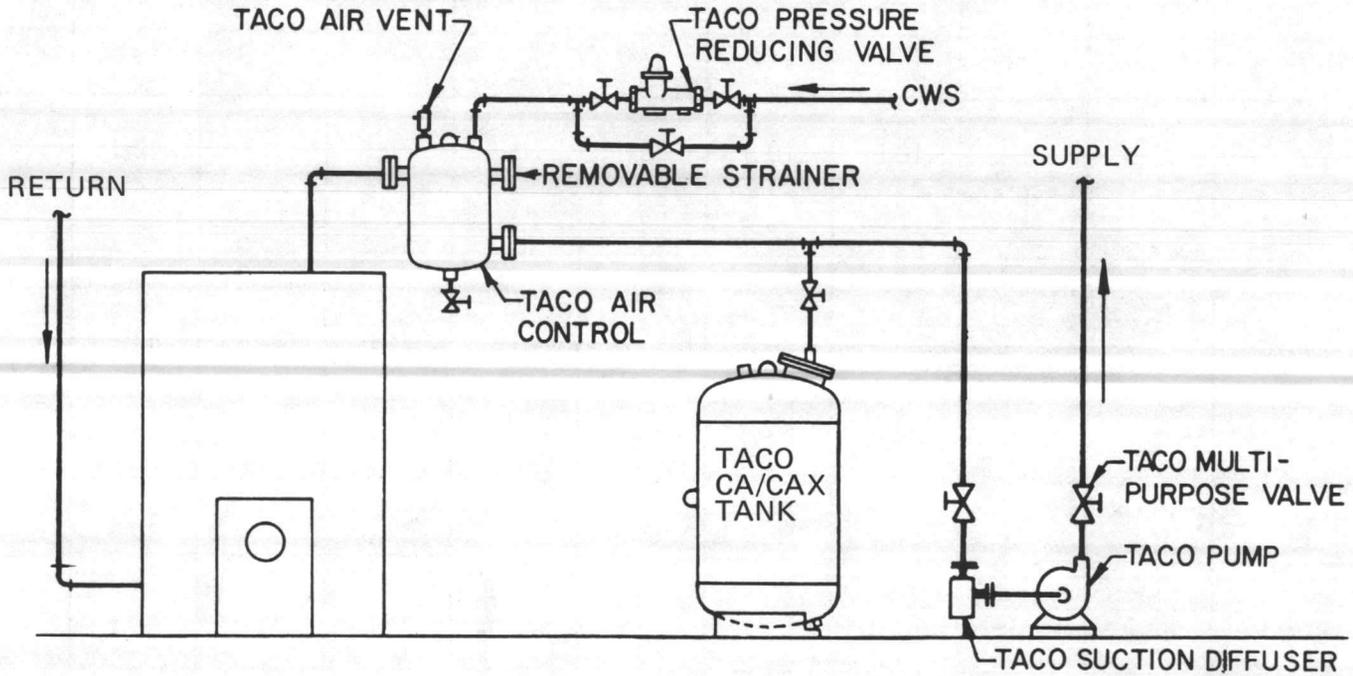
Diagram 3

HOW TO USE THE CHART

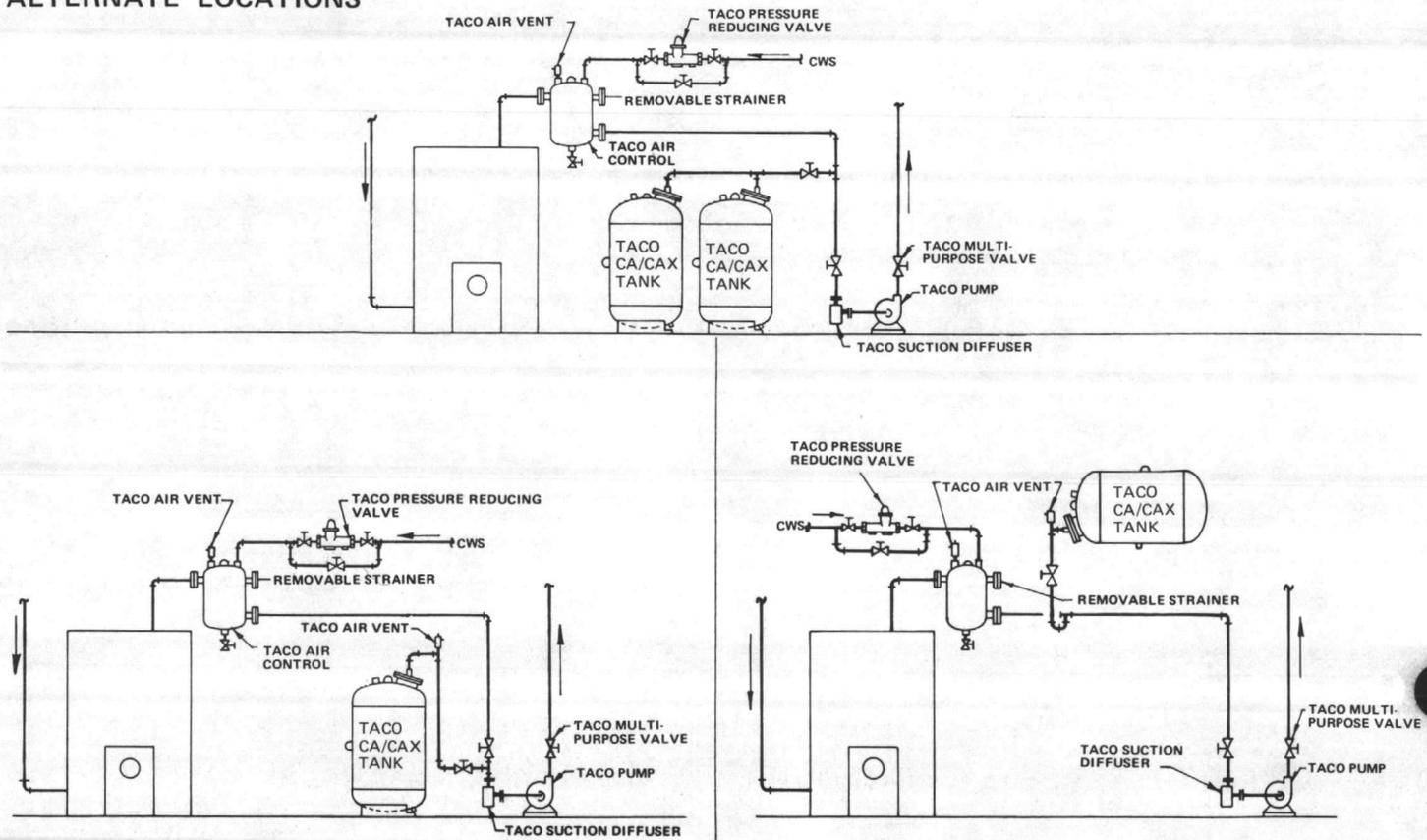
1. Determine ambient air temperature where the tank is being checked.
2. Locate the specified pre-charge pressure in the left hand column.
3. Follow across horizontally to the number under the ambient air temperature.
4. The number found under Step 3 is the temperature corrected air charge pressure in p.s.i. and should agree with the gauge reading observed at the tank.
5. If the temperature corrected air charge pressure differs by more than 1 p.s.i. from the pre-charge pressure specified for the system then correct it by bleeding pressure through the air charge valve, or by adding pressure with an air compressor.

CAPTIVE AIR TANK PIPING DIAGRAMS

RECOMMENDED LOCATION



ALTERNATE LOCATIONS



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

AIR CONTROL

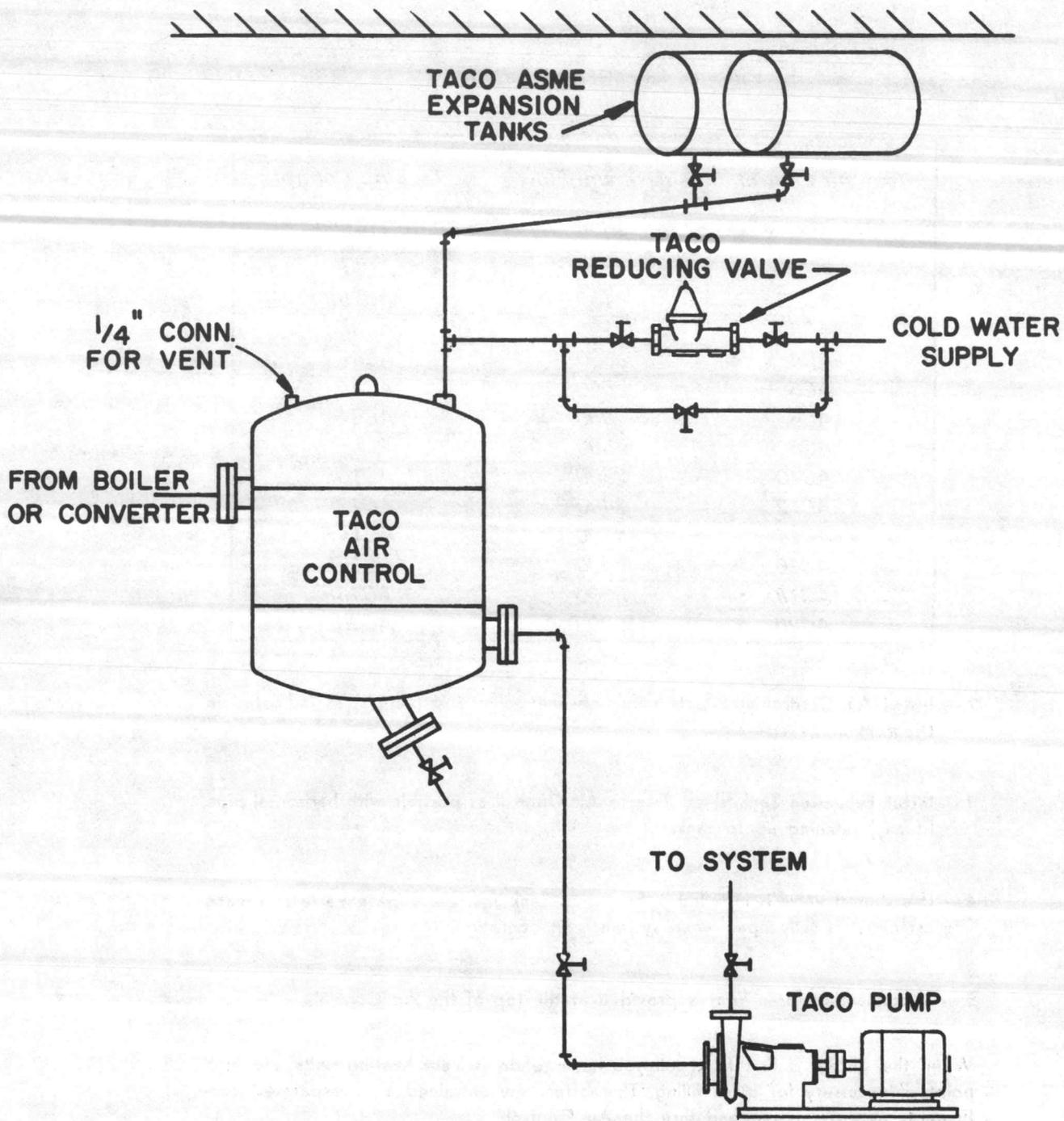
1 — Select proper size based on flow (GPM) thru System

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

- 2 — Install Air Control in Supply Line between boiler and pump(s) as indicated in Diagram on reverse side.
- 3 — Install Expansion Tank (s) as close to Air Control as possible with horizontal pipe (if any) pitching up to tank.
- 4 — If a shutoff valve is installed in Expansion Tank line, use a Gate Valve and make certain it is fully open when system is in operation.
- 5 — A connection for a Vent is provided at the top of the Air Control.

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

AIR CONTROL





INSTRUCTION SHEET

NUMBER

IS-100-1.3

Effective: May 1, 1981
Supersedes: IS 300-1-1
dated 11/25/68

Plant ID. No. 001-322

PUMP SERVICING INSTRUCTIONS - NOS.

121-7	1600-1	1620-1
122-7	1602-1	1622-1
131-6	1604-1	1624-1
132-6	1610-1	1630-1
133-6	1612-1	1632-1
138-2	1614-1	1634-1

ITEMS TO CHECK BEFORE STARTING

1. Motor and bracket have been properly lubricated at the factory and should not require additional lubricant. Before starting, check oil level in bracket thru sight oil gauge. Level should be between top and center of window. If, for some reason, level is below center of window, see instructions on oil well cover.
2. Check motor and power supply for proper wiring connections and voltage. If motor is damaged due to improper wiring hook-up, guarantee is void.
3. The casing is rotatable and may be installed in a vertical or horizontal pipe. The motor and bracket must be horizontal in all cases with oil well cover facing the ceiling.

LUBRICATION

Motor— Motor is well oiled before shipment in accordance with manufacturer's recommendation and should not require any oil upon arrival. When oil is required, follow instructions attached to the motor end shield plates.

Pump— (For best results TACO-LUBE #12 is recommended. Maintain oil level at all times within limits specified on oil well cover.

MOTOR ALIGNMENT

All circulator motors are aligned within required tolerances when shipped. They normally do not require any attention. If due to rough handling the motor base becomes bent, loosen screws connecting

cast iron and steel sections of the motor base and place shims between the two sections until the motor shaft is properly aligned with the pump shaft.

TO REPLACE WATER SEAL AND/OR IMPELLER

1. Stop pump and close suction and discharge valves.
2. Drain water from casing.
3. Remove pipe plug on opposite side of oil gauge and drain oil (water may have gotten into oil reservoir).
4. Remove motor assembly from bracket.
5. Remove bracket from pump body. Loosen set screw and pull out pump end of drive coupling. **DO NOT BEND SHAFT.**
6. Remove oil well cover, loosen set screw in inside Thrust Collar and while holding Thrust Collar, remove Impeller and Shaft, Thrust Washers and Thrust Collar.
7. Clean bearings and bracket and inspect for possible damage. Clean sight oil gauge.
8. Remove stationary seal from bracket, clean recess and apply a film of light oil to OD of new stationary seat rubber cup, press firmly in place with thumbs. Be certain it is "bottomed" equally, otherwise it might leak.
9. Gently remove old seal parts from shaft with a rotating motion and clean entire shaft with soft clean cloth (Do not use much pressure). Drop new spring and holder onto the shaft.
10. Apply a good film of oil, from the very end of the shaft right down to, and slightly beyond the end of the spring. With the seal in the palm of the hand (seat facing the hand) and with an oscillating motion, press seal over end of shaft then down to free length of the spring. Line up seal, spring and spring holder.
11. Thoroughly clean both seal faces with a soft clean cloth.
12. Remove set screw from Thrust Collar. Apply a film of oil to each side of Thrust Collar, then place a Thrust Collar Washer on each side of the Thrust Collar with the LIGHT COLORED (Cadmium Plated) SIDES facing the Thrust Collar. While holding this 3 Part Assembly (Thrust Collar and two Washers) in the oil reservoir with grooves on OD of Collar facing the Impeller, slide Impeller and Shaft into bracket so that hole in Shaft is directly in line with screw hole in Thrust Collar. Insert and tighten set screw until it bottoms in the hole in the shaft, then turn back 1/16 of a turn. This automatically adjusts the spring tension on seal. **THIS LAST OPERATION MUST BE ACCOMPLISHED IMMEDIATELY AFTER OPERATIONS 10 AND 11. IF TOO MUCH TIME ELAPSES, THE OIL MAY BE SQUEEZED OUT FROM UNDER SHAFT SEAL, PREVENTING THE RUBBER PART OF SEAL FROM SLIDING ON SHAFT WHICH IS NECESSARY WHEN PERFORMING OPERATION 12.**
13. Re-assemble motor and coupling assembly to bracket and bracket to casing, making certain that casing gasket is in good condition and properly located. Engage teeth of rubber coupling insert with those in the metal ends. Bring all three parts together, then back off one end about 1/32" and tighten. Do not squeeze rubber insert, some pump sizes use A "FIGURE-8" shaped one piece coupler. Install without stretching or compressing.
14. Open valves in suction and discharge lines and vent air thru vent holes, if provided. Start motor for TWO SECONDS, then stop and inspect for water leaks. If any leaks occur, one or more previous operations must be repeated.
15. If no leaks occur, re-fill oil reservoir as previously indicated under LUBRICATION-PUMP and replace oil well cover.
16. Start pump and again check for leaks. (Note: If pump is operated longer than 30 SECONDS without being primed, the mechanical seal could be damaged).

9969

12-100-1.3

Form No. 10-102

1. Major and minor bearings should be checked at the factory and should be checked at the job site. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition.

However, if the bearings are not checked at the factory, they should be checked at the job site. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition.

All bearings should be checked at the factory and at the job site. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition.

2. Check for proper fit and condition. Check for proper fit and condition.

3. Remove the bearings from the shaft. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition.

4. Check for proper fit and condition. Check for proper fit and condition.

5. Remove the bearings from the shaft. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition.

6. Check for proper fit and condition. Check for proper fit and condition.

7. Remove the bearings from the shaft. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition. Check for proper fit and condition.

8. Check for proper fit and condition. Check for proper fit and condition.



REPLACEMENT PARTS

NUMBER

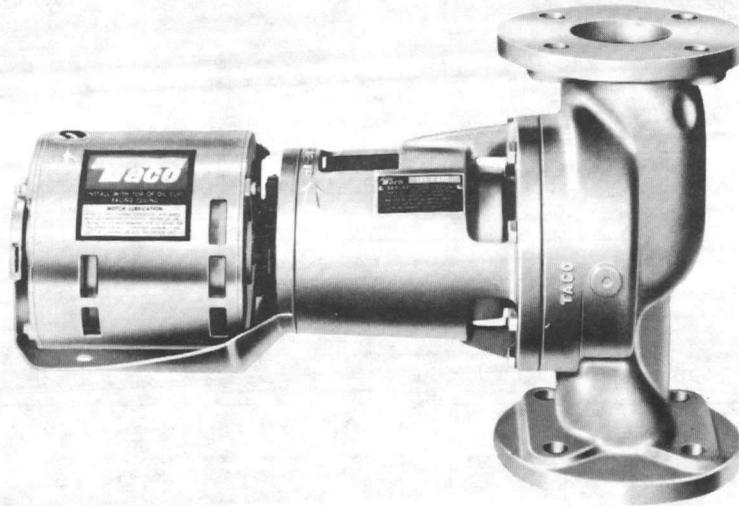
304-001

Effective: December 1, 1985
Supersedes: PL300-1
dated: 12/1/84

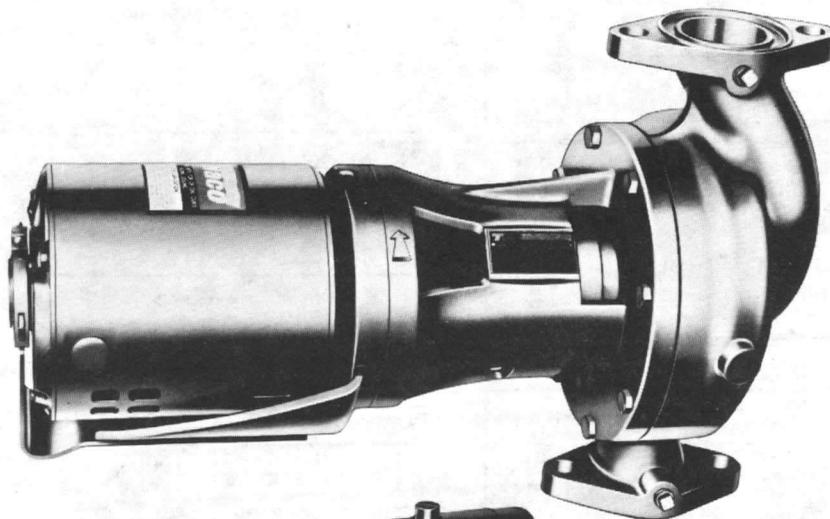
121 THRU 138 PUMPS 1600 SERIES PUMPS

IMPORTANT: When ordering, always specify part number, part name, and complete model number of pump.

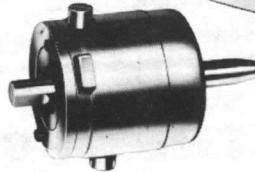
CARTRIDGE DESIGN PUMPS



121 - 138 SERIES PUMPS



1600 SERIES PUMPS

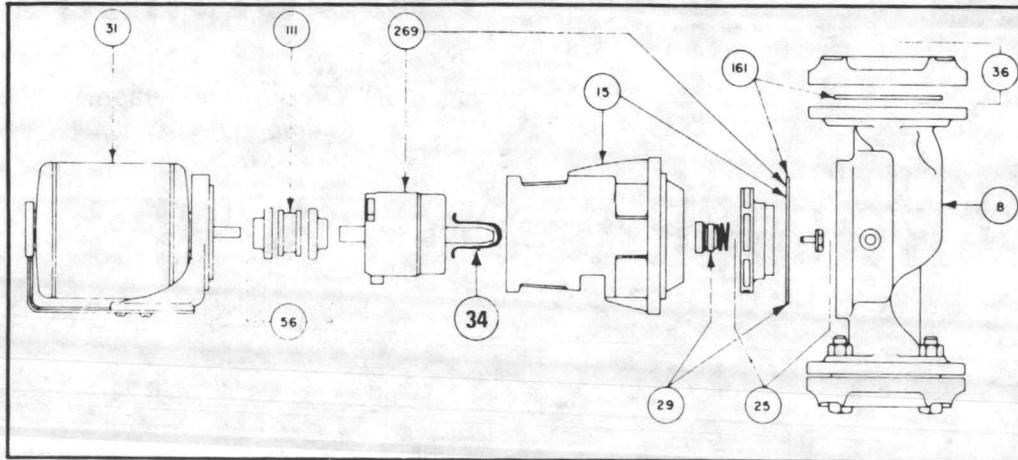


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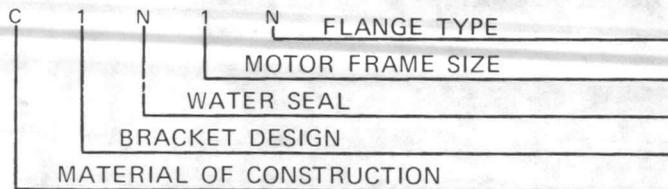
Form No. F304-001 Taco (Canada) Limited 1310 Aimco Blvd., Mississauga, Ontario L4W 1B2 Telephone: 416-625-2160 Telex: 06-961179

REPLACEMENT PARTS FOR (-9) AND SERIAL NUMBER CARTRIDGE DESIGN PUMPS



SERIAL NUMBER CODE

1600 - 4.25



MATERIAL OF CONSTRUCTION	
	X O O O O
A	CAST IRON PUMP AND IMPELLER (3)
B	ALL BRONZE PUMP AND IMPELLER
C	CAST IRON PUMP AND BRONZE IMPELLER

BRACKET DESIGN	
	O X O O O
1	ALL CURRENT STYLE PUMPS

WATER SEAL TYPE, ITEM #29	
	O O X O O
N	1600 - 170RP NI - RESIST
H	1600 - 170HRP TUNGSTEN CARBIDE
E	1600 - 170ERP CERAMIC

MOTOR FRAME SIZE*	
	O O O X O
1	48 FRAME (1/4, 1/3, 1/2 HP)
2	56 FRAME (3/4, 1 HP)
3	56 FRAME (1 1/2, & 2 HP)
4	56 FRAME (3 HP)

* Refer to standard motors only. See nameplate for other motors.

FLANGE TYPE	
	O O O O X
N	NPT (STANDARD)
D	DIN (EXPORT)

ITEM #8 REPLACEMENT BODY		
PUMP MOD. NO.	CAST IRON	BRONZE
121	121 - 018RP	121 - 018BRP
122	"	"
131, 32, 33 & 38 ¹	133 - 150RP	133 - 150BRP
1600, 10, 11 ¹	1610 - 001RP	1610 - 001BRP
1602, 1604 ²	N/A	N/A
1612, 14, 15	1614 - 001RP	1614 - 001BRP
1616, 18, 19	1618 - 004RP	1618 - 004BRP
1620, 22, 24	1634 - 001RP	1634 - 001BRP
1630, 1632	"	"
1634, 1635	"	"
1636, 1638	1640 - 002RP	1640 - 002BRP
1640, 1641	"	"

ITEM #36 REPLACEMENT FLANGE SET		
PUMP MOD. NO.	CAST IRON	BRONZE
121	1600 - 033RP	1600 - 033BRP
122	1600 - 034RP	1600 - 034BRP
131, 32, 33, & 38 ¹	"	"
1600, 10, 11 ¹	1600 - 031RP	1600 - 031BRP
1602, 1604 ²	"	"
1612, 14, 15	"	"
1616, 18, 19	1600 - 032RP	1600 - 032BRP
1620, 22, 24	"	"
1630, 1632	"	"
1634, 1635	"	"
1636, 1638	1600 - 174RP	1600 - 174BRP
1640, 1641	"	"

Note (1) When replacing Item #8 body on 131, 132, 133, 138 and 1600C - 1& -9, you must also order current style impeller.
 Note (2) Body for the 1602 & 1604 are no longer available. Consult factory.
 Note (3) 121 thru 138 only.

ITEM # 15 REPLACEMENT BRACKET					ITEM # 161 GASKET KIT
PUMP MOD. NO.	MOTOR FRAME SIZE (48)		MOTOR FRAME SIZE (56)		
121, 122	CAST IRON	BRONZE	CAST IRON	BRONZE	1600 - 050RP
1600, 10, 11	1600 - 155RP	1600 - 156RP	NA	NA	"
1602, 1604	"	"	"	"	"
1612, 20, 30	1600 - 175RP	1600 - 176BRP	"	"	"
131, 132	"	"	"	"	"
1615*	-	-	-	-	"
133, 138	NA	N/A	1604 - 023RP	1604 - 024RP	"
1614, 22, 24	"	"	1604 - 023RP	1604 - 024RP	"
1632, 34	"	"	1604 - 023RP	1604 - 024RP	"
1635*	-	-	-	-	1600 - 050RP
1616, 36	"	"	1604 - 025RP	1604 - 026RP	1618 - 006RP
1619*	-	-	-	-	"
1638, 40, 41	"	"	1604 - 025RP	1604 - 026RP	"

* Select bracket, per motor frame size code in serial number.

ITEM #25 REPLACEMENT IMPELLER ASSEMBLY								
PUMP NO.	(-9) PUMPS	CURRENT	DIA. -9 CUR.		PUMP NO.	(-9) PUMPS	CURRENT	DIA. -9 CUR.
121, 122	121 - 142BRP	121 - 142BRP	4.30	4.30	1618	1618 - 001BRP	N/A	7.900
131	131 - 075BRP	1630 - 023BRP	4.80	4.40	1619*	N/A	1619 - 001BRP	
132	132 - 063BRP	1630 - 022BRP	5.20	4.90	1620	1620 - 022BRP	N/A	5.100
133	133 - 075BRP	1632 - 022BRP	5.75	5.65	1622	1622 - 020BRP	N/A	5.850
138	138 - 037BRP	1634 - 023BRP	6.25	6.15	1624	1624 - 040BRP	N/A	6.500
1600	1600 - 179BRP	1610 - 020BRP	4.75	4.50	1630	1630 - 022BRP	1630 - 022BRP	4.900
1602	1602 - 025BRP	N/A		5.500	1632	1632 - 022BRP	1632 - 022BRP	5.650
1604	1604 - 028BRP	N/A		6.200	1634	1634 - 023BRP	1634 - 023BRP	6.150
1610	1610 - 019BRP	1610 - 019BRP		4.750	1635*	N/A	1635 - 001BRP	-
1611*	N/A	1611 - 001BRP		-	1636	1636 - 001BRP	1636 - 001BRP	6.400
1612	1612 - 019BRP	1612 - 019BRP		5.750	1638	1638 - 001BRP	1638 - 001BRP	6.900
1614	1614 - 018BRP	1614 - 018BRP		6.350	1640*	1640 - 001BRP	N/A	7.900
1615*	N/A	1615 - 001BRP		-	1641*	N/A	1641 - 001BRP	-
1616	1616 - 002BRP	1616 - 002BRP		7.100				

*When ordering, please advise diameter of impeller.

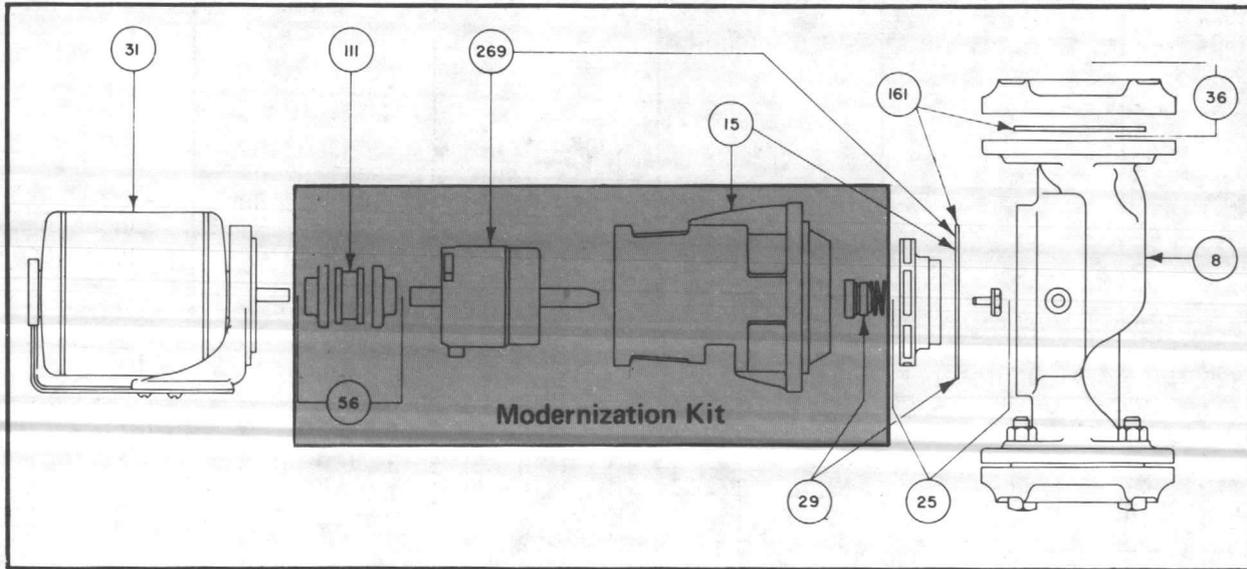
ITEM # 31 REPLACEMENT MOTOR ASSEMBLY*				
HP	115/60/1	115/230/60/1	200/60/3	230/460/60/3
1/4	121 - 151RP	N/A	121 - 148RP	121 - 137RP
1/3	131 - 143RP	N/A	131 - 115RP	131 - 137RP
1/2	N/A	132 - 096RP	132 - 066RP	132 - 097RP
3/4	N/A	133 - 119RP	133 - 140RP	133 - 134RP
1	N/A	138 - 119RP	138 - 148RP	138 - 142RP
1½	N/A	1636 - 013RP	1636 - 019RP	1636 - 010RP
2	N/A	1638 - 012RP	1638 - 015RP	1638 - 010RP
3	N/A	N/A	1640 - 013RP	1640 - 010RP

* When ordering other than standard, refer to nameplate, then consult factory.

ITEM # 34 SHAFT SLEEVE	1600 - 205	All -9 and Serial Number Pumps.
ITEM # 56 COUPLER	1624 - 053RP	All Inline Pumps ¼ thru 2 HP.
ITEM # 56 COUPLER	1624 - 041RP	All Inline Pumps 3 HP.
ITEM # 111 RUBBER INSERT	1624 - 004RP	All 4J Couplers.
ITEM # 111 RUBBER INSERT	1624 - 020RP	All 3J Couplers.
ITEM # 111 RUBBER INSERT	900 - 512	All 5J Couplers.
ITEM # 269 CARTRIDGE ASSY.	1600 - 160RP	All -9 and Serial Number Pumps.

REPLACEMENT PARTS FOR OLD STYLE PUMPS AND CIRCULATORS *

* 121+122-3-7; 131, 132+133-3-6; 138-1+2; 1600, 1602, 1604, 1610, 1612, 1614, 1620, 1622, 1624, 1630, 1632, 1634-1+C1.



- | | | |
|------------|-----------------------------|---|
| ITEM # 8 | BODY | Same as -9 and Serial Number Pumps. |
| ITEM # 25 | IMPELLER AND SHAFT ASSEMBLY | No longer available . Must purchase Item #74 Modernization Kit listed below, Plus -9 IMPELLER |
| ITEM # 29 | SEAL KIT | Part No. 1600 - 055RP |
| ITEM # 31 | MOTOR ASSEMBLY ¹ | Same as -9 and Serial Number Pumps. |
| ITEM # 36 | FLANGE SET | Same as -9 and Serial Number Pumps. |
| ITEM # 56 | COUPLER | Same as -9 and Serial Number Pumps. |
| ITEM # 111 | RUBBER INSERT | Same as -9 and Serial Number Pumps. |
| ITEM # 161 | GASKET KIT | Same as -9 and Serial Number Pumps. |

ITEM # 74 MODERNIZATION KIT*					
PUMP NO.	MOTOR FRAME SIZE (48)		MOTOR FRAME SIZE (56)		
	CAST IRON	BRONZE	CAST IRON	BRONZE	
121, 122	121 - 154RP	122 - 002RP	N/A	N/A	
131, 132 ²	131 - 144RP	132 - 145RP	133 - 147RP	138 - 153RP	
133, 138	N/A	N/A	"	"	
1600, 1610	121 - 154RP	122 - 022RP	N/A	N/A	
1602, 1604 ²	131 - 144RP	132 - 145RP	133 - 147RP	133 - 147RP	
1612, 1620 ²	"	"	133 - 147RP	138 - 153RP	
1630 ²	"	"	"	"	
1614, 1622	N/A	N/A	"	"	
1624, 1632	N/A	N/A	"	"	
1634	N/A	N/A	"	"	

Note (1) When replacing 1/3 or 1/2 HP 56 Frame (old) motor with a new 48 Frame motor, adapter kit # 1600 - 194RP must be ordered.

Note (2) Select modernization kit per motor frame size. Select impellers per selection chart on previous page, under -9 column



Submittal Data Information 1600 Series Pumps

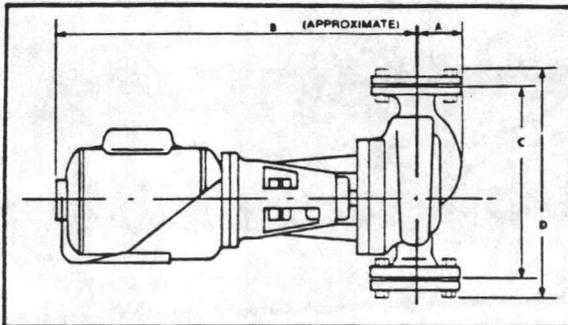
301-002

MODEL 1611

SUPERSEDES: SD300-1.2

Job: Semi Instantaneous Packages

ITEM NO.	MODEL NO.	IMPELLER DIA.	G.P.M.	HEAD IN FT.	H.P.	ELECTRICAL CHARACTERISTICS
	1600 B				1/4	115/1/40

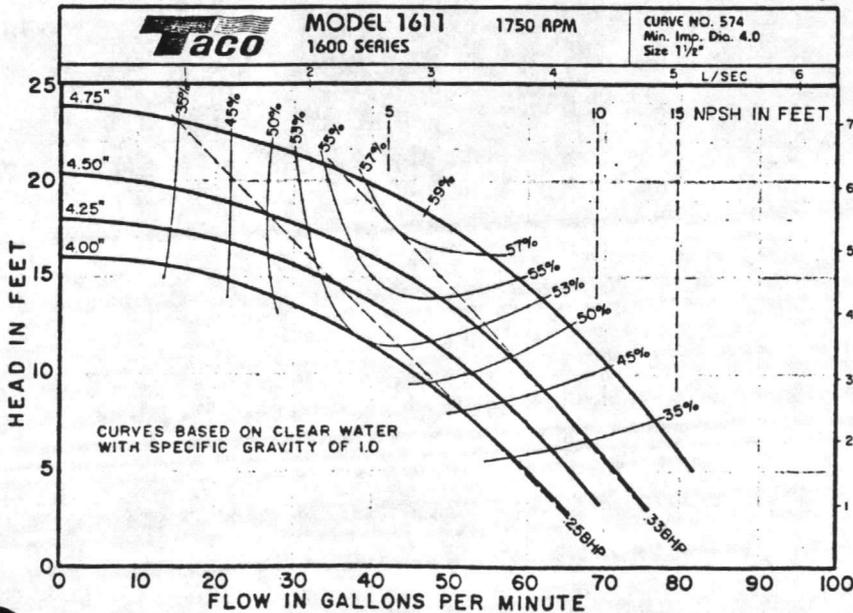


SIZES & DIMENSIONS:
(APPROXIMATE)

MODEL	Flange Size	H.P. (W)	A	B	C	D
1611	1 1/2	1/4 (187)* 1/3 (249)* 1/2 (373)*	3 (76)*	16 1/2 (419)* 16 1/2 (419)* 17 (432)*	10 1/4 (200)*	12 1/4 (327)*

*Millimeters

15400 - 1.4.1b



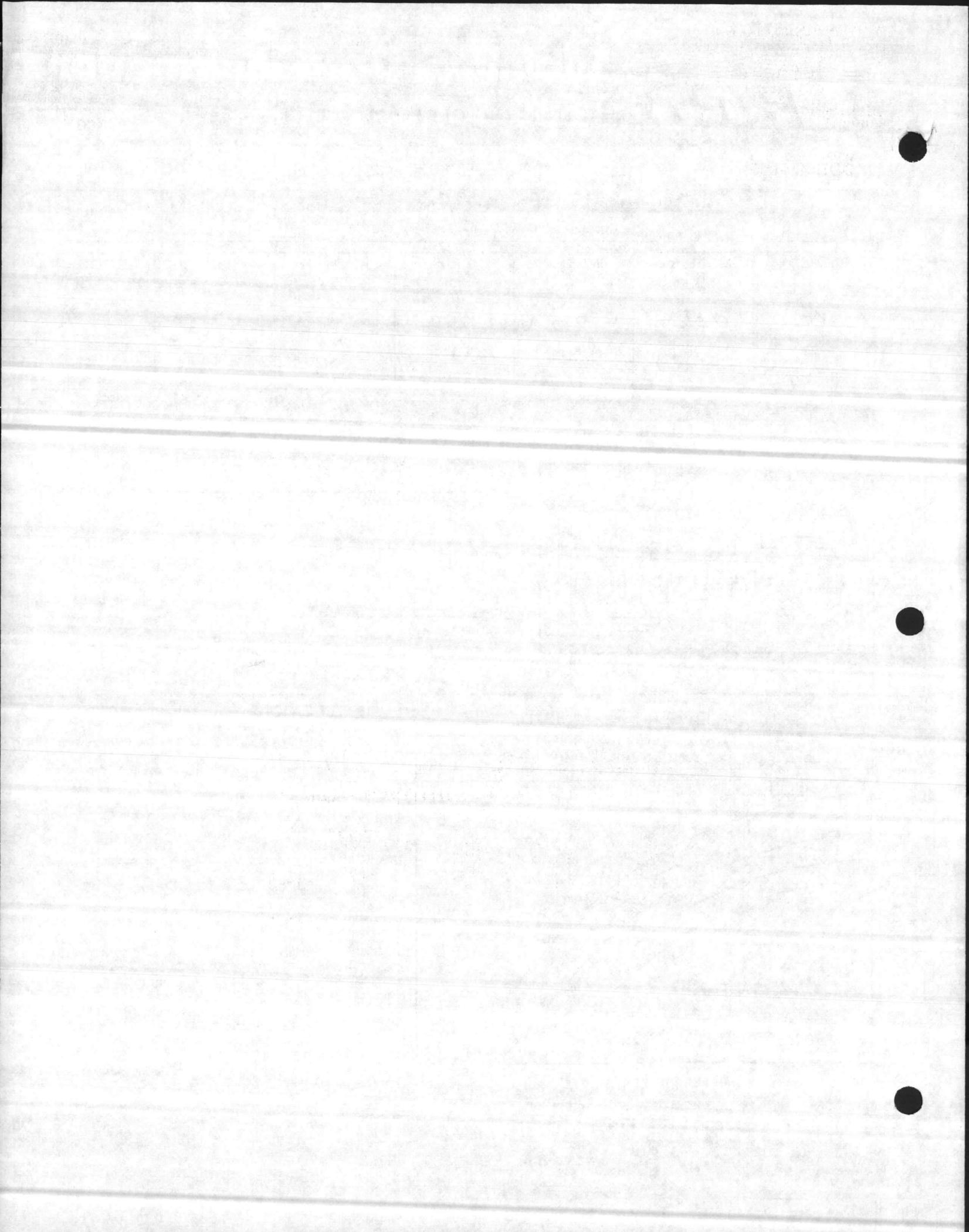
SPECIFICATIONS:

- MOTORS**
1750 RPM, Three Phase 200V or 230/460V 60C Sleeve Bearing Motors.
Also available in Single Phase with overload protection except 3 HP (2238W).
- BODY BRONZE**
Cast iron with flanged in-line connections. Companion flanges are included.
- IMPELLER**
Cast Bronze, Closed, Dynamically Balanced.
- DRIVE COUPLING**
Non-Metallic/Vibration Dampening
- SHAFT**
Alloy Steel with Cupro-Nickel Sleeve.
- FRAME**
Sleeve Bearing, Disc Type, Oil lubricated. REMOVABLE BEARING CARTRIDGE FITS ALL MODELS. Dip Stick to measure oil level.
- MECHANICAL SEAL**
2 Piece Standard—250°F (121°C) Operating Temp.
Hi-Temp—Extra Cost—300°F (149°C) Operating Temp.
- WORKING PRESSURE**
175 PSI (1207kPa) ... in accordance with ASA B16.1
NOTE: Flanges are tapped for gauges

Quality Through Design — COMPARE.

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

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REPLACEMENT PARTS

NUMBER

304-001

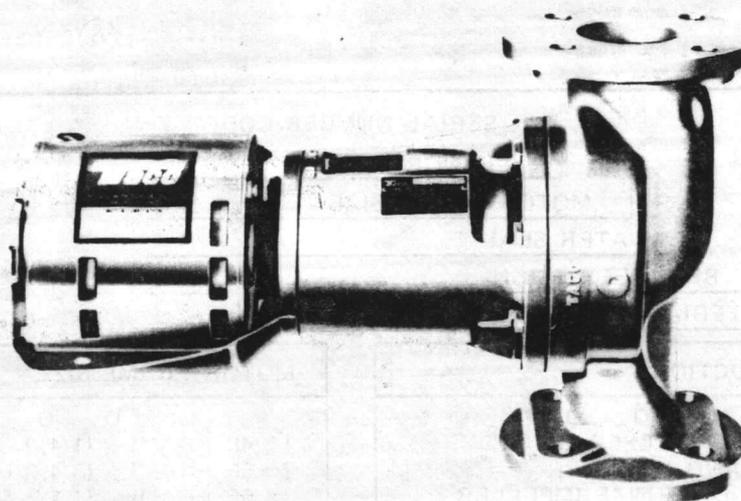
Effective: November 1, 1987

Supersedes: 304-001
dated: 12/1/85

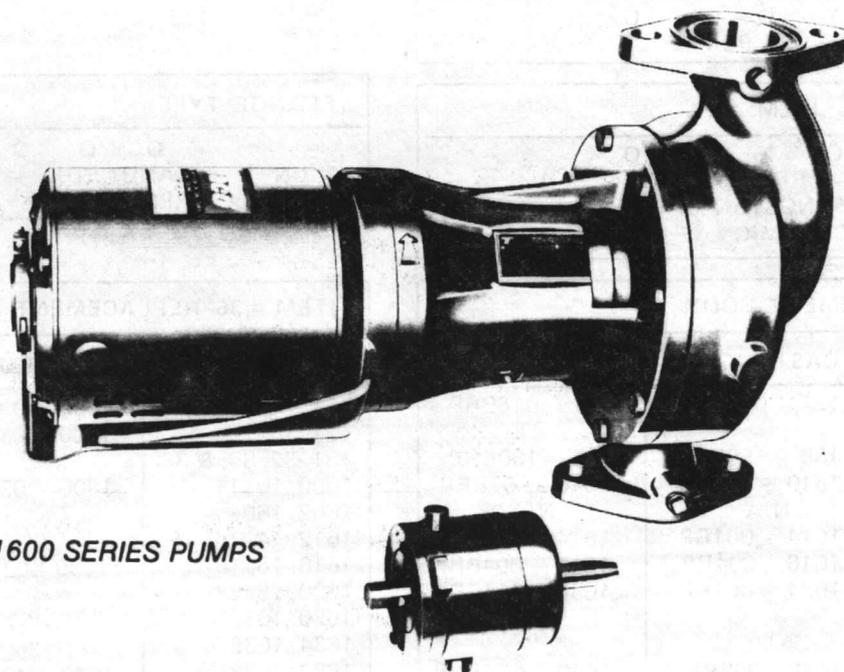
121 THRU 138 PUMPS 1600 SERIES PUMPS

IMPORTANT: When ordering, always specify part number, part name, and complete model number of pump.

CARTRIDGE DESIGN PUMPS

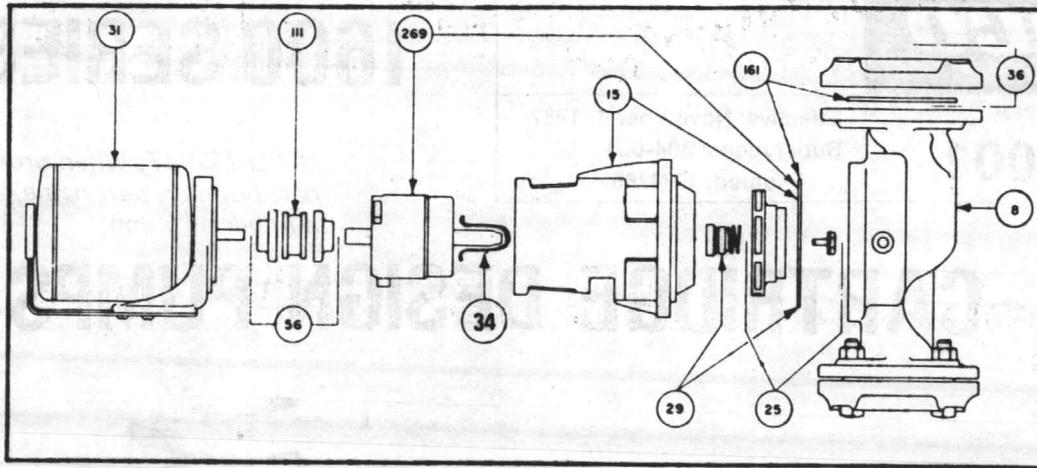


121 - 138 SERIES PUMPS



1600 SERIES PUMPS

REPLACEMENT PARTS FOR (-9) AND SERIAL NUMBER CARTRIDGE DESIGN PUMPS



SERIAL NUMBER CODE

1600 - 4.25



MATERIAL OF CONSTRUCTION	
X	O O O O
A	CAST IRON PUMP AND IMPELLER (3)
B	ALL BRONZE PUMP AND IMPELLER
C	CAST IRON PUMP AND BRONZE IMPELLER

MOTOR FRAME SIZE*	
	O O O X O
1	48 FRAME (1/4, 1/3, 1/2 HP)
2	56 FRAME (3/4, 1 HP)
3	56 FRAME (1 1/2, & 2 HP)
4	56 FRAME (3 HP)

* Refer to standard motors only. See nameplate for other motors.

BRACKET DESIGN	
	O X O O O
1	ALL CURRENT STYLE PUMPS

FLANGE TYPE	
	O O O O X
N	NPT (STANDARD)
D	DIN (EXPORT)

WATER SEAL TYPE, ITEM # 29	
	O O X O O
N	1600 - 170RP NI - RESIST
H	1600 - 170HRP TUNGSTEN CARBIDE
E	1600 - 170ERP CERAMIC

ITEM # 8 REPLACEMENT BODY		
PUMP MOD. NO.	CAST IRON	BRONZE
121	121 - 018RP	121 - 018BRP
122	"	"
131, 32, 33 & 38 ¹	133 - 150RP	133 - 150BRP
1600, 10, 11 ¹	1610 - 001RP	1610 - 001BRP
1602, 1604 ²	N/A	N/A
1612, 14, 15	1614 - 001RP	1614 - 001BRP
1616, 18, 19	1618 - 004RP	1618 - 004BRP
1620, 22, 24	1634 - 001RP	1634 - 001BRP
1630, 1632	"	"
1634, 1635	"	"
1636, 1638	1640 - 002RP	1640 - 002BRP
1640, 1641	"	"

ITEM # 36 REPLACEMENT FLANGE SET		
PUMP MOD. NO.	CAST IRON	BRONZE
121	1600 - 033RP	1600 - 033BRP
122	1600 - 034RP	1600 - 034BRP
131, 32, 33, & 38	"	"
1600, 10, 11	1600 - 031RP	1600 - 031BRP
1602, 1604	"	"
1612, 14, 15	"	"
1616, 18, 19	1600 - 032RP	1600 - 032BRP
1620, 22, 24	"	"
1630, 1632	"	"
1634, 1635	"	"
1636, 1638	1600 - 174RP	1600 - 174BRP
1640, 1641	"	"

Note (1) When replacing Item #8 body on 131, 132, 133, 138 and 1600C - 1& -9, you must also order current style impeller.
 Note (2) Body for the 1602 & 1604 are no longer available. Consult factory.

ITEM # 15 REPLACEMENT BRACKET					ITEM # 161 GASKET KIT
PUMP MOD. NO.	MOTOR FRAME SIZE (48)		MOTOR FRAME SIZE (56)		
121, 122	CAST IRON	BRONZE	CAST IRON	BRONZE	1600 - 050RP
1600, 10, 11	1600 - 155RP	1600 - 156RP	N/A	N/A	"
1602, 1604	"	"	N/A	N/A	"
1612, 20, 30	1600 - 175RP	1600 - 176BRP	N/A	N/A	"
131, 132	"	"	N/A	N/A	"
1615 *	-	-	-	-	"
133, 138	NA	N/A	1604 - 023RP	1604 - 024RP	"
1614, 22, 24	N/A	N/A	1604 - 023RP	1604 - 024RP	"
1632, 34	N/A	N/A	1604 - 023RP	1604 - 024RP	"
1635 *	-	-	-	-	"
1616, 36	N/A	N/A	1604 - 025RP	1604 - 026RP	1618 - 006RP
1619 *	-	-	-	-	"
1638, 40, 41	N/A	N/A	1604 - 025RP	1604 - 026RP	"

* Select bracket, per motor frame size code in serial number.

ITEM #25 REPLACEMENT IMPELLER ASSEMBLY								
PUMP NO.	(-9) PUMPS	CURRENT	DIA.		PUMP NO.	(-9) PUMPS	CURRENT	DIA. CUR.
			-9	CUR.				
121, 122	121 - 142BRP	121 - 142BRP	4.30	4.30	1618	1618 - 001BRP	N/A	7.900
131	131 - 075BRP	1630 - 023BRP	4.80	4.40	1619 *	N/A	1619 - 001BRP	
132	132 - 063BRP	1630 - 022BRP	5.20	4.90	1620	1620 - 022BRP	N/A	5.100
133	133 - 075BRP	1632 - 022BRP	5.75	5.65	1622	1622 - 020BRP	N/A	5.850
138	138 - 037BRP	1634 - 023BRP	6.25	6.15	1624	1624 - 040BRP	N/A	6.500
1600	1600 - 179BRP	1610 - 020BRP	4.75	4.50	1630	1630 - 022BRP	1630 - 022BRP	4.900
1602	1602 - 025BRP	N/A		5.500	1632	1632 - 022BRP	1632 - 022BRP	5.650
1604	1604 - 028BRP	N/A		6.200	1634	1634 - 023BRP	1634 - 023BRP	6.150
1610	1610 - 019BRP	1610 - 019BRP	4.750		1635 *	N/A	1635 - 001BRP	-
1611 *	N/A	1611 - 001BRP	-		1636	1636 - 001BRP	1636 - 001BRP	6.400
1612	1612 - 019BRP	1612 - 019BRP	5.750		1638	1638 - 001BRP	1638 - 001BRP	6.900
1614	1614 - 018BRP	1614 - 018BRP	6.350		1640 *	1640 - 001BRP	N/A	7.900
1615 *	N/A	1615 - 001BRP	-		1641 *	N/A	1641 - 001BRP	-
1616	1616 - 002BRP	1616 - 002BRP	7.100					

* When ordering, please advise diameter of impeller.

ITEM # 31 REPLACEMENT MOTOR ASSEMBLY *				
HP	115/60/1	115/230/60/1	200/60/3	230/460/60/3
1/4	121 - 151RP	N/A	121 - 148RP	121 - 137RP
1/3	131 - 143RP	N/A	131 - 115RP	131 - 137RP
1/2	N/A	132 - 096RP	132 - 066RP	132 - 097RP
3/4	N/A	133 - 119RP	133 - 140RP	133 - 134RP
1	N/A	138 - 119RP	138 - 148RP	138 - 142RP
1½	N/A	1636 - 013RP	1636 - 019RP	1636 - 010RP
2	N/A	1638 - 012RP	1638 - 015RP	1638 - 010RP
3	N/A	N/A	1640 - 013RP	1640 - 010RP

* When ordering other than standard, refer to nameplate, then consult factory.

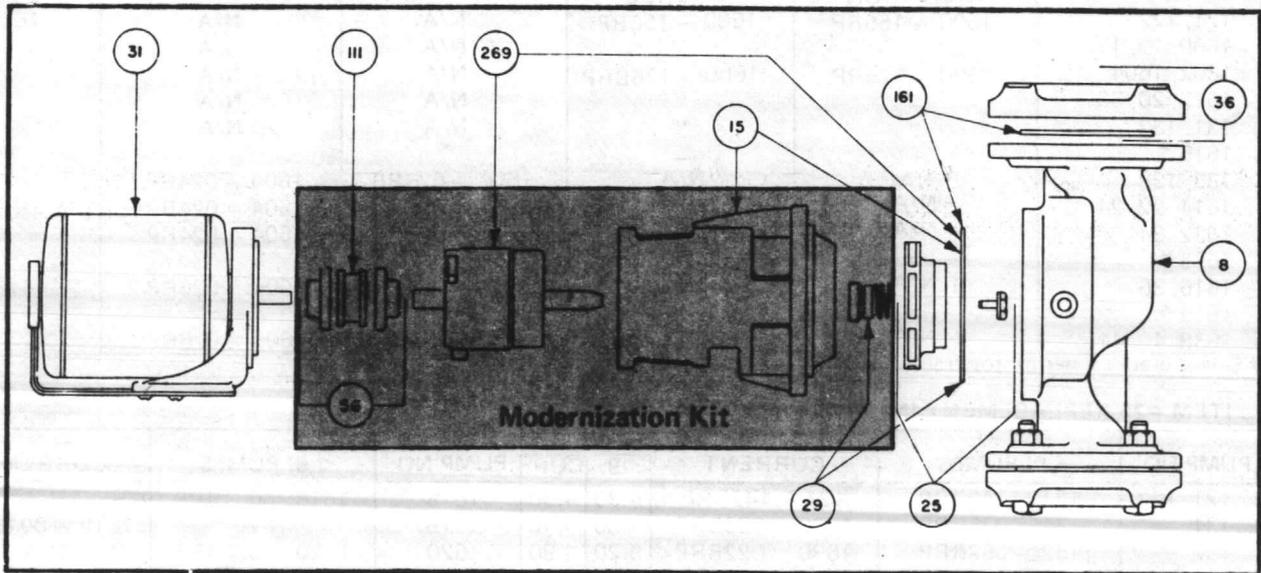
- ITEM # 34 SHAFT SLEEVE
- ITEM # 56 COUPLER
- ITEM # 56 COUPLER
- ITEM # 111 RUBBER INSERT
- ITEM # 111 RUBBER INSERT
- ITEM # 111 RUBBER INSERT
- ITEM # 269 CARTRIDGE ASSY.

- 1600 - 205
- 1624 - 053RP
- 1624 - 041RP
- 1624 - 004RP
- 1624 - 020RP
- 900 - 512
- 1600 - 160RP

- All -9 and Serial Number Pumps.
- All Inline Pumps ¼ thru 2 HP.
- All Inline Pumps 3 HP.
- All 4J Couplers.
- All 3J Couplers.
- All 5J Couplers.
- All -9 and Serial Number Pumps.

REPLACEMENT PARTS FOR OLD STYLE PUMPS AND CIRCULATORS *

*121+122-3-7; 131, 132+133-3-6; 138-1+2; 1600, 1602, 1604, 1610, 1612, 1614, 1620, 1622, 1624, 1630, 1632, 1634-1+C1.



- | | | |
|------------|-----------------------------|---|
| ITEM # 8 | BODY | Same as -9 and Serial Number Pumps. |
| ITEM # 25 | IMPELLER AND SHAFT ASSEMBLY | No longer available . Must purchase Item #74 Modernization Kit listed below, Plus -9 IMPELLER |
| ITEM # 29 | SEAL KIT | Part No. 1600 - 055RP |
| ITEM # 31 | MOTOR ASSEMBLY | Same as -9 and Serial Number Pumps. |
| ITEM # 36 | FLANGE SET | Same as -9 and Serial Number Pumps. |
| ITEM # 56 | COUPLER | Same as -9 and Serial Number Pumps. |
| ITEM # 111 | RUBBER INSERT | Same as -9 and Serial Number Pumps. |
| ITEM # 161 | GASKET KIT | Same as -9 and Serial Number Pumps. |

ITEM # 74 MODERNIZATION KIT*					
PUMP NO.	MOTOR FRAME SIZE (48)		MOTOR FRAME SIZE (56)		
	CAST IRON	BRONZE	CAST IRON	BRONZE	
121, 122	121 - 154RP	122 - 002RP	N/A	N/A	
131, 132 ²	131 - 144RP	132 - 145RP	133 - 147RP	138 - 153RP	
133, 138	N/A	N/A	"	"	
1600, 1610	121 - 154RP	122 - 022RP	N/A	N/A	
1602, 1604 ²	131 - 144RP	132 - 145RP	133 - 147RP	133 - 147RP	
1612, 1620 ²	"	"	133 - 147RP	138 - 153RP	
1630 ²	"	"	"	"	
1614, 1622	N/A	N/A	"	"	
1624, 1632	N/A	N/A	"	"	
1634	N/A	N/A	"	"	

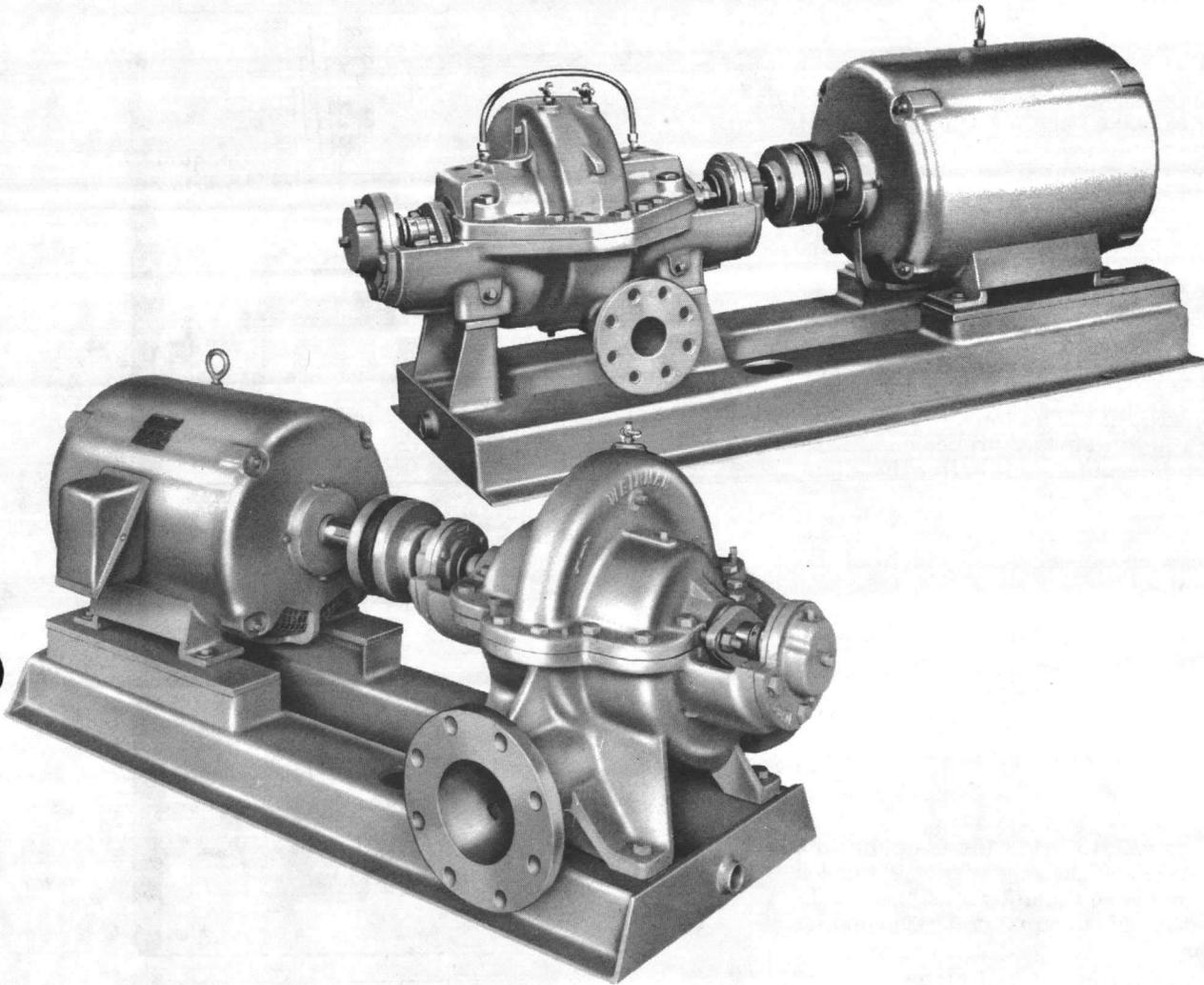
Note (2) Select modernization kit per motor frame size. Select impellers per selection chart on previous page, under -9 column

*Change

for quality, efficiency, dependability . . .

WEINMAN

SPLIT CASE PUMPS



WEINMAN

INSTALLATION and OPERATING INSTRUCTIONS
for SPLIT CASE PUMPS

INSTALLATION and OPERATING INSTRUCTIONS

These instructions are important . . . please read them thoroughly before installing your WEINMAN PUMP. Quiet and successful operation depends on proper installation and operating procedure. The paragraphs on **alignment** and **suction piping** are particularly essential. Misalignment and improper suction piping are the cause of a majority of pump troubles. In this manual, we have covered these two subjects with extreme thoroughness.

Keep these instructions on hand for future use, together with the enclosed parts list which may be helpful should you need replacement parts.



P.O. Box 1364
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Conway, AR 72032
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Section Nos. 1200, 1210, 1300 and 1310

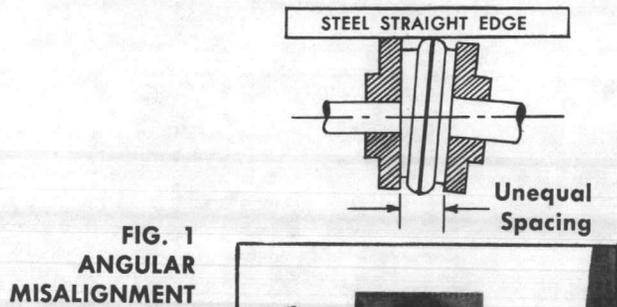
INSTRUCTIONS FOR ALIGNING PUMPS WITH WOOD'S SURE-FLEX COUPLINGS

Although it may have been perfectly aligned at the factory before shipment, a centrifugal pump with its driving unit mounted on a bed plate is almost certain to need re-alignment when placed on its foundation. Here's the correct procedure for setting and re-aligning your WEINMAN Pump.

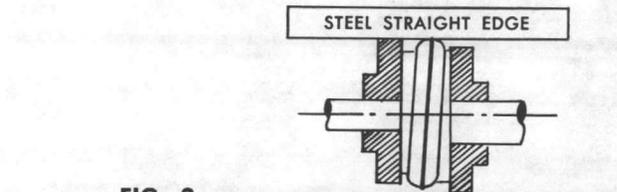
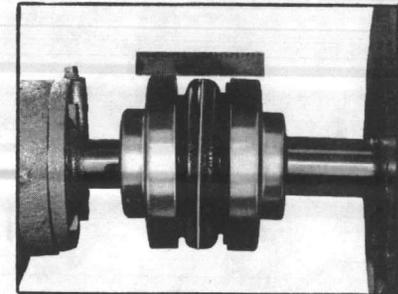
1. The foundation, with its bolts in pipe sleeves, should be deep enough to carry the weight of the pump without deflection or vibration. The foundation should be from 3" to 6" wider and longer than the bed plate. Allow $\frac{3}{4}$ " under bed plate for grouting. The top surface should be clean but rough to insure proper bond with grout. Do not do grouting until **after** the alignment has been established.
2. The minimum foundation weight should be approximately twice the combined weight of the pump and motor.
3. Place the unit on the foundation with bolts in their respective bed plate holes. Insert wedges under the bed plate near foundation bolts.
4. If a standard Sure-Flex with split insert is provided, force the ring away from the center over next to one of the hubs with a blunt screwdriver.
5. Adjust the wedges to bring the coupling into alignment. To check the alignment, just check the distance between the hubs at 90° intervals. When this spacing is unequal you have angular misalignment (Fig. 1).

It is the result of the bed plate not being on a true plane. Adjustment must be made by manipulating the wedges or using additional wedges to correct the situation.

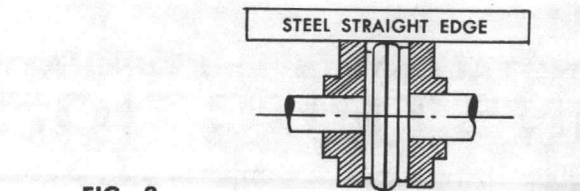
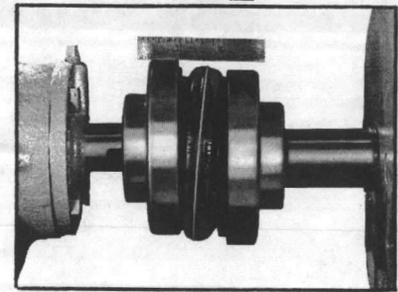
6. Now, check for parallel misalignment. An ordinary 6" scale will suffice on the regular Sure-Flex couplings. Lay the scale across the outside flanges. If parallel misalignment is found, (Fig. 2) it is caused by one of the four corners of the bed plate being too high. Withdraw slightly the wedge under the bed plate nearest the "high" corner. It is also possible that the motor may have shifted over the hold-down bolts during shipment or handling. In this case, loosen the hold-down bolts and bump the motor slightly in the direction necessary to bring its shaft with coupling into perfect alignment with pump shaft.



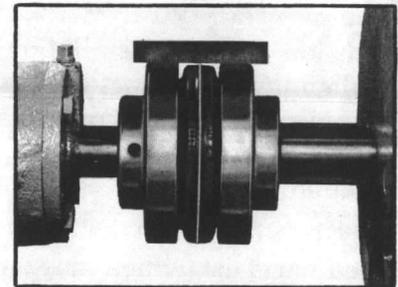
**FIG. 1
ANGULAR
MISALIGNMENT**



**FIG. 2
PARALLEL
MISALIGNMENT**



**FIG. 3
CORRECT
ALIGNMENT**



7. Perfect alignment (Fig. 3) exists only when the hub faces are parallel and concentric. The Sure-Flex coupling has been selected for use with WEINMAN Split Case Pumps because of its outstanding features. Sure-Flex Couplings are die cast or precision machined and all keyways and set screws are furnished as standard equipment. These lightweight couplings are simple to assemble and dis-assemble and require no lubrication. A particularly worthwhile feature of the Sure-Flex Coupling is its ability to absorb minor misalignment up to 4°, without damaging the coupling.
8. To complete the setting of your WEINMAN Pump, draw down slightly on the foundation bolt nuts. Provide a form or dam around the contour of the bed plate. Pour grout through holes, provided for this purpose, in sufficient quantity to reach a level of ¾" to 1" above the bottom of the bed plate. Allow grouting to set thoroughly, then proceed with pipe connections.

SUCTION PIPING: The illustrations on page 7 are offered as a help in avoiding errors frequently made in suction piping . . . such as abrupt changes in pipe size, the use of concentric reducer, and the placing of an elbow in a horizontal plane next to the suction nozzle of a double suction type of pump, etc.

The following are of equal importance and should be carefully observed:

1. Never use pipe of a smaller size than that for which the pump is fitted. Almost invariably, it is necessary to use one pipe size larger, and sometimes several sizes larger in order to avoid excessive frictional loss with a resultant prohibitively high working suction lift. Select the size pipe necessary so that when the frictional loss is added to the actual static suction lift, the total suction lift will not exceed 15 to 18 ft. When centrifugal pumps are subjected to a higher suction lift, they are likely to fall short of capacity . . . unless specifically ordered for an abnormal suction condition.
2. The suction pipe, from the source of water supply, should be laid with a gradual incline . . . not on a level . . . toward the pump, with the highest point in the line at the pump suction connection. If the pipe is level and if there are any high points in the line which will form air pockets, it is sometimes difficult to secure proper priming.
3. If conditions require the use of a foot valve and strainer, the area of the foot valve should be

from 1½ to 2 times the area of the suction pipe; and the strainer should have a free-opening area equal to 3 to 4 times the area of suction pipe. Otherwise excessive frictional loss will result.

4. If a gate valve is used on the suction line to a pump operating under a suction lift, the valve stem should be placed in a horizontal plane, or preferably in a vertical, downward position in order to avoid a possible air leak.
5. The end of the suction pipe should always be submerged from 18" to 4 or 5 ft., depending upon the size of pump and the entrance velocity. If only limited submergence can be had, the end of pipe should be belled or flared. A board floating on the surface of water surrounding the suction pipe will even be helpful against the formation of a vortex permitting air to enter the suction pipe.
6. Especially with pumps operating under high suction lift, the suction piping should be tested thoroughly against air leaks. A small volume of air will materially reduce the capacity of pump, and a larger volume will frequently unprime the pump.
7. Installations which will be subjected to considerable temperature variation should be provided with some means for compensating for expansion and contraction. A 50° temperature change means an expansion or contraction of approximately ¾" in a pipe line of 100 ft. length. This will result in distortion and misalignment of pump, and sometimes actual breakage.
8. The pipe should not be pulled into position by drawing down on the flange bolts. The pipe should meet the pump and the pump should not be required to meet the pipe. All piping should be supported independently of the pump. Pumps are not designed for carrying heavy loads imposed by piping and its contents.
9. If other than cold water is to be handled, refer to table on page 4 for limit of suction lift and/or amount of positive suction head . . . sometimes required in order to avoid vaporization.
10. In making installation, guard against the possibility of foreign material such as nails, bolts or pieces of waste being left in the line, likely to lodge in the impeller and cause loss of capacity.
11. When the suction supply is taken from a tank or sump, incoming water should never be allowed to fall from above the water level near the end of suction pipe. This will carry air down into the suction pipe.

**TABLES for SUCTION LIFT for Centrifugal Pumps
for Water at Different Elevations and Temperatures**

**ATMOSPHERIC PRESSURE, BAROMETER READING AND EQUIVALENT
HEAD OF WATER AT DIFFERENT ALTITUDES**

Altitude Above Sea Level in Feet	Atmospheric Pressure Pounds Per Sq. In.	Barometer Reading Inches of Mercury	Equivalent Head of Water Feet	Maximum Practical Suction Lift of Pumps in Feet
0	14.7	29.929	33.95	25
1000	14.2	28.8	32.7	23
2000	13.6	27.7	31.6	23
3000	13.1	26.7	30.2	22
4000	12.6	25.7	29.1	21
5000	12.1	24.7	27.9	20
6000	11.7	23.8	27.0	19
7000	11.2	22.9	25.9	19
8000	10.8	22.1	24.9	18
9000	10.4	21.2	24.0	17
10000	10.0	20.4	23.1	16

For Ft. Hd. of liquid divide Ft. Hd. of water by specific gravity of liquid pumped.

NOTE — Barometer in inches multiplied by 0.4908 equals pressure per square inch.

Suction lift is vertical distance from center of pump shaft to water level plus pipe friction and other losses, if any.

SUCTION HEAD REQUIREMENTS WHEN PUMPING HOT WATER

Suction Head Required for Both Centrifugal and Reciprocating Pumps when Handling Hot Water at Different Altitudes.

Minimum Allowable Head in Ft. on Suction	Temperatures of Water in Degrees F.									
	120	130	140	150	160	170	180	190	200	210
At sea level	-----	-----	-----	-----	0	3	5	7	10	12
At 2,000 alt.	-----	-----	-----	1	3	5	7	10	12	15
At 4,000 alt.	-----	0	1	3	5	7	10	12	14	-----
At 6,000 alt.	0	1	3	5	7	10	12	14	16	-----
At 8,000 alt.	0	3	5	7	9	12	14	16	-----	-----
At 10,000 alt.	2	4	7	9	11	14	16	18	-----	-----

PROPERTIES OF WATER AT VARIOUS TEMPERATURES FROM 40 TO 540 F

Temp F	Temp C	Specific Volume Cu Ft/Lb	Specific Gravity	Wt in Lb/Cu Ft	Vapor Pressure Psi Abs
40	4.4	.01602	1.0013	62.42	0.1217
50	10.0	.01603	1.0006	62.38	0.1781
60	15.6	.01604	1.0000	62.34	0.2563
70	21.1	.01606	0.9987	62.27	0.3631
80	26.7	.01608	0.9975	62.19	0.5069
90	32.2	.01610	0.9963	62.11	0.6982
100	37.8	.01613	0.9944	62.00	0.9492
120	48.9	.01620	0.9901	61.73	1.692
140	60.0	.01629	0.9846	61.39	2.889
160	71.1	.01639	0.9786	61.01	4.741
180	82.2	.01651	0.9715	60.57	7.510
200	93.3	.01663	0.9645	60.13	11.526
212	100.0	.01672	0.9593	59.81	14.696
220	104.4	.01677	0.9565	59.63	17.186
240	115.6	.01692	0.9480	59.10	24.97
260	126.7	.01709	0.9386	58.51	35.43
280	137.8	.01726	0.9293	58.00	49.20
300	148.9	.01745	0.9192	57.31	67.01
320	160.0	.01765	0.9088	56.66	89.66
340	171.1	.01787	0.8976	55.96	118.01
360	182.2	.01811	0.8857	55.22	153.04
380	193.3	.01836	0.8736	54.47	195.77
400	204.4	.01864	0.8605	53.65	247.31
420	215.6	.01894	0.8469	52.80	308.83
440	226.7	.01926	0.8328	51.92	381.59
460	237.8	.0196	0.8183	51.02	466.9
480	248.9	.0200	0.8020	50.00	566.1
500	260.0	.0204	0.7863	49.02	680.8
520	271.1	.0209	0.7674	47.85	812.4
540	282.2	.0215	0.7460	46.51	962.5

Computed from Keenan & Keyes' Steam Table.

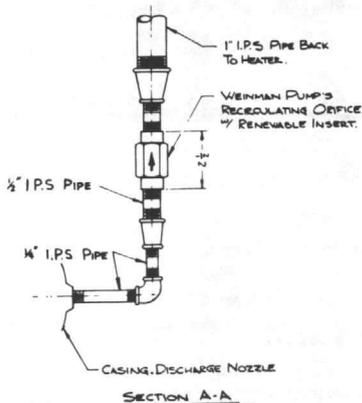
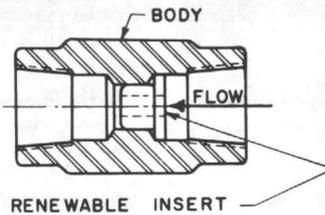
DISCHARGE PIPE: The discharge pipe should never be of a smaller size than that for which the pump is fitted and, in most cases, should be one and sometimes two sizes larger in order to avoid excessive frictional loss. Avoid sudden or abrupt changes in pipe sizes which cause shock or frictional losses. Use increasers of the concentric type. Eccentric increasers are not required for the discharge line.

Gate and check valves should be installed in the line with the check placed between pump and gate valve. A check valve, under most conditions of service, is required as a protection to the pump against excessive surge pressure when a foot valve is used on the suction, as well as for protection against reversed rotation if no foot valve is used.

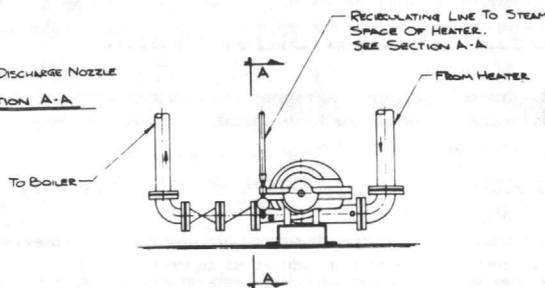
In installations where noise is highly objectionable, such as hospitals, hotels and apartment buildings, the discharge pipe should not be attached to steel work or hollow walls without being insulated properly against vibration. In extreme cases, it is desirable that the discharge line be provided with a flexible connection.

RECIRCULATING ORIFICE: A pump operating at or near shut-off, as in boiler feed service when there is no demand for steam, all the horsepower of the motor is converted into heating the water in the pump until eventually it turns to steam.

To prevent this, a small amount of water should be continuously recirculated from the pump discharge back to the inlet source which, in boiler feed service, is the deaerating heater. Weinman can supply and size an orifice for establishing the required amount of recirculation for any application. It has a bronze body tapped for $\frac{1}{2}$ " pipe on each end and is fitted with replaceable, stainless steel orifice inserts of various sizes.



INSTALLATION OF RECIRCULATING ORIFICE



PRIMING: Centrifugal pumps of the conventional type must be primed before they will start pumping. With a foot valve on the suction, the simplest method of priming is to fill the suction line and pump, including enough of the discharge line to bring the water level up a foot or two above the top of the casing or volute. The air vents should be left open until water flows several times with no trace of air. The shaft with impeller should be turned several times by hand in order to release air which may be trapped in the impeller.

If a portion of the suction line is laid on a near-level, several minutes may be required for the air to find its way to the highest point and escape through the air vents in top of casing. If the pump fails to pump when first started, it should be stopped and after a delay of a few minutes, the air vents should be reopened until a full stream of water, without any trace of air, flows out.

Do not allow a pump... especially a new one... to operate for a long period of time without being properly primed.

ROTATION: The rotation is indicated by arrow on the casing, and the correct rotation of three phase motors should be established before assembling coupling. The pump should not be operated backwards or in reverse rotation. If the motor operates in the wrong rotation, interchange any two of the lead wires and the opposite rotation will result.

STARTING: For initial starting, the gate valve in the discharge line should be closed, and opened gradually as the motor approaches full speed... usually in from five to ten seconds. After the pump has once been in operation so that the discharge line has been completely filled, it is then unnecessary to close the gate valve in starting.

STUFFING BOX PACKING: After starting the pump, adjust gland nuts evenly until leakage is a stream about the size of a pencil lead. This amount of leakage is required to provide cooling, lubrication and to avoid rapid wear of shaft sleeves. When packing becomes so worn that gland is fully entered and can no longer compress the packing, one ring of packing may be added. After further wear however, the box should be repacked by the following procedure:

1. Clean out all old packing from the box and remove seal cage if pump is so equipped. Note location of sealing water hole in stuffing box and when repacking be sure seal cage is installed opposite the hole. Failure to do this will block the flow of sealing liquid.
2. Inspect sleeve for wear and if it is scored or grooved it should be replaced.
3. Fit packing neatly around the shaft with ends fitting in a tight joint.
4. Force first ring firmly and evenly to the bottom of the box. Dipping rings in oil and graphite will aid running in of the packing.

Continued to Page 6

5. Insert remaining rings with joints staggered 180° apart. Compress each ring firmly as described above. Rotate shaft by hand each time a ring is inserted to aid in seating packing. If pump is equipped with seal cage, install it opposite sealing water connection.
6. When the box is full, compress the packing with the gland. Be sure to adjust gland evenly and also be sure that the gland has entered the box at least 1/8". If the packing will not compress enough to allow this amount of gland entrance, remove one ring of packing.
7. After pump is started, adjust gland nuts so that leakage is as described above. Care should be taken during the first hour of operation to take up on the packing gradually just enough to maintain this amount of leakage. The "breaking in" period of the packing is most important in the satisfactory performance of a stuffing box.

CARE OF BALL BEARINGS: The ball bearings on pump and motor, as shipped from factory, are furnished with sufficient lubricant for from two to three months' operation. Do not add more lubricant when putting the unit in service.

Injury to ball bearings is more likely to result from over-greasing than from under-greasing. The real purpose of a lubricant for ball bearings is to form a coating on the highly polished surfaces as a protection against corrosion, rather than for lubrication. An over supply of grease in ball bearings produces heating . . . due to friction . . . and causes the grease to ooze out of bearing housing along the shaft, as the bearing becomes warm.

Under usual conditions, ball bearings will reach a temperature of from 10° to 55° F. above surrounding temperature. Unless the bearing temperature reaches 125 F. above surrounding temperature, there is no cause for alarm.

Ball bearings require additional lubricant only two or three times per year, depending upon the continuity of service. Do not use more grease than necessary

to fill the bearing housing one-fourth to one-third full.

If bearings are removed from housing for cleaning, use extreme care to see that they are thoroughly dry before being re-installed. Use carbon-tetrachloride, or kerosene to clean bearings. Water or moisture is destructive to all ball bearings.

The particular brand of grease is unimportant, providing it is a lithium base grease, especially if the bearing is used in a location where there is excessive moisture or danger of water getting into the housing.

For temperatures of from 32° to 200° F. at the bearings, the following brands of lubricant are suggested:

Grease Lubricated Pumps and Motors:

American Oil Company.....	Amolith No. 2
Cities Service Oil Co.....	Trojan H2
Continental Oil Co.....	Conoco Super Lube
Humble Oil & Refining Co.....	Nebula EP No. 2
Fiske Bros.....	Lubriplate 630-2
Shell Oil Co.....	Alvania No. 2
Sinclair Refining Co.....	Litholine 2
Standard Oil of Ohio.....	Sohitran 2
Texaco Inc.....	Multifak 2
Union Oil Co.....	UNOBA No. 2

Oil Lubricated Pumps:

American Oil Co.....	American No. 31
Cities Service Oil Co.....	Pacemaker No. 3
Continental Oil Co.....	Conoco Dectol Medium
Humble Oil & Refining Co.....	Teresso 52
Fiske Bros.....	Lubriplate No. 2
Shell Oil Co.....	Tellus Oil 33
Sinclair Refining Co.....	Rubilene Medium
Standard Oil of Ohio.....	Sohiois 52
Texaco Inc.....	Regal Oil PC (R & O)
Union Oil Co.....	Red Line-Turmaco 300

MUELLER PUMP is prepared to supply suitable grease put up in foil tubes, about 1" diameter x 5" long . . . containing 1 3/4 ounces. Approximately 1/2 ounce of grease, or a teaspoonful for bearings of small size, and a tablespoonful for larger sizes, is needed each time a bearing is relubricated.

.....
PUMP TROUBLES and THEIR CAUSES

FAILURE TO PUMP

1. Pump not properly primed.
2. Wrong direction of rotation.
3. Speed too low.
4. Total head too high.

REDUCED CAPACITY AND/OR HEAD

1. Air pockets or leaks in suction line.
2. Clogged impeller.
3. Foot-valve-strainer too small or clogged.
4. Insufficient submergence for suction pipe.
5. Excessive suction lift . . . much over 15 ft.
6. Insufficient positive suction head (for hot water).
7. Total head more than that for which pump is intended.
8. Excessively worn impeller and wearing rings.

RAPID WEAR OF COUPLING CUSHIONS

1. Always the result of misalignment or a bent shaft.

PUMP LOSES PRIMING

1. Air leaks in suction line.
2. Excessive amount of air in water.
3. Water seal in stuffing box not functioning.
4. Excessive suction lift and pump operating too near shut-off point.

OVERLOADED DRIVING UNIT

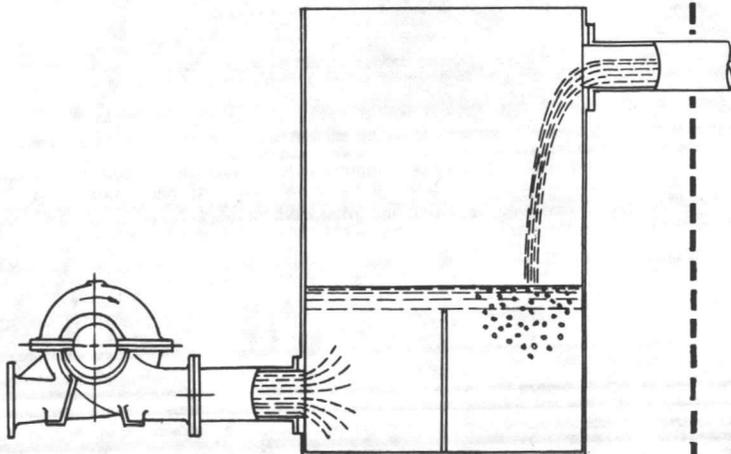
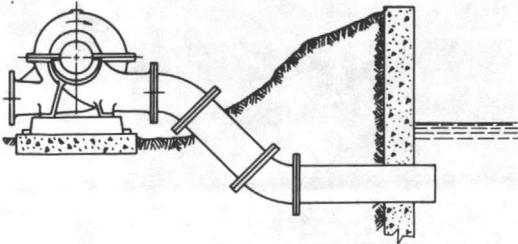
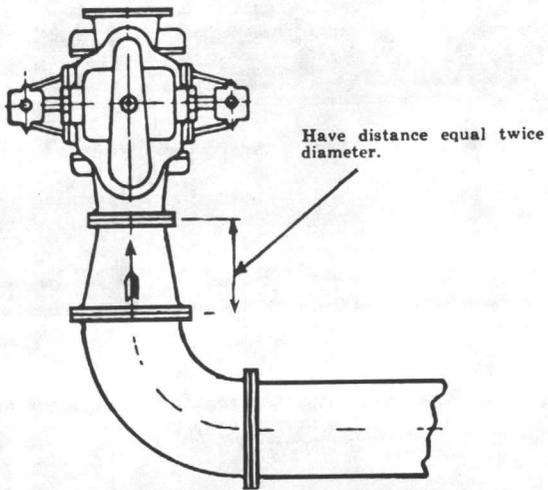
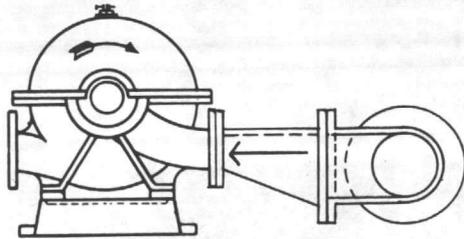
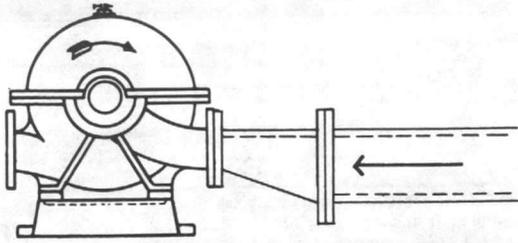
1. Head much lower than that for which pump is designed.
2. Speed too high . . . higher than that contemplated.
3. Liquid handled of high specific gravity and greater viscosity than that of water.

MECHANICAL TROUBLES AND NOISE

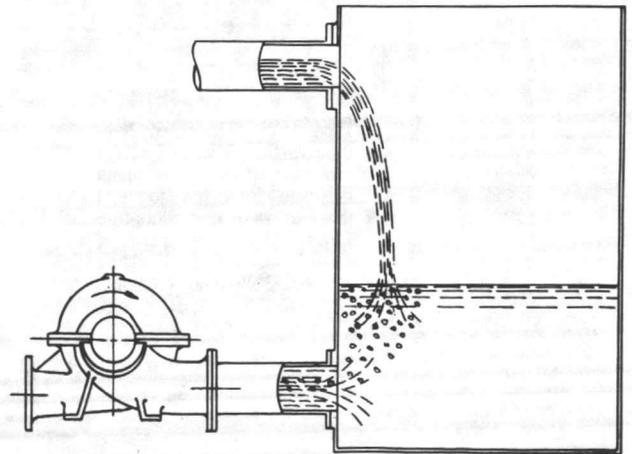
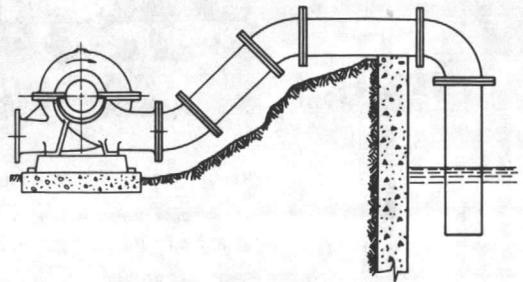
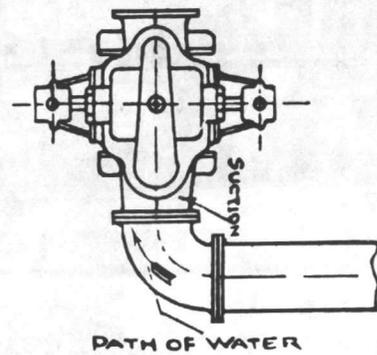
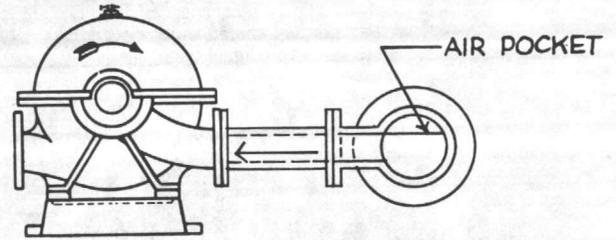
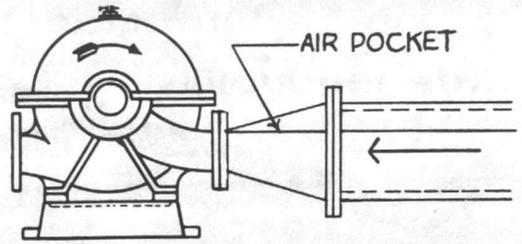
1. Misalignment.
2. Excessive suction lift or vapor binding (hot water).
3. Bent shaft and/or damaged bearings.
4. Suction and discharge piping not properly supported and anchored.

SUCTION PIPING

RIGHT

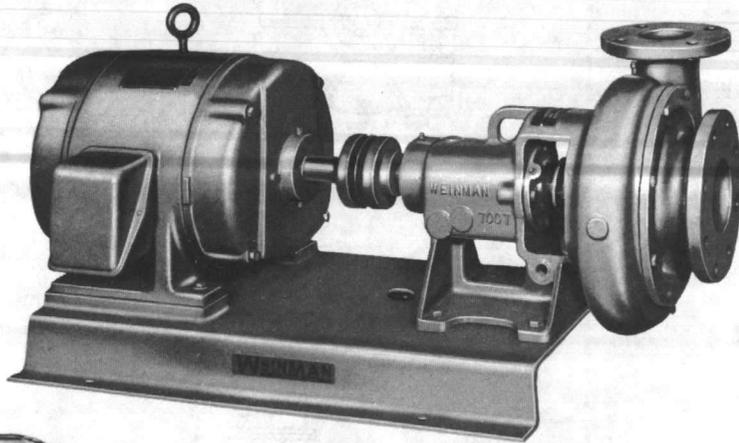


WRONG

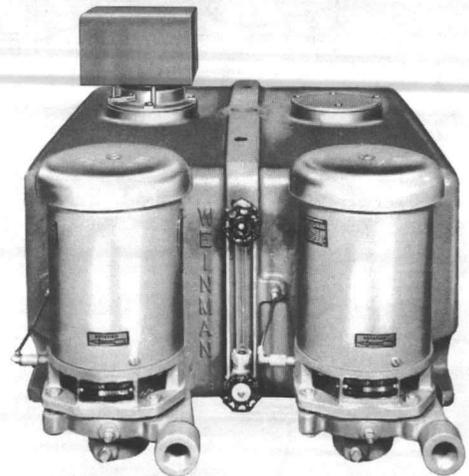
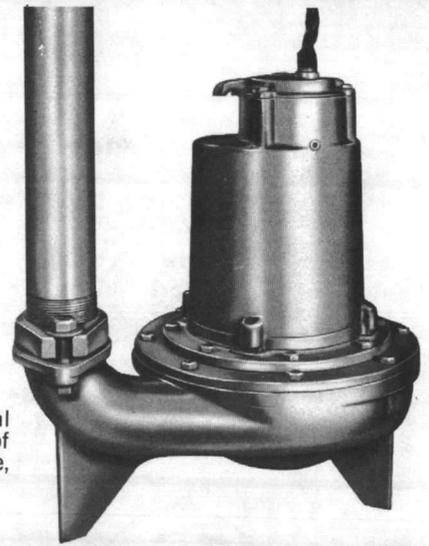


All types of industries rely on
WEINMAN Centrifugal Pumps
 for top performance
 ...dependability

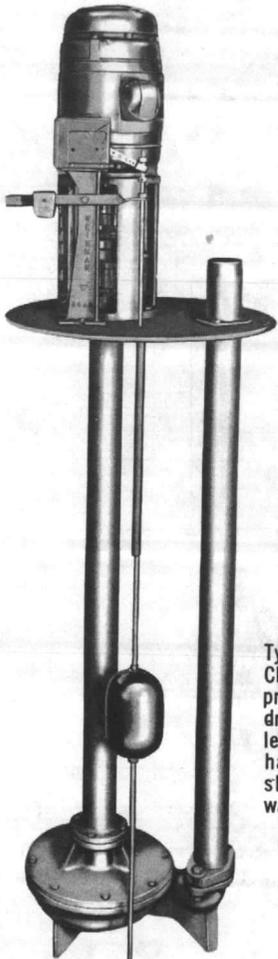
WEINMAN Type G-B single stage, end suction centrifugal pump is recommended for refrigeration plant service; hot and chilled water circulation . . . for virtually every phase of liquid handling.



Type MG Immersible General Service Pump furnishes years of dependable, low maintenance, submerged pumping service.

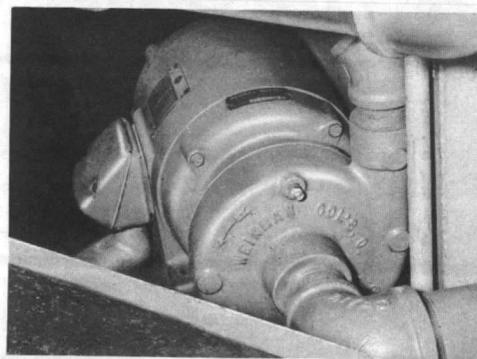


Type ACV and ADV Condensate Return Units with cast-iron receivers and vertically mounted Unipumps.



Type M-VS Submerged Non-Clog Vertical Sewage Ejectors provide fast, effective pump drainage from low to high level as well as trouble-free handling of raw sewage, sludge, trash and other wastes . . . without clogging.

Revolutionary Vortex Liquid Ring Type Y self-priming uni-pump. Pumps liquid, air, vapor or any mixture of these three.



General Service Unipumps for dependable, 'round-the-clock general purpose pumping, hot and chilled water circulation and pressure boosting.

Mueller Pump
 AERMOTOR-MIDLAND-WEINMAN
 A MUELLER COMPANY

P.O. Box 1364 Commerce & Exchange
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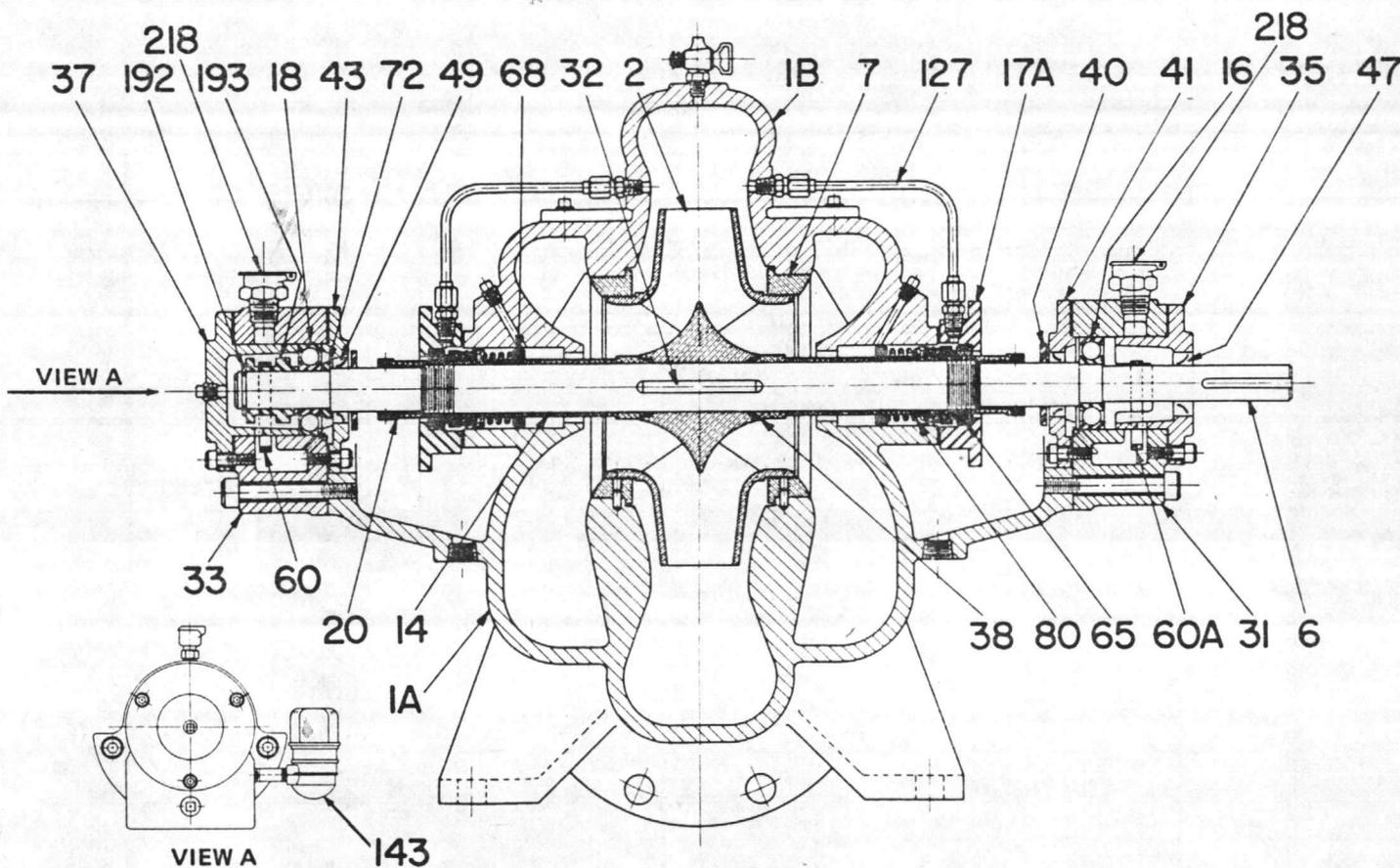
VALLEY PUMP GROUP
WEINMAN ENGINEERED PRODUCTS

Commerce & Exchange Sts. Conway, AR 72032
(501) 329-9811

Section No. 1200
Page 517
January 15, 1977

PARTS LIST

Types L-1, L-2, L-3, L-4, L-5, L-6, Split Case Pumps
Double Suction With Oil Lubricated Bearings
(With Mechanical Shaft Seals)



ITEM NO.	NAME	ITEM NO.	NAME	ITEM NO.	NAME
† 1A	CASING (LOWER HALF)	35	BEARING COVER (INBOARD)	* 73	CASING GASKET
† 1B	CASING (UPPER HALF)	37	BEARING COVER (OUTBOARD)		SUCTION SIDE (NOT SHOWN)
* 2	IMPELLER	*38	SHAFT SLEEVE GASKET	* 73A	CASING GASKET
6	SHAFT	40	DEFLECTOR (LIQUID)		DISCHARGE SIDE (NOT SHOWN)
* 7	CASING RING	41	BEARING CAP (INBOARD)	† * 80	MECHANICAL SHAFT SEAL
‡ * 8	IMPELLER RING (NOT SHOWN)	43	BEARING CAP (OUTBOARD)		(ROTATING ELEMENT)
14	SHAFT SLEEVE	*47	BEARING COVER SEAL (INBOARD)	127	SEAL PIPING
*16	BEARING (INBOARD)	*49	BEARING CAP SEAL	143	CONSTANT LEVEL OILER
17A	SEAL CAP	*60	OIL RING (OUTBOARD)	192	RETAINING RING (BEARING)
*18	BEARING (OUTBOARD)	*60A	OIL RING (INBOARD)	193	RING GUIDE
20	SHAFT SLEEVE NUT	† *65	MECHANICAL SHAFT SEAL	*194	BEARING HOUSING GASKETS
31	BEARING HOUSING (INBOARD)		(STATIONARY ELEMENT)		(INBOARD)
*32	IMPELLER KEY	68	SEAL COLLAR	*195	BEARING HOUSING GASKETS
33	BEARING HOUSING (OUTBOARD)	72	THRUST COLLAR		(OUTBOARD)
				218	OIL CAP

†Furnished Only In Pairs As Complete Units

*For Domestic Service We Recommend These Parts Be Carried In Stock As Spares

‡Double Wearing Rings Furnished As Standard Equipment On 8' And Larger Pumps

All Others As Special Equipment Only

WHEN WRITING THE FACTORY REGARDING YOUR PUMP - ALWAYS INCLUDE SERIAL NUMBER

Supersedes Section 1200, Page 517
Dated January 1972



VALLEY PUMP GROUP
 WEINMAN ENGINEERED PRODUCTS

Commerce & Exchange Sts. Conway, AR 72032
 (501) 329-9811

MATERIAL OF CONSTRUCTION

Item No.	Name	Standard Fitted	All Iron	All Bronze	Ductile Iron Bronze Fitted
1A	Casing (Lower Half)	C.I.	C.I.	Bronze	Ductile
1B	Casing (Upper Half)	C.I.	C.I.	Bronze	Ductile
2	Impeller	Bronze	C.I.	Bronze	Bronze
6	Shaft	SAE 1045	SAE 1045	SAE 1045	SAE 1045
7	Casing Ring	Bronze	C.I.	Bronze	Bronze
8	Impeller Ring	Bronze	C.I.	Bronze	Bronze
13	Packing	Graphite-Asbestos	Graphite-Asbestos	Graphite-Asbestos	Graphite-Asbestos
14	Shaft Sleeve	Bronze*	C.I.	Bronze*	Bronze*
16	Bearing (Inboard)	Steel	Steel	Steel	Steel
17A	Seal Cap	C.I.	C.I.	Bronze	Ductile
18	Bearing (Outboard)	Steel	Steel	Steel	Steel
20	Shaft Sleeve Nut	Bronze	C.I.	Bronze	Bronze
29	Seal Cage	Bronze	C.I.	Bronze	Bronze
31	Bearing Housing (Inboard)	C.I.	C.I.	C.I.	C.I.
32	Impeller Key	Stainless	Stainless	Stainless	Stainless
33	Bearing Housing (Outboard)	C.I.	C.I.	C.I.	C.I.
35	Bearing Cover (Inboard)	C.I.	C.I.	C.I.	C.I.
37	Bearing Cover (Outboard)	C.I.	C.I.	C.I.	C.I.
38	Shaft Sleeve Gasket	Plant fiber	Plant fiber	Plant fiber	Plant fiber
40	Deflector (Liquid)	Neoprene	Neoprene	Neoprene	Neoprene
41	Bearing Cap (Inboard)	C.I.	C.I.	C.I.	C.I.
43	Bearing Cap (Outboard)	C.I.	C.I.	C.I.	C.I.
47	Bearing Cover Seal (Inboard)	Leather.	Leather	Leather	Leather
49	Bearing Cap Seals	Leather	Leather	Leather	Leather
60	Oil Ring (Outboard)	Brass	Brass	Brass	Brass
60A	Oil Ring (Inboard)	Brass	Brass	Brass	Brass
63	Stuffing Box Bushing	Brass	Steel	Brass	Brass
65	Mechanical Shaft Seal (Stationary Element)	Ceramic	Ceramic	Ceramic	Ceramic
72	Thrust Collar	Steel	Steel	Steel	Steel
73	Casing Gasket - Suction Side	Plant fiber	Plant fiber	Plant fiber	Plant fiber
73A	Casing Gasket - Disch. Side	Plant fiber	Plant fiber	Plant fiber	Plant fiber
80	Mechanical Shaft Seal (Rotating Element)	Carbon	Carbon	Carbon	Carbon
127	Seal Piping	Nylon	Nylon	Nylon	Nylon
143	Sight Oil Gauge	Brass	Brass	Brass	Brass
192	Retaining Ring (Bearing)	Steel	Steel	Steel	Steel
193	Ring Guide	Steel	Steel	Steel	Steel
194	Bearing Housing Gaskets (Inboard)	Plant fiber	Plant fiber	Plant fiber	Plant fiber
195	Bearing Housing Gaskets (Outboard)	Plant fiber	Plant fiber	Plant fiber	Plant fiber

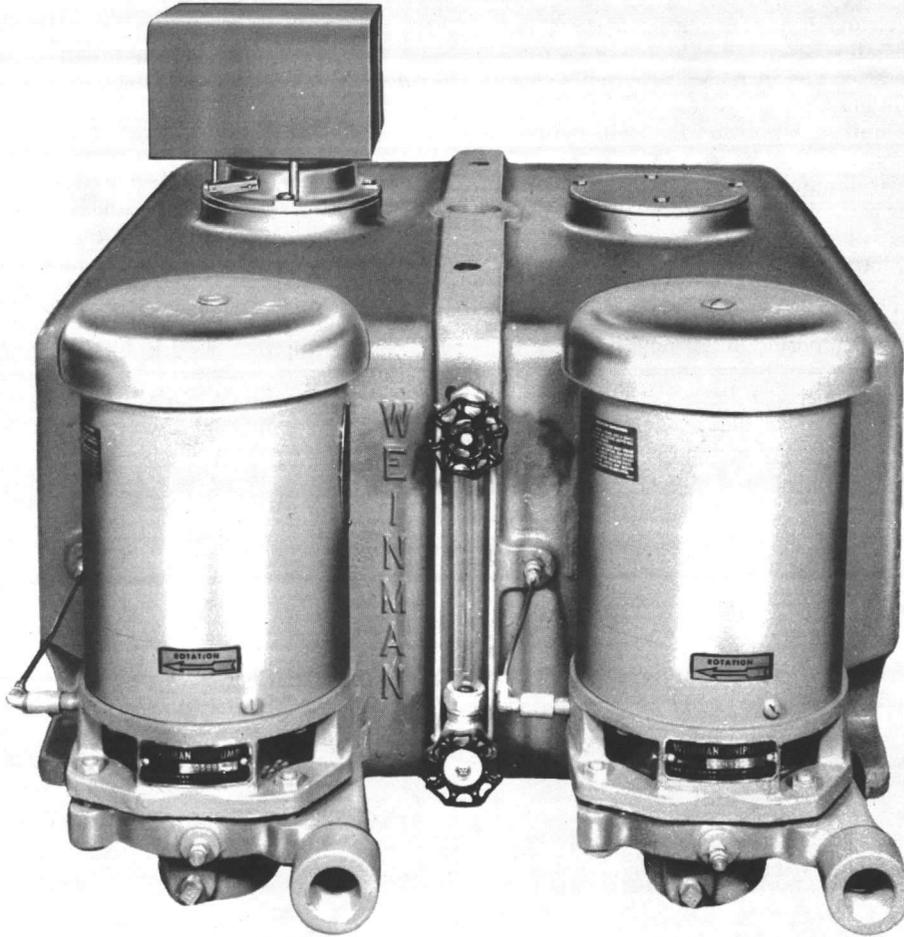
*Aluminum Bronze, 235 Brinell

ASTM B148-49 (9C) H.T.

for quality, efficiency, dependability...

WEINMAN

CONDENSATE RETURN AND
BOILER FEED UNITS
TYPES ACV, ACKV, AEV, AEKV, ADV and AFV



INSTALLATION and OPERATING INSTRUCTIONS

These instructions are important. Please read them thoroughly before installing your Weinman Unit. Quiet, trouble-free operation depends on proper installation and operation procedure. By carefully following the procedure outlined you will insure top performance from your Weinman equipment over a long period of time.

Keep these instructions on hand for future reference, along with the enclosed parts list which will be of help to you should you need replacement parts.



A MUELLER COMPANY

P.O. Box 1364 Commerce & Exchange
Conway, Arkansas 72032 501-329-9811

WEINMAN

INSTALLATION and OPERATING INSTRUCTIONS
for CONDENSATE RETURN and BOILER FEED UNITS

TYPES ACV, ACKV, AEV,
AEKV, ADV and AFV

How to install, maintain and operate WEINMAN Condensate Return and Boiler Feed Units

Your Weinman Condensate Return and Boiler Feed Units are precision designed and built with quality materials and fine workmanship to warrant superior performance under the toughest operating conditions. To insure continued successful operation it is essential the following installation, maintenance and operation instructions be followed in every detail.

INSTALLATION

- STEP 1:** Choose a clean, dry, well ventilated area in which to install your unit. This not only assures proper operation and increased service life, but speeds maintenance.
- STEP 2:** Install the unit in a position that will permit the condensate to flow by gravity into the receiver. This eliminates the possibility of the return lines becoming moisture laden, thus preventing the system from freeing itself of air.
- STEP 3:** After installation, be certain the unit is perfectly level. Shim it when necessary to level.
- STEP 4:** Connect the discharge piping carefully. Be sure that it is supported independently to prevent pipe strain from being transferred to the pump casing. It's good to install a union, gate valve, and check valve in the discharge line.
- STEP 5:** Hook up the return piping making certain that it slopes slightly toward condensate receiver.
- STEP 6:** Install the vent piping. Be sure it is open to the atmosphere at all times.

WIRING

Check the motor nameplate for specific wiring requirements. For safe and proper operation, fuses installed in the safety switches and all wiring must conform to recommendations of the National Electrical Code.

PUMP ROTATION

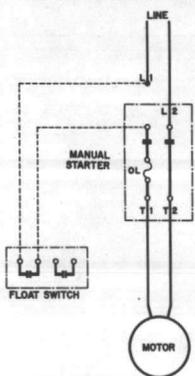
Pump rotation is clockwise as you look down on the pump. Single phase motors are wired so that they rotate clockwise automatically. Three phase motors, however, should be checked carefully for proper rotation prior to operation. To do this:

1. Connect wiring leads to pump motor in the usual manner.
2. Start the motor the first time by just touching the starter button and then stopping the motor immediately. When you do this check the pump shaft for proper clockwise rotation.
3. If pump rotation is counter-clockwise, switch any two of the motor wires to obtain proper rotation.

TYPICAL WIRING DIAGRAMS

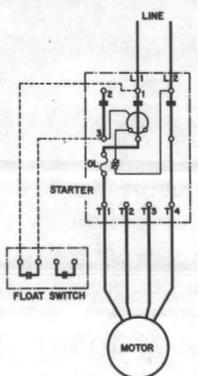
FLOAT SWITCH

SINGLE PHASE MANUAL STARTER



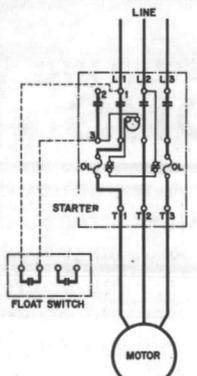
When using manual starter with three position selector switch (Hand-Off-Auto), connect line L1 to "Hand" terminal of switch, and float switch in series to "Auto" terminal and to line L1.

SINGLE PHASE MAGNETIC STARTER



When using magnetic starter with three position selector switch (Hand-Off-Auto), connect float switch to terminals 1 and 2. For low voltage, connect terminals T1 to T2, and T3 to T4. For high voltage, connect terminal T2 to T3.

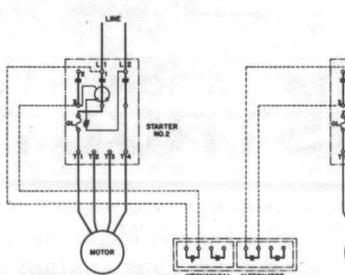
THREE PHASE MAGNETIC STARTER



When using magnetic starter with three position selector switch (Hand-Off-Auto), connect float switch to terminals 1 and 2.

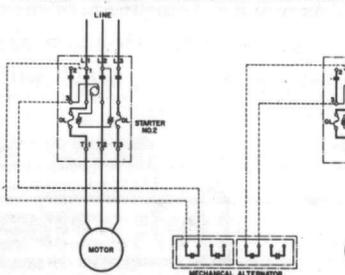
MECHANICAL ALTERNATOR

SINGLE PHASE MAGNETIC STARTER



When using magnetic starter with three position selector switch (Hand-Off-Auto), connect alternator to terminals 1 and 2. For low voltage, connect terminals T1 to T2 and T3 to T4. For high voltage, connect terminal T2 to T3.

THREE PHASE MAGNETIC STARTER



When using magnetic starter with three position selector switch (Hand-Off-Auto), connect alternator to terminals 1 and 2.

LUBRICATION

Under normal condensate service requirements, lubricate motor bearings about once a year. **WARNING! EXCESSIVE GREASING DAMAGES BEARINGS JUST AS QUICKLY AS INSUFFICIENT GREASING.** It is essential to use a good grade of grease. Any of the following brands are acceptable for Weinman Pumps:

American Oil Company.....Amolith No. 2
 Cities Service Oil Company.....Trojan H2
 Humble Oil & Refining Company..Nebula EP No. 2
 Shell Oil Company.....Alvania No. 2
 Sinclair Refining Company.....Litholine 2
 Texaco Inc.....Multifak 2
 Union Oil Company.....UNOBA No. 2

OPERATION

Operation of Weinman Condensate Return and Boiler Feed Units is simple and easy, if you observe these rules in keeping them in proper condition.

New or repaired water systems must be flushed for several days to eliminate all impurities and make sure the entire system is clean. This simple precaution will give you years more of maintenance-free service.

Heating systems should be flushed thoroughly at the start of each heating season for the same reason.

To flush your Weinman Unit . . . remove the drain plug at the receiver and drain the system water into the sewer. If the system water remains dirty after flushing . . . operate it for several days, draining the water into the sewer until it becomes clean.

DISASSEMBLY

Whenever it is necessary to repair the motor or replace the mechanical seal, the pump can be removed from its casing quickly and easily without disturbing the piping.



INSTALLING A NEW MECHANICAL SEAL

CAUTION: This seal is a precision product and should be handled accordingly. Be especially careful not to scratch or chip the lapped sealing faces of the washer and floating seat. If reinstalling a used seal, both sealing faces should be relapped.

INSTALLING STATIONARY ELEMENT

The seat must be seated securely in the seat ring with the lapped face out. The *unlapped* face is marked and correctly assembled when shipped. Oil the seat ring with *light oil* and seat it firmly and squarely. If this cannot be done with the fingers, use a sleeve as shown in Fig. 1, inserting the cardboard shipping disc between the sleeve and the lapped face to prevent scratching sealing face.

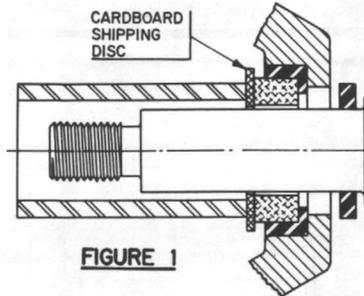


FIGURE 1

INSTALLING ROTATING ELEMENT

Oil shaft with *light oil*. Shaft should be clean and polished smooth. Slide seal body on shaft (washer end first) and seat firmly. A sleeve as shown in Fig. 2 will facilitate this operation and prevent the rubber driving ring from pulling out of place as the seal body is slid along the shaft. Assembly of impeller automatically sets seal in proper position.

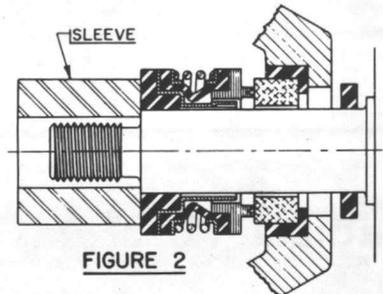
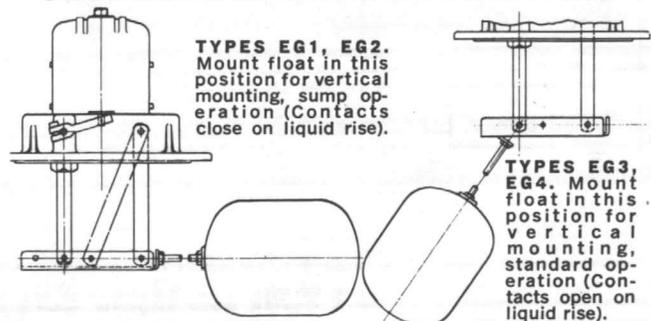


FIGURE 2

Make sure at all times, and particularly before final assembly, that both sealing faces are absolutely clean. Sealing faces should be oiled with clean, light oil.

NEVER RUN THE SEALING FACES DRY. The liquid being handled insures proper lubrication unless other methods of lubrication have been specified. In some cases a short period of operation is required to clear up slight leakage.

REVERSING FLOAT POSITION WHEN USING MECHANICAL ALTERNATOR



TYPES EG1, EG2. Mount float in this position for vertical mounting, sump operation (Contacts close on liquid rise).

TYPES EG3, EG4. Mount float in this position for vertical mounting, standard operation (Contacts open on liquid rise).

PUMP TROUBLES AND THEIR CAUSES

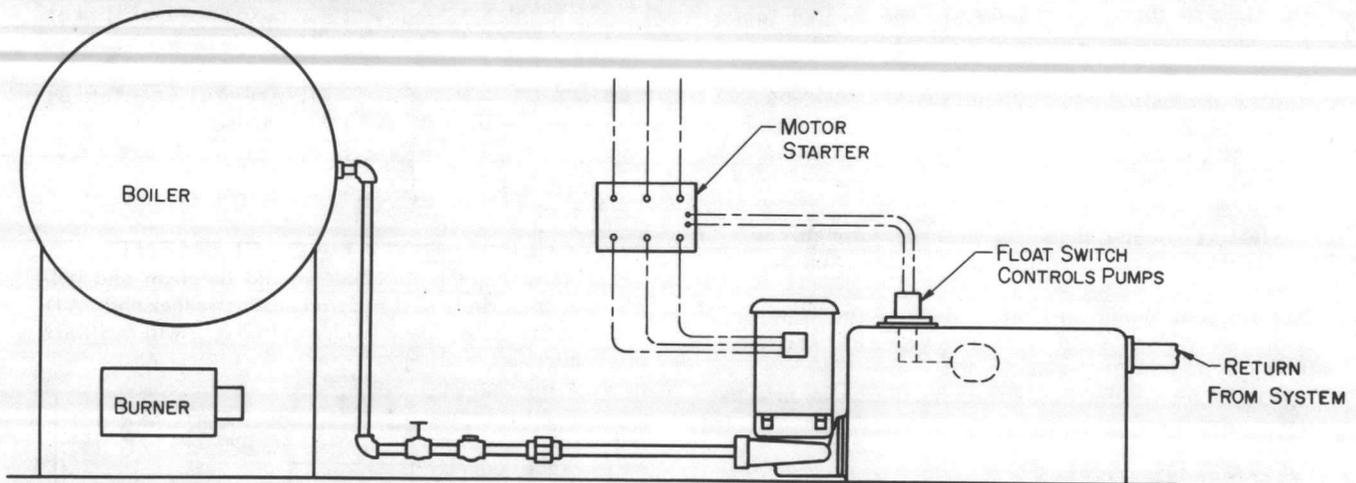
A. Failure to Pump

1. No water in the receiver
2. Rotation in wrong direction
3. Speed too low
4. Return water too hot

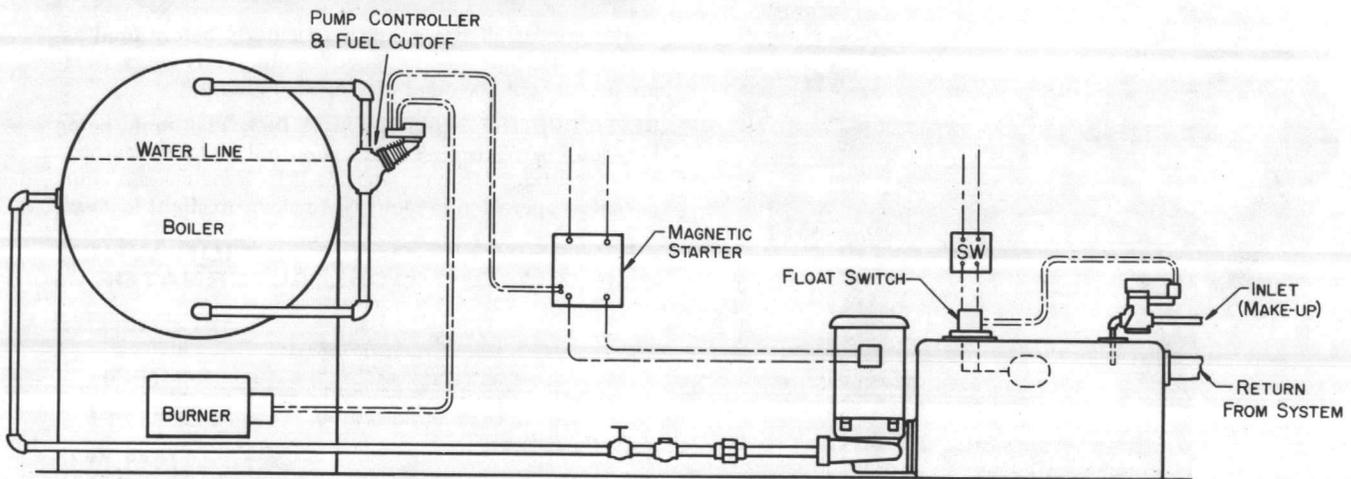
B. Overloaded Driving Unit

1. Total head too low
2. Unit misalignment (check for piping strains)

CONDENSATE RETURN UNIT CIRCUIT



BOILER FEED UNIT CIRCUIT



Mueller Pump
AERMOTOR-MIDLAND-WEINMAN

A MUELLER COMPANY

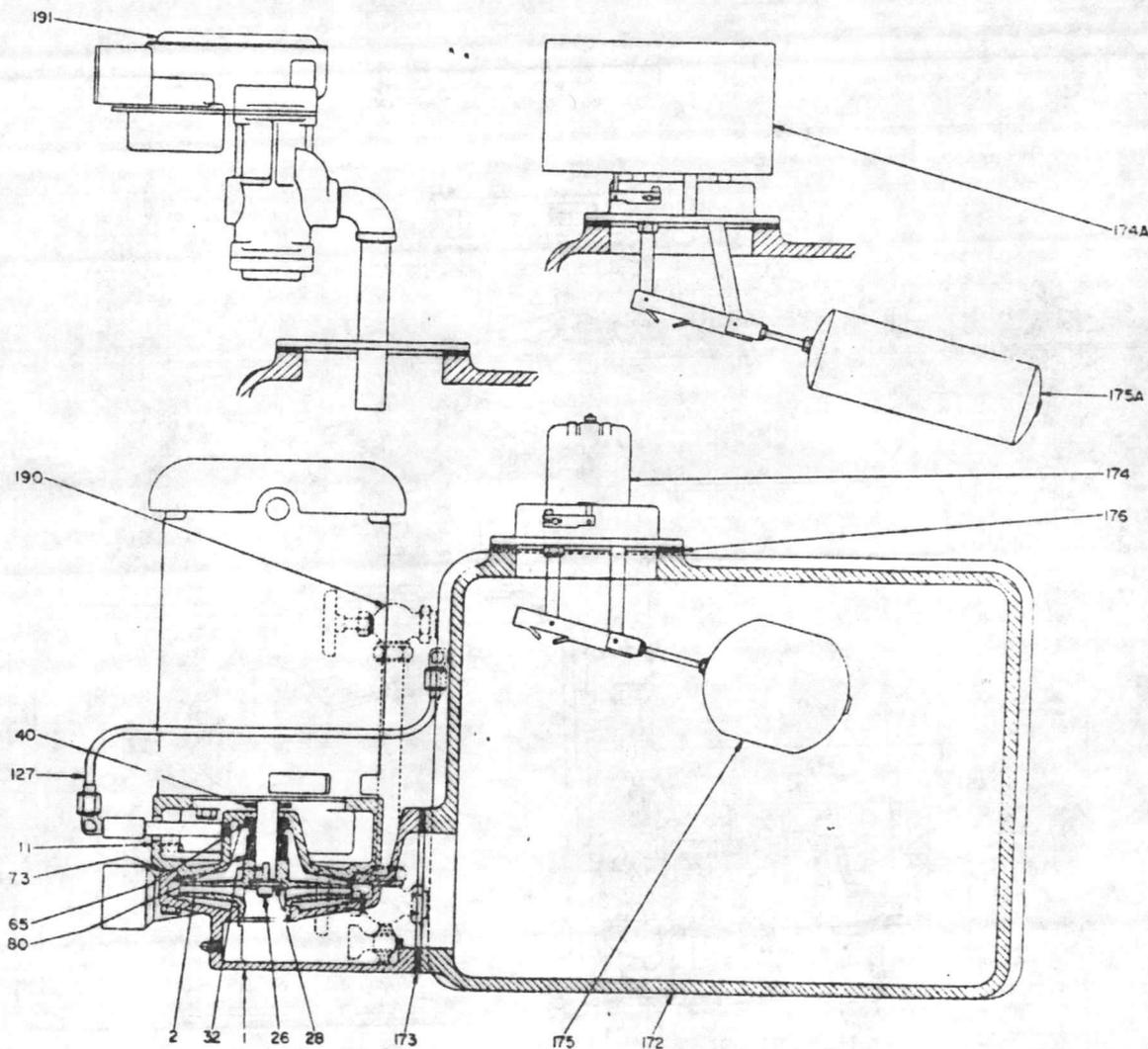
P.O. Box 1364 Commerce & Exchange
Conway, Arkansas 72032 501-329-9811

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WEINMAN

REPAIR PARTS LIST

**TYPES "ACV & AEV" VERTICAL CONDENSATE UNIT
CAST IRON RECEIVERS
(With Type 6 Mechanical Shaft Seal)**



Item No.	Name	Material of Construction (St'd Fitted)	Item No.	Name	Material of Construction (St'd Fitted)
1	CASING	CAST IRON	127	SEAL VENT PIPING	COPPER
* 2	IMPELLER	BRONZE	172	RECEIVER	CAST IRON
11	CASING COVER	CAST IRON	* 173	RECEIVER GASKET	RUBBER
* 26	IMPELLER SCREW	STAINLESS	174	FLOAT SWITCH	Sq. D. #9037
* 28	IMPELLER SCREW WASHER	STAINLESS	174A	MECHANICAL ALTERNATOR	Sq. D. #9038
* 32	IMPELLER KEY	STAINLESS	175	FLOAT (Float Switch)	COPPER
40	DEFLECTOR (Liquid)	NEOPRENE	175A	FLOAT (Alternator)	COPPER
† * 65	MECHANICAL SHAFT SEAL (Stationary Element)	CERAMIC	176	FLOAT SWITCH GASKET	RUBBER
* 73	CASING GASKET	ASBESTOS	190	WATER GAUGE	BRASS
† * 80	MECHANICAL SHAFT SEAL (Rotating Element)	CARBON	191	MAKE-UP VALVE (When Specified)	McDonnell #101

* FOR DOMESTIC SERVICE WE RECOMMEND THESE PARTS BE CARRIED IN STOCK AS SPARES.

† FURNISHED ONLY IN PAIRS AS COMPLETE UNIT.

WHEN WRITING THE FACTORY REGARDING YOUR PUMP - ALWAYS INCLUDE SERIAL NUMBER

Supersedes Section No. 900, Page 501

Dated January 1972



Instruction Sheet

202-001

Heat Exchangers

INSTALLATION

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

CLEANING

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

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

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

NOTE

Commercially available cleaners may also be used.

REPLACEMENT PARTS

When ordering replacement parts specify

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

Normally, the only replacement parts required would be:

- 1 - Tube Bundle
- 1 - Set of Gaskets

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

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

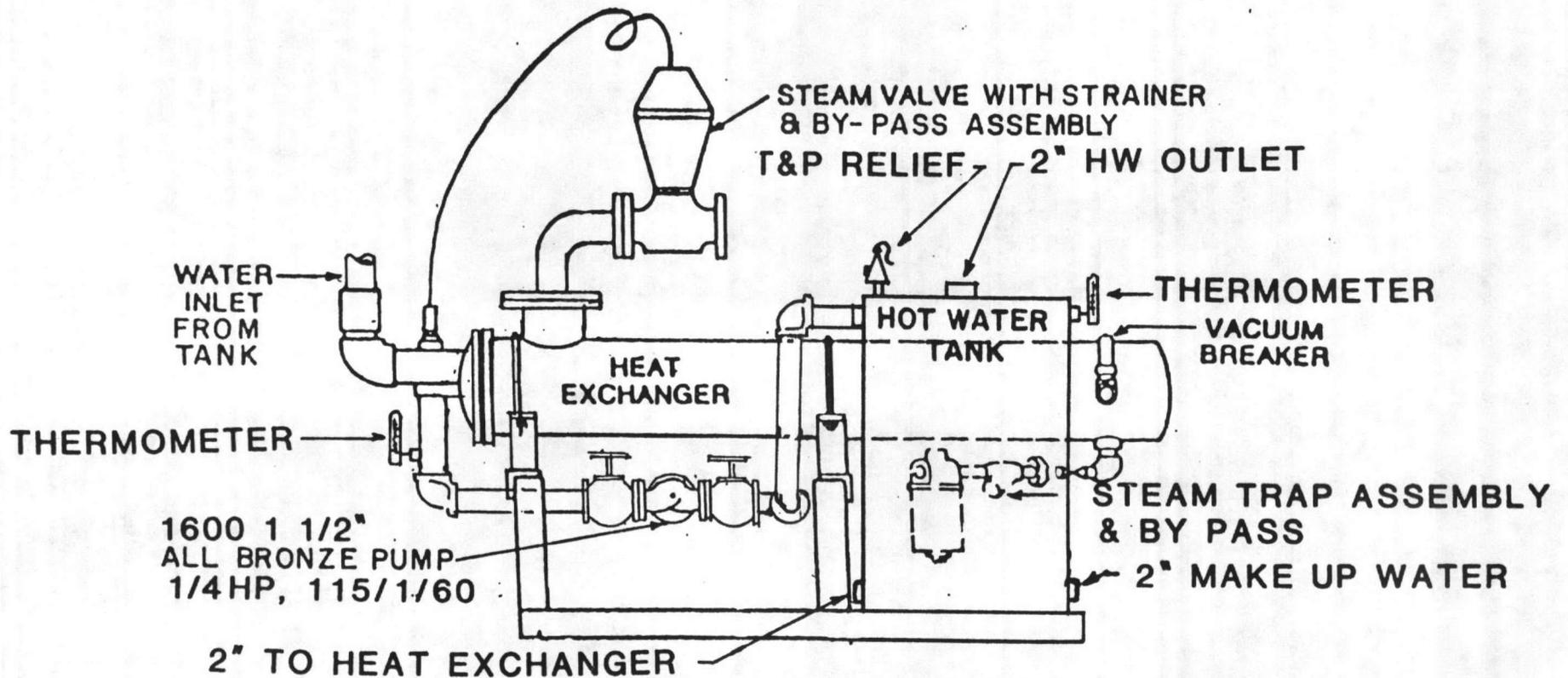
Replacement heads are also available if required.

Quality Through Design — COMPARE.

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

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TACO, INC.

TACO SEMI-INSTANTANEOUS DOMESTIC HOT WATER HEATER



ALL DOMESTIC H W PIPING SHALL BE COPPER
ALL STEAM & CONDENSATE PIPING SHALL BE STEEL





5214



Submittal Data Information U Tube Heat Exchangers

201-009

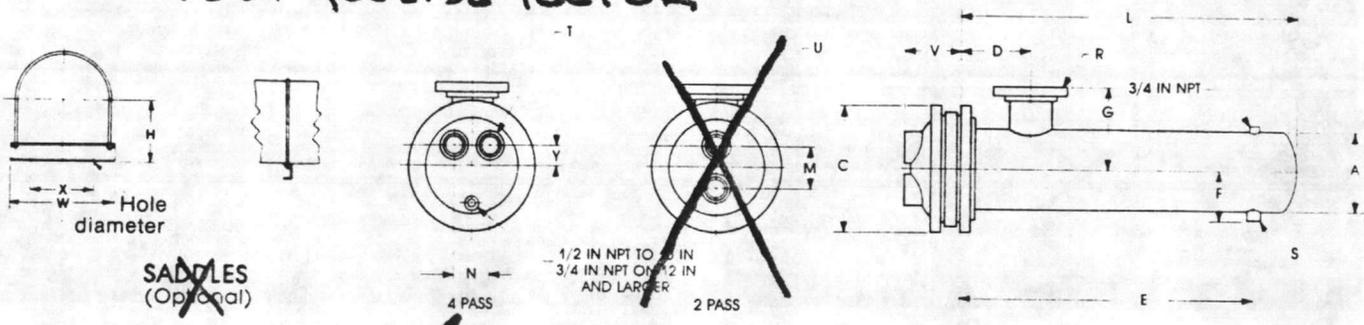
8" DIAMETER STEAM

SUPERSEDES: SD200-1

Job: SEMI INSTANTANEOUS PACKAGES

Item No.	Model No.	Pass	GPM Tubes	Temp. In	Temp. Out	Steam Pressure Shell	Pressure Drop Tubes	Velocity Tubes
heat Ex.	G 8408 S	4	40 GPM	40 °F	120 °F	5 PSI	3.08 Ft.	3.21 SPS

.001 FOULING FACTOR



DIMENSIONS
8 Inch Diameter

Model Number		Cast Iron Heads				Dimensions (Inches)											Heating Surface (sq. ft.)	Shipping Weight (lbs.)
2 Pass	4 Pass	2 Pass M	4 Pass U	2 Pass N	4 Pass T	Y	V	2 and 4 Pass A	C	D	E	F	G	L	R	S		
G8204S	G8404S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	18	6	6	24	2T	1T	16.5	192
G8206S	G8406S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	30	6	6 1/2	36	2 1/2T	1T	25.1	234
G8208S	G8408S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	42	6	6 13/16	48	3T	1T	33.7	283
G8210S	G8410S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	54	6	8 3/8	60	4F	1T	42.4	326
G8212S	G8412S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	66	6	8 3/8	72	4F	1 1/4T	51.0	369
G8214S	G8414S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	78	6	8 3/8	84	4F	1 1/4T	59.7	390
G8216S	G8416S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	90	6	8 3/8	96	6F	1 1/4T	68.3	453
G8218S	G8418S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	102	6	8 3/8	108	6F	1 1/4T	76.9	496
G8220S	G8420S	5	3T	4	2T	2	4 1/4	8 3/8	13 1/2	8	114	6	8 3/8	120	6F	1 1/4T	85.6	540

SADDLE DIMENSIONS: H-7 5/16; W-11 1/4; X-9; Hole Dia.-5/8.

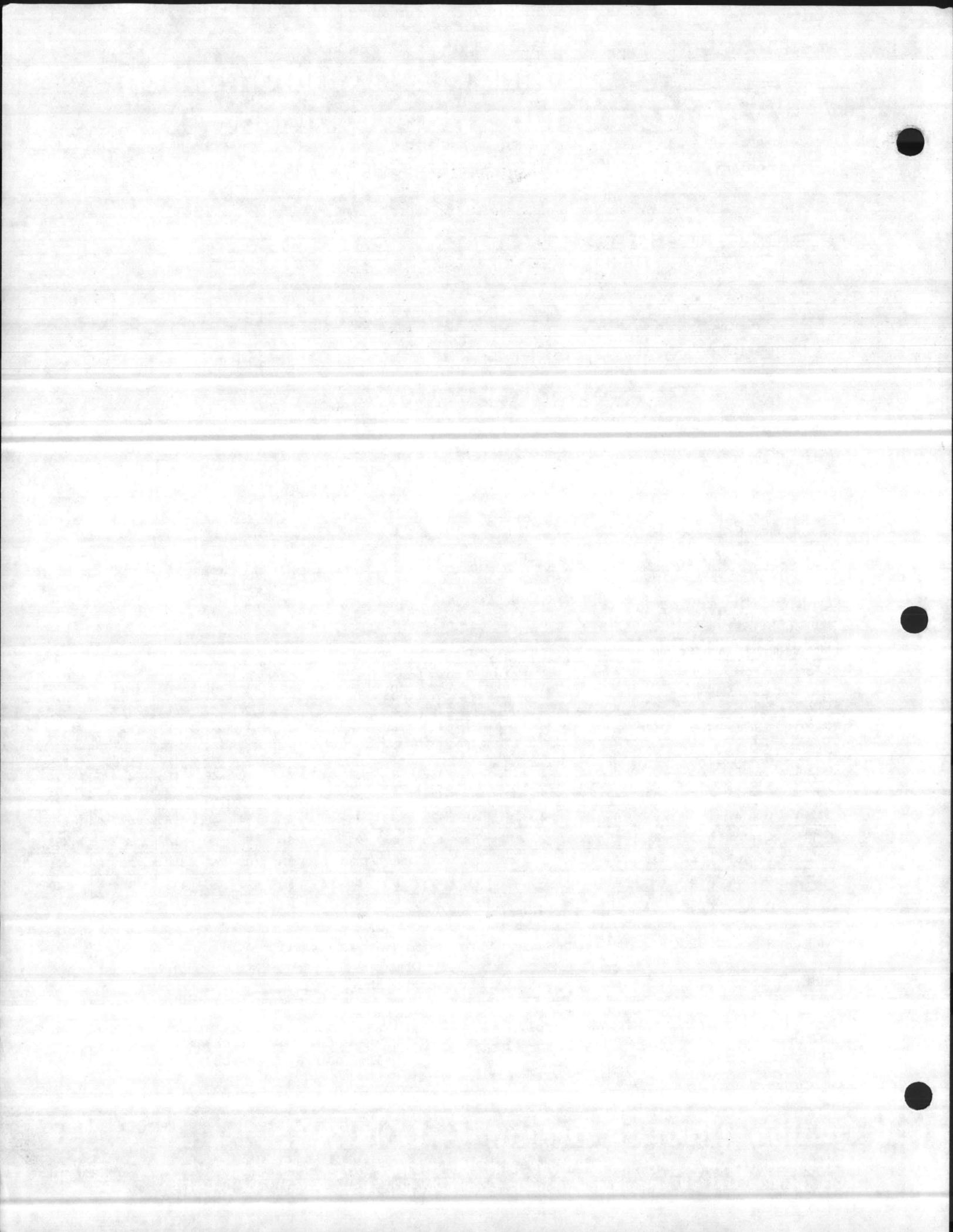
MATERIALS OF CONSTRUCTION (Unless otherwise indicated, standard will be furnished.)

Shell	Standard Steel	Optional 304ss, 316ss
Head	Cast Iron 4-10" Fabricated Steel 12-30"	Fabricated Steel, Cast Bronze, Fabricated 304ss/316ss Cast Bronze, Fabricated 304ss/316ss
Tubes	3/4 x 20 BWG Copper	3/4 x 18 BWG Copper, Steel, 304ss, 316ss, 90/10 Cu Ni, Admiralty
Tube Sheet	Steel	Bronze Brass, 304ss, 316ss, 90/10 Cu Ni
Separators	Steel	Bronze Brass, 304ss, 316ss, 90/10 Cu Ni
Working Pressure	150 PSIG (ASME)	Consult Factory
Max. Temperature	375°F	Consult Factory

Quality Through Design — COMPARE.

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

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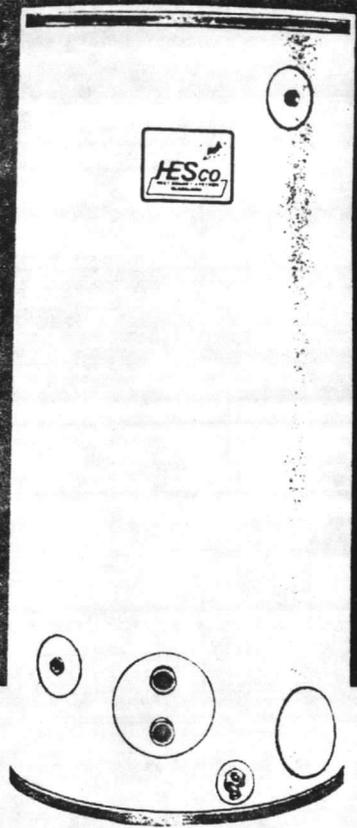


5214



COMMERCIAL STORAGE GLASSLINED WATER TANKS

- 82, 120 and 200-gallon storage capacities
- 5-year limited warranty



Hesco Commercial Storage Tanks are designed for installations where peak demands require additional storage capacities of 82, 120, or 200 gallons or more. Larger quantities of stored water can be obtained simply by manifolding several tanks together.

Hesco Commercial Storage Tanks meet the efficiency performance criteria set forth in ASHRAE 90A-1980 (1982 requirements) and the BOCA code.

Features:

Glasslined Tank: The interior of each tank is coated with durable high silica content glass, best-suited for commercial tanks, which are subjected to large quantities of high-temperature water.

Foam Insulation: Polyurethane foam insulation is the most effective in use today. Highly-resistant to heat loss, foam keeps water in the tank where it belongs. Two inches of foam is equal to 5½ inches of ½-lb. density fiberglass; foam is over 2½ times better. With an "R Value" of 16.67, foam saves fuel, and money!

Anode Rod: Large rod suspended in the tank protects against corrosive action on the inner tank surface.

T & P Valve Opening: Separate 1" NPT opening is provided for installation of a temperature and pressure relief

valve.

Welded Steel Couplings: No internal threads to leak or corrode.

Triple-Tested Tanks: Pressure-tested three times during manufacture for high quality assurance.

Brass Drain Valve: Durable with long shank that makes hose connection easy.

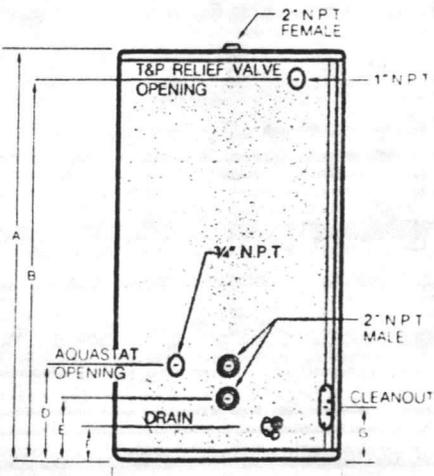
Handhole Cleanout: Provides easy access for periodic inspection of tank interior.

Jacket: Finished in gleaming enamel with contrasting trim. Exceptionally durable and easy-to-clean.

Maximum Hydrostatic Working Pressure 150 P.S.I.

Five-Year Limited Warranty: Complete details available at the nearest sales office.

Foam retainer patent no. 4,447,377



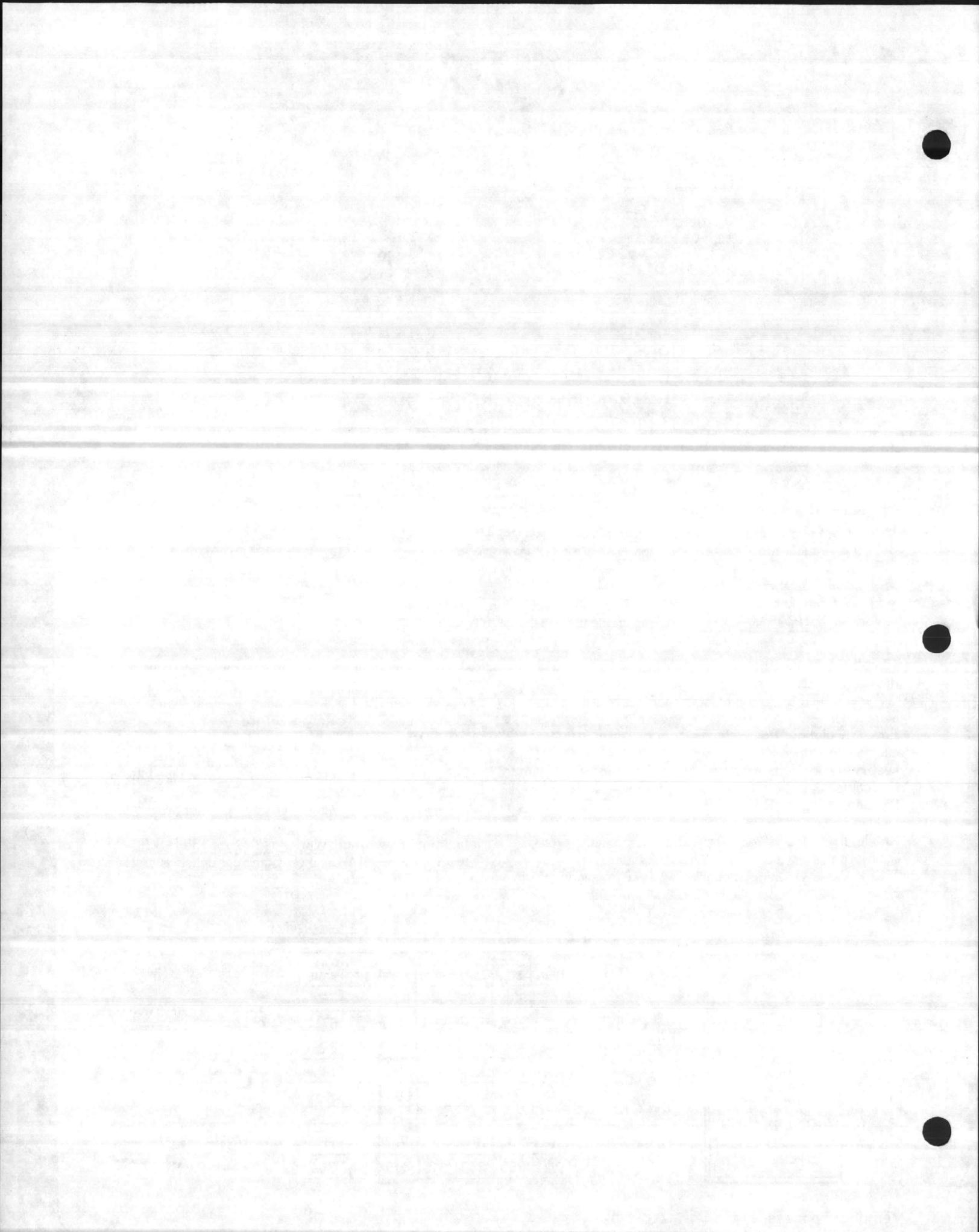
Model No. Storage Cap. (Gals.)	H6-82-OCRT		H6-120-OCRT		H6-200-OCRT	
	STD.	ASME	STD.	ASME	STD.	ASME
A	63½	63¾	64¼	64¼	-	76
B	56½	55½	56¾	55½	-	67¾
C	24	24	28	28	-	32
D	11½	12	11½	12	-	14½
E	7½	8	7½	8	-	10½
F	3¾	4	3¾	4	-	9½
G	5¾	6½	5¾	6½	-	11¼
Shipping Wt.	250	350	315	415	-	750

For ASME models add ASME to model number. Example: H6-120-OCRT ASME.

150 PSI hydrostatic working pressures



ASME



SEMI INSTANTANEOUS PACKAGE

**WATSON
McDANIEL**

Watson McDaniel Company

Valley Forge Corporate Center

975 Madison Ave • Norristown, Pa. 19401 (215) 666-5711

TELEX 706 395

TEMPERATURE REGULATORS

Series 150, 151, 152, 153, 175

Manufacturers of: RELIEF VALVES • STEAM TRAPS • PRESSURE & TEMPERATURE REGULATORS • STRAINERS

DIRECT ACTING and REVERSE ACTING
SINGLE SEATED and DOUBLE SEATED
BALANCED and UNBALANCED

APPLICATIONS:

Watson McDaniel Temperature Regulators automatically control the temperature of the fluid by positioning the valve in proportion to the temperature deviation sensed by the bulb.

Temperature Regulators are used on hot water generators, heat exchangers, hot water storage tanks, two temperature water systems, fuel oil heaters, steam tables, open tank or kettle control, circulating dryers, drying rooms, heating and cooling ducts, sterilizing equipment, engine jacket cooling and liquid coolers.

The following pages describe the numerous types of valve bodies and temperature actuator assemblies available for above application.

OPERATION:

The valve selected to control temperature is actuated by a hermetically sealed bellows, capillary tube and bulb assembly. When the temperature rises around the bulb, the volatile liquid inside the actuator assembly vaporizes and transmits force to the valve stem by the expansion of the actuator's bellows. Conversely, when the bulb temperature decreases, this will cause some of the vaporized volatile liquid in the bulb to revert back to liquid form, resulting in a lower force on the valve stem and readjustment of the regulator's flow.

Each temperature regulator is supplied with a fixed degree temperature span that is adjustable within the actuator's range.

Control of the desired temperature is achieved by adjusting the spring tension to exactly counterbalance the force of the bellows on the valve stem.

CONSTRUCTION:

The Watson McDaniel Temperature Regulators are a self-actuated, vapor-pressure operated valve for maintaining the temperature of a fluid in response to the temperature changes at the bulb. Temperature regulators are supplied as a complete unit with temperature bulb, capillary tubing, bellows, bracket and valve body assembly as selected.

Temperature Regulators are available with two (2) types of valve action.

Direct Acting valves where a rise in temperature will close the valve. (Hot water generators, heat exchangers, storage tanks, fuel oil preheaters, steam tables, etc.)

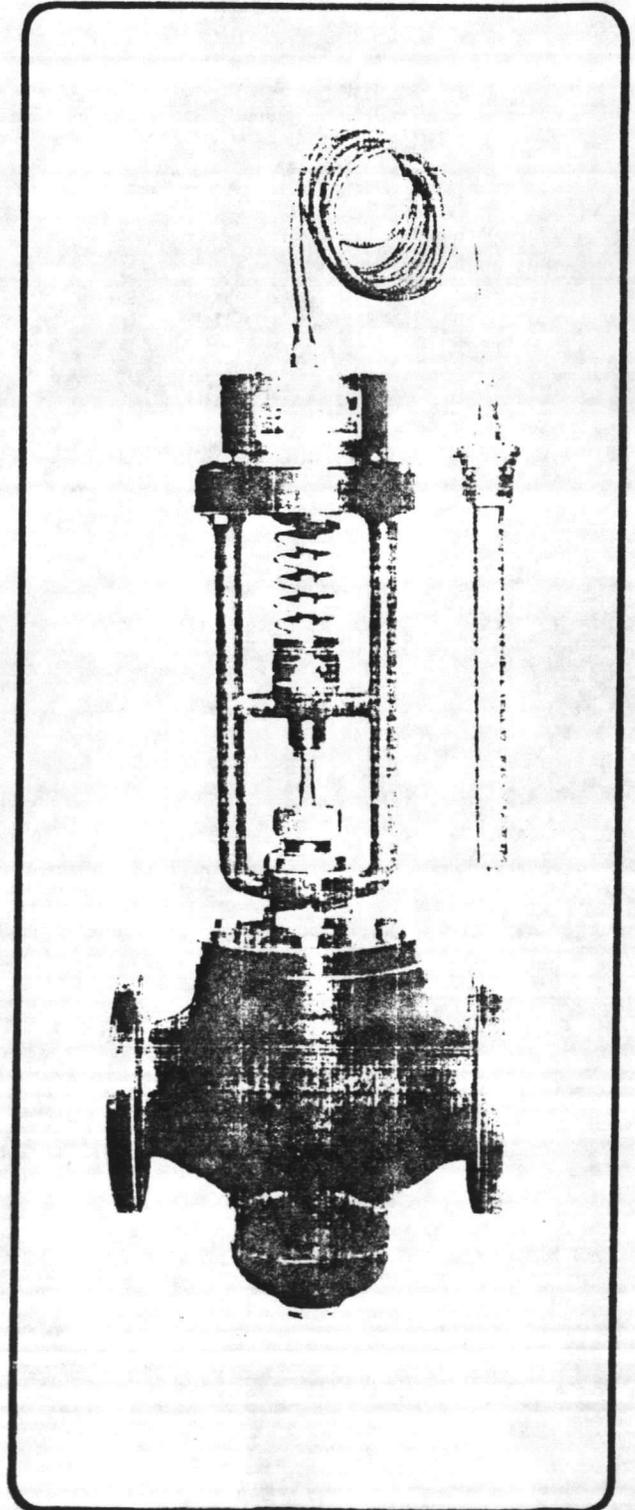
Reverse Acting valves where a rise in temperature will open the valve. (Engine jacket cooling, recirculating lines, control for cooling systems, etc.)

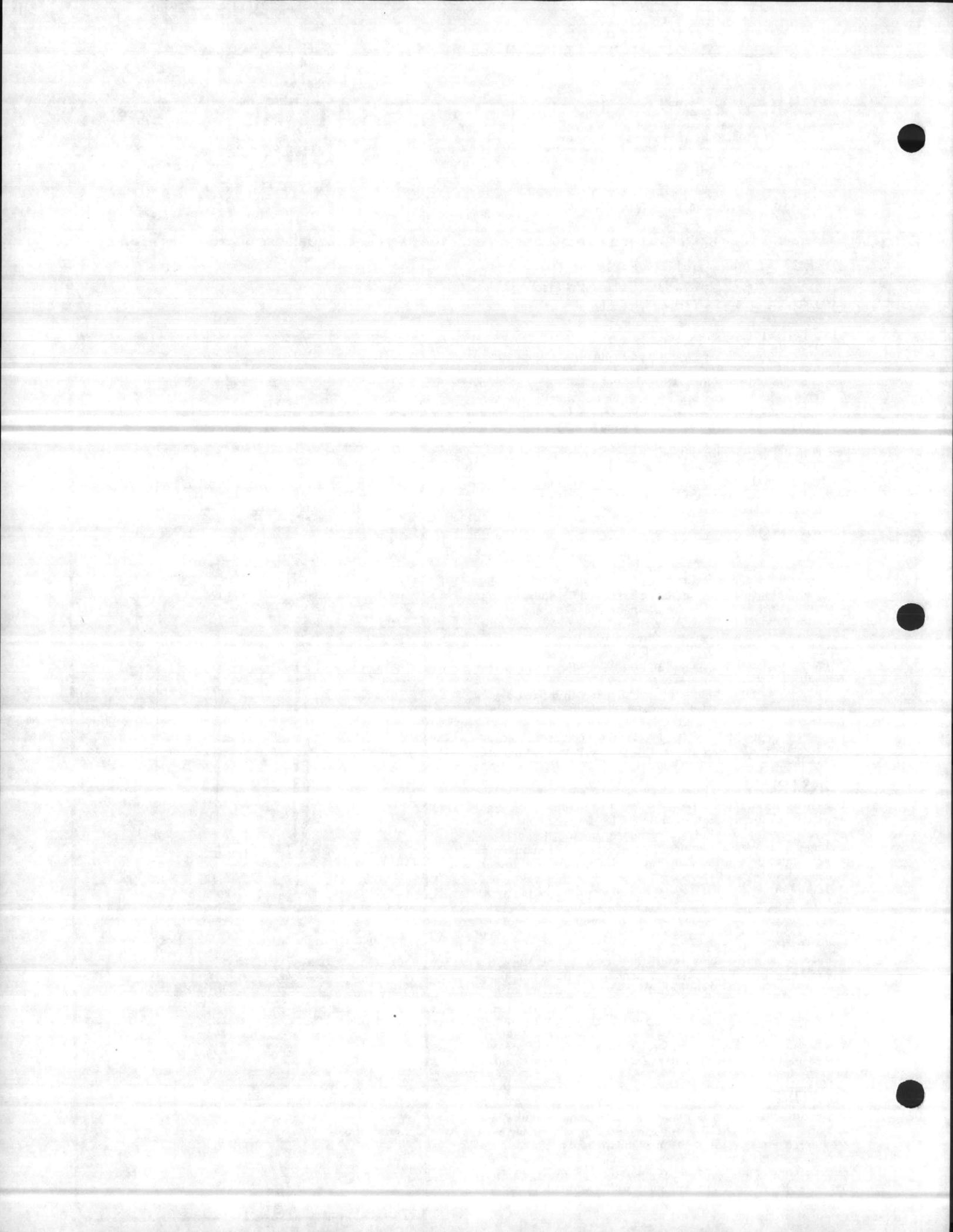
Standard temperature Regulators are supplied with heavy bronze body in sizes 1/2" to 1 1/2", high tensile iron body in sizes 2" to 6". The standard actuator, bulb and capillary are furnished in copper. Separable sockets (wells) are furnished as extra and when used, should be filled with oil to help the heat transfer.

FEATURES:

Temperature selection is made by turning adjustment wheel at bottom of spring. 10 ft. of armored capillary tubing with reinforced ends is supplied on standard units.

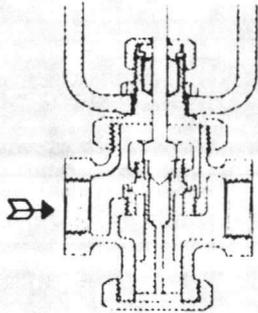
Overheat Protection prevents damage to bellows when bulb is subject to excessive temperatures. Series 175 Temperature Regulators are supplied with overheat protection as standard. Other series regulators can be supplied with overheat protection as an extra.





Series 175 DIRECT ACTING

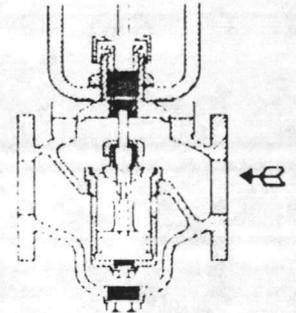
A Rise in Temperature
Will CLOSE Valve



TEMPERATURE REGULATORS

Series 175 DIRECT ACTING

A Rise in Temperature
Will CLOSE Valve



Series 175 Temperature Regulators are single seated, balanced valves, for use on high pressure or where pressure fluctuates. They are especially suited for both continuous or dead end service. The Series 175 Regulators utilize an internal balancing pilot which equalizes the differential pressure, thereby reducing the force necessary to actuate the valve. The balanced valve also eliminates the hysteresis of control temperature sometimes found in an unbalanced or semi-balanced valve.

See chart below for recommended maximum pressure using bronze or stainless trim.

Thermal bulb temperature ranges can be selected from charts on Pages 2, 3 and 4.

Capacity charts can be found on Pages 5 and 6.

MAXIMUM PRESSURES • DIMENSIONS • WEIGHTS

SERIES 175 DIRECT ACTING								
Valve Size	Max. Pressure		A Scrd.	A 125# Fig.	A 250# Fig.	B	C	Approx. Shpg. Weight (Lbs.)
	Bronze Trim PSI	Stainless Trim PSI						
1/2	250	250	4 1/8	---	---	2 3/8	14	18
3/4	250	250	4 1/8	---	---	2 3/8	14	18
1	200	200	4 1/8	---	---	2 3/8	14	18
1 1/4	200	200	5	---	---	3 1/8	14 1/2	19
1 1/2	200	200	5 1/4	---	---	3 3/8	14 1/2	20
2	150	150	9 1/2	10 7/8"	10 7/8"	5 3/4	16 1/2	60
2 1/2	150	150	---	10 7/8"	11 1/4"	6 1/4	22	95
3	150	150	---	10 7/8"	11 3/8"	7 1/8	23	112
4	150	150	---	12 1/2"	13 1/8"	8 1/4	24	135
5	150	150	---	13 1/8"	14"	8 3/4	24	175

REFER TO
DRAWING #1

FOR USE WITH FLANGED ENDS

The table below shows standard temperature bulb ranges for valve selected above.

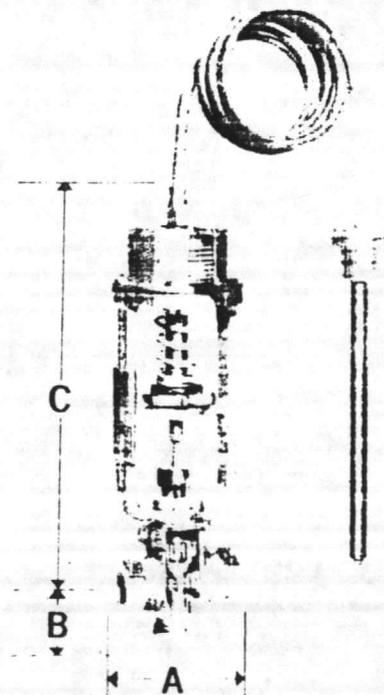
TEMPERATURE HEAD ACTUATORS								
Valve Size	Std. Bulb Range	Bulb Length D	Bulb Dia. E	Bushing Pipe Thread F	Std. Capillary Length	Dry Well or Separable Socket		
						G	H	J
2 1/2"	60°-100°	29 3/4"	1 1/8"	1 1/4"	10 ft	1 1/4"	30 1/2"	1 1/4"
	80°-120°	29 3/4"	1 1/8"	1 1/4"	10 ft	1 1/4"	30 1/2"	1 1/4"
	100°-140°	29 3/4"	1 1/8"	1 1/4"	10 ft	1 1/4"	30 1/2"	1 1/4"
to 6"	120°-160°	17 1/2"	3/8"	1 1/4"	10 ft	1"	18 1/2"	1"
	140°-180°	17 1/2"	3/8"	1 1/4"	10 ft	1"	18 1/2"	1"
	160°-200°	17 1/2"	3/8"	1 1/4"	10 ft	1"	18 1/2"	1"
	180°-220°	17 1/2"	3/8"	1 1/4"	10 ft	1"	18 1/2"	1"
	200°-240°	17 1/2"	3/8"	1 1/4"	10 ft	1"	18 1/2"	1"
220°-260°	17 1/2"	3/8"	1 1/4"	10 ft	10 ft	1"	18 1/2"	1"

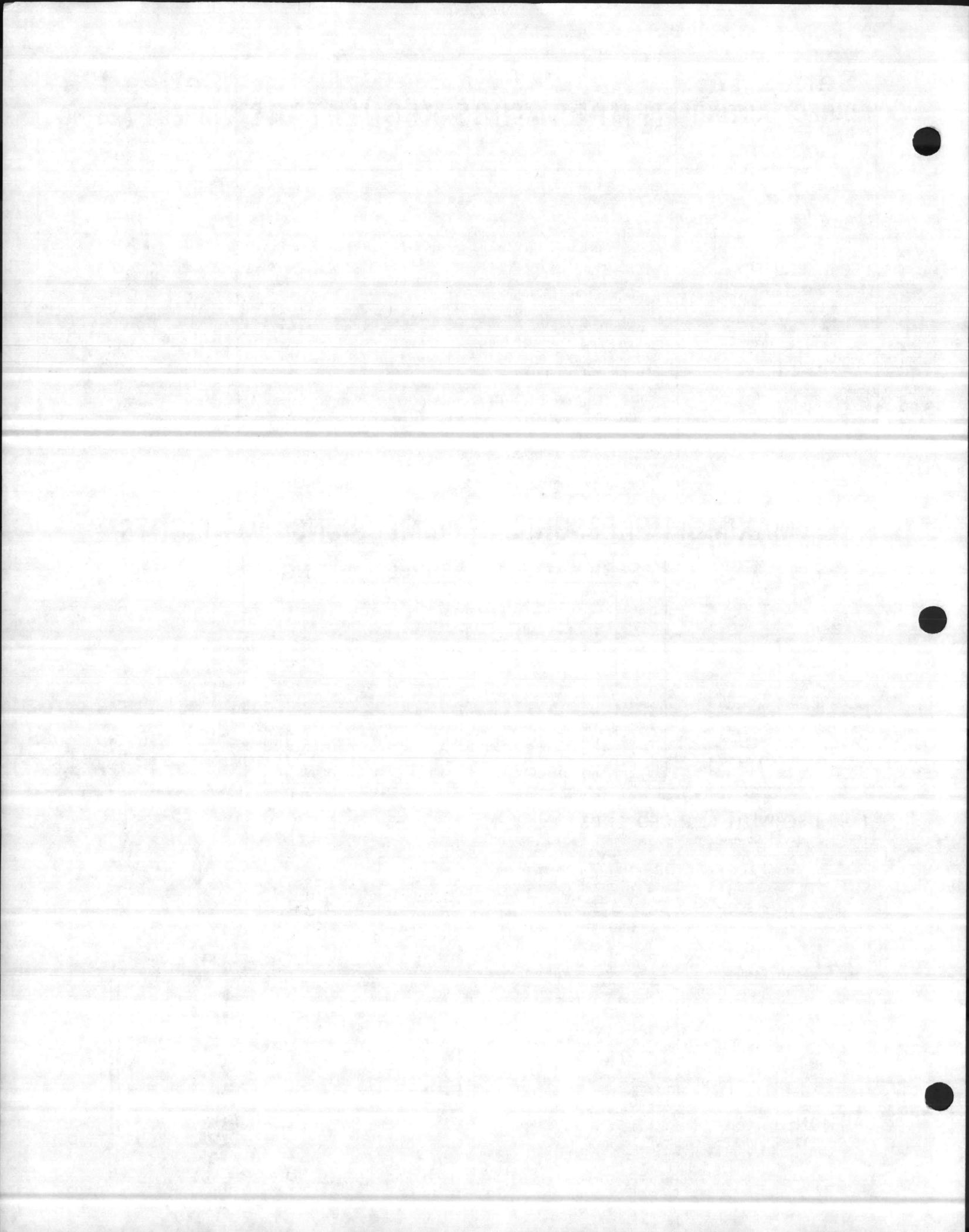
REFER TO
DRAWING #1

REFER TO
DRAWING #2

CAUTION:

Units with 100°F. or less minimum temperature, are specially cross ambient filled so ambient (room) temperature will not affect operation. Units with 110°F. or higher minimum temperature, are standard filled. If ambient (room) temperature is within 20°F. of minimum temperature of unit to be used, a cross ambient temperature unit is required.





WATSON McDANIEL

WATSON McDANIEL COMPANY
975 Madison Avenue
Valley Forge Corporate Center, Norristown, PA 19403
(215) 666-5712 • Telex 706395

FLOAT & THERMOSTATIC STEAM TRAPS Series FT

Manufacturers of: **RELIEF VALVES • STEAM TRAPS • PRESSURE & TEMPERATURE REGULATORS • STRAINERS**

Capacities to 12,095 #/HR. Side Inlet—Side Outlet

APPLICATION

Watson McDaniel Float and Thermostatic steam traps are designed to freely remove large quantities of condensate and air from unit heaters, space heaters, water heaters, converters, pressing machines and all steam process equipment. They are also used for draining mains and risers on low pressure systems.

Float and Thermostatic steam traps are especially well suited for apartments, hospitals, office buildings and schools because they work quietly.

OPERATION

Float and Thermostatic Traps are noiseless in operation as their internal parts move slowly and quietly when discharging air and condensate.

As air and condensate enter the trap body, they are removed through separate discharge ports. Air and non-condensables are discharged through the air vent into the separate air bypass built into the cover of the trap. The thermostat closes the air vent when the temperature surrounding the element reaches the rated pressure-temperature range of the trap.

As the trap body fills with condensate, the float will rise sufficiently to open the valve seat and discharge the condensate through the trap outlet port.

Float and Thermostatic Traps are designed to modulate the flow of condensate with the rise and fall of the float as changes in condensate level occur within the trap body.

CONSTRUCTION

All working parts of a Watson-McDaniel Float and Thermostatic Trap are made of corrosion-resistant stainless steel for longer service life.

Compact and rugged, the trap body is cast with two inlet and two outlet pipe connections that can accommodate a variety of pipe hook-ups for a range of applications.

A stainless steel bellows-type air vent is used instead of the phosphor-bronze helical disc diaphragm to provide greater efficiency, improved protection against sudden surges in the flow of condensate and resistance to corrosion.

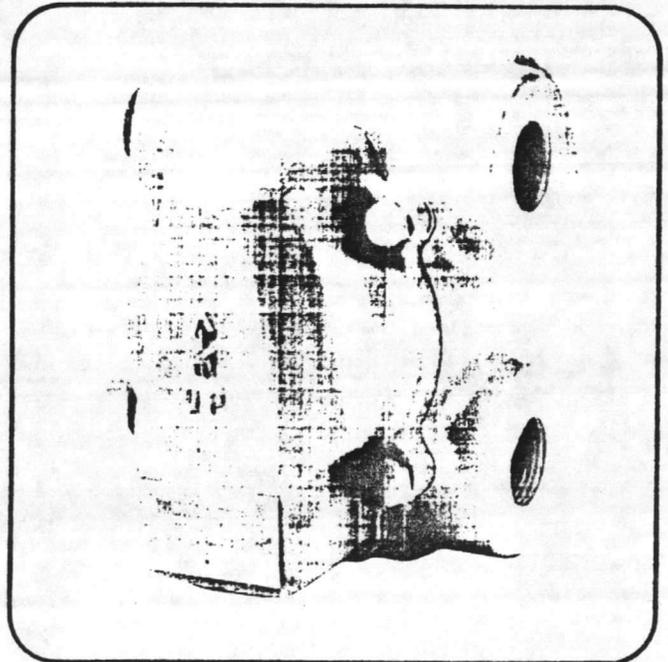
All working parts of the trap are attached to the cover casting for easy access. Designed for in-line servicing, the unit may be inspected and parts replaced without breaking any pipe connections.

FEATURES

- Noiseless operation--Parts move slowly and quietly
- Valves and seats--Stainless steel
- Float--Heavy duty stainless steel
- In-line servicing--All working parts attached to cover
- Thermostatic air vent--Balanced pressure type, all stainless steel bellows and valve

Also Available: Watson McDaniel Float Traps

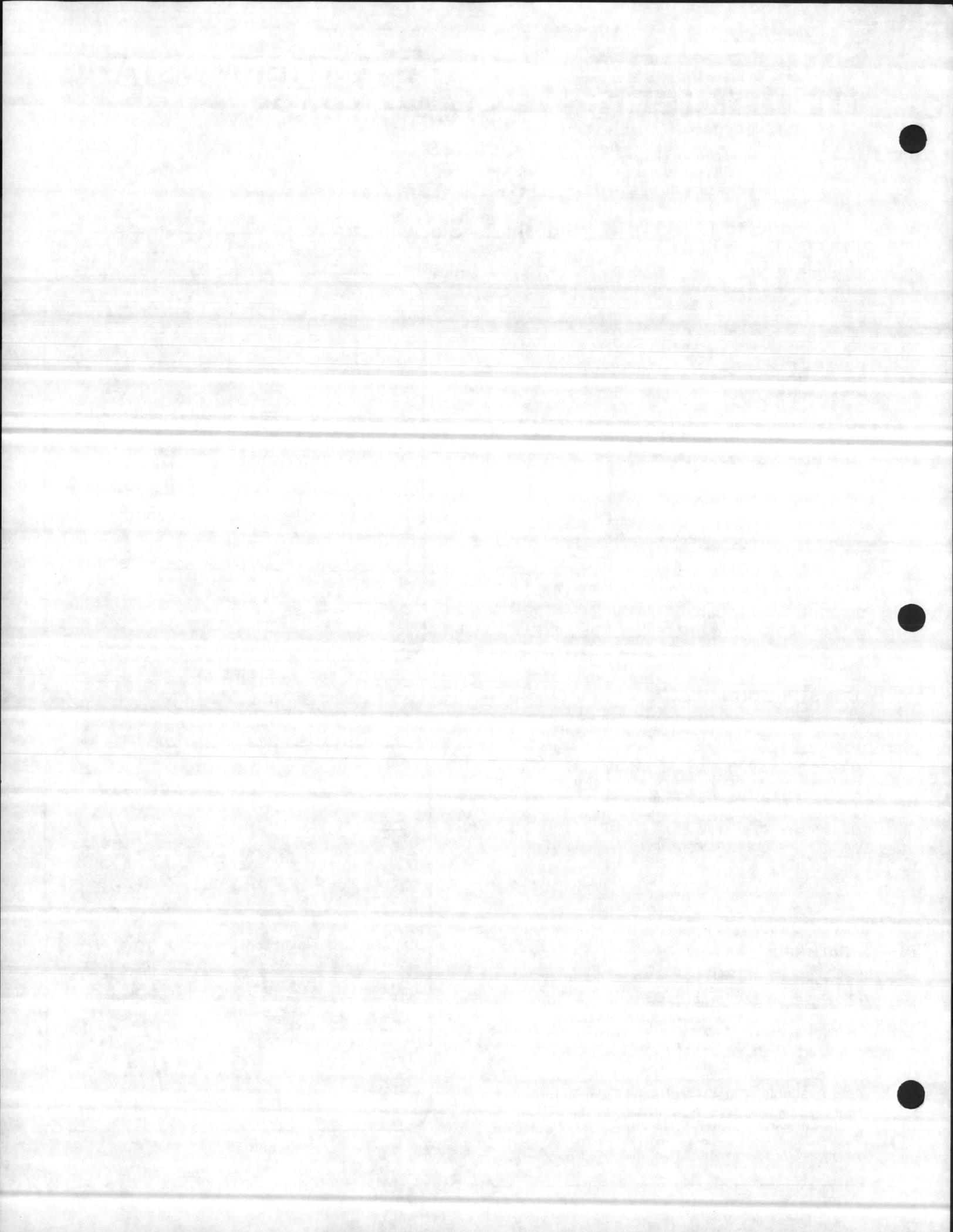
Float traps are similar to float and thermostatic traps, except that they do not use the thermostatic element. They are used to remove quantities of condensate from pipe lines, air receivers and any part of a compressed air line where condensate could collect.



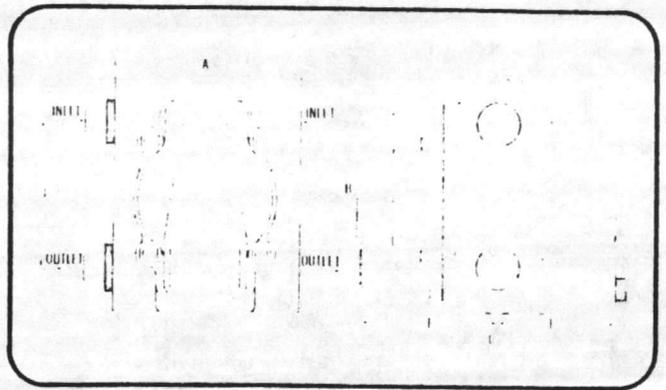
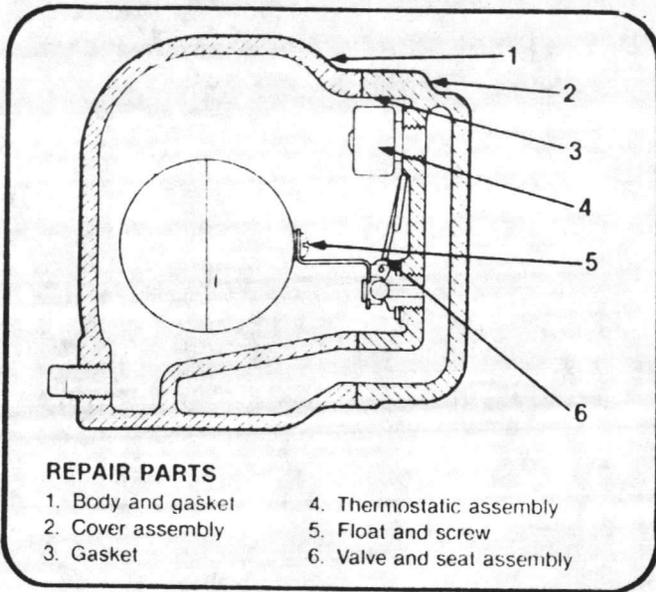
SERIES FT



SERIES FT



FLOAT and THERMOSTATIC STEAM TRAPS



DIMENSIONS AND WEIGHTS

SERIES	A	B	C	D	E	F	Shipping Weights
FT-3, FT-4, FT-33, FT-34, FT-63, FT-64, FT-123, FT-124	4 1/8	5	5 1/8	3 3/8	2 3/4	2 3/8	7 lbs. 5 oz
FT-6, FT-35, FT-36, FT-65, FT-66, FT-125	5	6 1/8	6 1/2	4 3/8	3 3/8	3 1/2	11 lbs 10 oz
FT-7	6 3/8	7 1/8	8 1/2	5 1/4	4 1/2	3 3/8	20 lbs 12 oz
FT-8, FT-37, FT-38, FT-67, FT-68, FT-127, FT-128	6	11	8 3/2	7 1/2	4 1/2	4 3/8	29 lbs 12 oz

MATERIALS

Body & Cover	Cast iron ASTM-A-126 Class 30
Nuts & Bolts	High tensile steel
Gasket	Compressed asbestos
Float	Stainless steel
Valve & Seat Assembly	Stainless steel
Thermostatic Assembly	Balanced pressure, stainless steel bellows and valve.

OPERATING PRESSURES

SERIES	FT
Maximum Operating Pressure	125 psig @ 353° F
Maximum Allowable Pressure	175 psig @ 377° F

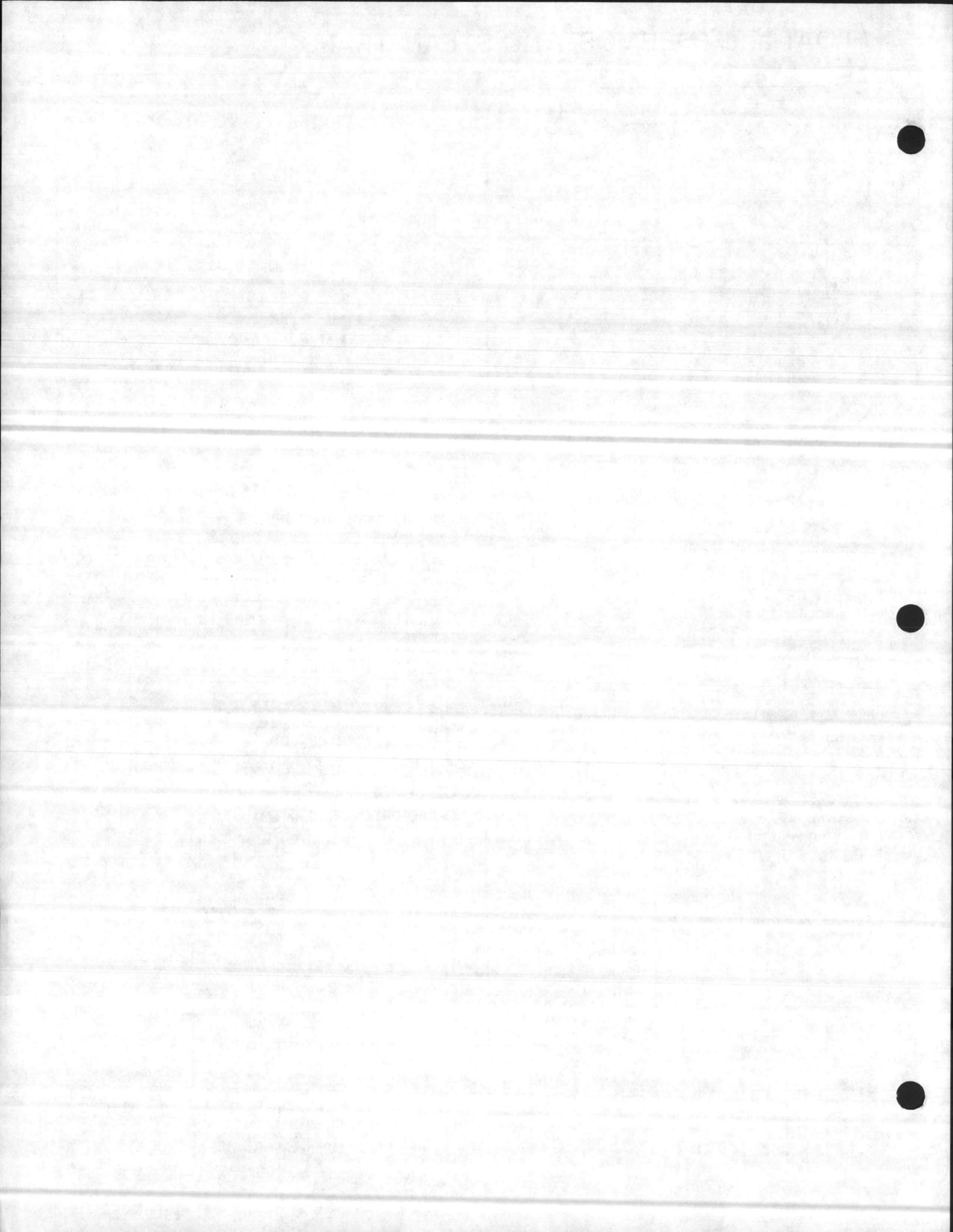
NOTE: The Float and Thermostatic Steam Trap can be used at any pressure below its maximum operating pressure stamped on the cover but with resulting loss in capacity.

CAPACITY TABLE IN POUNDS OF CONDENSATE PER HOUR SHEMA RATING—A SAFETY FACTOR IS NOT REQUIRED FOR PEAK LOADS.

SERIES	FT-3	FT-4	FT-6	FT-7	FT-8	SERIES		
PIPE CONNECTIONS	3/4"	1"	1 1/4"	1 1/2"	2"	PIPE CONNECTIONS		
TRAP ORIFICE	3/4"	3/2"	2 3/4"	1 1/2"	1 1/8"	TRAP ORIFICE		
PRESSURE DIFFERENTIAL PSIG	1/2	70	175	425	850	1775	PRESSURE DIFFERENTIAL PSIG	
	3/2	100	250	600	1200	2500		
	3/4	120	300	735	1470	3060		
	1	140	350	850	1700	3550		
	2	200	500	1200	2400	5000		
	3	205	512	1230	2460	5125		
	5	210	525	1260	2520	5250		
	10	220	550	1320	2640	5500		
	15	230	575	1380	2760	5750		
								1/4
								1/2
								3/4
								1
								2
								3
						5		
						10		
						15		

CAPACITY TABLE IN POUNDS OF CONDENSATE PER HOUR A SAFETY FACTOR OF 2 or 3 TO 1 IS REQUIRED FOR PEAK LOADS.

SERIES	FT-33	FT-34	FT-35	FT-36	FT-37	FT-38	FT-63	FT-64	FT-65	FT-66	FT-67	FT-68	FT-123	FT-124	FT-125	FT-126	FT-127	FT-128	
PIPE CONNECTIONS	3/4"	1"	1"	1 1/4"	1 1/2"	2"	2 1/4"	1"	1"	1 1/4"	1 1/2"	2"	3/4"	1"	1"	1 1/4"	1 1/2"	2"	
TRAP ORIFICE	1/4"	1/4"	1/4"	1/4"	3/8"	1/2"	3/4"	3/4"	3/4"	3/8"	3/8"	3/8"	# 39	# 39	1/8"	1/8"	1/8"	1/8"	
PRESSURE DIFFERENTIAL — PSIG	1/2	300	300	600	600	2045	2045	195	195	360	360	1075	1075	105	105	180	180	530	530
	1	405	405	880	880	2625	2625	265	265	485	485	1100	1300	145	145	250	250	750	750
	2	530	530	1205	1205	3560	3560	360	360	660	660	1700	1700	190	190	300	300	970	970
	3	650	650	1470	1420	4260	4260	410	410	780	780	2000	2000	215	215	350	350	1200	1200
	5	890	890	1845	1845	5660	5660	580	580	1020	1020	2600	2600	320	320	455	455	1650	1650
	10	1210	1210	2560	2560	7890	7890	770	770	1410	1410	3750	3750	430	430	635	635	2250	2250
	15	1485	1485	3230	3230	9440	9440	990	990	1740	1740	4350	4350	520	520	775	775	2720	2720
	20	1705	1705	3715	3715	10590	10590	1110	1110	1980	1980	4750	4750	605	605	915	915	3200	3200
	25	1885	1885	4100	4100	11360	11360	1210	1210	2200	2200	5050	5050	640	640	1005	1005	3400	3400
	30	2010	2010	4405	4405	12095	12095	1290	1290	2420	2420	5400	5400	680	680	1100	1100	3600	3600
	40							1410	1430	2670	2670	5960	5960	755	755	1270	1270	4000	4000
	50							1560	1560	2910	2910	6500	6500	820	820	1360	1360	4400	4400
	60							1680	1680	3135		6950	6950	880	880	1460	1460	4800	4800
	70													940	940	1570	1570	5090	5090
	80													1000	1000	1680	1680	5380	5380
	90													1040	1040	1770	1770	5690	5690
	100													1080	1080	1865	1865	6000	6000
	125													1190	1190	2110	2110	6600	6600

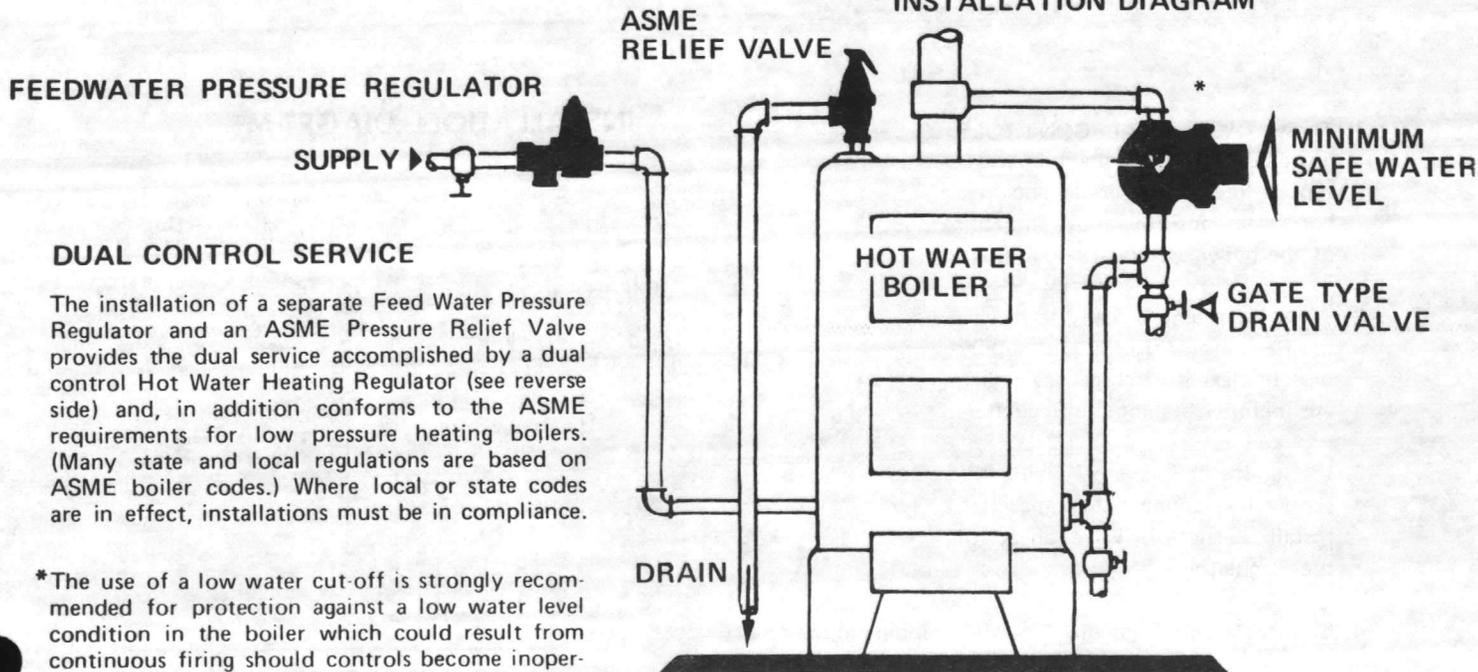


	INSTRUCTION SHEET
	NUMBER IS-100-2.2A
	Effective: May 1, 1983 Supersedes: IS100-2.2A dated 8/1/81

TACO REDUCING VALVE PRESSURE REGULATORS

INSTRUCTIONS FOR INSTALLING

INSTALLATION DIAGRAM



DUAL CONTROL SERVICE

The installation of a separate Feed Water Pressure Regulator and an ASME Pressure Relief Valve provides the dual service accomplished by a dual control Hot Water Heating Regulator (see reverse side) and, in addition conforms to the ASME requirements for low pressure heating boilers. (Many state and local regulations are based on ASME boiler codes.) Where local or state codes are in effect, installations must be in compliance.

*The use of a low water cut-off is strongly recommended for protection against a low water level condition in the boiler which could result from continuous firing should controls become inoperative or a break occur in the return piping.

FEED WATER PRESSURE REGULATORS

These regulators must be installed in the cold water supply line to the boiler and in a horizontal position. When piping is ready to receive the regulator, flush out the supply pipe to clear it of chips scale, dirt, etc. before installing regulator. Install regulator with the supply line connected to the inlet. Install a shut-off valve ahead of the regulator. Regulator is set to feed water at approximately 15 lbs. pressure. To readjust regulator, follow instruction No. 7 on reverse side of this sheet. These regulators have a strainer screen which should be removed and cleaned at least twice a year.

SERIES WITH FAST FILL AND PURGE LEVER

These valves are equipped with a unique and simple "fast fill and purge lever" . . . which permits rapid filling of the system . . . and sustained flow for air purging.

This advanced design incorporates a removable "push" rod which is actuated by the position of the "purge lever." When the lever is raised to the vertical position, it presses the "push" rod down which manually forces the valve wide open for maximum flow. Returning the lever to its normal position releases tension on the rod permitting the valve to maintain normal pressure in the system automatically.

*LOW WATER CUT-OFF

Install a low water cut-off so that the raised line cast on float chamber body is on a level with the top of the boiler. Top of switch box should be reasonably level. Piping to the top and bottom float chamber connections should conform to that shown on installation diagram. Keep the float chamber clean by periodically opening the valve below the float chamber to flush out mud and sediment. Do this at least once each month.

IMPORTANT:

When water main pressure exceeds 100 lbs. or is variable, a domestic service type water pressure reducing valve should also be installed in addition to this feed valve regulator. This reduces the pressure for accurate, longer life feed valve performance, as well as providing quiet, economical service pressure to the domestic fixtures.

TACO HOT WATER
HEATING DUAL CONTROLS

INSTRUCTIONS FOR INSTALLING

1. These TACO DUAL CONTROLS must be installed in the cold water supply line to the boiler and in a horizontal position above the top of the boiler as shown on diagram.

2. When the piping is ready to receive the Regulator, flush out the supply pipe to clear it of chips, scale, dirt, etc. before installing the Regulator.

3. Install the "Regulator" with the supply line connected to the inlet. Install a shut-off valve ahead of the Regulator.

4. Connect a pipe from the "DRAIN" tapping in the relief valve to above some convenient open drain such as a floor drain or set tubs. Always obey local regulations.

Do not install a valve of any kind in this line. This drain must always pitch down from the regulator. No portion of the drain line should be above the regulator. Drain pipe must not be smaller than the drain tapping provided. The relief valve is non-adjustable and set to relieve at 30 lbs.

5. To fill the system, open the shut-off valve ahead of the Regulator. This valve must always be kept open when the system is in operation. Water will flow into the system until it is full and under pressure.

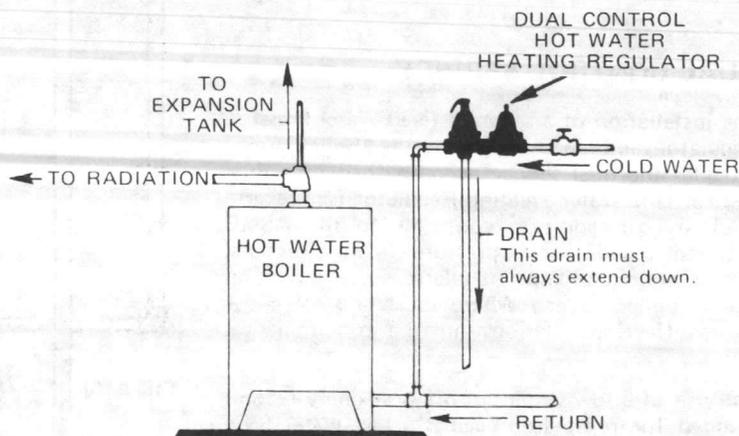
6. The pressure reducing valve of the Regulator is set to deliver water to the boiler at approximately 15 lbs. pressure. This pressure is sufficient for a 3-story building.

7. To reset the reducing valve for higher pressure (when the pressure is not sufficient to lift the water to highest radiation), calculate the number of feet from the regulator to the top of highest radiation. Multiply this by .43 and add 3 lbs. This will give the pressure needed to raise the water to the highest radiator and keep it under pressure — loosen lock nut. Turn adjusting screw clockwise slowly until the gauge indicates the pressure calculated. Then lock adjustment.

8. The regulator screen should be cleaned at beginning of each heating season.

9. The air cushion tank sometimes becomes filled with water (waterlogged). This is usually indicated by dripping of the relief valve when the burner is running. To recharge with air, close gate valve between tank and system and open gate valve in drain pipe. Allow tank to completely drain (this requires from 10 to 15 minutes), then close drain valve and open valve between tank and system.

INSTALLATION DIAGRAM



IMPORTANT

Please Note Footnote at Bottom
of Reverse Side of This Sheet



TEMPERATURE REGULATORS Series 175

WATSON McDANIEL COMPANY
975 Madison Avenue

Valley Forge Corporate Center, Norristown, Pa. 19403 (215) 666-5711

Manufacturers of: **RELIEF VALVES • STEAM TRAPS • PRESSURE & TEMPERATURE REGULATORS • STRAINERS**

INSTALLATION AND OPERATING INSTRUCTIONS

INSTALLATION: Before installing the temperature regulator, be sure to blow out the pipe line, removing all dirt, pipe scale, pipe chips, etc. A Watson McDaniel Company "Y" type strainer should be placed on the inlet side of the regulator. Install a by-pass line with hand shutoff valves around the temperature regulating valve. If the bulb is located in a pipe, a hand valve downstream from the bulb should be installed.

The regulating valve is marked showing the direction of flow and must be installed in a horizontal run of pipe. Regulator must be placed in the line with the temperature head actuator above the horizontal run of pipe. **NOTE: VALVE WILL NOT OPERATE IF VALVE BODY IS INSTALLED IN A VERTICAL RUN OF PIPE.**

The thermostatic bulb can be located in any position, in accordance with the following rules:

In horizontal bulb position, the word "TOP" stamped on bulb flange must face upward.

In vertical bulb position, the flange of the bulb must be at the highest point with bulb pointing downward.

The capillary tubing connecting thermostatic bulb with the bellows SHOULD NOT be bent below a 3" (three inch) radius. A 4" radius or more is recommended.

Temperature head actuators with temperature ranges starting with 100°F and below are supplied with a special thermal actuator which enables regulators to operate in ambient (room) temperature.

Units with temperature ranges starting with 110°F or higher should not be used when ambient temperature is within 20°F of the bulb range. When room temperature is above bulb range, a special cross-ambient temperature head actuator will be supplied if room temperature is included on order.

OPERATION: Each temperature regulator is supplied with a fixed degree temperature span that is adjustable within the actuator's range. Control of the desired temperature is achieved by adjusting the spring compression. Turning the adjustment wheel and increasing the spring compression will *open* the valve.

Location of the thermostatic bulb is important:

ON INSTANTANEOUS HEATERS, the bulb should be in the heater outlet line and as close to point of discharge as possible.

ON HOT WATER GENERATORS OR STORAGE HEATERS, the bulb should be located inside the tank but at least 4" above heating coils.

ON FUEL OIL HEATERS, the bulb should be located in a vertical rise of pipe on the discharge side. Good practice is to enlarge the pipe size where bulb is located, to obtain free flow of oil around the bulb.

ON STEAM TABLES, the bulb should be located inside water table jacket, as high above steam coils as possible without touching heated containers.

ON OPEN TANK APPLICATIONS, the bulb can hang in the liquid, fully submerged, and the valve will control the tank temperature. Care should be taken to protect bulb from damage.

NOTE: When heating with steam, coils should be vented to eliminate air and properly trapped, to drain condensate.

For recommendations on any temperature application, details of the service, sketches, etc., should accompany the request for information.

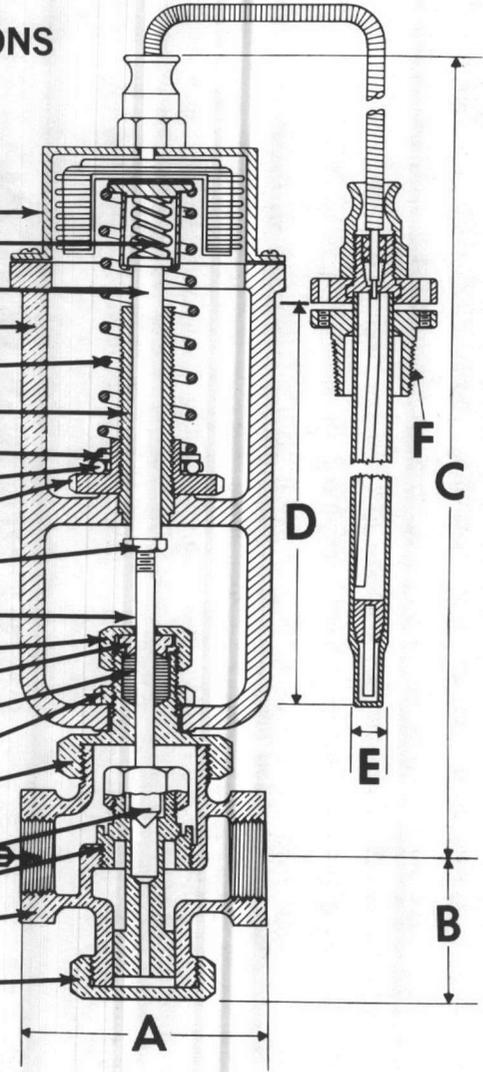
WARRANTY

Each Watson McDaniel Company Product is warranted against defects in material and workmanship for one year from date of shipment. This warranty extends to the first retail purchaser only. All defective material must be returned to the person from whom you purchased the Product, transportation prepaid, free of any liens or encumbrances, and if found to be defective will be repaired free of charge or replaced, at the warrantor's or seller's option. If the material is replaced, any replacement will be invoiced in the usual manner and after inspection of alleged defective material an adjustment will be made for depreciation caused by purchaser use. In no event will Watson McDaniel Company be liable to do more than refund the original contract price.

Incidental and consequential damages are excluded, whether under this warranty or otherwise. All implied warranties, including warranties of merchantability and fitness for a particular purpose, are disclaimed and excluded.

SCREWED CONNECTIONS

- 1 — TEMPERATURE HEAD ACTUATOR [BULB, CAPILLARY TUBE & BELLOWS ASSEMBLY]
- 2 — OVERHEAT PROTECTION UNIT
- 3 — UPPER STEM
- 4 — BRACKET
- 5 — REGULATING SPRING
- 6 — ADJUSTMENT GUIDE
- 7 — THRUST WASHER
- 8 — THRUST BEARING
- 9 — ADJUSTMENT WHEEL
- 10 — STEM LOCK NUT
- 11 — VALVE STEM
- 12 — PACKING NUT
- 13 — PACKING GLAND
- 14 — PACKING (TEFLON)
- 15 — BRACKET LOCK NUT
- 16 — TOP BONNET
- 17 — MAIN VALVE ASSEMBLY
- 18 — VALVE SEAT RING
- 19 — VALVE BODY
- 20 — BOTTOM CAP

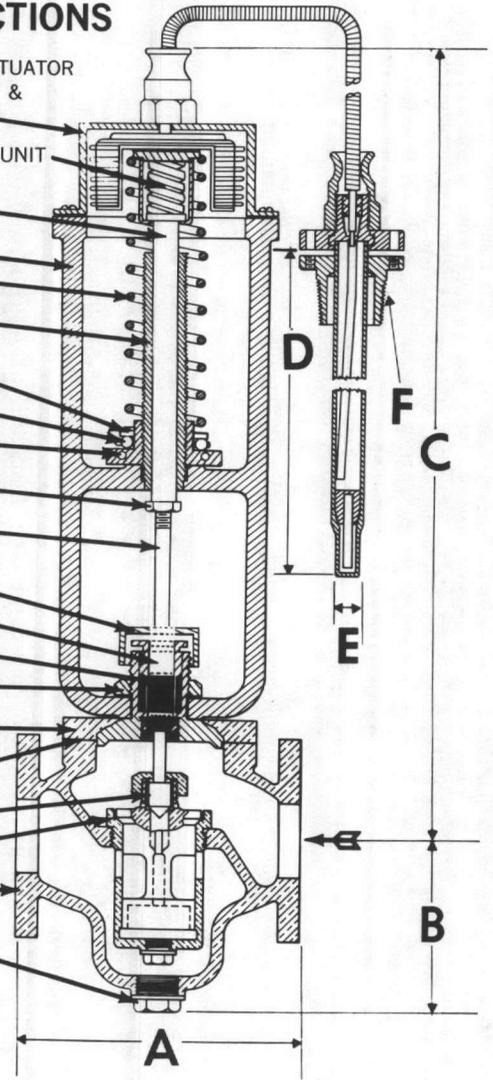


SERIES 175

NOTE: When ordering parts give serial number of valve.

FLANGED CONNECTIONS

- 1 — TEMPERATURE HEAD ACTUATOR [BULB, CAPILLARY TUBE & BELLOWS ASSEMBLY]
- 2 — OVERHEAT PROTECTION UNIT
- 3 — UPPER STEM
- 4 — BRACKET
- 5 — REGULATING SPRING
- 6 — ADJUSTMENT GUIDE
- 7 — THRUST WASHER
- 8 — THRUST BEARING
- 9 — ADJUSTMENT WHEEL
- 10 — STEM LOCK NUT
- 11 — VALVE STEM
- 12 — PACKING NUT
- 13 — PACKING GLAND
- 14 — PACKING (TEFLON)
- 15 — BRACKET LOCK NUT
- 16 — TOP BONNET
- 17 — TOP BONNET GASKET
- 18 — MAIN VALVE ASSEMBLY
- 19 — VALVE SEAT RING
- 20 — VALVE BODY
- 21 — BOTTOM PLUG



SERIES 175

JOB: _____

ENGINEER: _____

CONTRACTOR: _____

SUBMITTED BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

WATSON McDANIEL COMPANY • AREA CODE 215-666-5711
975 MADISON AVE., VALLEY FORGE CORPORATE CENTER • NORRISTOWN, PA. 19403

SIZE AND DIMENSIONS						
SIZE	A	B	C	D	E	F

CERTIFIED THAT DIMENSIONS ARE CORRECT _____

INSTALLATION AND OPERATING INSTRUCTIONS

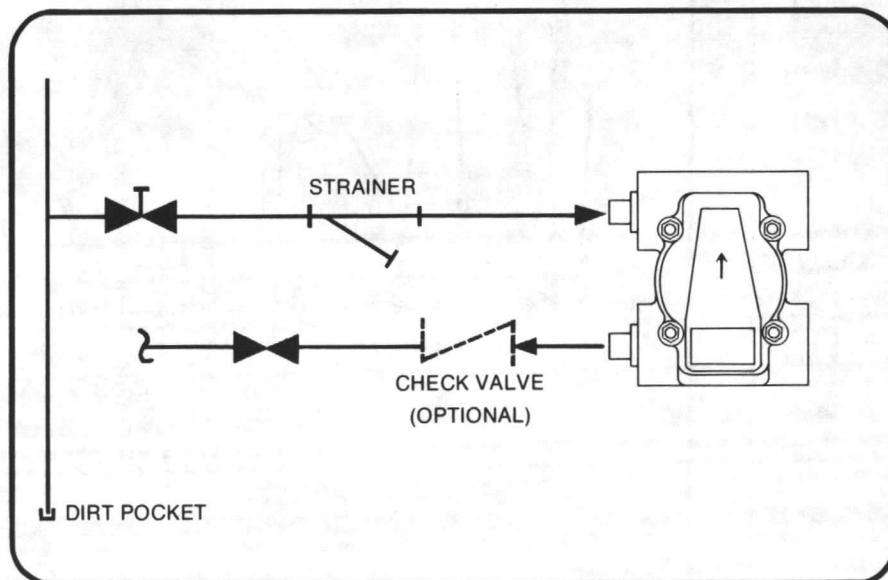
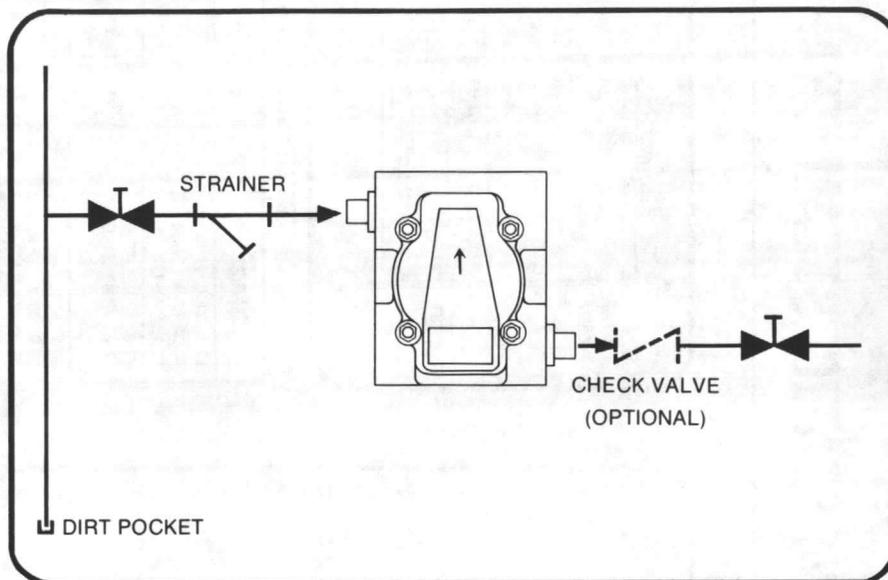
Before installing the Watson McDaniel Series FT Float And Thermostatic Steam Trap, blow down the piping that leads to the trap's inlet. Use full line pressure. Be sure that the maximum operating pressure (MOP) of the trap is adequate for the installation. The MOP is stamped on the casting.

Install the trap with the inlet below the liquid level of the equipment to be drained. The recommended hookup method is shown at right. Make inlet piping as short as possible with a minimum of elbows and other restrictions. Install a dirt pocket in the line ahead of the trap.

To allow maintenance and provide maximum service, install a valve on each side of the trap and a strainer ahead of the inlet. All valves should be of the full ported type to avoid restricting flow.

If the discharge piping is to be elevated, be sure that the differential pressure is adequate at all times to provide proper drainage. Install a check valve (optional) in the discharge piping near the trap to prevent backflow when the system is not in operation.

The Watson McDaniel Series FT Float And Thermostatic Steam Traps are automatically primed by the initial flood of condensate on start-up. When installed they are ready for operation.

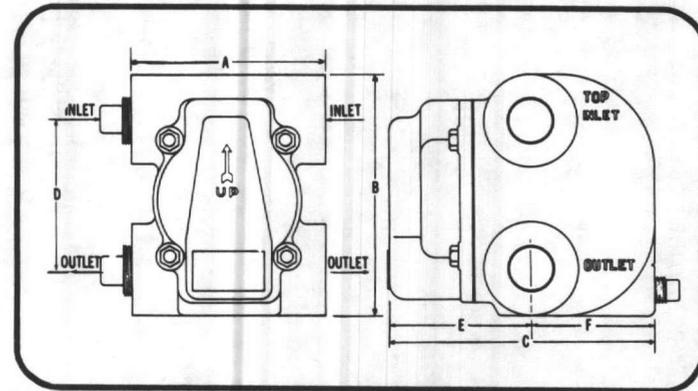
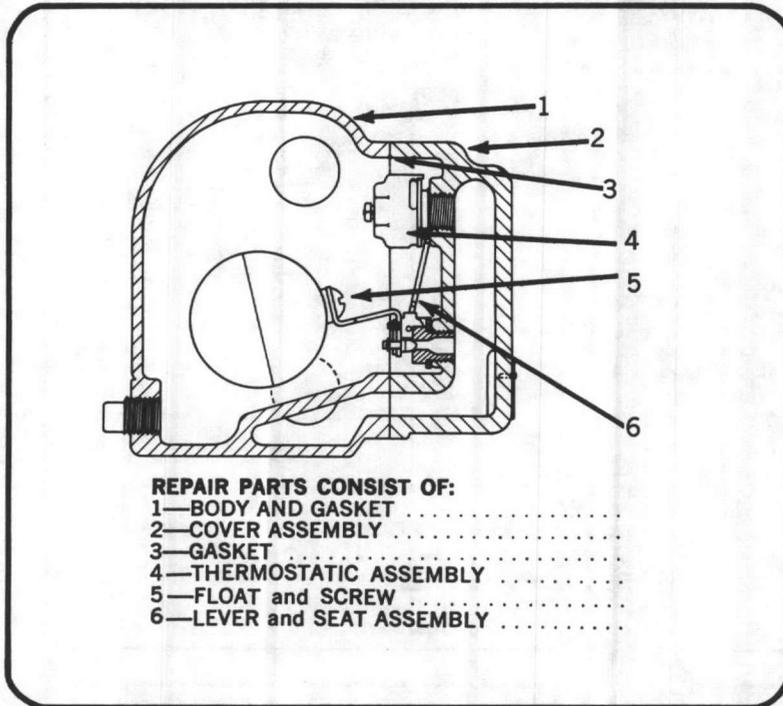


WARRANTY

Each Watson McDaniel Company Product is warranted against defects in material and workmanship for one year from date of shipment. This warranty extends to the first retail purchaser only. All defective material must be returned to the person from whom you purchased the Product, transportation prepaid, free of any liens or encumbrances, and if found to be defective will be repaired free of charge or replaced at the warrantor's or seller's option. If the material is replaced, an adjustment will be made for depreciation caused by purchaser use, and the purchaser will be invoiced accordingly. In no event will Watson McDaniel Company be liable to do more than refund the original contract price.

Except for the foregoing warranty, Watson McDaniel makes no express or implied warranty including any implied warranty of merchantability or fitness for a particular purpose. Incidental and consequential damages are excluded, whether under this warranty or otherwise.

FLOAT and THERMOSTATIC STEAM TRAPS



DIMENSIONS AND WEIGHTS

SERIES	A	B	C	D	E	F	Shipping Weights
FT-3, FT-4, FT-33, FT-34 FT-63, FT-64, FT-123, FT-124	4 $\frac{1}{8}$	5	5 $\frac{1}{2}$	3 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	7 lbs. 5 oz.
FT-6, FT-35, FT-36, FT-65 FT-66, FT-125, FT-126	5	6 $\frac{1}{8}$	6 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{8}$	3 $\frac{1}{2}$	13 lbs. 10 oz.
FT-7	6 $\frac{3}{8}$	7 $\frac{1}{16}$	8 $\frac{3}{32}$	5 $\frac{1}{4}$	4 $\frac{1}{32}$	3 $\frac{13}{16}$	20 lbs. 12 oz.
FT-8, FT-37 FT-67, FT-127	6	11	8 $\frac{3}{32}$	7 $\frac{1}{32}$	4 $\frac{1}{32}$	4 $\frac{1}{16}$	39 lbs. 12 oz.

SIZE AND DIMENSIONS						
SIZE	A	B	C	D	E	F

CERTIFIED THAT DIMENSIONS ARE CORRECT _____

JOB: _____

ENGINEER: _____

CONTRACTOR: _____

SUBMITTED BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

TAB PLACEMENT HERE

DESCRIPTION:

NO CONTENTS

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MORGAN - KIRKMAN ASSOCIATES

P.O. BOX 33442
RALEIGH, N.C. 27606
(919) 851-0603

P.O. BOX 172
FAYETTEVILLE, N.C. 28302
(919) 484-5796

P.O. BOX 29146
GREENSBORO, N.C. 27408
(919) 643-6156

OCTOBER 4, 1987

PROJECT: MEDICAL/DENTAL CLINIC
LOCATION: CAMP LEJUNE, NORTH CAROLINA

ENGINEER: SIX ASSOCIATES
LOCATION: ASHEVILLE, NORTH CAROLINA

CONTRACTOR: SNEEDEN, INC.
LOCATION: WILMINGTON, NORTH CAROLINA

HUMIDIFIER: BY PURE STEAM





PURE STEAM

Humidifier
Company

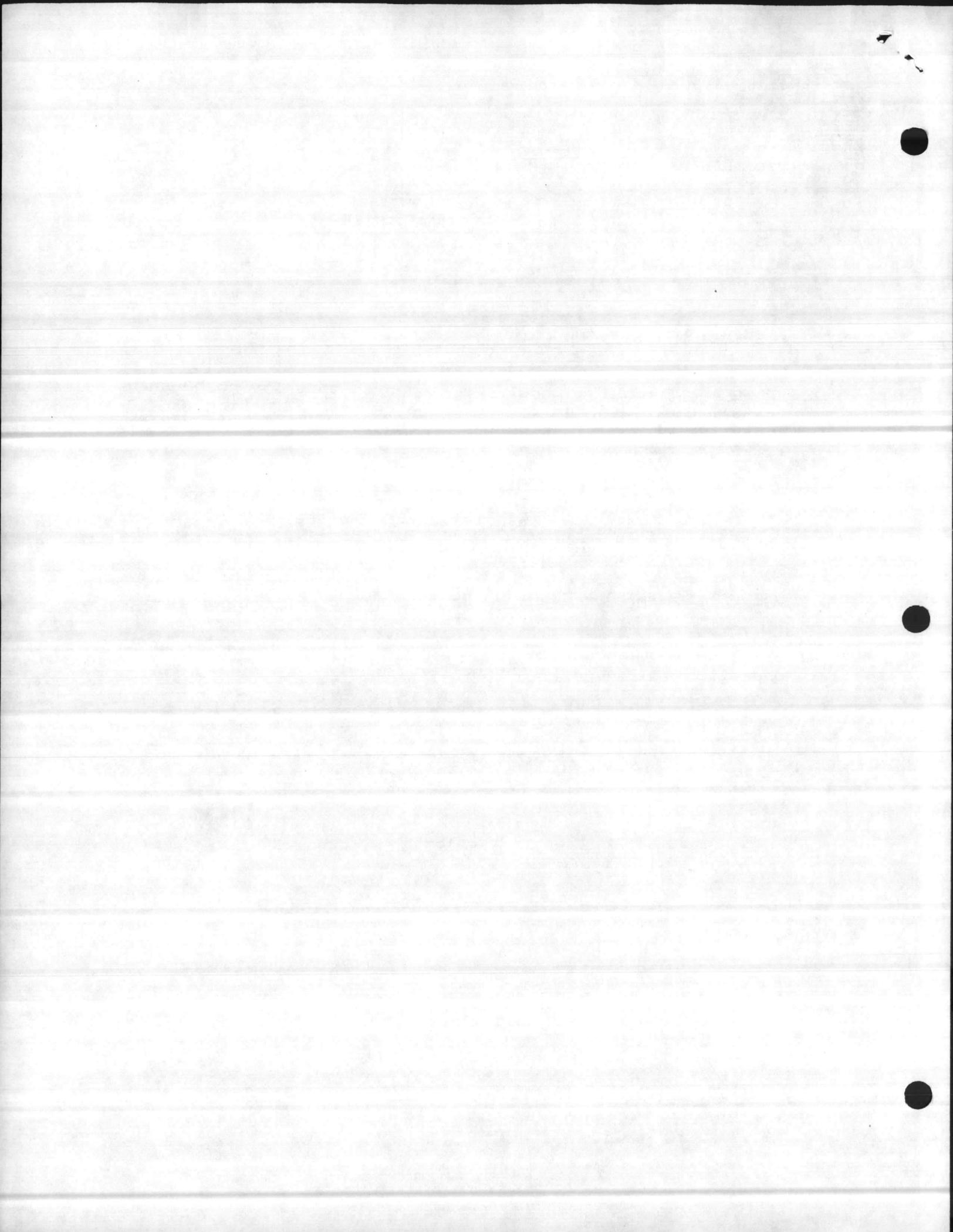
OPERATION AND MAINTENANCE OF PURE-STEAM HUMIDIFIERS

- 1) SEPARATOR - No maintenance required.
- 2) DISPERSION TUBE - No maintenance required.
- 3) VALVE - PNEUMATIC - Should be inspected annually to be sure that a) the diaphragm in the actuator is not leaking air, b) the valve closes off tightly, c) the stem packing is not leaking steam.

VALVE - ELECTRIC - Should be inspected annually to confirm that the stem packing is not leaking and that the valve closes tightly.

VALVE - SOLENOID - Requires no maintenance

- 4) STRAINER - Clean screen a few days after humidifier is put in operation and annually thereafter.
- 5) STEAM TRAP - Inspect annually.





TROUBLE SHOOTING

TOO MUCH HUMIDITY

1. Humidity controller out of calibration.
2. Valve stem sticking.
3. Valve spring broken.
4. Foreign matter preventing valve from closing.

TOO LITTLE HUMIDITY

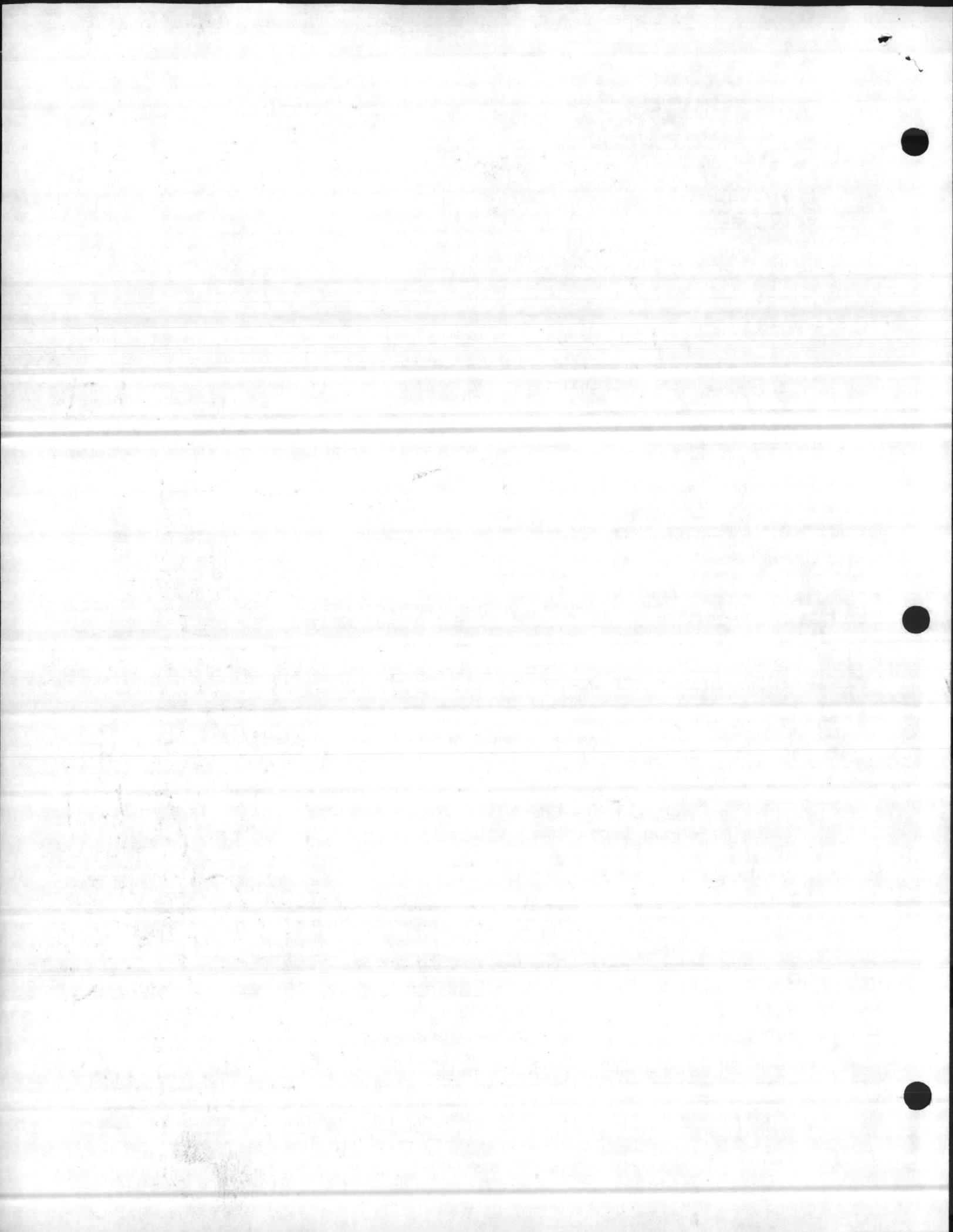
1. Strainer screen plugged.
2. Stop valve not fully open.
3. Silencer media dirty.
4. Humidity controller out of calibration.
5. Inadequate steam pressure.
6. Undersized humidifier.
7. Automatic control valve not opening fully.
 - a) Pneumatic valve operator leaking air.
 - b) Valve stem sticking.

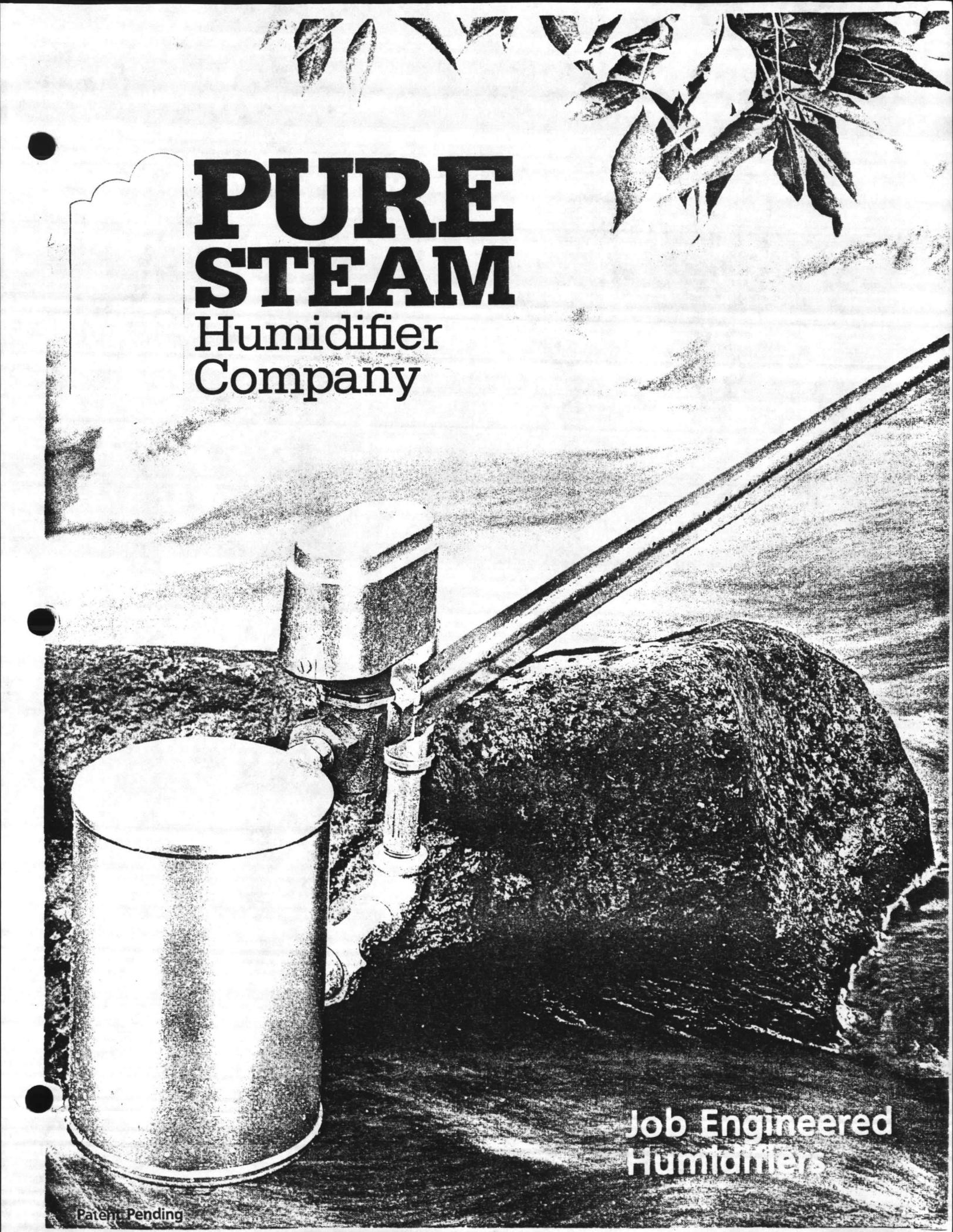
HUMIDIFIER DISCHARGES WATER

1. Faulty drainage:
 - a) Return line pressure greater than humidifier pressure.
 - b) Return line flooded.
 - c) Dirty steam trap.
 - d) Too much vertical lift.
 - e) Wrong type steam trap, float type must be used.
2. Faulty steam supply:
 - a) Humidifier supply not taken from top of main.
 - b) Too low (below 2 psi) steam pressure.
 - c) Long, untrapped supply line.
 - d) Steam main flooded due to priming boiler.

HUMIDITY SWINGS ABOVE AND BELOW CONTROL POINT

1. Boiler pressure swings too widely.
2. Faulty or inaccurate humidity controller.
3. Humidifier oversized.
4. Humidity controller in poor sensing location.
5. Pressure reducing valve not controlling accurately.



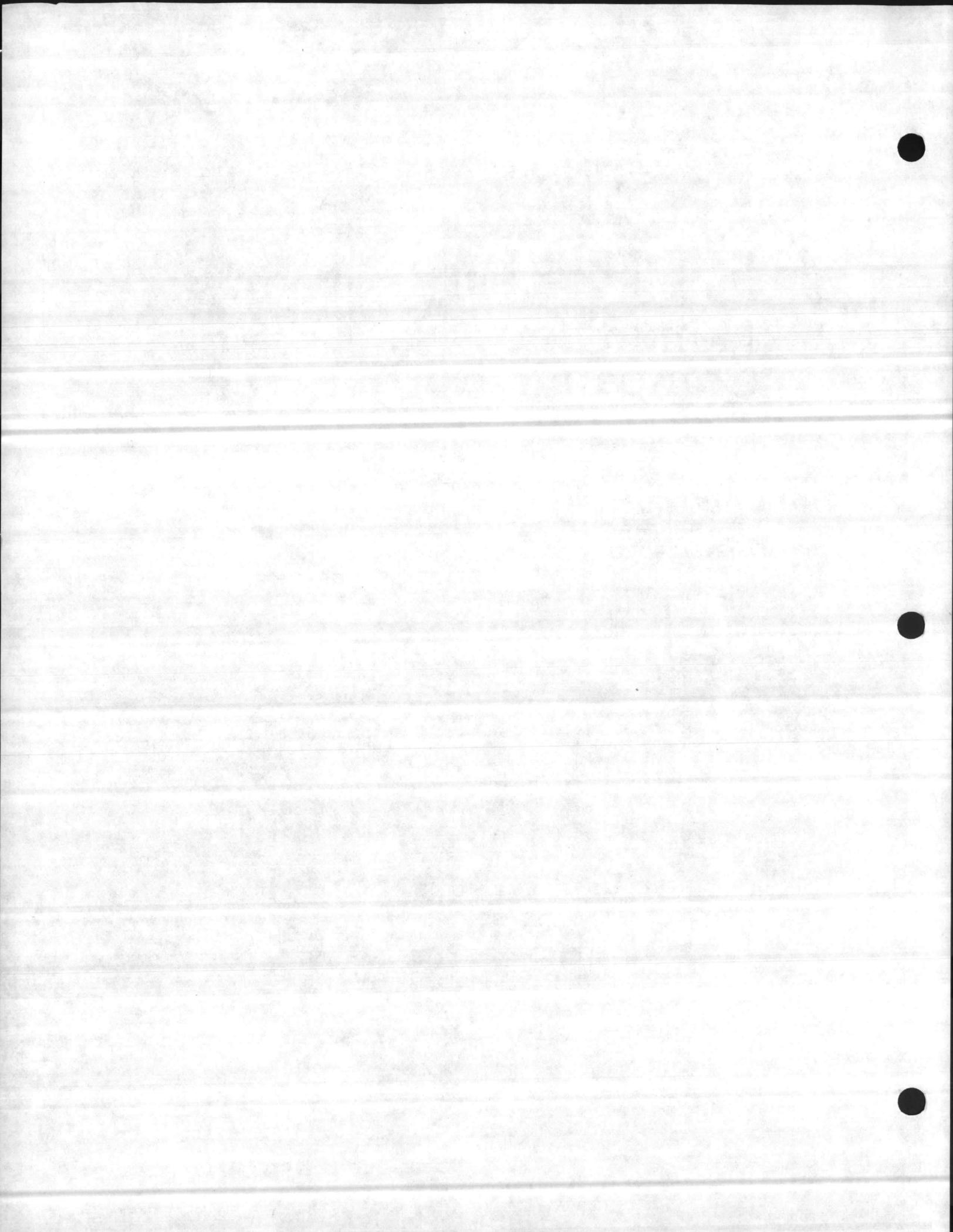


PURE STEAM

Humidifier
Company

Job Engineered
Humidifiers

Patent Pending



Features & Typical Operation

**PURE
STEAM**

Each Pure-Steam humidifier is "job engineered" to assure highly efficient steam release into the air stream by custom machining the proper number of orifices to the proper size.

High quality control valves and operators assure accurate response and metering of humidity. If you prefer to use your own valves and operators, we will factory mount them for you. Or, if you have a preference for certain valve/operator combinations, we can usually supply them with the unit. Just another way we "job engineer" the humidifiers to meet your needs.

Only high quality stainless steel is used in the separator and dispersion tubes; no corrosion for longer service.

Steam jacketing around the tubes means any condensate is "flashed off". Only pure steam is delivered, free of water, odor or particulate.

Units are light in weight; piping supports them. No special hangers or supports means easy installation.

A variety of attachment options gives you the flexibility of installing the Pure-Steam humidifier in confined spaces.

Externally mounted steam control valve can be quickly removed for service or exchange.

Detailed operating/installation instructions are included with each unit.

Temperature Switches

Temperature switches prevent humidifier operation during some unusual occurrence such as boiler priming or a malfunctioning steam trap has flooded the unit. Their use is recommended.

Principle of Operation

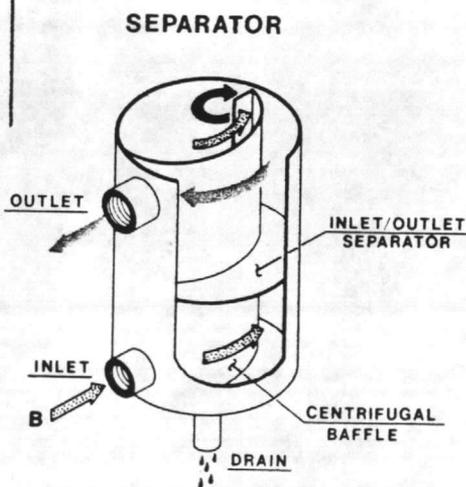
Single tube, multiple tube and area type humidifiers all operate in the same basic way. In the case of the single tube and area types, steam and condensate enter the humidifier at inlet to jacket (A), circulate around and pre-heat the sealed off inner chamber of the tube and then enter the separator at inlet to separator (B).

Inside the separator the condensate hits the internal baffle and, flowing in a circular direction, is slowed down and drains through the drain trap.

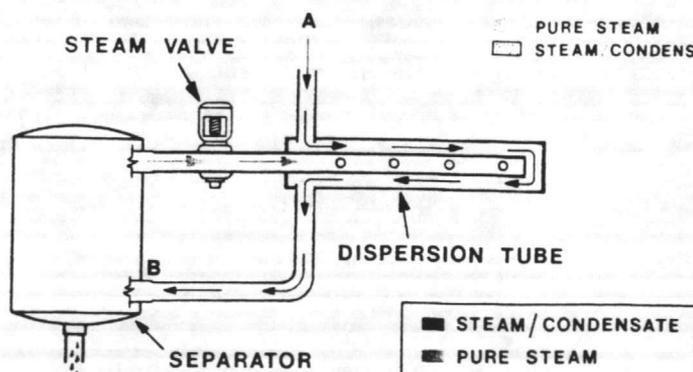
When there is a call for humidity, the control valve opens and allows steam to flow into the dispersion tube(s) and is expelled for distribution. If any condensate is formed when passing through the control valve it is re-evaporated inside the dispersion tube(s).

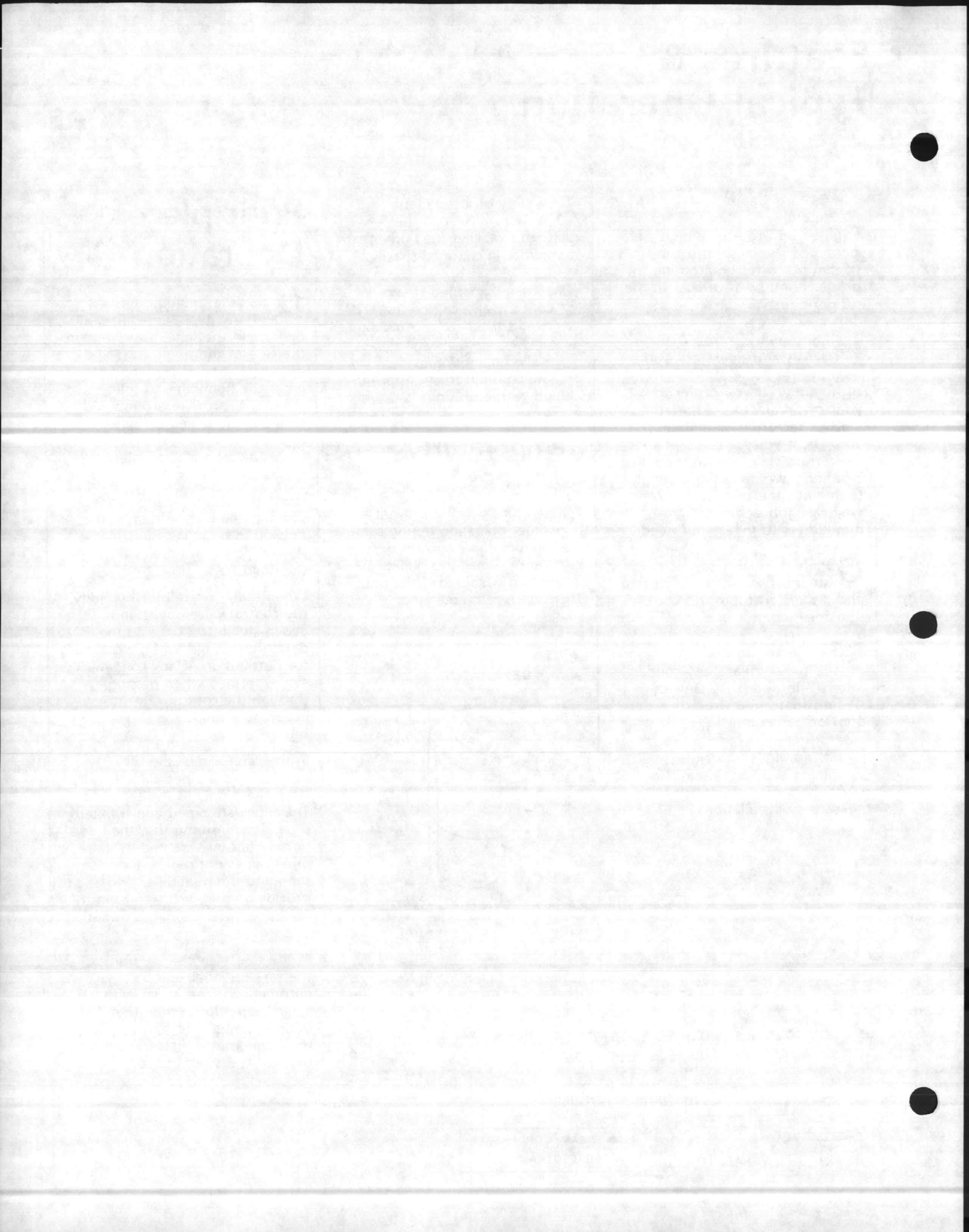
In the case of multiple tube units, steam is piped directly from the supply to the separator. The tubes are piped and trapped separately, insuring that the additional resistance created by extra piping does not reduce the steam supply to the humidifier and also providing additional trap capacity for the greater condensate that is created.

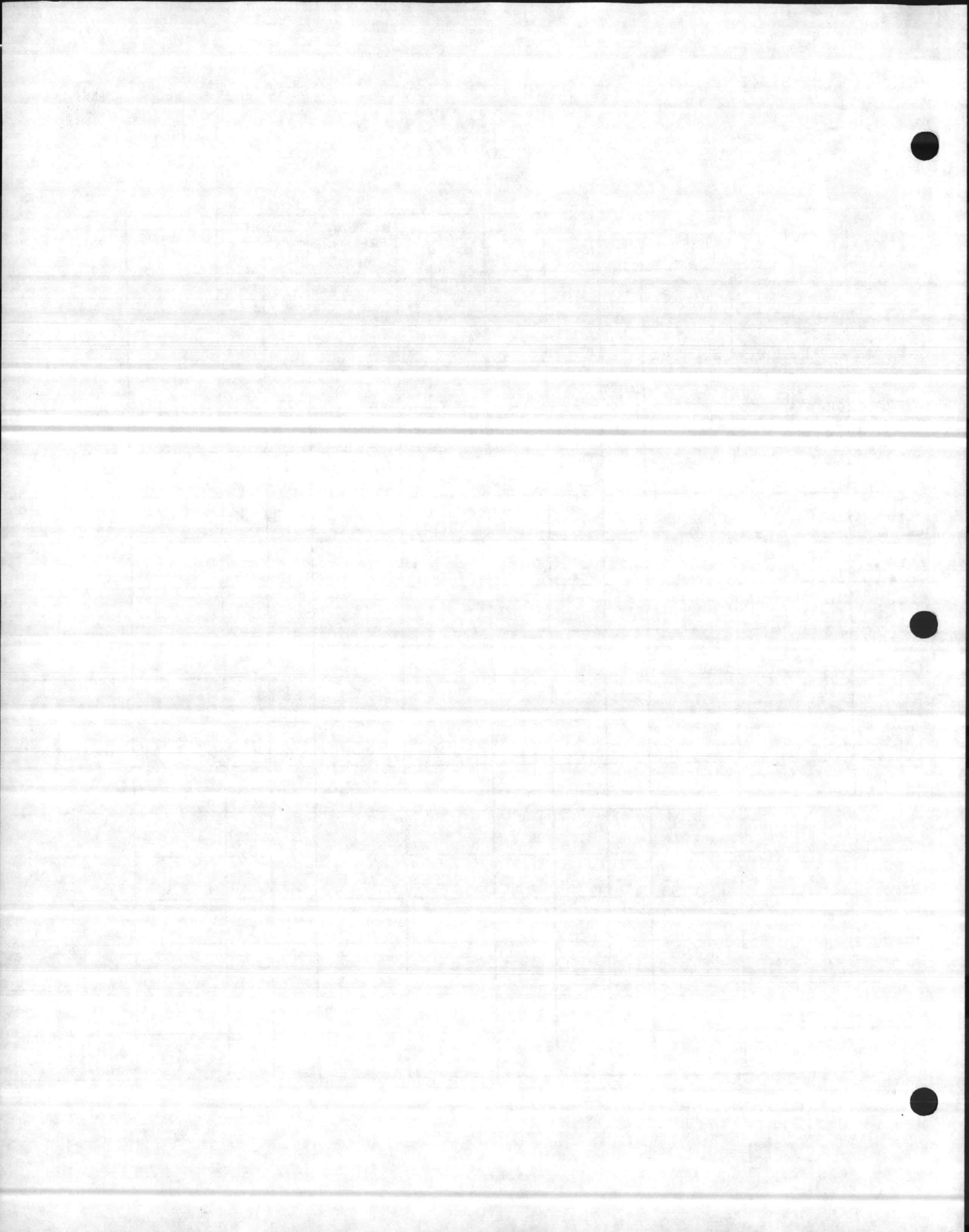
In the case of area type units, the fan (optional) starts automatically and assists with steam dispersion. When the desired humidity level is reached, the humidistat signals the valve to close and stops the fan.

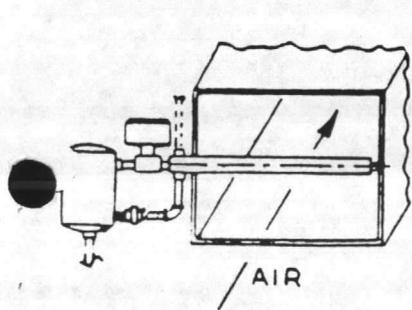


■ PURE STEAM
□ STEAM CONDENSATE

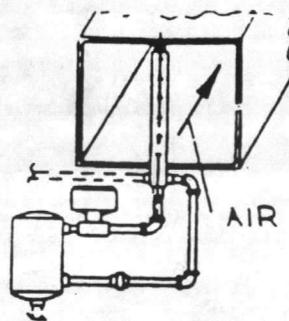




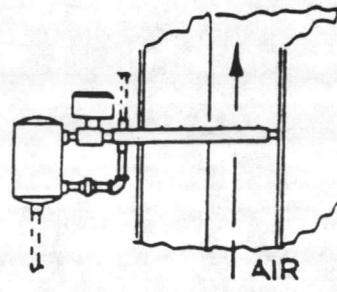




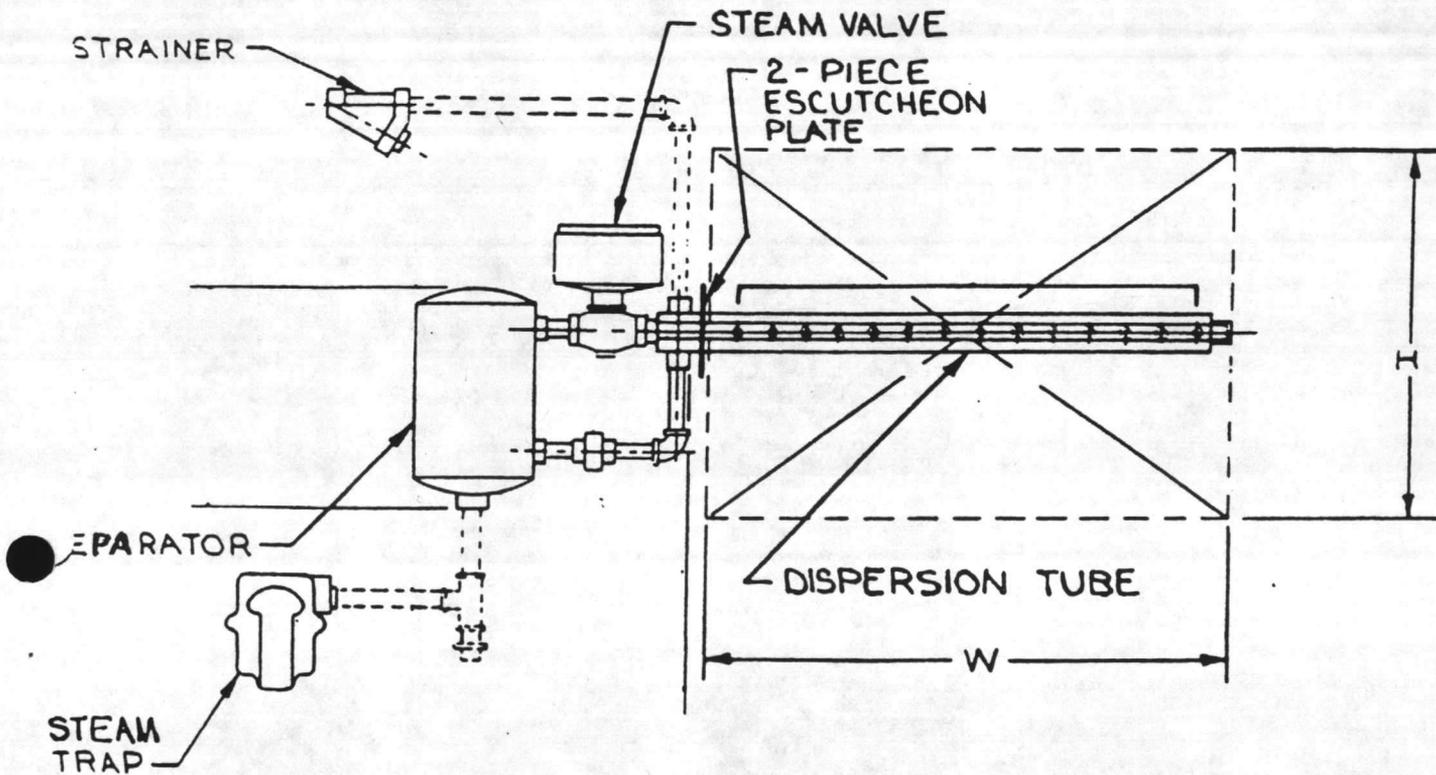
HORIZONTAL APPLIC.
FIGURE 1



VERTICAL APPLIC.
FIGURE 2



VERT. MT./VERT. DISC.
FIGURE 3



Specifications of Pure-Steam Humidifiers

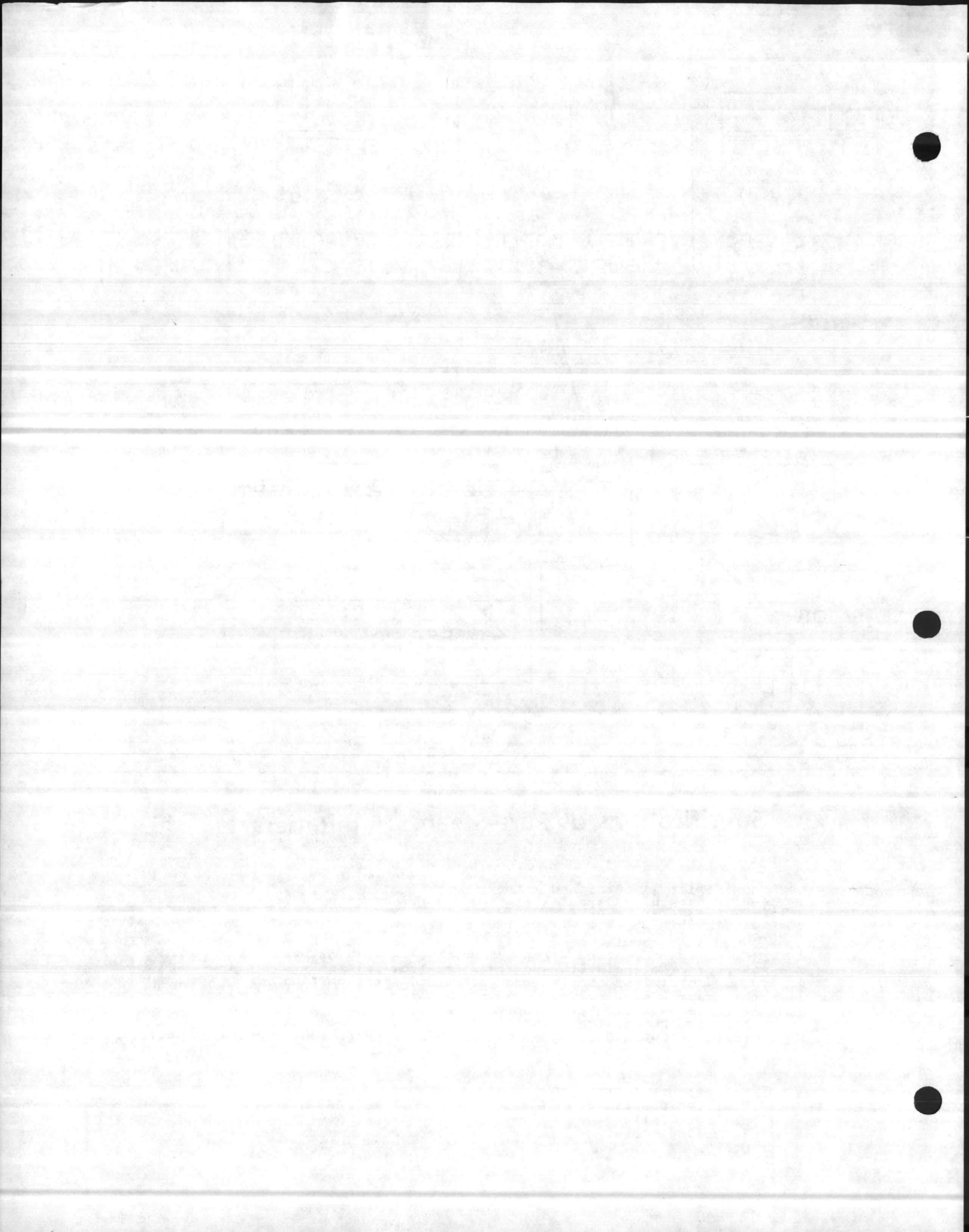
MODELS

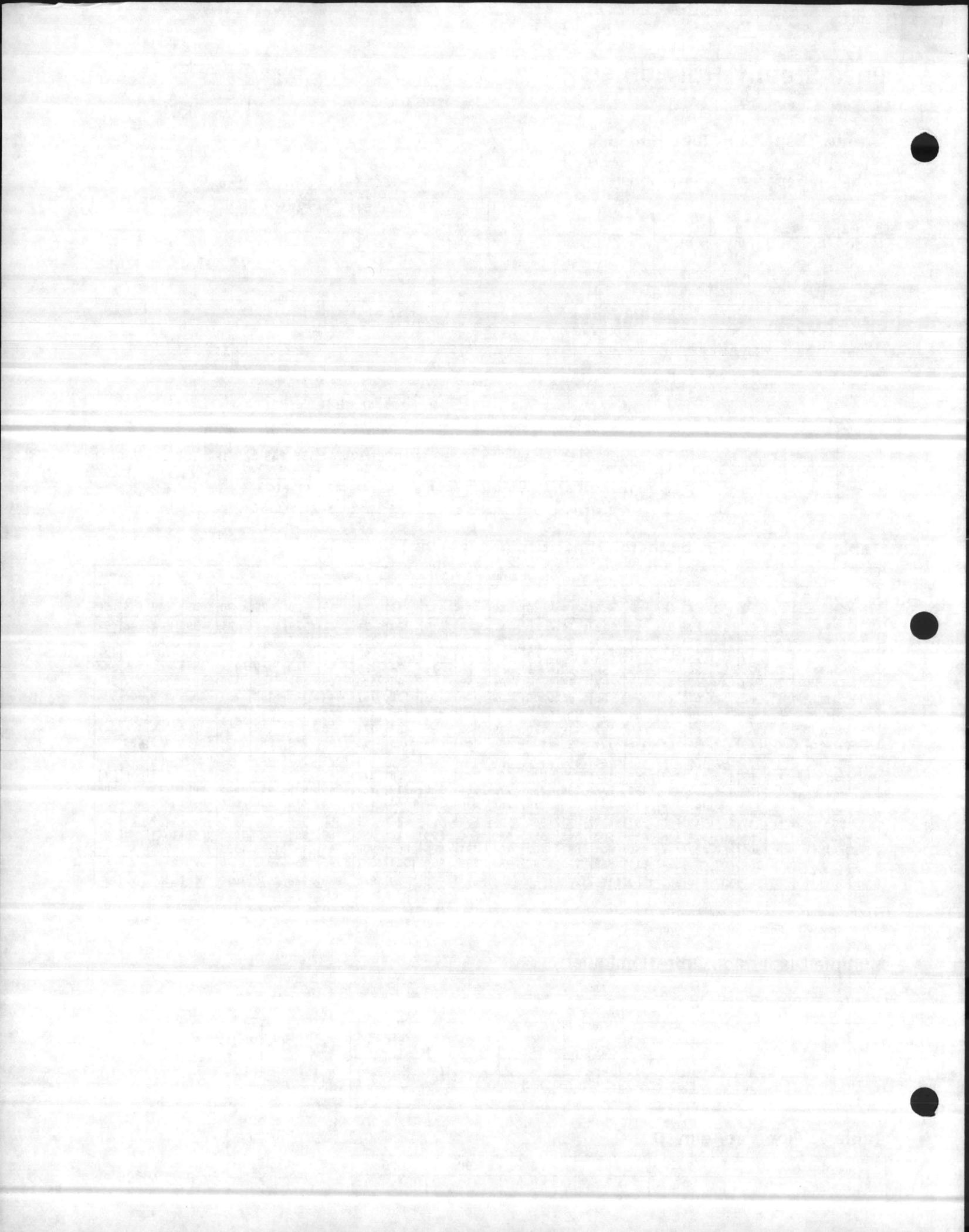
Each humidifier is furnished with;

1. Type 304 stainless steel steam separator (centrifugal type)
2. Inlet Y type strainer
3. Normally closed steam valve with operator to be
 - Pneumatic modulating
 - Electric modulating - control voltage-----24V or-----115V.
 - Electric solenoid (two-position) control voltage-----24V or-----115V.
4. Type 304 stainless steel steam jacketed dispersion tube
5. Steam trap
 - Float and thermostatic (up to 15 psi)
 - Inverted bucket trap (16 psi and above)
6. Two-piece escutcheon plate (to seal opening where tube penetrates duct).

OPTIONS

- Temperature switch
- Positive positioner
- Hi Limit switch
- Insulated jacket
- Others





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Chet Adams Company

Sales Engineers

HEATING

AIR CONDITIONING EQUIPMENT

VENTILATING

AIR POLLUTION SYSTEMS

ENERGY CONSERVATION

August 30, 1988

MAINTENANCE AND OPERATING INSTRUCTIONS

Project: Medical Dental Clinic
Camp Lejeune, NC

Architect: Six Assoc. Inc.

Engineer: James M. Lorick Jr.

Contractor: Sneed, Inc.
Wilmington, NC

Sales Rep: Chet Adams Company
Cary, NC

Manufacturer: ILG Industries

EXHAUST FANS

- EF-1,13 2 - CRF 67 Centrifugal direct drive PRV, 100 CFM @ 1/8" SP, 1/25 HP, 120/1/60 with birdscreen, backdraft damper, disconnect, and prefab curb.
- EF-2,18 2 - CRF 67 DITTO EF-1 except 110 CFM @ 1/8" SP, 1/25 HP.
- EF-3 1 - CRF 67 DITTO EF-1 except 140 CFM @ 1/8" SP, 1/70 HP.
- EF-4 1 - CRF 67 DITTO EF-1 except 195 CFM @ 1/8" SP, 1/70 HP.
- EF-5 1 - CRF 67 DITTO EF-1 except 55 CFM @ 1/8" SP, 1/25 HP.
- EF-6 1 - CRF 67 DITTO EF-1 except 75 CFM @ 1/8" SP, 1/25 HP.
- EF-7 1 - CRF 82 DITTO EF-1 except 260 CFM @ 1/8" SP, 1/25 HP.
- EF-8 1 - CRB 12 Centrifugal belted PRV, 280 CFM @ 1/8" SP, 1/4 HP, 120/1/60, with birdscreen, backdraft damper, disconnect, and prefab curb.
- EF-9 1 - CRB 24 DITTO EF-8 except 4275 CFM @ 1/4" SP, 1 HP, 208/3/60.
- EF-10 1 - CRF 82 DITTO EF-1 except 235 CFM @ 1/8" SP, 1/25 HP.
- EF-11 1 - CRB 12 DITTO EF-8 except 490 CFM @ 1/4" SP, 1/4 HP.
- EF-12 1 - CRB 12 DITTO EF-8 except 340 CFM @ 1/4" SP, 1/4 HP.

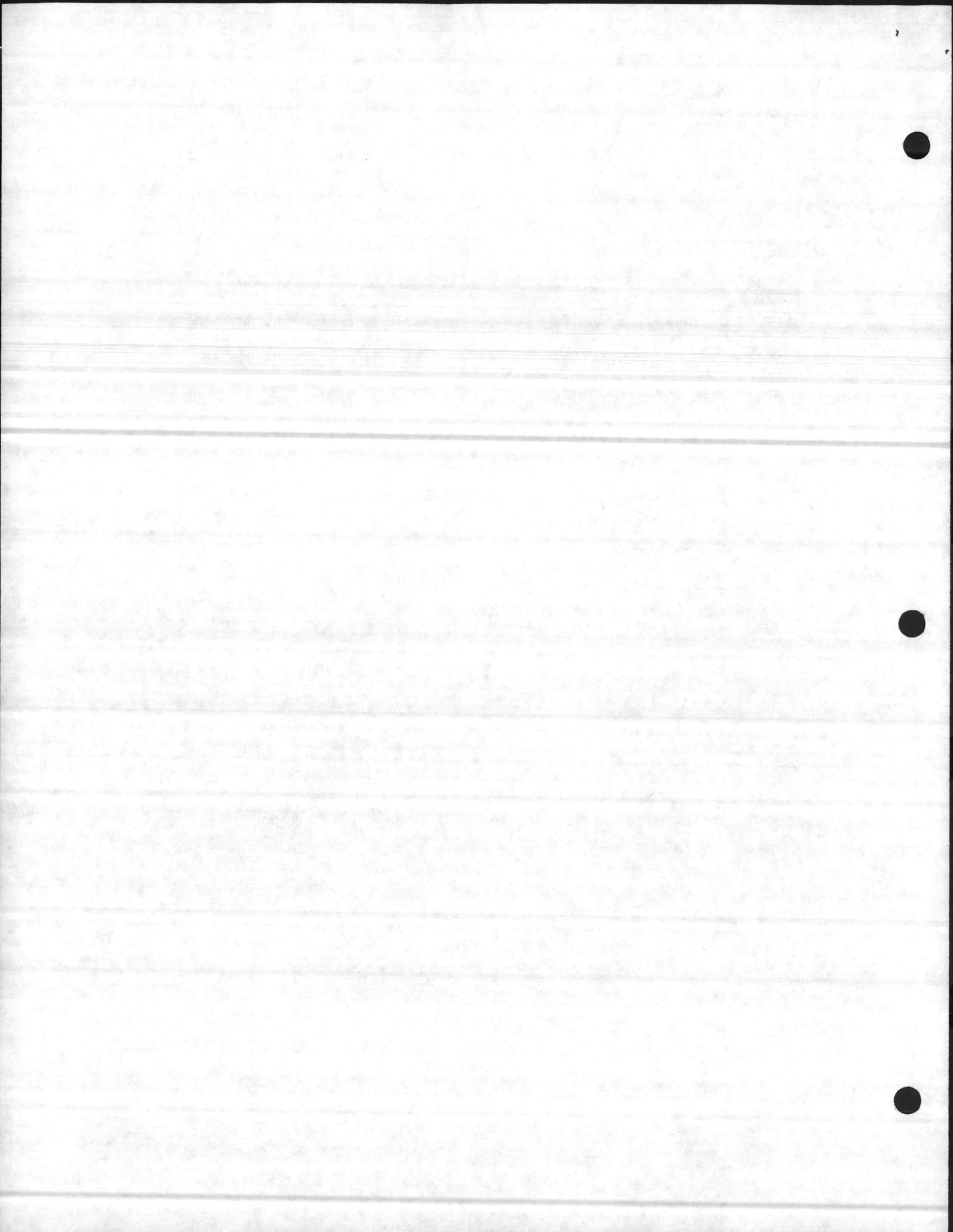


Medical Dental Clinic
Camp Lejeune, NC

Page 2

EXHAUST FANS (continued)

- EF-14 1 - CRB 12 DITTO EF-8 except 460 CFM @ 1/4" SP, 1/4 HP.
- EF-15,17 2 - CRF 67 DITTO EF-1 except 120 CFM @ 1/8" SP, 1/70 HP.
- EF-16 1 - CRB 12 DITTO EF-8 except 145 CFM @ 1/4" SP, 1/4 HP.
- EF-19 1 - CRF 67 DITTO EF-1 except 105 CFM @ 1/8" SP, 1/25 HP.
- EF-20 1 - CRB 12 DITTO EF-8 except 465 CFM @ 1/4" SP, 1/4 HP.
- EF-21 1 - CRF 67 DITTO EF-1 except 90 CFM @ 1/8" SP, 1/25 HP.
- EF-22 1 - CRB 30 DITTO EF-8 except 8520 CFM @ 1/4" SP, 1-1/2 HP,
208/3/60.

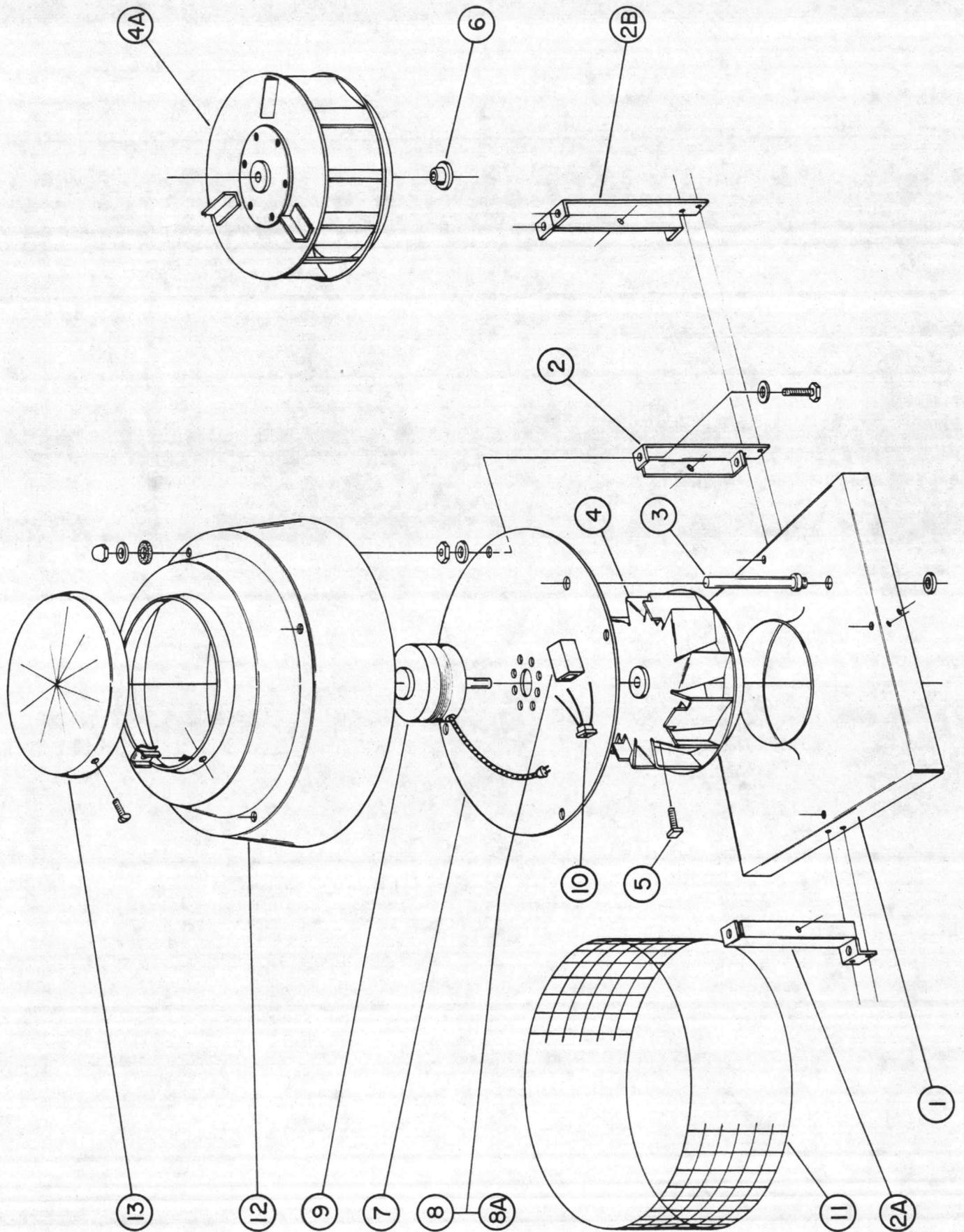


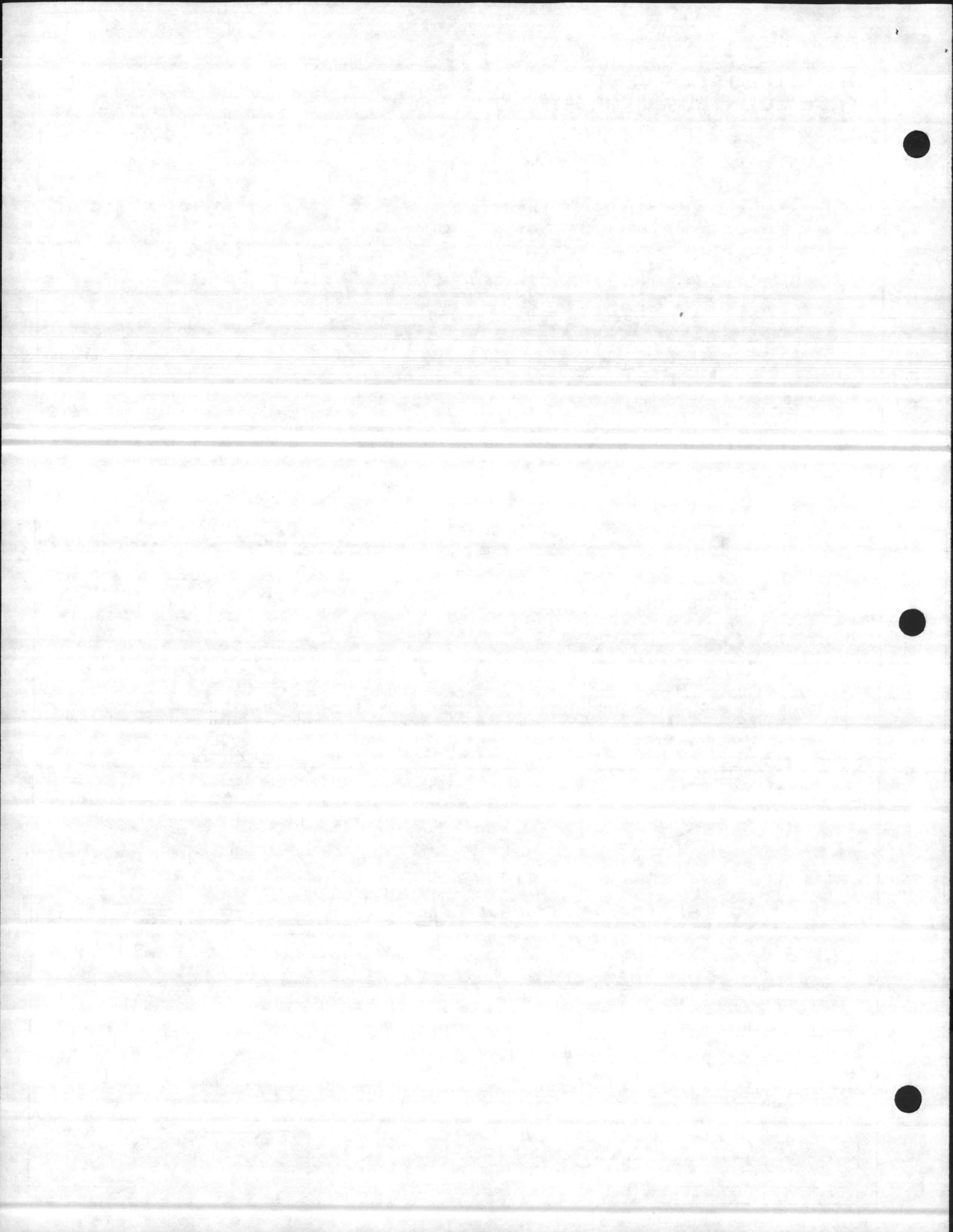
AN 23740-1

CRF 67 TO 150 ROOF VENTS. —FACE MOUNTED MOTORS—

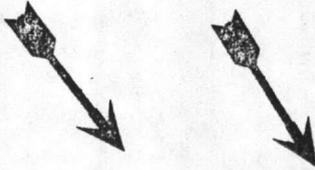


DRAWN BY: AL. LUTZ
DATE: MAY 1985
APPROVED BY: G.R.I.





DRAWN LUTZ	1	CREATED	MAY 1985						
CHECKED									
DATE MAY 1985	CRF 67 TO 150 ROOF VENTS. —FACE MOUNTED MOTORS—							SHEET 2 OF 2	AN 23740-1



NO.	NAME OF PART	PART NO.				
		67	82	100	122	150
1	INLET BASE CN 21147	2106-1803B	2108-1803B	2110-1803B	2112-1807B	2115-1805B
2	MOTOR SUPPORT BRACKET	A2106-5206A				
2A		_____	_____	_____	A2112-5214A	_____
2B		_____	_____	_____	_____	A2113-5210A
3	CONDUIT & CONNECTOR	A2106-0405A			A2112-0412A	A2113-0405A
4	WHEEL ASSY. AN 16771	5/16" BORE	2106-9010B	_____	_____	_____
		3/8" BORE	_____	2108-9006A	_____	_____
		1/2" BORE	2106-9011B	2108-9005A	2110-9005B	_____
4A	WHEEL ASSY. CN 23417	_____	_____	_____	B2112-9406C	_____
5	SET SCREW, SQ. HD.	1/4-20 x 3/4"				
6	BUSHING	8000-0107				
7	MOTOR PLATE	C2106-1107A			C2112-1117A	C2113-1115B
8	OUTLET BOX & COVER	A2106-1601B & A9919-1700A				
8A	DISCONNECT SWITCH SELECTION SHT.	AN 16512				
9	MOTOR	AS SPECIFIED				
10	RECEPTACLE & TERMINAL ASSY.	AN 21152				
11	BIRDSCREEN BN 20461	8500-4807				
12	ROOF CN 20448	2106-2414B			2112-2412B	2113-2406B
13	DOME	B2106-2413B				

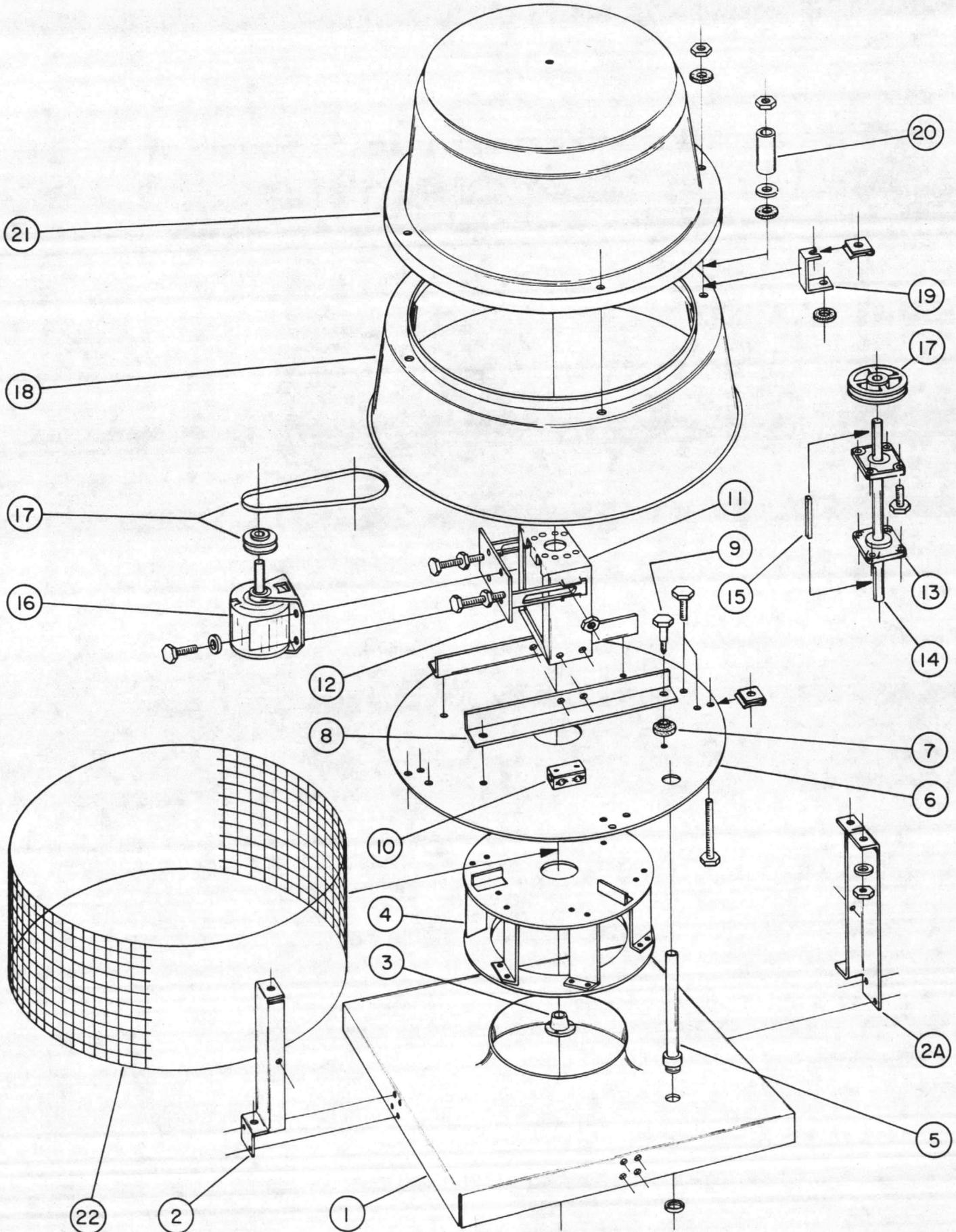


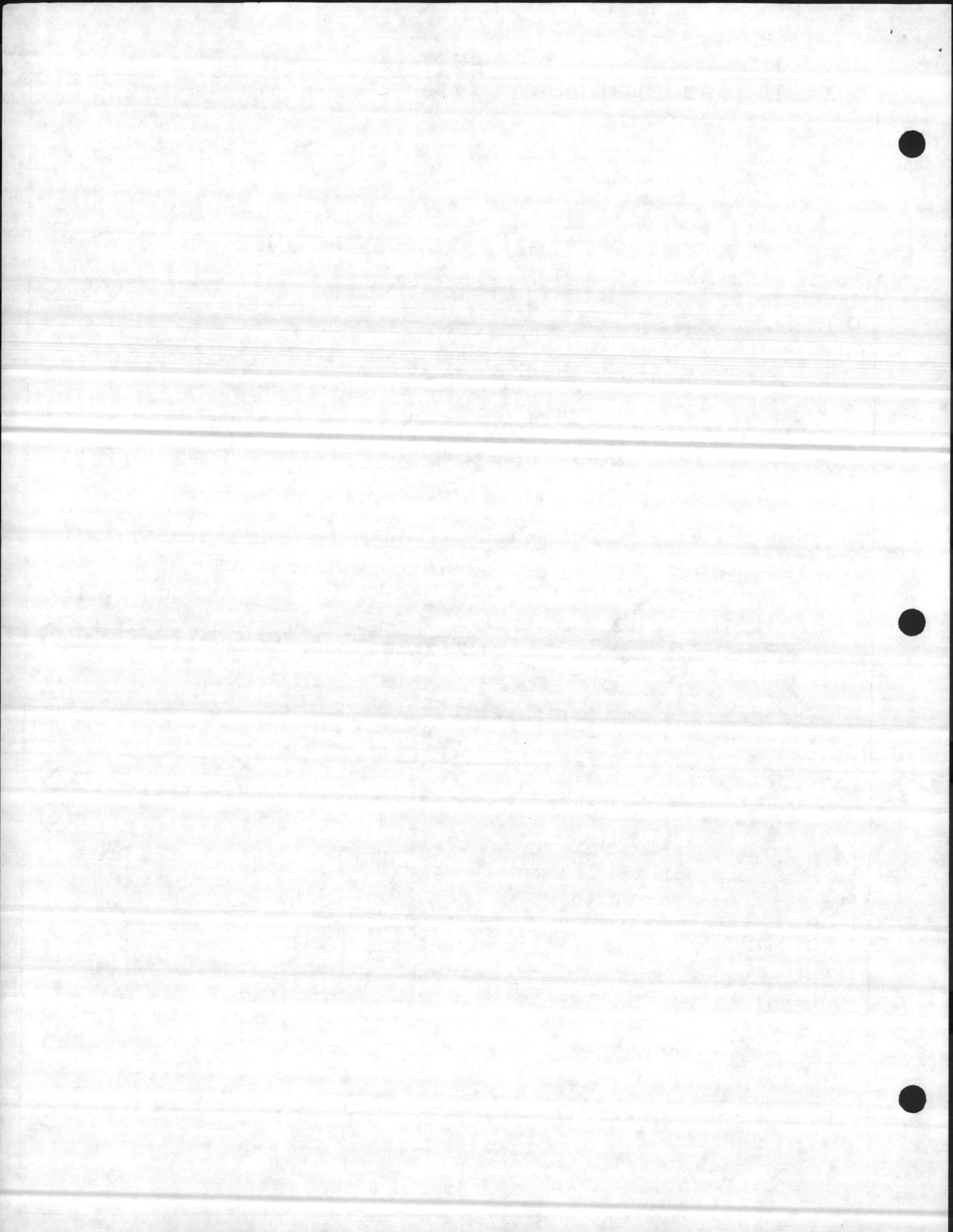
AN 23736-1

CRB 12 TO 18 ROOF VENTILATOR



DRAWN BY: AL. LUTZ
DATE: FEB. 1985
APPROVED BY: G.R.I.





DRAWN

LUTZ

CHECKED

I CREATED

FEB. 1985

SHEET 2 OF 2

DATE

FEB. 1985

CRB 12 TO 18 ROOF VENTILATOR PARTS CAT. DRG. AN 23736

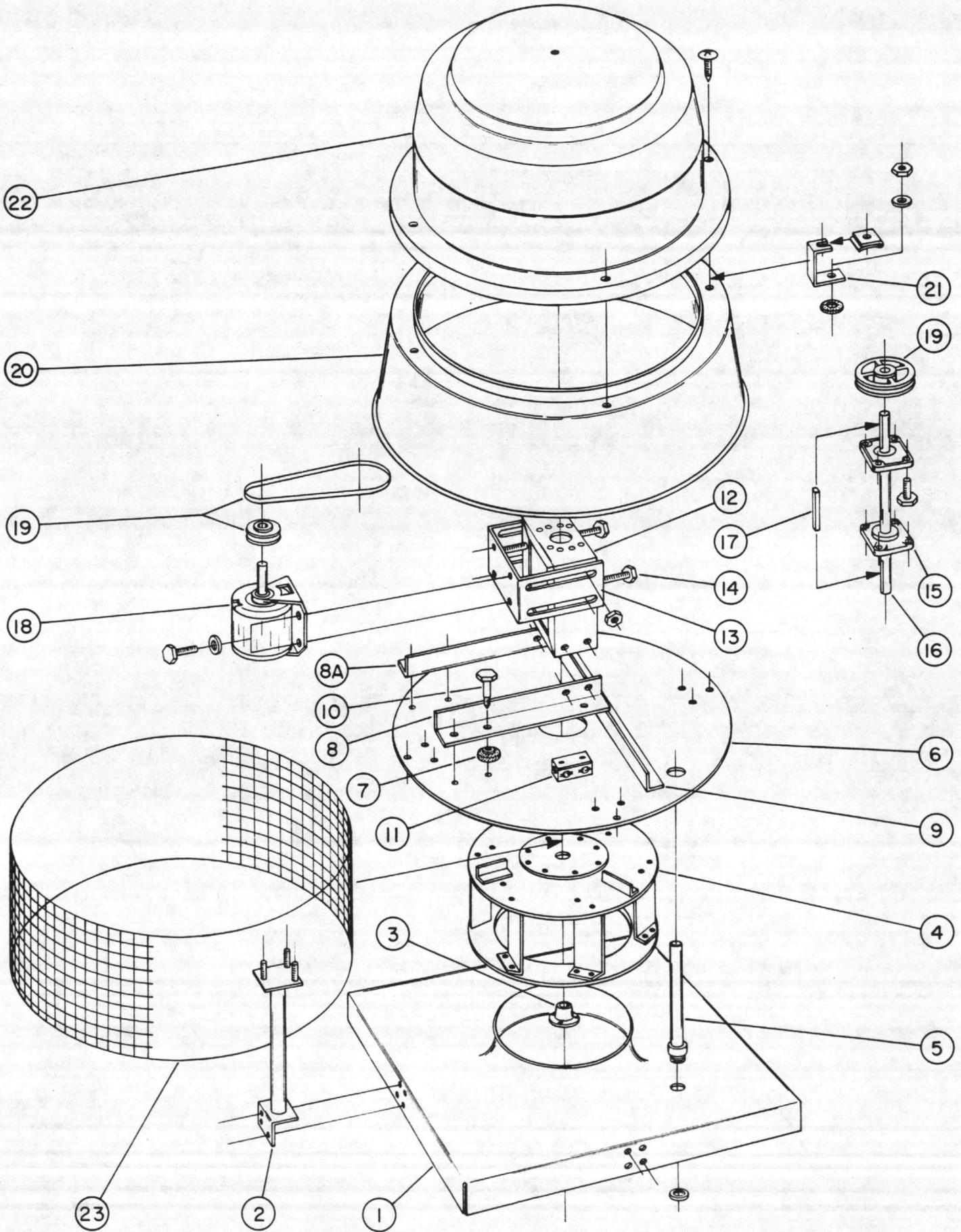
NO.	NAME OF PART		12	15	18
			PART NO.		
1	INLET BASE	CN 23462	2112-1808A	2115-1806A	2118-1802A
2	DISC SUPPORT BRACKET		A2112-5224A	A2115-5208A	_____
2A			_____	_____	A2118-5210A
3	BUSHING	CN 21851	8000-0063		
4	WHEEL ASSY.	CN 23457	2112-9306B	2115-9307B	2118-9304B
5	CONDUIT	AN 23446	2112-0413A	2115-0404A	2118-0401A
6	COMPARTMENT DISC	CN 23454	2112-2606A		2118-2602B
7	VIBRATION ISOLATOR		A8500-6325		
8	DRIVE PAK BASE		A2112-1121A		A2118-1113B
9	ISOLATOR SCREW		A7442-3037		
10	DISCONNECT SWITCH		AS REQUIRED		
11	BEARING FRAME		C2112-1120A		
12	MOTOR PLATE ASSY.		A2112-9032A		
13	BEARINGS	BN 23478	8000-1367		
14	SHAFT	BN 21131	2113-2500B		
15	KEY		7851-0004		
16	MOTOR		AS SPECIFIED		
17	DRIVE		AS REQUIRED		
18	ROOF SKIRT	BN 23449	2112-2415A		2118-2404B
19	ROOF SKIRT BRACKET		_____	_____	A2118-1114A
20	SPACER		A2112-1122A		_____
21	ROOF		C2112-2413A		CN 23450 2118-2405A
22	BIRDSCREEN	AN 23445	2112-5223A	2115-5207A	2118-5204A

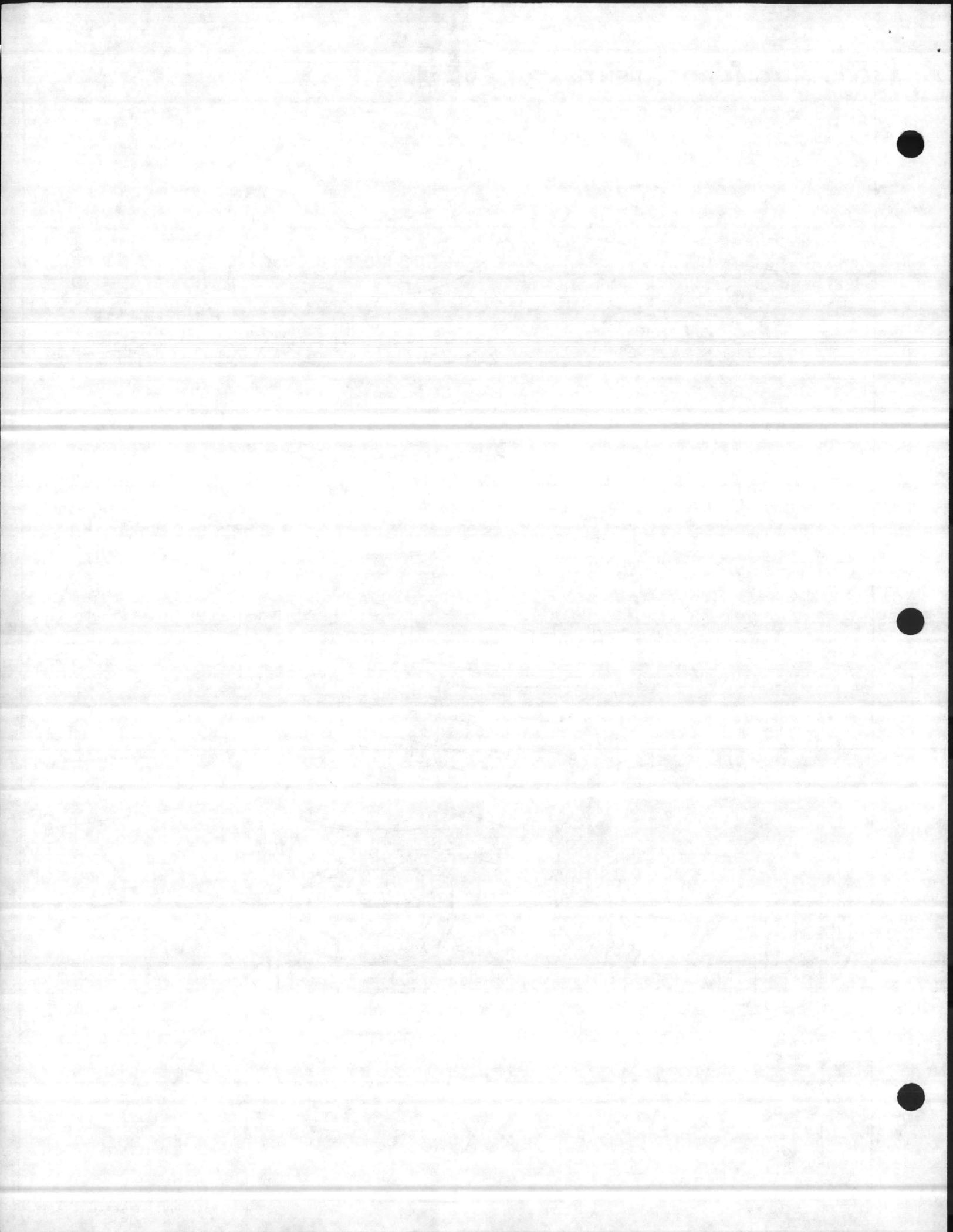


CRB 24 TO 44 ROOF VENTILATOR



DRAWN BY AL. LUTZ
DATE FEB. 1985
APPROVED BY G.R.I.





DRAWN LUTZ	1	CREATED	FEB. 1985						
CHECKED									
DATE FEB. 1985	CRB 24 TO 44 ROOF VENTILATOR — PARTS CAT. DRG.							SHEET 2 TO 2 AN 23737	

NO.	NAME OF PART		PART NO.			
			24	30	36	44
1	INLET BASE	CN 23462	2124-1804A	2130-1804A	2136-1804A	2144-1802A
2	DISC SUPPORT ASSY.		2124-9027A	2130-9046A	2136-9024A	B2144-9028B
3	BUSHING	CN 21851	8000-0032		8000-0041	
4	WHEEL ASSEMBLY	CN 23457 AN 23481	2124-9307B	2130-9308A	2136-9308A	2144-9303A
5	CONDUIT	AN 23446	2124-0402A	2130-0402A	2136-0400A	2144-0400A
6	COMPARTMENT DISC	CN 23455	2124-2606A	2130-2611A	2136-2611A	2144-2600A
7	VIBRATION ISOLATOR		A8500-6325			
8	DRIVE PAK BASE	R.H.	A2124-1117A	A2130-1102A	A2136-1103B	A2144-1101A
8A		L.H.	A2124-1118A	A2130-1103A	A2136-1104B	A2144-1102A
9	DRIVE PAK BASE ANGLE				B2136-1105A	B2144-5206A
10	ISOLATOR SCREW		A7442-3037			
11	DISCONNECT SWITCH		AS REQUIRED			
12	BEARING FRAME ASSY.		B2124-9025A		B2136-9023A	
13	MOTOR PLATE		C2124-1116A		C2136-1102A	
14	ADJUSTING BOLT ASSY.	AN 23567	2124-9026A	2130-9045A	2130-9045A	
15	BEARINGS	BN 23478	8000-1368		8000-1369	
16	SHAFT		BN 16907 1042-2500C	AN 21086 1642-2403B	BN 22316 5718-2503A	
17	KEY		7851-0034			
18	MOTOR		AS SPECIFIED			
19	DRIVE		AS REQUIRED			
20	ROOF SKIRT	BN 23449	2124-2404B	2130-2403B	2136-2400B	2144-2400A
21	ROOF SUPPORT BRACKET		A2124-1119A			
22	ROOF	CN 23450	2124-2405A	2130-2404A	2136-2401A	2144-2401A
23	BIRDSCREEN	AN 23445	2124-5210A	2130-5203A	2136-5203A	2144-5202A



STANDARD TERMS AND CONDITIONS OF SALE

No provision, term or condition of Buyer's order which is inconsistent with, different from or in addition to Seller's terms and conditions shall be binding upon Seller unless expressly agreed to in writing and signed by a duly authorized representative of Seller. Seller shall not be obligated to Buyer in any way until written acceptance of Buyer's order is made by Seller's duly authorized representative at its offices: 2850 North Pulaski Road, Chicago, Illinois. Seller's quotation shall be considered as an invitation to trade and shall not be construed as an offer to contract. The equipment and products described are herein referred to as the "goods."

PRICE

1. Prices are F.O.B. point of shipment.
2. Prices set forth on Seller's quotation are firm for a period of thirty (30) days from the date of the quotation. In the event of any changes in specifications indicated by Buyer's purchase order, Seller may adjust the price to cover such changes.
3. If, at Buyer's request, shipment is extended beyond six (6) months from date of Seller's written quotation, Seller may increase the stated price of the unshipped goods one percent (1%) per month.
4. Prices of goods not manufactured by Seller are at all times subject to revision to reflect price increases by Seller's suppliers.
5. All prices are subject to the addition of any Federal, State or local taxes which may be applicable to the sale, purchase, delivery, storage, use or processing of the goods sold. Any such tax shall be due and payable to Seller at or before the time the tax is payable by Seller to the taxing authority, or in lieu thereof, Buyer may provide Seller with a tax exemption certificate acceptable to the taxing authority.

PAYMENT TERMS

1. Terms of payment are thirty (30) days net from date of invoice, no discounts, unless otherwise specified.
2. Interest at the rate of one and one-half percent (1.5%) per month (18% per annum), or the maximum lawful rate allowable, will be charged, whichever is less, on all past due invoices.
3. No payments made to representatives or agents will be valid. Payments shall be made directly to Seller, at its home office, Chicago, Illinois.
4. Minimum billing for any goods sold by the Seller shall be \$25.00 net, exclusive of all transportation.
5. Pro rate retainage fees or back charges will not be accepted by Seller. Collection of such deductions from payments will be enforced at Buyer's expense.
6. Seller shall not be liable for any liquidated damages or penalties whatsoever unless otherwise agreed to in writing.
7. Seller reserves the right to require full payment in advance of shipment, posting of security for payment, or other payment arrangements when in Seller's judgment, open billing terms are not acceptable.

DELIVERY AND ACCEPTANCE

1. Delivery dates are estimated by Seller and are not guaranteed.
2. Shipments shall be made by the method or carrier deemed most feasible by Seller and Seller reserves the right to ship all or part of the goods from any shipping point other than the points specified herein.
3. Risk of loss or damage passes to the Buyer upon delivery of the goods to the carrier at point of shipment.
4. Buyer shall inspect all goods upon receipt. If Buyer rejects all or part of the goods, Buyer shall give Seller written notice of rejection, specifying the reasons therefore within five (5) days after receipt of the goods. In the event Buyer does not so notify Seller, Buyer shall be deemed to have accepted the goods.

WARRANTY AND LIMITATIONS OF LIABILITY

SELLER WARRANTS THAT THE GOODS SHALL BE FREE FROM DEFECTS IN MATERIALS OR WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF INITIAL INSTALLATION OR FOR A PERIOD OF EIGHTEEN (18) MONTHS FROM DATE OF SHIPMENT, WHICHEVER PERIOD FIRST EXPIRES. NO WARRANTY IS MADE OR OFFERED WITH RESPECT TO ANY PROTECTIVE COATINGS APPLIED TO THE GOODS. SELLER'S WARRANTY OBLIGATIONS WITH RESPECT TO GOODS NOT MANUFACTURED BY SELLER SHALL NOT EXCEED THE OBLIGATIONS UNDERTAKEN BY THE MANUFACTURER THEREOF UNDER EXPRESS WARRANTY TO SELLER.

If, in Buyer's judgment, the goods do not meet the warranties expressed above, and the Buyer notifies Seller of the defect within a reasonable time after discovery of the defect and within the warranty period, Seller agrees to correct the defect by repairing or replacing, F.O.B. point of manufacture, any parts or components of the goods determined by Seller to be defective, or at its option by issuing credit for the defective parts or components. Seller shall not be liable for labor or other charges, costs or expenses related to the removal, shipping, handling, installation or re-installation of any goods or components.

THE EXPRESS WARRANTIES SET FORTH ABOVE ARE GIVEN BY SELLER IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IT IS EXPRESSLY AGREED THAT BUYER'S EXCLUSIVE REMEDY AND SELLER'S LIABILITY SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF, OR THE ISSUANCE OF CREDIT FOR, DEFECTIVE PARTS OR COMPONENTS.

SELLER EXPRESSLY DISCLAIMS ANY AND ALL LIABILITY FOR AND SHALL NOT BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES RESULTING FROM OR ARISING FROM OR OUT OF DEFECTIVE GOODS, SELLER'S NEGLIGENCE, BREACH OF WARRANTY, BREACH OF CONTRACT, ANY TORT, OR CLAIMS BASED UPON STRICT LIABILITY OF THE SELLER. IN NO EVENT SHALL SELLER BE LIABLE FOR CONSEQUENTIAL DAMAGES OR LOSSES COMMERCIAL IN NATURE.

NUCLEAR USE

1. Buyer covenants, represents and warrants that neither Buyer nor any third party shall use, re-sell or otherwise dispose of any goods or part thereof in connection with any activity or process involving nuclear fission or fusion or any use or handling of any source, special nuclear or by-product material, as those materials are defined in the U.S. Atomic Energy Act of 1954 (as amended), without Seller's prior written consent, and until such time as Buyer, or such third party, at no expense to Seller, shall have arranged for insurance coverage, indemnities, and waivers of liability, recourse and subrogation, all acceptable to Seller, and all fully adequate in the opinion of Seller, to protect Seller (and its subcontractors and suppliers) against liability of any kind whether in contract, tort (including negligence), strict liability or otherwise. The aforesaid covenants, representations and warranties shall survive this contract and sale.
2. Seller shall not be obligated to deliver the goods until such insurance, indemnities and waivers have been procured and are legally operative in Seller's favor. Buyer's failure to comply with any provisions of this paragraph entitled "Nuclear Use" shall be cause for Seller to cancel this contract without liability to Seller, and pursue any remedies provided in law or equity by this contract, the Uniform Commercial Code, or otherwise.

EXCUSABLE DELAY

Seller shall not be deemed to be in default on account of delays in the delivery of goods or in the performance of this contract or any other act to be performed by Seller due to any of the following causes: acts of God; acts of Buyer; insurrections or riots; fires; floods; explosions; earthquake or serious accidents; epidemics or quarantine restrictions; any act of government affecting prices, fuels, materials, facilities or completed goods; strikes, labor troubles causing cessation, slow-down or interruption of work; shipment delays; inability to obtain materials, fuel, accessories, manufacturing facilities, transportation, equipment or parts; any other cause to the extent it is beyond Seller's control.

TERMINATION AND RETURNED GOODS

1. Termination of the order by Buyer, or any part thereof, will not be effective unless agreed to in writing by Seller. Accepted terminations will be subject to all charges incurred by Seller for material consumed, work performed and all other expenses incurred to the date of acceptance.
2. Goods accepted for return and credit are subject to a twenty percent (20%) charge for handling and/or reconditioning, unless otherwise agreed by Seller. Transportation charges for returned goods must be prepaid by Buyer. Before returning goods Buyer must obtain Seller's authorization, and attach Seller's "Return Material Tag" to all shipments. Notice of shipment must be given to Seller on the day of shipment and Buyer must furnish a copy of the Bill of Lading, order number and invoice date.
3. Goods manufactured specifically to order or to specifications of Buyer may not be returned for credit. Changes requested by Buyer in non-stock goods after commencement of manufacturer will be subject to a revision in price to reflect additional costs.
4. Use of materials, parts or equipment furnished by Buyer will subject the order to termination without any liability on the part of Seller if the said materials, parts or equipment are defective or will not perform to Seller's requirements. However, Buyer shall be liable to pay Seller's costs and expenses through date of termination.

PATENTS AND TRADEMARKS

Seller shall indemnify the Buyer against liability for infringement of any United States Letters Patent arising out of the manufacture, sale or use of any of Seller's goods furnished, provided that the Buyer shall promptly notify Seller of any such claim and give Seller the opportunity to defend against such claim. The Buyer shall be responsible for all such loss when a particular process or system, or the goods of a particular manufacturer or manufacturers is specified, or when infringement is incurred by employing the furnished Seller's goods in combination with other parts or goods. All drawings and data furnished by Seller shall remain its property and shall be returned to Seller upon request.

DEVELOPMENT CHANGES, DESIGN AND SPECIFICATIONS

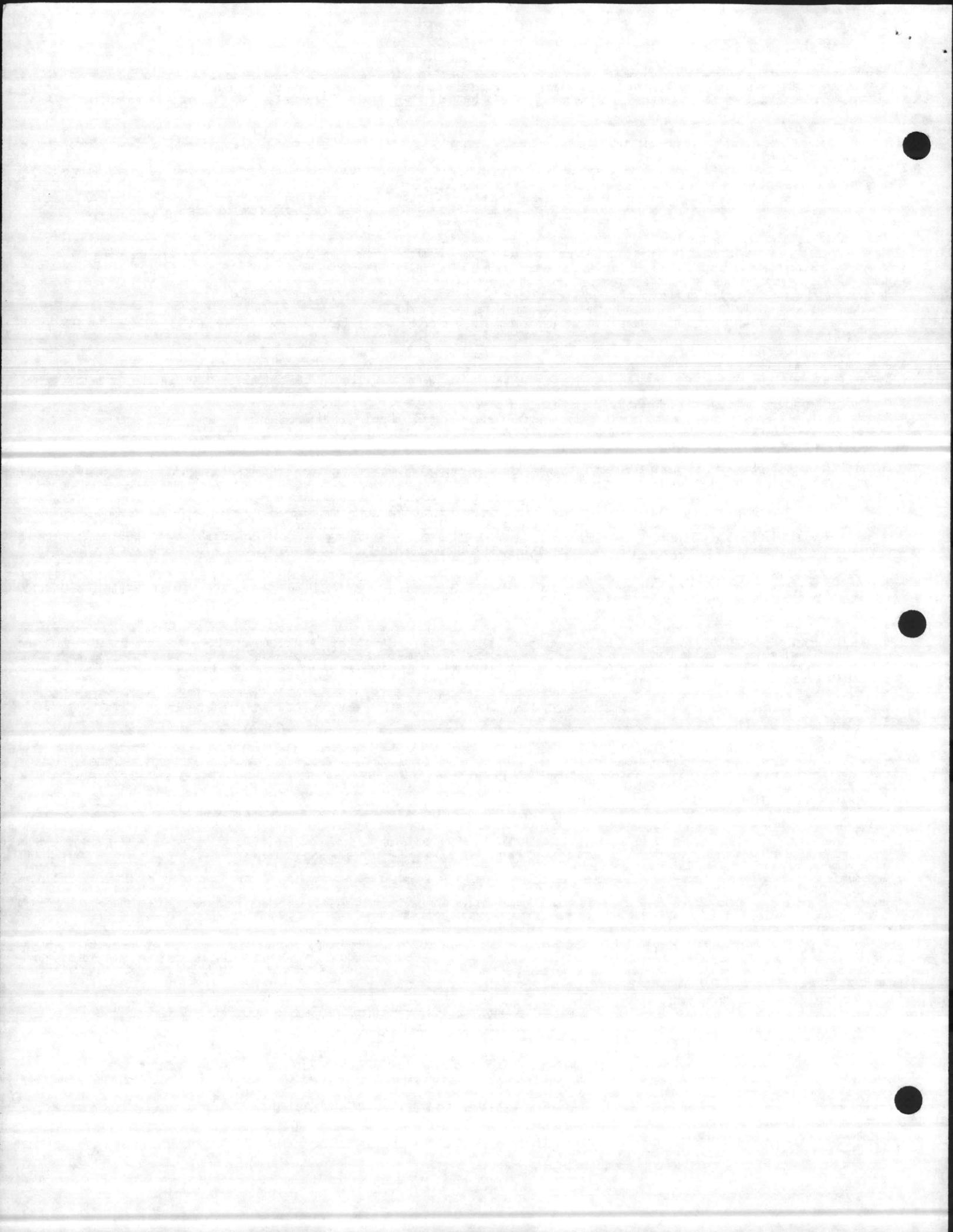
1. Changes in design or specifications may be made at Seller's discretion and Seller has no obligation to incorporate such changes in goods manufactured prior to the change.
2. Seller may furnish Buyer with goods which have been subject to changes in design or specifications provided such changes do not adversely affect price, delivery, or any guaranteed performance of the goods or make unusable or obsolete any other item of goods furnished to Buyer under this contract.
3. All drawings, instructions and/or technical and engineering services which Seller may furnish with respect to installation or use of the goods are furnished solely for the review and approval of the Buyer. Seller makes no representation or warranty with respect to the accuracy or sufficiency of any such information and disclaims all liability in connection with their use or application.
4. Seller reserves the right to correct any factory, engineering, clerical or stenographic errors or omissions which may appear upon review and verification of data referred to in Seller's quotation, or Buyer's order.

COMPLIANCE WITH LAWS

No representation or claim is made regarding compliance with the Occupational Safety and Health Act of 1970, or its amendments, or any other federal, state or local laws, ordinances, codes, rules or regulations which may apply to the goods or their installation.

GOVERNING LAW AND SEVERABILITY

1. This agreement shall be governed in all respects by the law of Illinois.
2. This contract shall be binding upon and shall inure to the benefit of the parties, their successor and assigns.
3. If any provision or term herein is found to be invalid or unenforceable as a matter of law or by public policy, it shall be considered to be severed from the remainder of the terms and conditions which shall remain in full force and effect.





A CHECK IN THE APPROPRIATE SQUARE INDICATES THE TYPE OF BEARINGS USED IN THE MOTOR POWERING THIS EQUIPMENT

GENERAL INSTRUCTIONS FOR FAN MOTORS

- RELUBRICATABLE BALL BEARINGS - An instruction tag from the manufacturer is included with the motor and the recommendations contained therein should be followed.
- SEALED BALL BEARINGS - The bearings are factory-packed with a general purpose bearing lubricant and require no further attention. The life of the grease is dependent upon the number of operating hours and temperature. Under normal conditions of operation (8 hours per day, 5 days per week and average ambient temperature of 80 deg. F) the expected grease-life will be approximately seven years. The life may be greater or less depending upon the enclosure of the motor, RPM, type of mounting, variation in ambient temperature and operating duty cycle. In terms of hours of operation, expected life may be stated as approximately 30,000 hours for open motors and 20,000 hours for enclosed motors when working in an average ambient temperature of 80 deg. F.
- SEALED SLEEVE BEARINGS - Bearings of this type are provided with a large lubricant reservoir and require no attention. Because of the extremely light loads on motors with this type of bearing, the life will compare favorably with larger motors having sealed ball bearings.
- RELUBRICATABLE SLEEVE BEARINGS - The bearing is essentially the same as the sealed sleeve bearing with the exception that it may be relubricated to secure extended life. To obtain maximum life, 5 or 6 drops of SAE20 Motor Oil or Electric Motor Bearing Oil should be added after every 1,000 hours of operation.

NOTE: THE STATEMENTS REGARDING EXPECTED LIFE DO NOT CONSTITUTE A GUARANTEE, EXPRESSED OR IMPLIED - BUT SERVE ONLY AS AN INDICATION OF WHAT MAY BE EXPECTED OF THE EQUIPMENT. (REFER TO STANDARD TERMS AND CONDITIONS OF SALE.)

GENERAL NOTES REGARDING FAN EQUIPMENT

1. OVERLOAD PROTECTION - Some motors are provided with built-in overload protection. This fact is so noted on the Motor Rating Plate. If the motor does not contain built-in overload protection, it is mandatory that this protection be provided by starters in the motor circuit. The starters are to be equipped with overload protection devices of a rating suitable for the current rating of the motor.
2. PERIODIC CLEANING - Periodic cleaning of all fan equipment is strongly recommended. Dirt and grease accumulations on the impeller cause vibration which greatly increases stresses and loads on the motor bearings. A program of preventive maintenance will greatly increase fan and motor life.
3. CHECKING DIRECTION OF ROTATION - Care should be taken to insure the proper direction of rotation. This is particularly true in the case of centrifugal type roof ventilators. This type of equipment will deliver air when running in either direction; however, the load is greatly increased when operation is in the wrong rotation. This is a very common cause of overload tripping in centrifugal type roof ventilators. When this trouble is experienced, try reversing fan rotation before increasing the size of the overload protection.
4. MOTOR OVERLOAD - Forward-curve and radial-bladed fans consume maximum horsepower at 0 in. Static Pressure. Some fans of this type are powered so that operation at 0 in. Static Pressure will overload the motor. Check Catalog Ratings to determine minimum Static Pressure operation if overloading is experienced with this type of equipment.
5. CHECKING RUNNING CLEARANCE - To achieve maximum performance and efficiency, fans are precision-built machines. Upon occasion, parts will shift slightly due to mishandling in shipment. This can cause binding of the rotating assembly. Before placing any fan in operation, the impeller should be turned by hand to ensure that no binding or interference is present.



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Water
Treatment
Specialties

imcor

®

Industrial Maintenance Corporation

3520 Tryclan Drive • Charlotte, North Carolina 28217 • (704) 525-6967

AUGUST 29, 1988

MAINTENANCE & OPERATING INSTRUCTIONS

FOR

MEDICAL/DENTAL CLINIC

M.C.B. CAMP LEJEUNE, NORTH CAROLINA

Gilbert bond

2/20/88



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Glipser Corp
New York, N.Y.

imcor®

WATER TREATMENT
SPECIALISTS

- - BY-PASS FEEDERS - -

IMCOR Custom Designed Feeders Are:

Easy to Install

Safe to Use

Suitable for Liquid, Powder, or Briquettes

Maintenance Free

Available in Popular Sizes

Type HV - 2 gallon, and AV - 5 gallon (other sizes available on special order) By-Pass Feeders are equipped with a large 3-1/2" diameter opening. Closing requires only a 1/4" turn for a perfect seal every time, eliminating troublesome fill valves. The cover and "O" ring seal are removed as a unit; however, only when all pressure has been released from the feeder.

All IMCOR Feeders are suitable for hot or cold water applications up to 200 psi working pressure. Feeders are normally furnished without valves and fittings; refer to drawing for these requirements and some suggested piping diagrams.

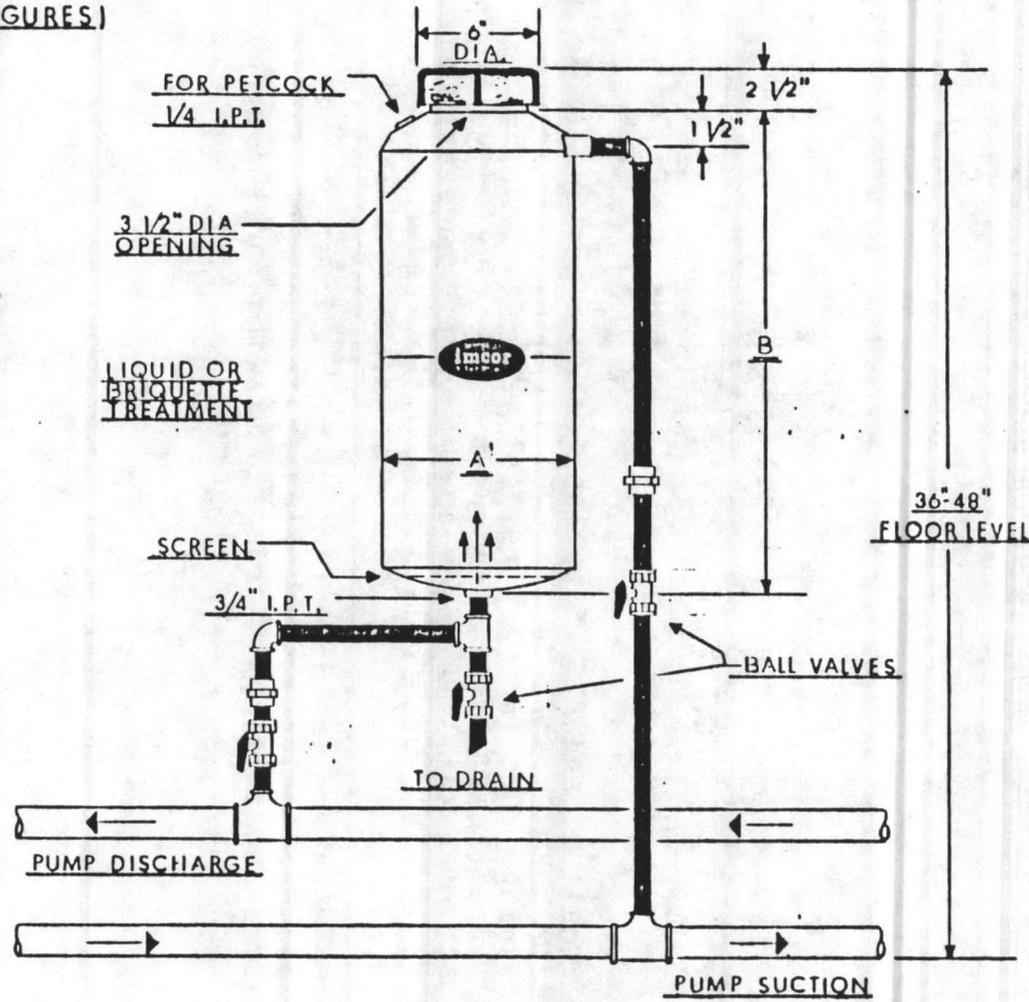
ANALYSIS - CHEMICALS - EQUIPMENT

Industrial Maintenance Corporation

PHONE (704) 525-8967 / CHARLOTTE, NORTH CAROLINA 28217

IMCOR BY-PASS FEEDERS
(INSTALLATION FIGURES)

FIG. 1



FEEDER TYPE	CAPACITY GALLONS	MAXIMUM PRESSURE	VALVES AND FITTINGS	DIM A	DIM B
HV	2	200 PSI	3/4 INCH	7 1/4"	14
AV	5	200 PSI	3/4 INCH	10 3/8"	16 1/2

FIG. 3

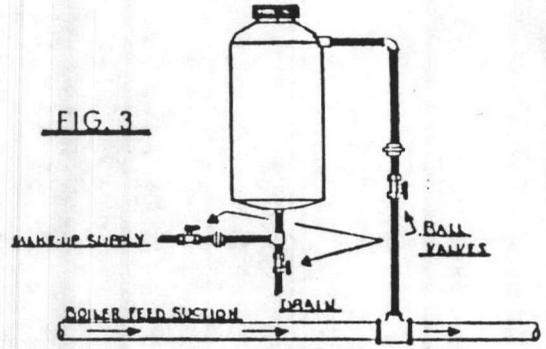
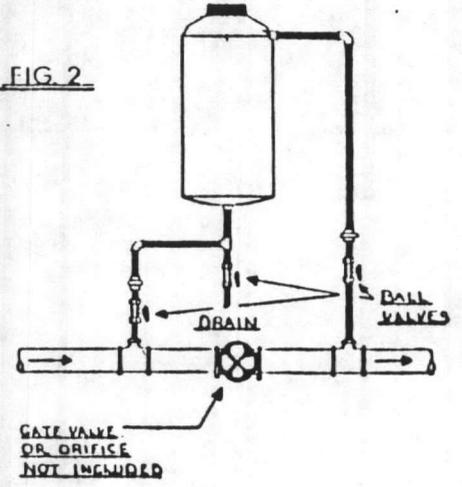


FIG. 2



IMCOR BY-PASS FEEDERS 12-51

SCALE: NONE APPROVED BY: _____ DRAWN BY: T&S

DATE: 9/16/87 REVISION: _____

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DESCRIPTION:

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Jack Adams Industrial Sales, Inc.

P.O. BOX 311 • FUQUAY-VARINA, NC 27526
TELEPHONE (919) 552-3432

DATE: SEPTEMBER 28, 1987

PROJECT: MEDICAL / DENTAL CLINIC
M.C.B. CAMP LEJEUNE , NC
CONTRACT NO. N62470-85-C-5214

ENGINEER: SIX ASSOCIATES
ASHEVILLE, NC

CONTRACTOR: SNEEDEN, INC.
WILMINGTON, NC

EQUIPMENT: MAKE - UP AIR HEAT RECOVERY UNITS
TAG: MAU - 1 & 2

MANUFACTURER: DES CHAMPS LABORATORIES, INC.
EAST HANOVER , NEW JERSEY

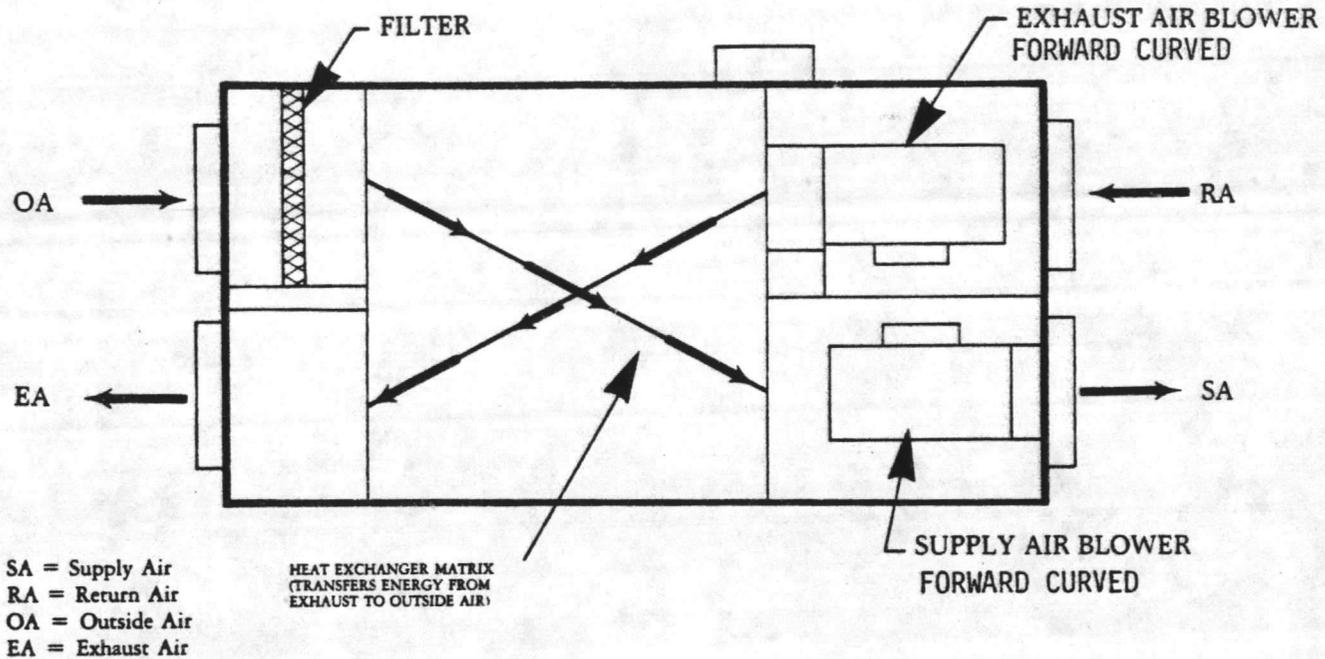
John Adam Industrial
Soleing

CLADON CREST

DESCRIPTION

E-Z-AIRE is a high efficiency air-to-air heat exchanger designed to meet the growing needs in commercial energy recovery applications. Each unit is factory assembled, wired and tested to ensure years of reliable service.

The six models illustrated enable you to provide coverage over a wide range of operating flows and efficiencies.



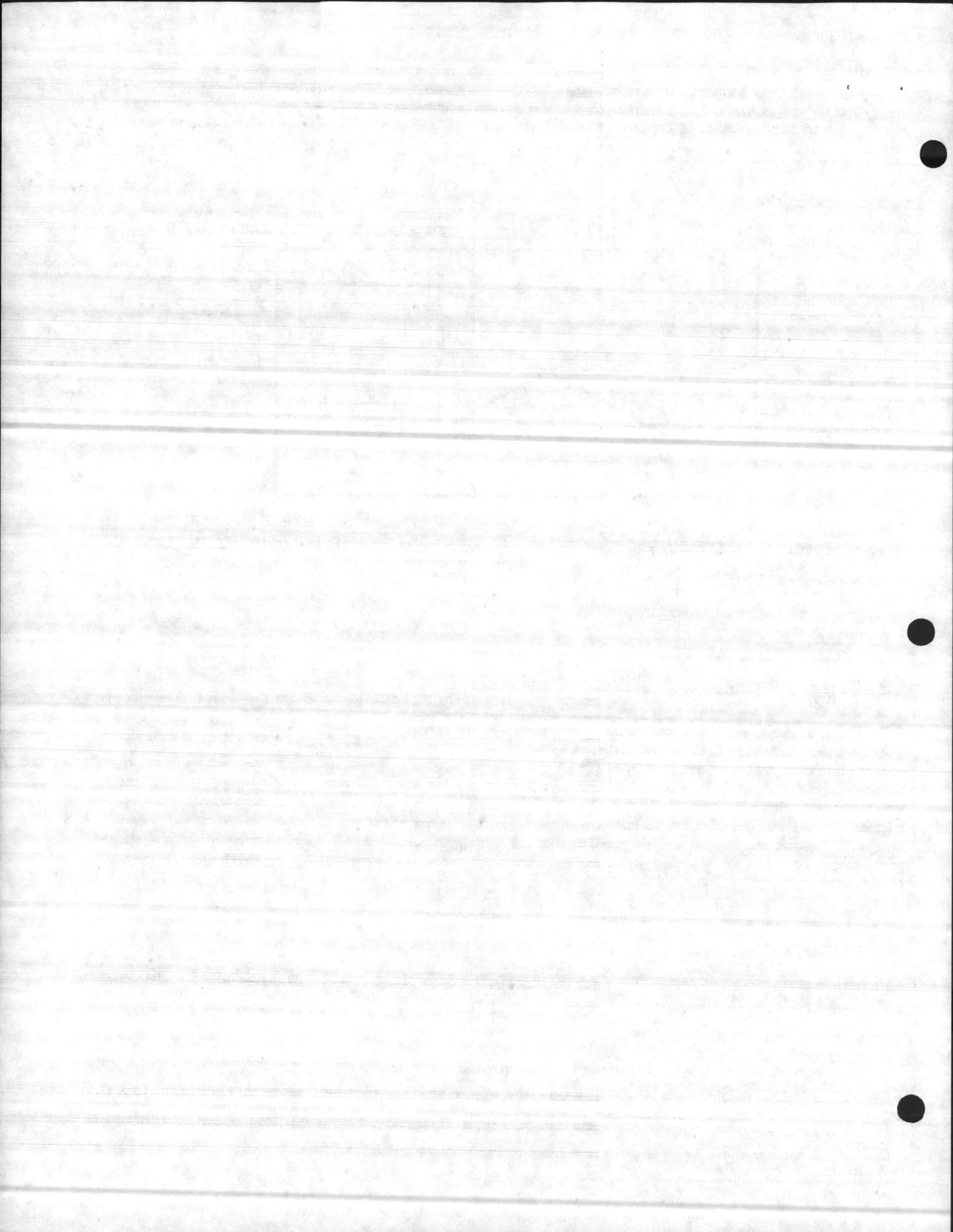
OPERATION

E-Z-AIRE is a unique and simple counterflow air-to-air plate type heat exchanger. Counterflow airstreams are brought into close proximity separated by one continuous, dimpled and folded sheet of aluminum, which acts as a primary heat transfer surface. This heat transfer surface is configured to form a matrix with two completely separate and distinct air passages. The ends of the matrix are sealed for maximum separation of airstreams.

The heat exchanger transfers the thermal energy from the exhaust airstream to the intake airstream thereby recovering a large portion of the energy that would normally be lost to atmosphere through mechanical exhaust systems.

STANDARD FEATURES

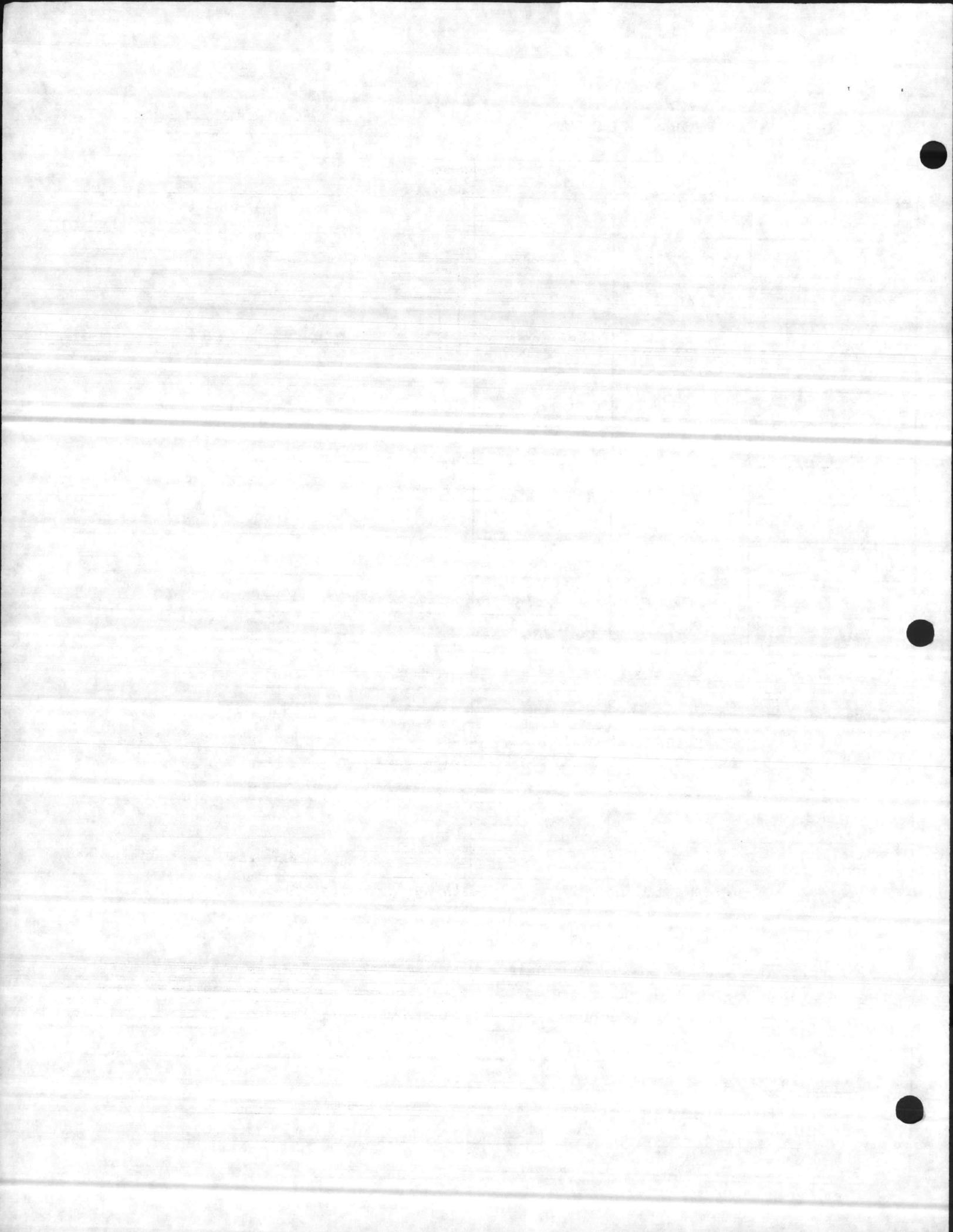
- Units are available for either indoor or outdoor installation. Outdoor installation required for this project.
- All units are constructed of heavy gauge galvanized steel
- High efficiency motors ensure quiet, low-cost operation
- Folded aluminum heat exchanger for maximum heat transfer and low maintenance
- Units are applicable for either end or bottom supply and return. Bottom supply & return required for this project
- Defrost package includes thermostat which automatically shuts off supply air blower when defrost is necessary
- Low voltage package allows line voltage to be reduced to 24 volts for controls



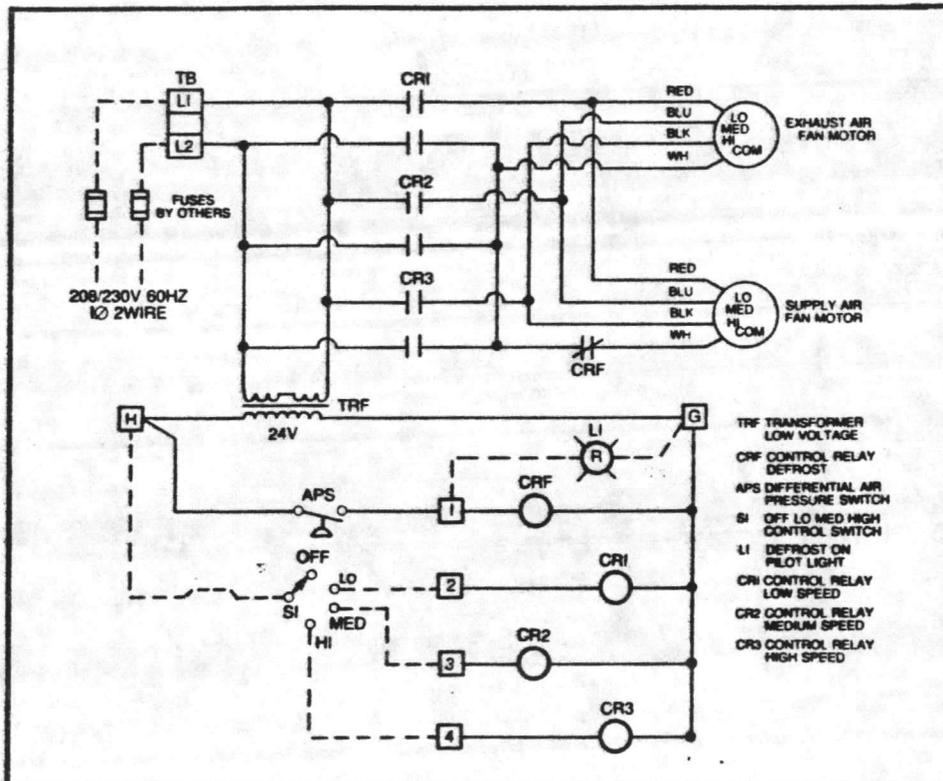
CERTIFIED PERFORMANCE DATA

System No.	MAU-1	MAU-2
Quantity	1	1
DLI Model No.	E2A-2270	E2A-1570
Plate Surface (sq. ft.)	2080 [±] ft.	1520 [±] ft.
Altitude	SEA Level	SEA Level
Supply SCFM	770	560
O/A °F	14°F	14°F
S/A °F	58°F	58°F
Δ P Air (w.c.)	.5" esp	.5" esp
Plate Spacing	.244	.244
Exhaust SCFM	1100	800
R/A °F	70°F	70°F
E/A °F	41°F	41°F
Dew Point °F	-	-
Condensate lb/hr	-	-
Δ P Air (w.c.)	.5" esp	.5" esp
Plate Spacing	.244	.244
Efficiency	70%	70%
Recovered Heat BTU/HR	36,760	26,735

 DES CHAMPS LABORATORIES INCORPORATED Box 440 • 17 Farinella Drive • East Hanover, N.J. 07936 • 201-454-1360	
SERIES 74 Z-DUCT HEAT EXCHANGER SUBMITTAL DRAWING	
Job Name	CAMP LEJUNE M.C.B.
Engineer	SIX ASSOCIATES
DLI Rep	JACK ADAMS IND. SALES Date 9/24/87
Customer P.O.	298 DLI No. R-1956
Drawn By	Dwg. No. Rev.

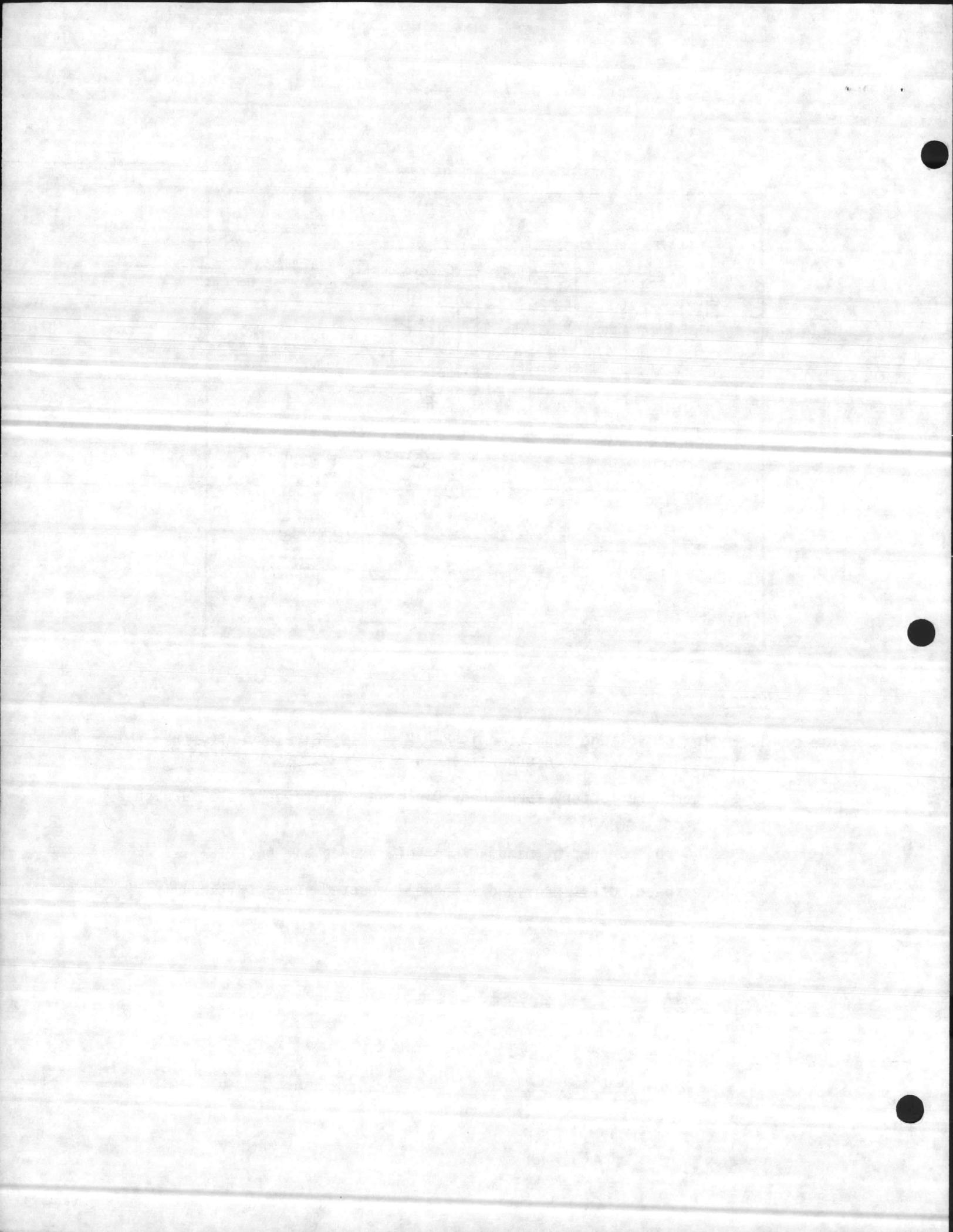


E-Z-AIRE SCHEMATIC WIRING DIAGRAM
STANDARD



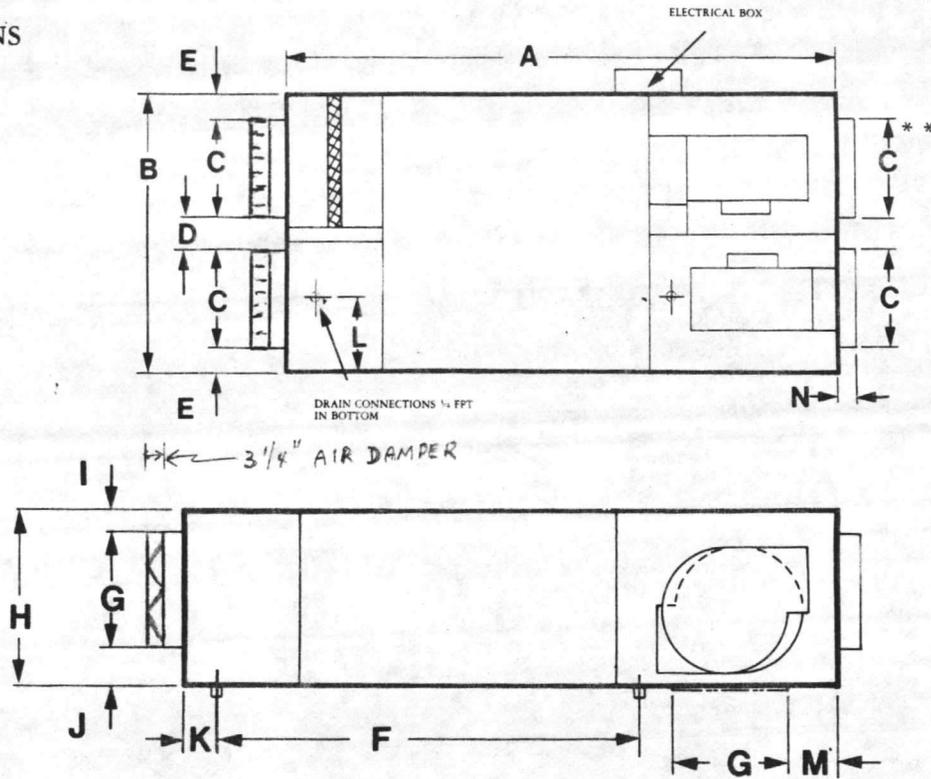
NOTES:

1. Equipment voltage submitted is 208/230 - 1Ø. Please verify that this voltage is correct before release.
2. Starters are factory furnished. Disconnect is to be field furnished by contractor.
3. Roof Curb provided by manufacturer of make-up air unit.
4. Three speed motors provided with wall mounted speed switch.



E-Z-AIRE™

DIMENSIONS

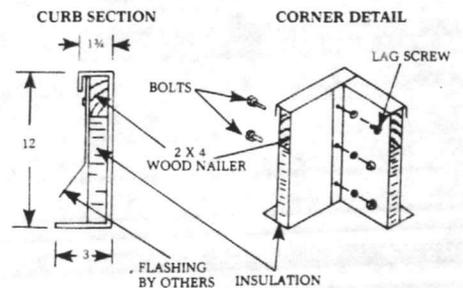
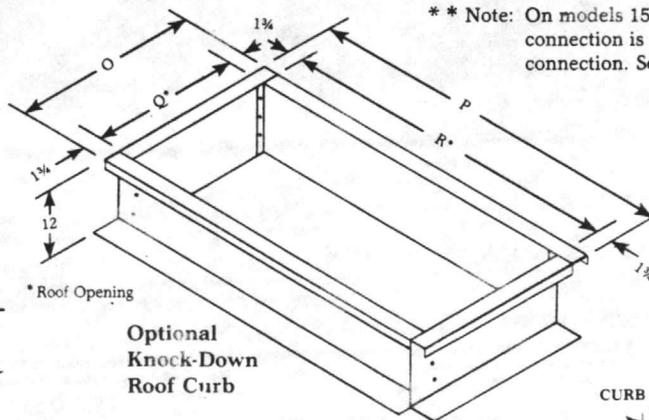
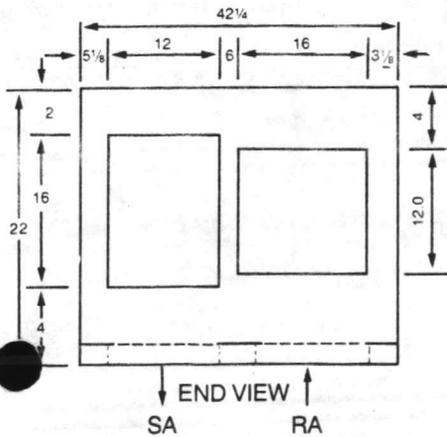


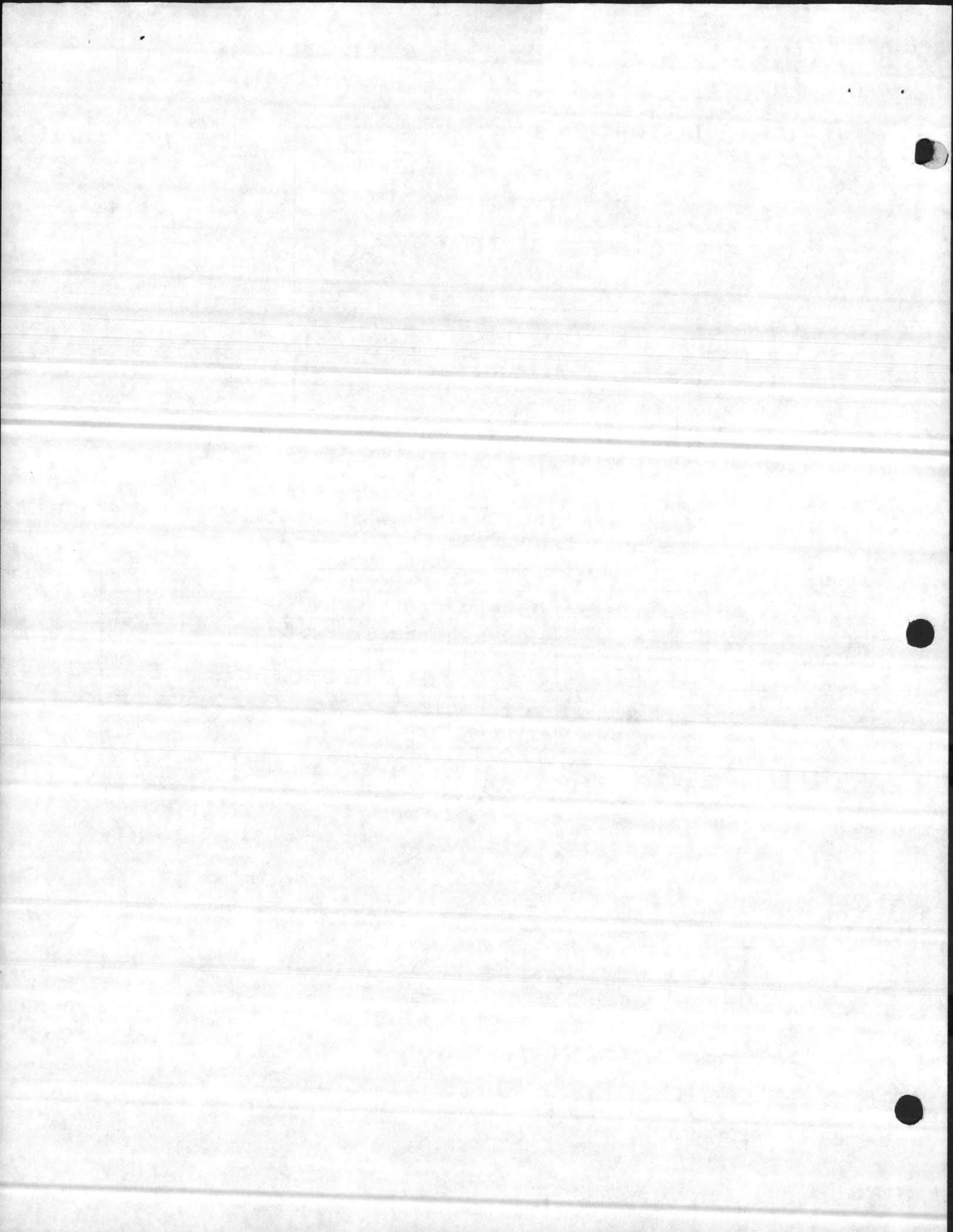
MODEL	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q*	R*
EZA-970	68	34½	12	4	3⅞	42½	12	18	2	4	3½	9	4⅞	2	33	66	29½	62½
EZA-985	92	34½	12	4	3⅞	66½	12	18	2	4	3½	9	4⅞	2	33	90	29½	86½
EZA-1570	68	42¼	12	8	5⅞	42½	16	22	2	4	3½	9	4⅞	2	41	66	37½	62½
EZA-1585	92	42¼	12	8	5⅞	66½	16	22	2	4	3½	9	4⅞	2	41	90	37½	86½
EZA-2270	72	42¼	16	4	3⅞	42½	16	29	5	8	3½	11	4⅞	2	41	70	37½	66½
EZA-2285	96	42¼	16	4	3⅞	66½	16	29	5	8	3½	11	4⅞	2	41	94	37½	90½

* Roof Opening

** Note: On models 1570 and 1585 only, return air duct connection is rotated 90° from the supply air connection. See Figure 1

Figure 1





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DESCRIPTION:

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MAINTENANCE AND OPERATIONS INSTRUCTIONS

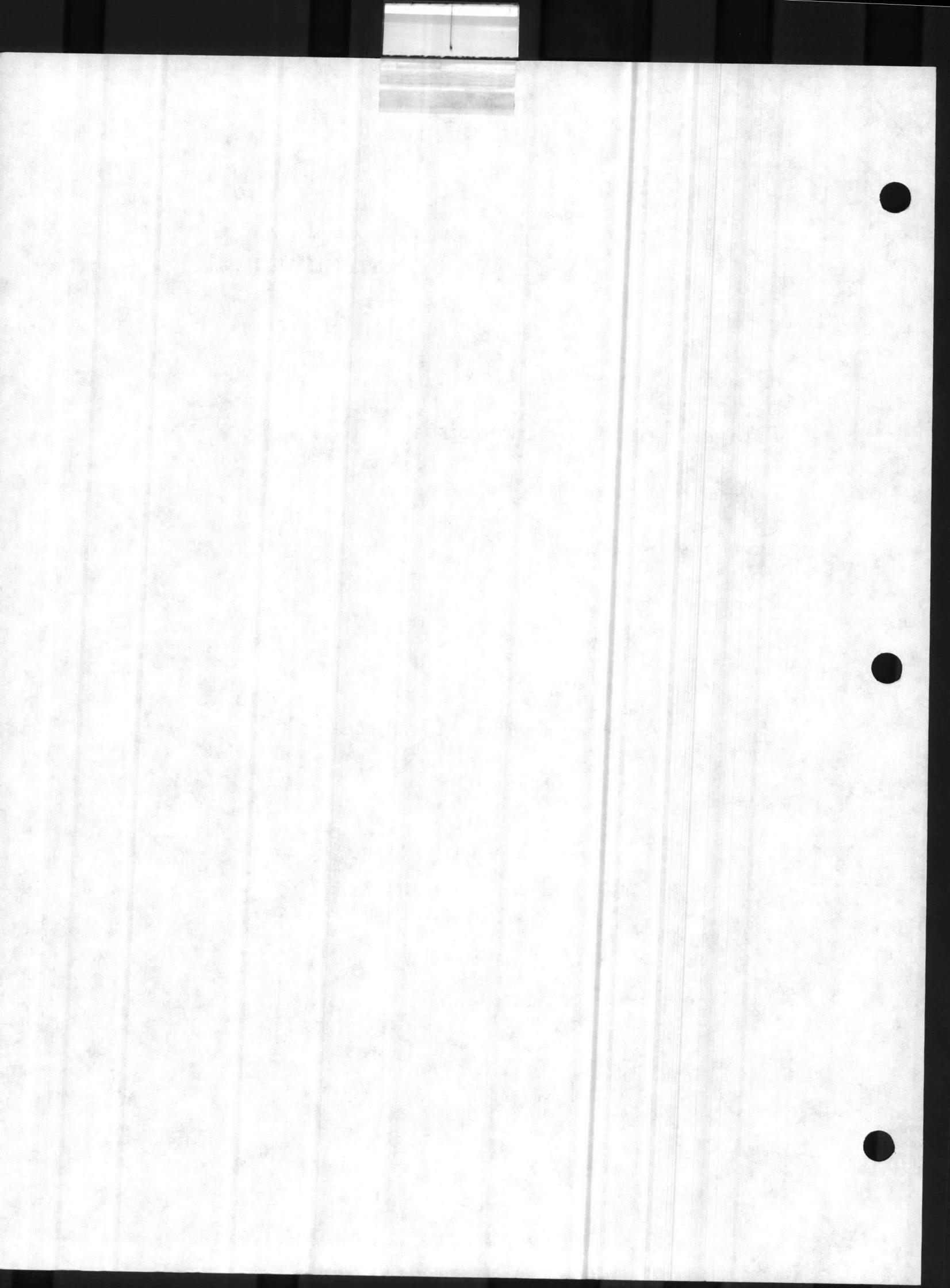
JOB: MEDICAL / DENTAL CLINIC
CAMP LEJEUNE, NC

ARCHITECT: SIX ASSOCIATES INCORPORATED

ENGINEER: SIX ASSOCIATES INCORPORATED

CONTRACTOR: SNEEDEN, INC.

SUBMITTED BY: TRIANGLE AUTOMATED CONTROLS, INC.



SEQUENCE OF OPERATION

3.6.2

HEATING HOT WATER CONTROL :

Convertor control uses outside air reset through 2 input controller HC-1. Reset schedule is such that at 23°F outside, leaving water temperature is 180°F and at 60°F outside, leaving water temperature is 108°.

A bulb thermostat with element in outside air OAT-1 shall de-energize pumps P-1 and P-2 at temperatures above 65°F. Auxiliary contacts in motor starters of pumps P-1 and P-2 shall interlock convertor steam valve to shut valve when pumps are not running.

Reverse action shall take place on pumps and valves when outside air temperature drops below 65°.

3.6.3

MECHANICAL EQUIPMENT ROOM AND CRAWL SPACE EXHAUST FANS 8, 9, 22:

Fan shall be controlled by space thermostat. On a rise in temperature above 80°F (adjustable), the Fan shall be energized and respective O.A. dampers shall open. On a drop in temperature the reverse shall occur.

3.6.4

EXHAUST FANS:

FANS 7, 11, 14, 16, 20:

These Fans shall be indexed on and off by timeclock TCK.

FANS 3, 12, 17:

These Fans shall be controlled by wall switch.

FANS 5, 6, 15, 21:

These Fans are controlled by space mounted cooling thermostat.

3.6.6

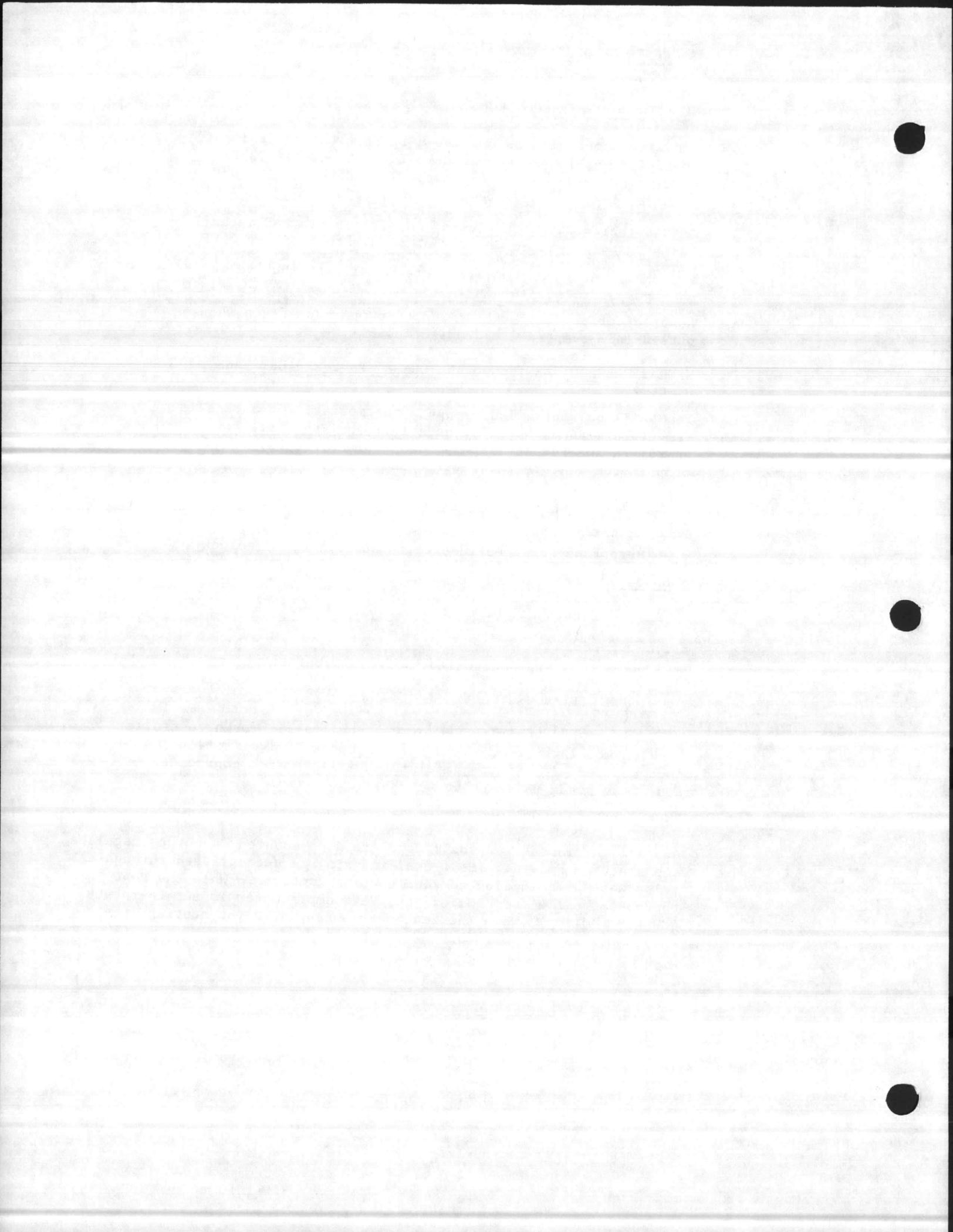
STEAM HUMIDIFIER CONTROL:

A space mounted humidity sensor H-1 shall act through controller HC-2 to modulate steam valve V-2 for space humidification. A duct mounted high limit humidistat shall override controller and close steam valve above 65% RH.

3.6.7

ROOMS WITH VAV CONTROL:

A space thermostat T-2 shall modulate duct mounted damper to regulate the space thermostat. Heat/cool indexing is accomplished through relay R-5 which is tied to zone heating contacts. When the zone thermostat calls for cooling, the VAV damper motor is set to rotate CCW for cooling. When the zone thermostat calls for heating, the VAV damper is set to rotate CW for cooling.





a Siebe company

General Instructions

Solid State Sensing Temperature and Humidity Series TS-8000 and HS-8000

Temperature Sensing

GENERAL INFORMATION

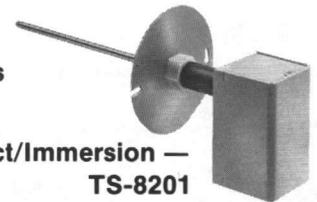
Sensing is accomplished by the use of a temperature sensitive Balco resistance wire packaged in the form of room, duct, averaging and outdoor type configurations. The design of the entire system is around a 1000 Ω sensing element at 70°F.

WIRING

Make all electrical connections to the element in accordance with the installation and wiring diagram for the job. Comply with national and local electrical codes. Do not use the element box as a junction box for other control circuits. It is generally advisable to use flexible conduit for connecting box to rigid conduit. Restrict element leads to shortest length practical. Barber-Colman twisted cable or factory approved cable should be used.



Room —
TS-8100 Series



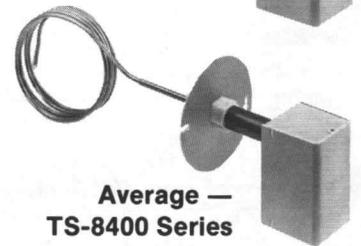
Duct/Immersion —
TS-8201



Outdoor —
TS-8501



Immersion —
TS-8201-106



Average —
TS-8400 Series

Part No.	Use	Location	Mounting	Terminal Code Wiring
TS-8101	Room Sensor w/o Setpoint	Wall		⑦ } Output ⑧ } Terminals
TS-8111	Room Sensor w/Setpoint	Wall		
TS-8201	Duct Immersion 7" Immersion Length	Duct or Well AT-215 3/4" NPT		Pigtails: Black } (C) Controlling Black } (L)* Controlling *Found only on the TS-8331
TS-8201-106	Immersion 4" Insertion Length	Well AT-225 1/2" NPT		
TS-8331	Lagged Sensor	Duct		
TS-8405	5' Average	Duct		
TS-8422	22' Average	Duct		
TS-8241	Diffuser	Ceiling	Mount on Face of Ceiling Diffuser. See Instructions for B-C Models PB, PS or SFS, SFB. Pg. 2	Pigtails: Black Black
TS-8261	Light Fixture	Light Fixture	Mount in Return Grill of Light Fixture	Pigtails: Black Black
TS-8501	Outdoor Air	Outside of Building	Use Conduit Connectors	Pigtails: Black } Black } Controlling
TS-8531	Solar	Outside of Building		Orange } Element Orange } (Solar)
TS-8533	Econostat	Outside of Building		Red } Heater Red } (Econostat)

Solid State Humidity Sensing

Sensing is accomplished by the use of a nonorganic resistance type material which will be housed either in a room or duct type mounting base. Selection of the proper AH-100 series element will provide the capability of control over a 15% range. Elements are available through the span of 5% to 95% R.H.

The average resistance of each element at midrange is approximately 22,000 ohms; except the violet element, which is 50,000 ohms. A resistor of appropriate value may be substituted in the bridge circuit to verify the element resistance.

CAUTION

Do not measure resistance of element with an ohmmeter, as DC voltage across the element will cause polarization and a new element will be required. Basic element is not repairable. Order a replacement from the factory or local branch office.

CARE OF ELEMENT

The elements are wrapped with a moisture pervious cellophane, which actually is an air filter. On installations using duct elements, where air velocities are reasonably high **do not remove cellophane.** Always install element with wrapping so that perforations in cellophane are on downstream side of air currents. Punch more holes (only in downstream side of cellophane) to increase element sensitivity.

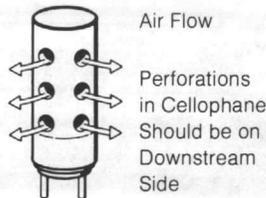


TABLE 1.

Part Number	Sensing Element Color	Relative Humidity Range
AH-100	Violet	85% to 95%
AH-101	Blue	70% to 85%
AH-102	Green	50% to 70%
AH-103	Yellow	40% to 55%
AH-104	Orange	30% to 45%
AH-105	Brown	10% to 30%

WIRING

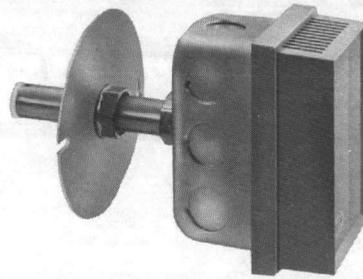
Make all electrical connections to the device in accordance with the installation wiring diagram for the job. Comply with national and local electrical codes. Restrict element leads to shortest length practical, using three conductor twisted cable, 18 gauge minimum.

CAUTION

Power wiring must never be installed in the same conduit.

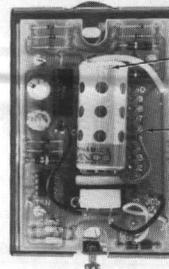
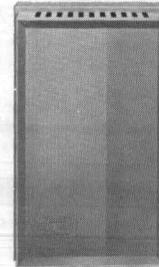
LOCATION

Locate the sensing element where it will be exposed to unrestricted natural air circulation and to the average conditions of the controlled space. Do not locate it near extreme sources of heat, cold, or moisture.



Duct —
HS-8200 Series

Room —
HS-8100 Series



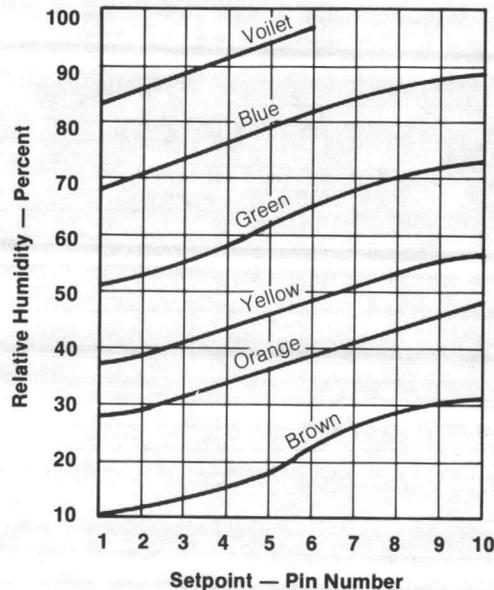
AH-100 Series
Humidity Element

Setpoint
Pins

CALIBRATION

1. Place DC-VOM on output of CP-8102 controller, OP1 (+) and COM (-).
2. Read humidity at the sensor.
3. Place jumper on proper pin, per chart below.
4. Adjust the controller (CAL A) to 7.5 Vdc output.
5. Refer to CP-8102 literature if further details are required.

GENERAL INFORMATION



MOUNTING OF DIFFUSER SENSOR TS-8241

Sensor should be mounted to the face of the ceiling diffuser so that it projects downward into the room. See Figure 1. If the diffuser has an adjustable pattern, the discharge air direction must be adjusted to a horizontal pattern. This will insure a representative sample of room air over the element (Figure 2). The transmitter will not perform satisfactorily if the discharge is adjusted to a vertical pattern.

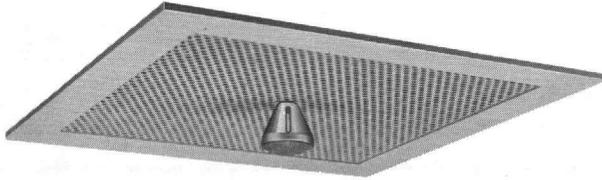


Figure 1.
Sensor Mounted in Perforated Face Ceiling Diffuser Model PB or PS

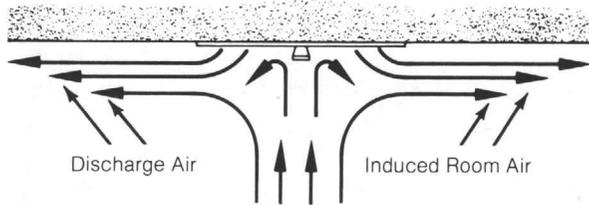


Figure 2.
Room Air Induced over Sensor by Discharged Air

A 7/16-inch hole is required in the diffuser face for mounting. The SFS and SFB louver faced diffusers are available in nine air patterns, both in the square and rectangular design. For proper installation, use Table 2 which shows sensor location and the mounting figure referred to in the installation procedure. APNS-107 must be ordered separately.

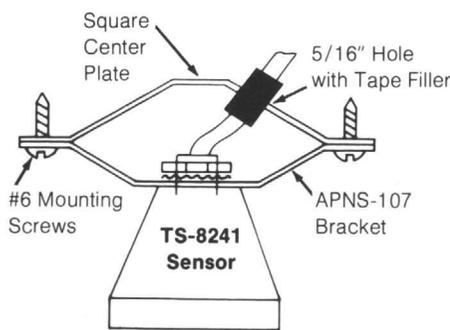


Figure 3

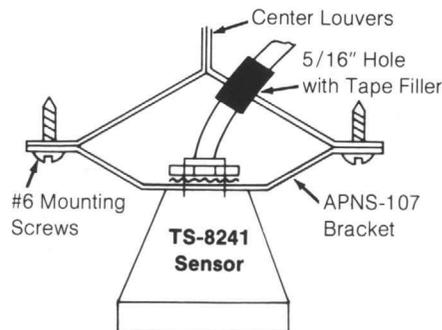


Figure 4

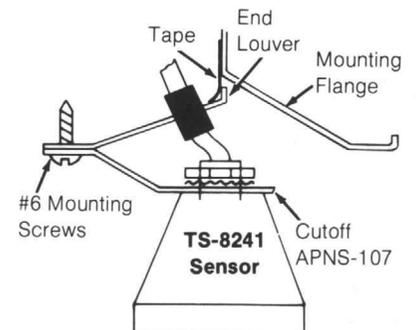


Figure 5

SENSOR MOUNTING PROCEDURE ON SFS AND SFB USING APNS-107 KIT

1. Drill a 5/16" hole for sensor leads.
 - a. Fig. 3. Locate hole center on an angled surface about 5/16" from an edge of the 1/2" square so as to avoid drill contact with the welded center plate mounting brackets.
 - b. Fig. 4. Locate the hole center on one louver about 5/16" from junction of two center back to back louvers.
 - c. Fig. 5. Locate hole center on an end louver about 1/2" from the junction of the louver and the mounting flange.
2. Bring field leads through the 5/16" hole. If required, remove the louver assembly from the mounting flange.
3. Center the APNS-107 bracket over the 5/16" hole (use as a template) and drill 1/8" holes for the mounting screws.
 - a. Fig. 3. Drill two holes near edges of square center plate.
 - b. Fig. 4. Drill two holes, one each on bottom edge of back to back louvers.
 - c. Fig. 5. Drill one hole on end louver.
4. Assemble the sensor to APNS-107 bracket as shown in Figs. 3, 4, and 5.
5. Cut off one side of APNS-107 as shown.
5. Make field connections to sensor leads and push leads up through the 5/16" hole.

Wrap friction or electrical tape around the leads and fill the 5/16" hole, preventing direct primary air passage over the sensor.
6. Attach APNS-107 as shown in Figs. 3, 4, and 5 using #6 screws.

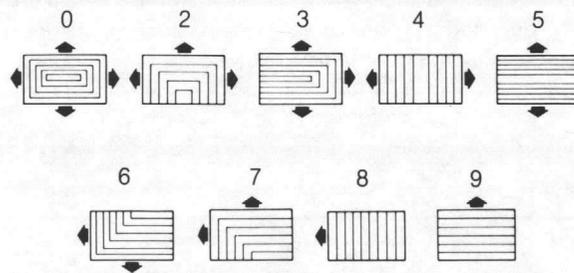
Fig. 5. Cover the crack between the end louver and mounting flange at least 12" on each side of the sensor. A 24" length of 3/4" tape stuck to mounting flange can be used.
7. The sensor installation is complete.

TABLE 2. SENSOR LOCATION AND FIGURE SHOWING MOUNTING DETAILS

Air Pattern	SENSOR LOCATION			
	Center of Diffuser	Center of Side with No Air Throw	Corner Opposite Air Throw	End Opposite Air Throw
	Sq. Rect.	Sq. Rect.	Sq. Rect.	Sq. Rect.
0	Fig. 3 Fig. 4			
2		Fig. 4		
3	Fig. 4			
4				
5				
6			Fig. 3 Fig. 5	
7				
8				Fig. 5
9				

AIR PATTERNS (As Viewed from Diffuser Face)

Number is air pattern designation when ordering.



TS-8241 must not be located nearer than 18" from a wall or corner of a room when used on air patterns 2, 6, 7, 8, or 9. This allows space for induced air to pass over TS-8241.

Specifications		Temperature Sensors				Humidity Sensors		
		Room Light Fixture Diffuser*	Duct/Immersion	Averaging	Selective Ratio Discharge	Sensors must be ordered separately. Refer to Sensor Range Table 1.		
						Room	Duct	
Package	Size**	4¾×2¾×1½	4¾×3½×9½	4¾×3½×†	4¾×3½×9½	4¾×2¾×1½	4¾×3½×9½	
	Mounting	Wall	Duct/Immersion	Duct	Duct	Wall	Duct	
	Mounting Position	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	
	Connection	Terminals	Pigtails	Pigtails	Terminals	Pigtails	Pigtails	
	Ambient Temp. Limits	-40 to 250°	-40 to 250°	-40 to 250°	-40 to 250°	35 to 135°	35 to 135°	
Sensor	Resistance	1000 Ω	1000 Ω	1000 Ω	1000 Ω			
	Sensitivity	2.2 Ω/°F	2.2 Ω/°F	2.2 Ω/°F	2.2 Ω/°F			
	Length		6"	5' or 22'	6"		6"	
Input	Control Range							
	Impedance							
	Adjust	Setpoint Range	55 to 85°				Up to 20% R.H.	Up to 20% R.H.
		Calibration Range					±5%	±5%
		Throttling Range						
Ratio					5 to 20/1			
Output	Voltage	Impedance						
		Range						
		Reference				Negative	Negative	Negative
	Power Supply	Voltage						
		Current Regulation						
Load	Voltage							
	Current							
Power	Voltage				6.2 Vdc ±4	24Vac±10%	24Vac±10%	
	Current				1 mA	25 mA	25 mA	

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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



a Siebe company

General Instructions

Solid State Sensing Temperature and Humidity Series TS-8000 and HS-8000

Temperature Sensing

GENERAL INFORMATION

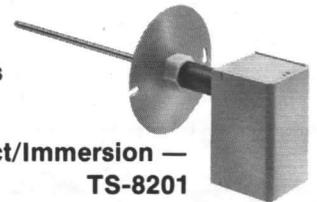
Sensing is accomplished by the use of a temperature sensitive Balco resistance wire packaged in the form of room, duct, averaging and outdoor type configurations. The design of the entire system is around a 1000 Ω sensing element at 70°F.

WIRING

Make all electrical connections to the element in accordance with the installation and wiring diagram for the job. Comply with national and local electrical codes. Do not use the element box as a junction box for other control circuits. It is generally advisable to use flexible conduit for connecting box to rigid conduit. Restrict element leads to shortest length practical. Barber-Colman twisted cable or factory approved cable should be used.



Room —
TS-8100 Series



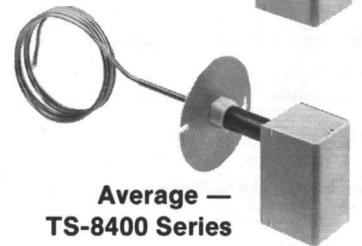
Duct/Immersion —
TS-8201



Outdoor —
TS-8501



Immersion —
TS-8201-106



Average —
TS-8400 Series

Part No.	Use	Location	Mounting	Terminal Code Wiring
TS-8101	Room Sensor w/o Setpoint	Wall		⑦ } Output ⑧ } Terminals
TS-8111	Room Sensor w/Setpoint	Wall		
TS-8201	Duct Immersion 7" Immersion Length	Duct or Well AT-215 3/4" NPT		Pigtails: Black } (C) Controlling Black } Black } (L)* Controlling Black } *Found only on the TS-8331
TS-8201-106	Immersion 4" Insertion Length	Well AT-225 1/2" NPT		
TS-8331	Lagged Sensor	Duct		
TS-8405	5' Average	Duct		
TS-8422	22' Average	Duct		
TS-8241	Diffuser	Ceiling	Mount on Face of Ceiling Diffuser. See Instructions for B-C Models PB, PS or SFS, SFB. Pg. 2	Pigtails: Black Black
TS-8261	Light Fixture	Light Fixture	Mount in Return Grill of Light Fixture	Pigtails: Black Black
TS-8501	Outdoor Air	Outside of Building	Use Conduit Connectors	Pigtails: Black } Black } Controlling
TS-8531	Solar	Outside of Building		Orange } Element Orange } (Solar)
TS-8533	Econostat	Outside of Building		Red } Heater Red } (Econostat)

Solid State Humidity Sensing

Sensing is accomplished by the use of a nonorganic resistance type material which will be housed either in a room or duct type mounting base. Selection of the proper AH-100 series element will provide the capability of control over a 15% range. Elements are available through the span of 5% to 95% R.H.

The average resistance of each element at midrange is approximately 22,000 ohms; except the violet element, which is 50,000 ohms. A resistor of appropriate value may be substituted in the bridge circuit to verify the element resistance.

CAUTION

Do not measure resistance of element with an ohmmeter, as DC voltage across the element will cause polarization and a new element will be required. Basic element is not repairable. Order a replacement from the factory or local branch office.

CARE OF ELEMENT

The elements are wrapped with a moisture pervious cellophane, which actually is an air filter. On installations using duct elements, where air velocities are reasonably high **do not remove cellophane.** Always install element with wrapping so that perforations in cellophane are on downstream side of air currents. Punch more holes (only in downstream side of cellophane) to increase element sensitivity.

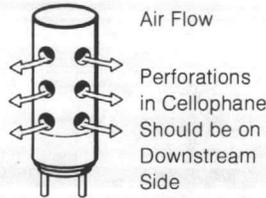


TABLE 1.

Part Number	Sensing Element Color	Relative Humidity Range
AH-100	Violet	85% to 95%
AH-101	Blue	70% to 85%
AH-102	Green	50% to 70%
AH-103	Yellow	40% to 55%
AH-104	Orange	30% to 45%
AH-105	Brown	10% to 30%

WIRING

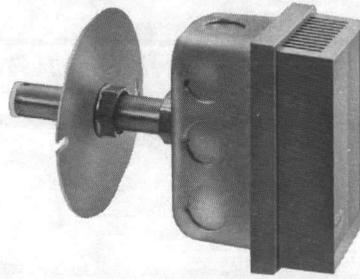
Make all electrical connections to the device in accordance with the installation wiring diagram for the job. Comply with national and local electrical codes. Restrict element leads to shortest length practical, using three conductor twisted cable, 18 gauge minimum.

CAUTION

Power wiring must never be installed in the same conduit.

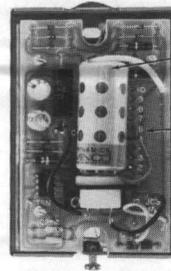
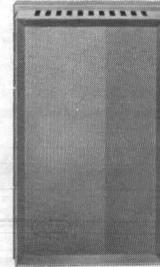
LOCATION

Locate the sensing element where it will be exposed to unrestricted natural air circulation and to the average conditions of the controlled space. Do not locate it near extreme sources of heat, cold, or moisture.



Duct —
HS-8200 Series

Room —
HS-8100 Series



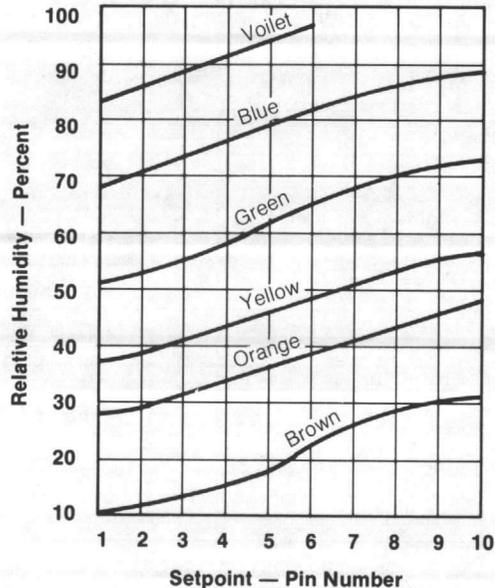
AH-100 Series
Humidity Element

Setpoint
Pins

CALIBRATION

1. Place DC-VOM on output of CP-8102 controller, OP1 (+) and COM (-).
2. Read humidity at the sensor.
3. Place jumper on proper pin, per chart below.
4. Adjust the controller (CAL A) to 7.5 Vdc output.
5. Refer to CP-8102 literature if further details are required.

GENERAL INFORMATION



MOUNTING OF DIFFUSER SENSOR TS-8241

Sensor should be mounted to the face of the ceiling diffuser so that it projects downward into the room. See Figure 1. If the diffuser has an adjustable pattern, the discharge air direction must be adjusted to a horizontal pattern. This will insure a representative sample of room air over the element (Figure 2). The transmitter will not perform satisfactorily if the discharge is adjusted to a vertical pattern.

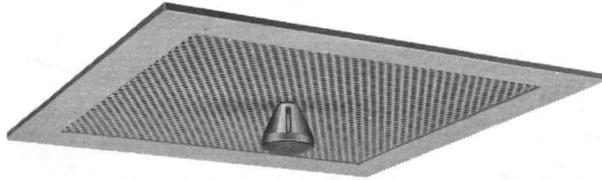


Figure 1.
Sensor Mounted in Perforated Face Ceiling Diffuser Model PB or PS

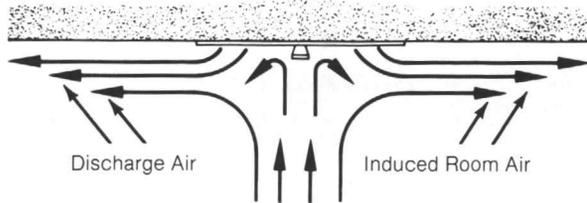


Figure 2.
Room Air Induced over Sensor by Discharged Air

A 7/16-inch hole is required in the diffuser face for mounting. The SFS and SFB louver faced diffusers are available in nine air patterns, both in the square and rectangular design. For proper installation, use Table 2 which shows sensor location and the mounting figure referred to in the installation procedure. APNS-107 must be ordered separately.

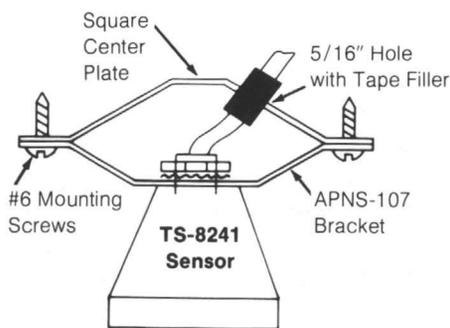


Figure 3

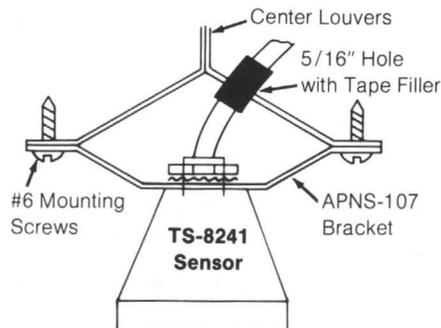


Figure 4

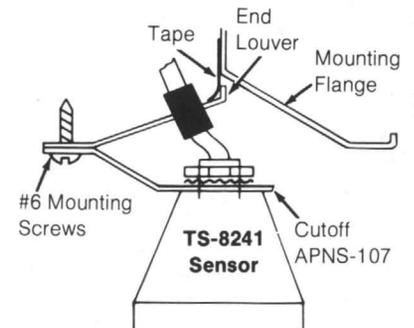


Figure 5

SENSOR MOUNTING PROCEDURE ON SFS AND SFB USING APNS-107 KIT

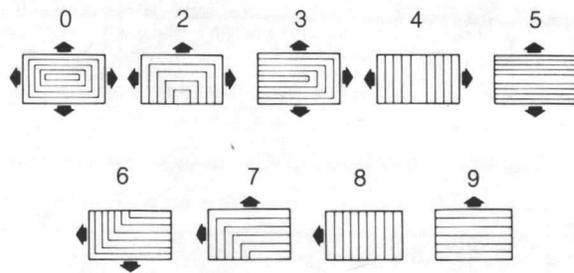
1. Drill a 5/16" hole for sensor leads.
 - a. Fig. 3. Locate hole center on an angled surface about 5/16" from an edge of the 1/2" square so as to avoid drill contact with the welded center plate mounting brackets.
 - b. Fig. 4. Locate the hole center on one louver about 5/16" from junction of two center back to back louvers.
 - c. Fig. 5. Locate hole center on an end louver about 1/2" from the junction of the louver and the mounting flange.
2. Bring field leads through the 5/16" hole. If required, remove the louver assembly from the mounting flange.
3. Center the APNS-107 bracket over the 5/16" hole (use as a template) and drill 1/8" holes for the mounting screws.
 - a. Fig. 3. Drill two holes near edges of square center plate.
 - b. Fig. 4. Drill two holes, one each on bottom edge of back to back louvers.
 - c. Fig. 5. Drill one hole on end louver.
4. Assemble the sensor to APNS-107 bracket as shown in Figs. 3, 4, and 5.
 - Fig. 5. Cut off one side of APNS-107 as shown.
5. Make field connections to sensor leads and push leads up through the 5/16" hole.
 - Wrap friction or electrical tape around the leads and fill the 5/16" hole, preventing direct primary air passage over the sensor.
6. Attach APNS-107 as shown in Figs. 3, 4, and 5 using #6 screws.
 - Fig. 5. Cover the crack between the end louver and mounting flange at least 12" on each side of the sensor. A 24" length of 3/4" tape stuck to mounting flange can be used.
7. The sensor installation is complete.

TABLE 2. SENSOR LOCATION AND FIGURE SHOWING MOUNTING DETAILS

Air Pattern	SENSOR LOCATION			
	Center of Diffuser	Center of Side with No Air Throw	Corner Opposite Air Throw	End Opposite Air Throw
	Sq. Rect.	Sq. Rect.	Sq. Rect.	Sq. Rect.
0	Fig. 3 Fig. 4			
2		Fig. 4		
3	Fig. 4			
4				
5				
6			Fig. 3 Fig. 5	
7				
8				Fig. 5
9				

AIR PATTERNS (As Viewed from Diffuser Face)

Number is air pattern designation when ordering.



TS-8241 must not be located nearer than 18" from a wall or corner of a room when used on air patterns 2, 6, 7, 8, or 9. This allows space for induced air to pass over TS-8241.

Specifications		Temperature Sensors				Humidity Sensors		
		Room Light Fixture Diffuser*	Duct/Immersion	Averaging	Selective Ratio Discharge	Sensors must be ordered separately. Refer to Sensor Range Table 1.		
						Room	Duct	
Package	Size**	4¾×2¾×1½	4¾×3½×9⅞	4¾×3½×+	4¾×3½×9⅞	4¾×2¾×1½	4¾×3½×9⅞	
	Mounting	Wall	Duct/Immersion	Duct	Duct	Wall	Duct	
	Mounting Position	Vertical	Vertical	Vertical	Vertical	Vertical	Vertical	
	Connection	Terminals	Pigtails	Pigtails	Terminals	Pigtails	Pigtails	
	Ambient Temp. Limits	-40 to 250°	-40 to 250°	-40 to 250°	-40 to 250°	35 to 135°	35 to 135°	
Sensor	Resistance	1000 Ω	1000 Ω	1000 Ω	1000 Ω			
	Sensitivity	2.2 Ω/°F	2.2 Ω/°F	2.2 Ω/°F	2.2 Ω/°F			
	Length		6"	5' or 22'	6"		6"	
Input	Control Range							
	Impedance							
	Adjust	Setpoint Range	55 to 85°				Up to 20% R.H.	Up to 20% R.H.
		Calibration Range					±5%	±5%
		Throttling Range						
Ratio					5 to 20/1			
Output	Voltage	Impedance						
		Range						
		Reference				Negative	Negative	Negative
	Power Supply	Voltage						
		Current						
Load	Voltage							
	Current							
Power	Voltage				6.2 Vdc ±.4	24Vac±10%	24Vac±10%	
	Current				1 mA	25 mA	25 mA	

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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



General Instructions

CP-8102 Electronic Two Input Temperature or Humidity Controller

FUNCTIONS

Electronic controller receives temperature or humidity sensor inputs and sends a variable electronic signal, 1 to 15 Vdc, to up to six System 8000[®] actuators or relays (controlled devices). Additional devices can be controlled with the use of adapters. These actuators or relays operate heating, cooling, humidification or dehumidification equipment in HVAC systems.

FEATURES AND BENEFITS

The reliable, easy to install CP-8102 electronic controller incorporates an amplifier with inputs for 1000ohm Balco[®] temperature sensors, humidity sensors or remote setpoint adjuster. Two setpoint dials, ratio authority dials, throttling range dials and calibration potentiometers are visible and accessible without removing controller cover allow for easy field adjustment. Coded screw terminals make sensor, remote setpoint, power supply and output signal wiring easy to install and change. The CP-8102 controller is used with other System 8000 devices.

Table 1. Specifications

Part Number	Control Dial Range Setpoint "A"	Control Dial Range Setpoint "B"	Throttling Range for 3 Vdc Output Change	Authority Ratio Adjustment Setpoint "A" Setpoint "B"	Control Output Voltage†	Power Required	Power Supply Available
CP-8102	20 to 120°F	20 to 120°F	Adjustable 2 to 10°F by Dial*	.5:1 to 25:1 Adjustable by Dial	1 to 15 Vdc 10 mA Max. Factory Set for D.A.	20 Vdc 23 mA	6.2 Vdc 7 mA Max.
CP-8102-116	-6 to 48°C	-6 to 48°C	Adjustable 1 to 6°C by Dial*				

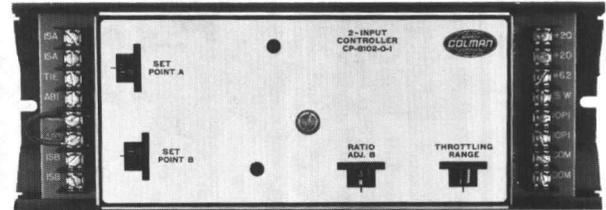
* See ADJUSTMENTS for additional throttling ranges.

† Units factory calibrated for 7.5 Vdc output with sensor at setpoint temperature.

Options: None.

ACCESSORIES:

AD-8122	Signal adaptor for dual outputs (two direct acting)
AD-8123	Signal adaptor for dual outputs (one direct, one reverse acting)
AD-8124	Signal adaptor for dual outputs (one reverse, one direct acting)
AD-8912	12" enclosure
AD-8969-201	Off set resistor kit: 5, 10, 15 & 20°F
AD-8969-901	Extended throttling range jumper
ASP-301	Power supply required for HSP-6X81 humidity transmitter
ASP-581	Indication meter 20 to 80% RH
AT-8122	Remote setpoint adjuster, dual scale 20 to 120°F (-6 to 49°C)
AT-8155	Remote setpoint adjuster, dual scale 50 to 250°F (10 to 121°C)
AT-8158	Remote setpoint adjuster, dual scale 55 to 85°F (13 to 29°C)
AT-8222-101	Setpoint scale for humidity 20% to 100%
AT-8435	Remote setpoint adjuster, dual scale 50 to 450°F (10 to 232°C) for use with TS-8204 only
CN-8101	Multi-purpose bridge
HS-8101	Room humidity sensor
HS-8201	Duct humidity sensor
TS-8101	Room sensor



CP-8102

Wiring Connections: Coded screw terminals for all control inputs and outputs.

Safe Ambient Temperature Limits:

Operation: 40 to 135°F (4.4 to 57°C)

Storage: -40 to 160°F (-40 to 71°C)

Dimensions: 4" (102 mm) high × 11" (279 mm) wide × 2-1/2" (64 mm) deep

TS-8111	Room sensor with setpoint
TS-8131	Room button type sensor
TS-8201	Duct/immersion sensor
TS-8204	High temp. duct/immersion sensor requires AT-8435 remote setpoint for all applications except differential control
TS-8241	Diffuser sensor
TS-8261	Light fixture sensor
TS-8331	Lagged sensor (CN-8101 is required)
TS-8405	5' averaging sensor
TS-8422	22' averaging sensor
TS-8501	Outdoor sensor
TS-8531	Solar sensor (CN-8101 is required)
TS-8533	Econostat sensor
Tool-201	Calibration kit for system 8000

DEFINITIONS

Mode of Operation: Either direct-acting or reverse-acting.

Direct-acting (D.A.) means that an increase in temperature at the sensor(s) causes the voltage output (OP1) to increase.

Reverse-acting (R.A.) means that an increase in temperature at the sensor(s) causes the voltage output (OP1) to decrease.

Reset Control Action: The direction of reset determines whether input A setpoint is reset upward or downward on a temperature decrease at input B.

Direct reset: (D.R.) A temperature decrease on input B resets input A setpoint downward.

Reverse reset: (R.R.) A temperature decrease on input B resets input A setpoint upward.

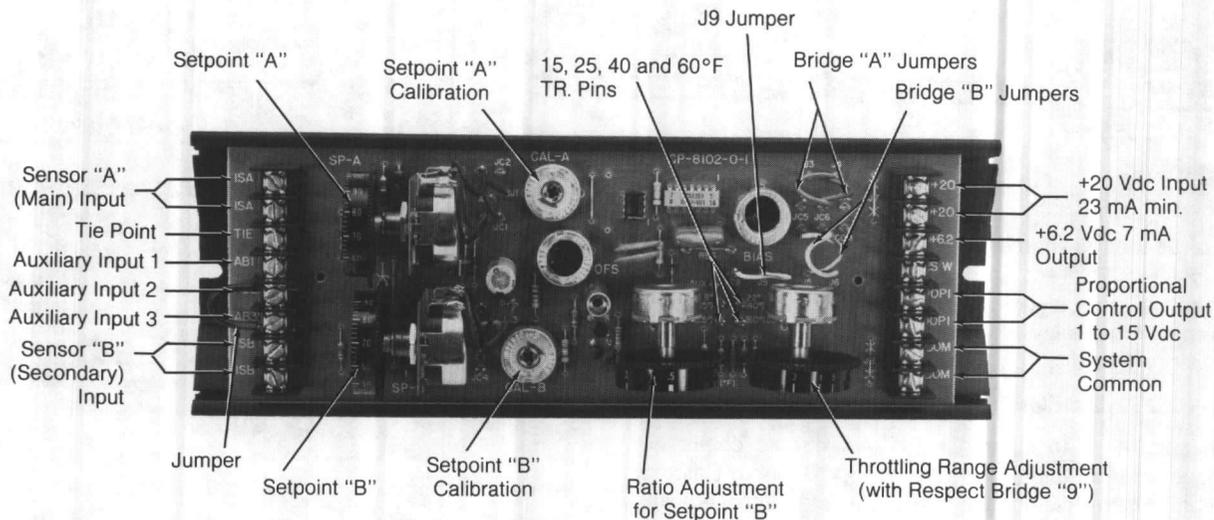


Figure 1. CP-8102

CONTROL TERMINAL INPUTS (See Figure 1)

ISA: Any TS-8000 Temperature Sensor (1000 ohm Balco)

ISB: Any TS-8000 Temperature Sensor (1000 ohm Balco)

AB1, AB2, AB3: Auxiliary inputs; any remote setpoint adjuster AT-8000 series, HS-8X01 humidity sensor, CN-8101 multi-purpose bridge

CONTROL TERMINAL OUTPUT (See Figure 1)

OP1: 1 to 15 Vdc (10 mA maximum). Units factory calibration for 7.5 Vdc output with sensor at setpoint temperature.

ADJUSTMENTS: (See figure 1)

Temperature Setpoint "A": By dial 20 to 120°F (-6 to 48°C), or by remote setpoint adjuster (See Accessories).

Temperature Setpoint "B": By dial 20 to 120°F (-6 to 48°C), or by remote setpoint adjuster (See Accessories).

Setpoint "A" Calibration: By potentiometer.

Setpoint "B" Calibration: By potentiometer. For reset control, set Setpoint "B" at value where Setpoint "A" will be reset. Adjust Setpoint "A" at control point required with no reset from sensor "B".

THOTTLING RANGE: By dial 2 to 10°F, 1 to 6°C. By pin selection 15, 25, 40 and 60°F (8, 14, 22, 33°C). Remove J9 jumper from JC9 and attach to required throttling range pin. By extended throttling range adjuster, AD8969-901 (order separately), 55, 65, 75, 85, 100, 115, 125 and 140°F (31, 36, 42, 47, 56, 64, 69 and 78°C). The throttling range is the sum of the T.R. pins connected.

AUTHORITY RATIO

ADJUSTMENT: By dial .5 to 25:1. Ratio is the number of degrees change at Sensor "B" required to reset Setpoint "A" one (1) degree. Example: 25:1 means a 25°F (14°C) change at Sensor "B" will reset Setpoint "A" 1°F (.5°C).

Table 2

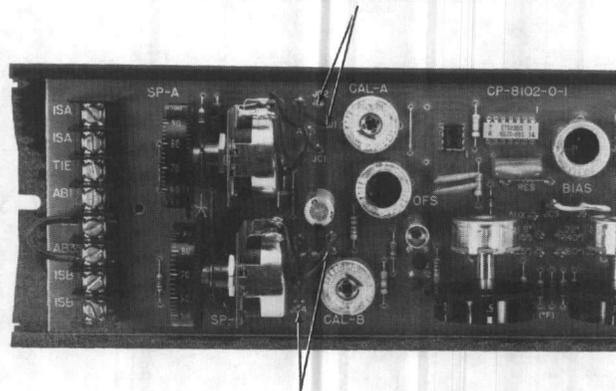
Controller Function	Jumper Connections Required	
	Bridge "A"	Bridge "B"
Direct Acting*	J4 to JC6 J3 to JC5	J5 to JC5 J6 to JC6
Reverse Acting	J4 to JC5 J3 to JC6	J5 to JC6 J6 to JC5
Internal Setpoint Active*	J1 to JC1	J2 to JC3
Internal Setpoint Inactive for Remote Setpoint	J1 to JC2	J2 to JC4
Disable Bridge "B" for Single Sensor Input	Remove Jumper from AB2 to AB3	

* As supplied from factory.

To Obtain Reverse Reset: Both bridges should have the same action. Example: both direct acting, or both reverse acting.

To Obtain Direct Reset: Bridges should have different action. Example: one direct and one reverse acting.

Disable "A" Bridge Setpoint
Disconnect Jumper J1 from JC1 Pin and reconnect to JC2 Pin.



Disable "B" Bridge Setpoint if "B" Bridge is to be used. Disconnect Jumper J2 from JC3 Pin and reconnect to JC4 Pin.

Figure 2. Disabling Setpoint "A" and/or Setpoint "B"

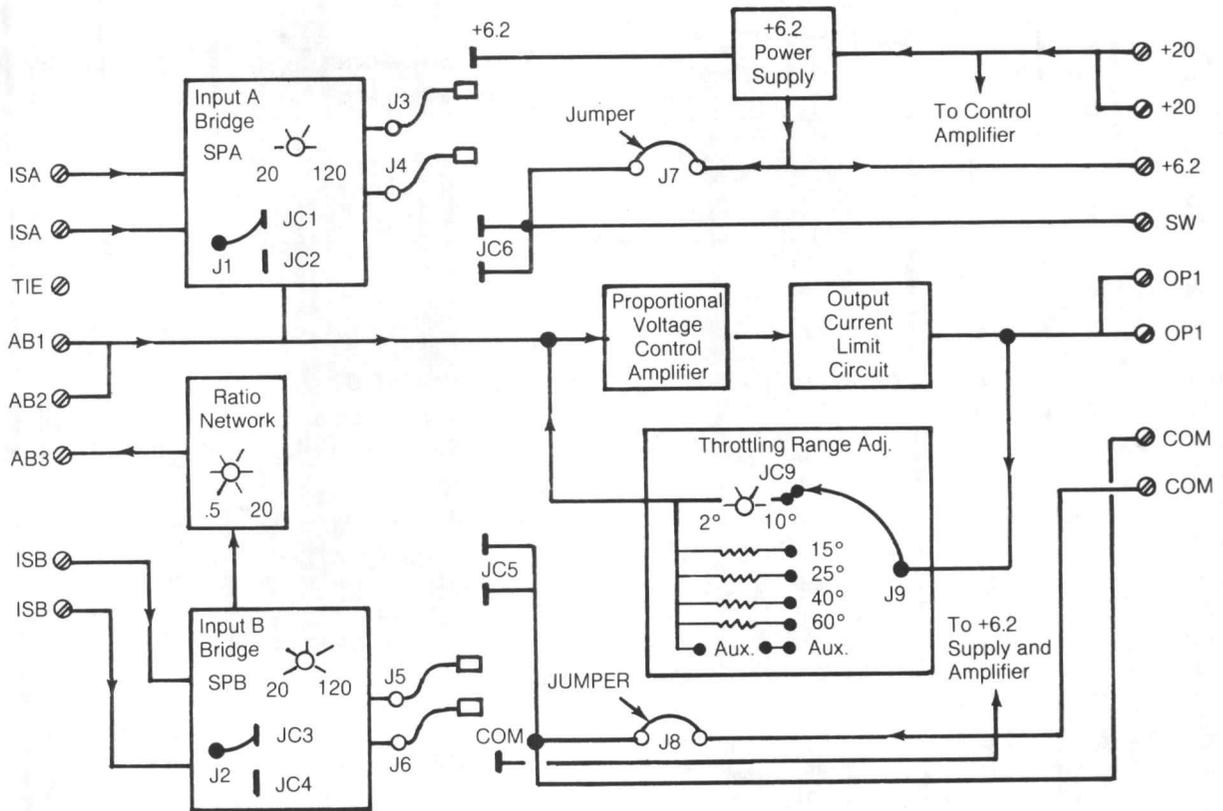


Figure 3. CP-8102 Controller Block Diagram

PRE-INSTALLATION: Open the carton and visually inspect the device for part number and obvious defects before proceeding with the installation.

NOTE

Mounting screws are not provided.

INSTALLATION: Device may be mounted, in any position, in an inside location near the controlled equipment using the two slots in the track. AD-8912 enclosures can be ordered separately for remote installations.

CAUTION

Avoid locations where excessive vibration, moisture, corrosive fumes or vapors are present, or where high radio frequency or electro-magnetic interference generating devices are near.

See Figure 4 for mounting dimensions.

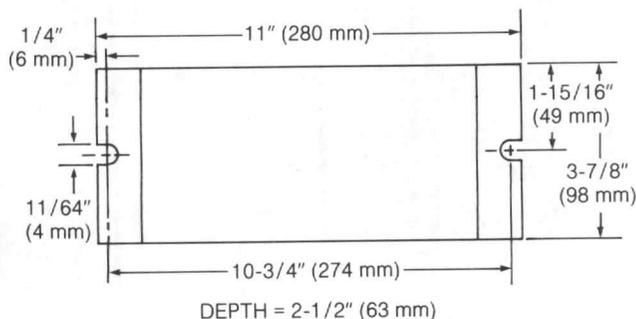


Figure 4. Mounting Dimensions

GENERAL WIRING INFORMATION

Make all connections according to job wiring diagrams and in compliance with national and local codes.

Two separate No. 18 twisted pair wires (six turns per foot [.3m]).

Class II, low voltage, are suitable for up to 1000 feet (300 m) for the sensor leads. See table 3 for longer runs.

CAUTION

Never run line voltage in the same conduit with unshielded sensing element leads. Use copper conductors only.

Shielded cable (Belden No. 8422 or equivalent) must be used when it is necessary to install the DC signal leads in the same conduit with power wiring, or when it is known that high RFI/EMI generating devices are near. Ground the shield at the controller only on the COM (-) terminal.

Table 3. Wiring Lengths

Wire Gauge	LENGTH OF RUN IN FEET**						
	"HS" Sensor To CP-8102	"TS" Sensor To CP-8102	CN-8101, AT-81X4 TS-8601 To CP-8102	"HSP" Transmitter To CP-8102	TSP-8101 To CP-8102	CP-8102 To Controlled Device	CP-8102 To Adaptor*
22	125	—	—	—	—	—	—
18	300	1,000	1,000	250	Should be in Same Panel as Controller	1,000	1,000
16	—	2,250	—	—	—	2,250	2,250
14	—	4,000	—	—	—	4,000	4,000

* AD-8101, AD-812X, AD-8201, AD-8301, AD-8501

**1 Ft. approx. .3 meter

GENERAL RULES FOR WIRING CP-8102 TO CONTROLLED DEVICE(S)

1. Never connect red lead (or +20 terminal) of any controlled device which has a regulated power supply to the red lead (or +20 terminal) of any other controlled device (see Figure 5).
2. Controlled devices (MP-52XX) with unfiltered and unregulated power supplies must be filtered. CP-8102 will provide filtering for a maximum of two MP-52XX by connecting the two red leads together at the controller's +20 terminal (see Figure 6).
3. Controlled devices with filtered and unregulated supplies: Up to six controlled devices with the red leads (+20 terminals) can be connected together. Number of units paralleled depends on the current (mADC) requirements of the controller or adaptor.

Table 4. Controlled Device Power Supply Characteristics

Filtered & Regulated	Filtered & Unregulated	Unfiltered & Unregulated
CC-8101 CC-8102 CC-8103 CC-8111 Series CC-8118 Series CC-8218 Series CP-8161 Series CP-8301 Series* CP-8425 Series CP-8501 Series CP-8502 Series	MP-54XX MS-8XXX Actuators	MP-52XX Actuators

* Except CP-8301-101 which does not have a power supply.

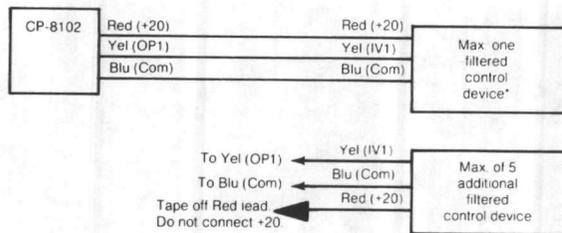


Figure 5. Controlled Devices All Filtered

FIELD CHECKOUT

Units are factory calibrated and tested and should not require field checkout. If required, proceed as follows (see Figure 1):

NOTE

The following procedures can be used for either reverse or direct acting connected CP-8102 controllers.

1. Initial Conditions for CP-8102
 - A. Jumper between AB2 and AB3 disconnected.
 - B. 20 Vdc +1 - 1.5 Vdc (23 mA) applied to the +20 and common terminals. This power is normally supplied by the controlled device.
2. Connect a 20,000 ohm/volt DC VOM meter between the OP1 (+) terminal and COM (-) terminal of the CP-8102. Use a 20 Vdc or less range.
3. Disconnect the temperature sensing element "A" from the ISA terminals of the CP-8102. Short ISA terminals together and VOM reading should be 1 Vdc or less if bridge "A" is direct acting and more than 15 Vdc if bridge A is reverse acting.
4. Open ISA terminals and VOM reading should be greater than 15 Vdc if bridge "A" is direct acting and less than 1 Vdc if bridge "A" is reverse acting.
5. The CP-8102 is a good unit if it passes tests in steps 3 and 4. Replace the unit if tests 3 and 4 are not met.

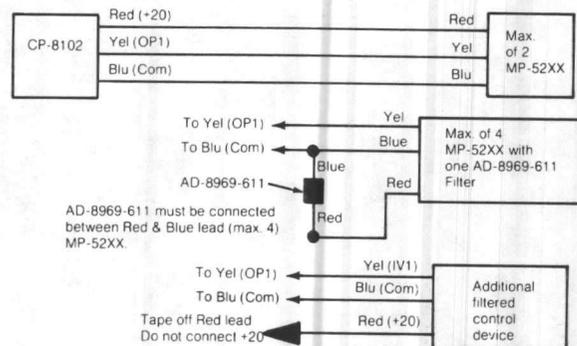


Figure 6. At Least One of the Controlled Devices in MP-52XX (Unfiltered)

FIELD CALIBRATION PROCEDURES FOR CONTROLLERS WITH ONE AND TWO INPUTS

(See Figures 7 and 9):

The following procedures can be used for either reverse or direct acting connected CP-8102 controllers.

The CP-8102 is factory calibrated and shipped with both inputs connected for direct acting output.

Normally, the CP-8102 (connected for either direct or reverse acting) requires no field calibration but if a field calibration check or recalibration becomes necessary, then proceed as follows:

1. Initial Conditions for CP-8102:
 - A. Setpoint "A" set for: 70°F.
 - B. Setpoint "B" set for: 70°F.
 - C. Ratio adjustment set for: 1:1.
 - D. Throttling range adjustment set for: 3°F.
 - E. Jumper between AB2 and AB3 disconnected.
 - F. 20 Vdc (23 mA) applied to the +20 and common terminals. This power is normally supplied by the controlled device.
2. Connect a 20,000 ohm/volt DC VOM meter between the OP1 (+) terminal and COM (-) terminal of the CP-8102. Use a 20 Vdc or less range.
3. Calibration of "A" input. Use one of the following two methods.

A. Temperature measurement methods:

Accurately measure the temperature at the temperature sensing element "A". Adjust setpoint "A" until the dial reading agrees with the temperature measured. Rotate setpoint "A" calibration potentiometer (located just to the right of setpoint "A" dial) until a VOM reading of 7.5 ± 2 Vdc is obtained.

B. Sensing element substitution method:

Disconnect the temperature sensing element "A" from the ISA terminals of the CP-8102. Reconnect a 1000 ohm $\pm 1\%$ wire wound resistor (TOOL-203) to the ISA terminals. Adjust setpoint "A" for 70°F. Rotate setpoint "A" calibration potentiometer (located just to the right of setpoint "A" dial) until a VOM reading of 7.5 ± 2 Vdc is obtained.

NOTE

Method B above does not calibrate out any errors due to sensing element tolerances or wire lead resistance.

4. Calibration of "A" input complete.

If "B" input is not being used (jumper between AB2 and AB3 removed) then proceed to step 7 below.
5. Reconnect jumper between AB2 and AB3.
6. Calibration of "B" input. Use one of the following two methods.

A. Temperature measurement method:

Accurately measure the temperature at the temperature sensing element "B". Adjust setpoint "B" until the dial reading agrees with the temperature measured. Rotate setpoint "B" calibration potentiometer

(located just to the right of setpoint "B" dial) until a VOM reading of 7.5 ± 2 Vdc is obtained.

B. Sensing element substitution method:

Disconnect the temperature sensing element "B" from ISB terminals of the CP-8102. Reconnect a 1000 ohm $\pm 1\%$ wire wound resistor (TOOL-203) to the ISB terminals. Adjust setpoint "B" for 70°F. Rotate setpoint "B" calibration potentiometer (located just to the right of setpoint "A" dial) until a VOM reading of 7.5 ± 2 Vdc is obtained.

NOTE

Method B above does not calibrate out any errors due to sensing element tolerances or wire lead resistance.

7. CP-8102 calibration is complete. Remove all test meters, test resistor, etc. Reconnect all elements, place setpoints, throttling range and ratio adjustments as required for the application.

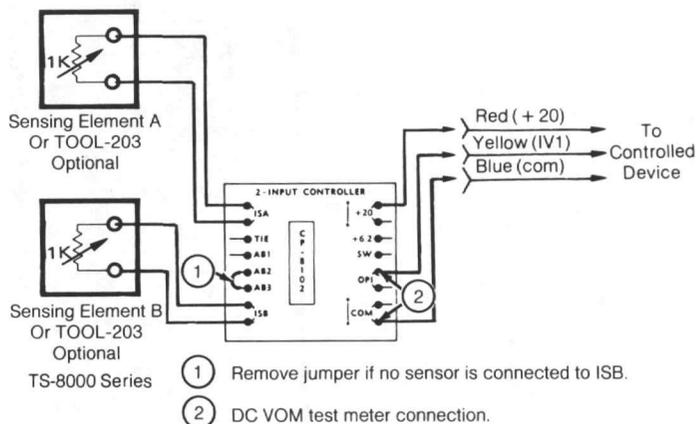


Figure 7. One or Two sensor Application

FIELD SERVICE

Units are factory calibrated and tested for direct acting control (D.A.) and reverse reset (R.R.) and should not require service. If required, proceed as follows (see Figure 8):

Power Supply

Apply +20; +1, -1.5 Vdc (23 mA) to the +20 and common terminals. Proper power supply is always required for unit to function properly. The +6.2 (± 3) Vdc should be available from the controller, if required.

Test

Connect a 20,000 ohm/volt DC VOM meter between +20 and common terminals. Controller power supply +20, +1 -1.5 Vdc (indicated by M1 in Figure 8) should be measured. Power supply is normally supplied by controlled device. Check +6.2 (± 3) Vdc power supply of controller with VOM.

Service

If the +20 Vdc level is not measured, service the (lead) controlled device, power supply or installation wiring as necessary to insure proper power supply.

Controller Output

See Field Calibration Procedures, on this page, for calibration of "A" setpoint using sensor element substitutes.

Test

With signal output measured between OP1 and COM at $7.5 \pm .2$ Vdc, rotate setpoint "A" dial several degrees (in increments of 1°F) each way from 70° setting to vary the M2 reading from 1 to 15 Vdc. The number of degrees that setpoint dial "A" is changed to vary the reading on M2 3 Vdc should be approximately 3°F (if T.R. is set at 5°F , 3 Vdc will change over 5°F).

Service

See Field Calibration Procedures, on page 5, for calibration of "B" setpoint using sensor element substitutes. (Make certain that jumper is connected to AB2 and AB3.)

Adjusting setpoint "B" several degrees from 70°F setting will cause the M2 reading to vary from 1 to 15 Vdc.

If output voltage cannot be made to vary over a 1 to 15 Vdc range, then replace the CP-8102 as defective.

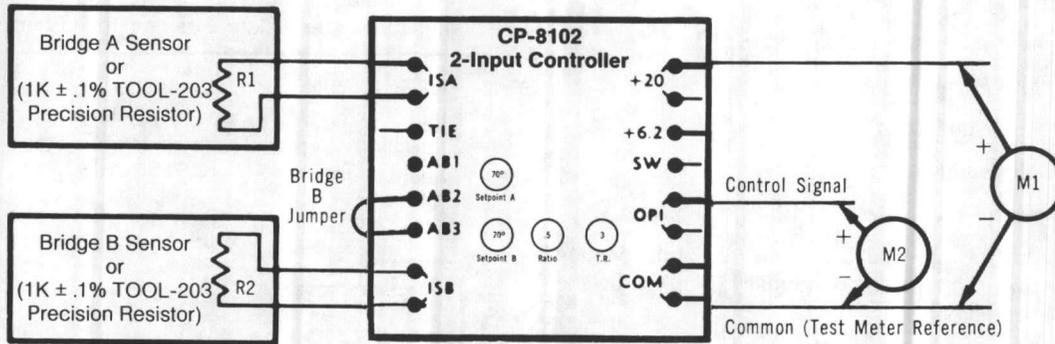


Figure 8.

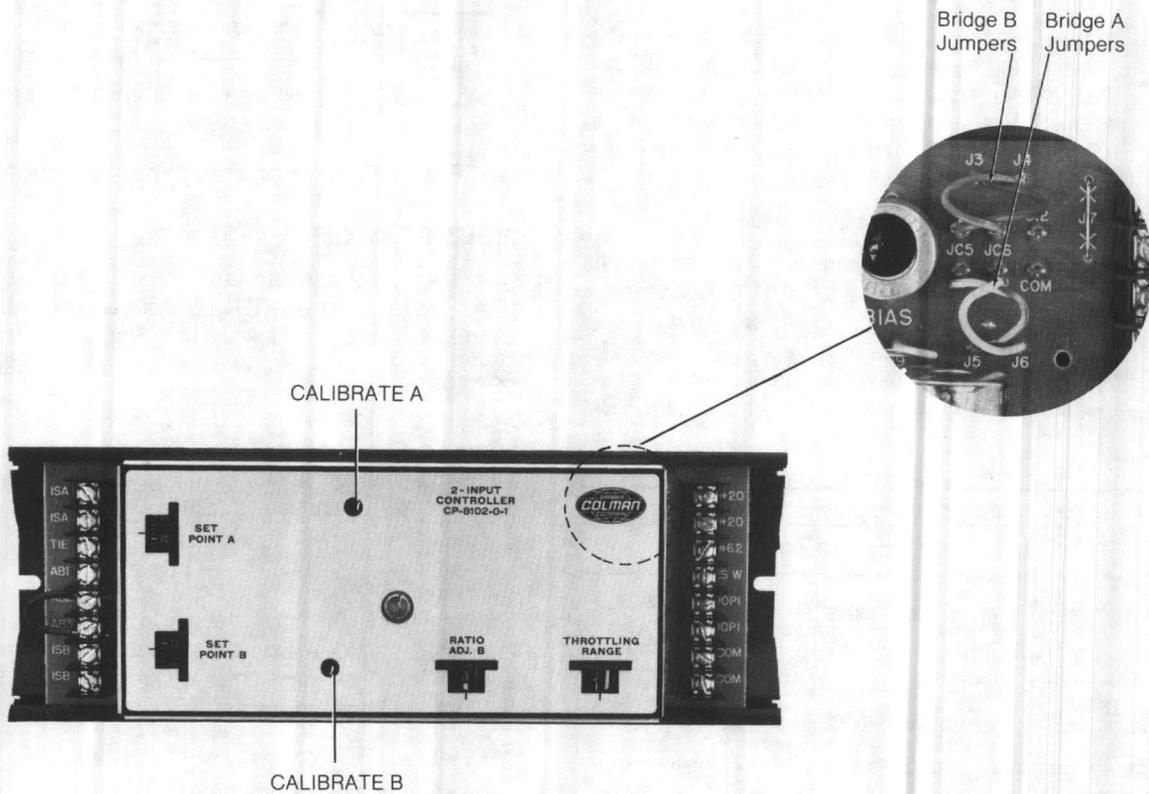


Figure 9.

MAINTENANCE

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

TYPICAL APPLICATIONS

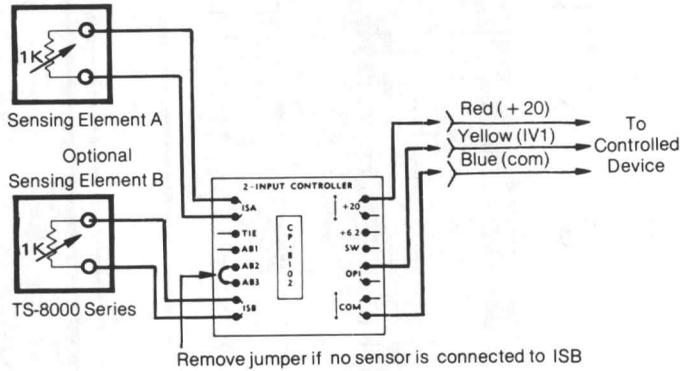


Figure 10. One or Two Temperature Sensor Application

Hot water reset is typical application for a two sensor application of the CP-8102. For example, perimeter radiation temperature, with hot water as a heating medium, is increased as the temperature of the outside air decreases. This method of control is known as reverse reset. A reset schedule shown below in table requires the hot water temperature to increase from 100° to 170°F, a change of 60°F, as the outside air temperature decreases from 60° to 0°F. If the throttling range of the CP-8102 controller is 10°F the setting of the CP-8102 will be as follows:

Setpoint "A": 110°

Setpoint "B": 60°

Ratio Adjustment: 1 (change in outside air temperature / change in hot water temperature)

Throttling Range: 10°F

Note: Controller function is Direct Acting * (see table 2)

* Factory setting

Table 5. Reset Schedule

Outside Air Temp. (°F)	Water Temperature (°F)
60	110
0	170

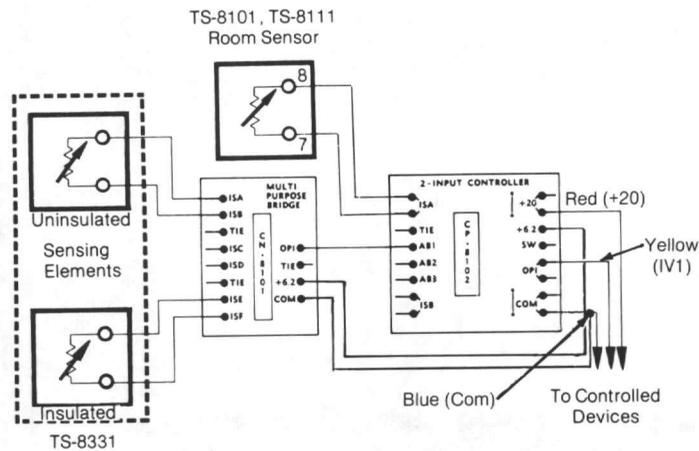


Figure 11. Derivative (Lagged) Sensor

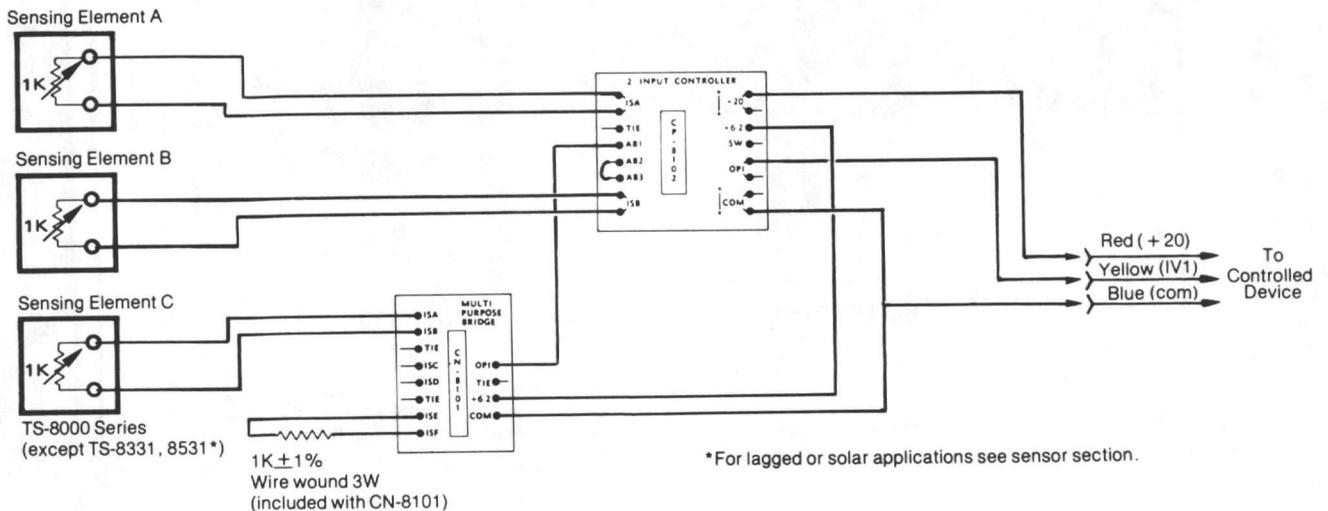


Figure 12. Three Temperature Sensor Application*

*For lagged or solar applications see sensor section.

SINGLE UNIT SUMMER/WINTER SWITCHING (Continued):

Table 6. Bridge Connections for Summer/Winter (See Figure 15.)

BRIDGE "A" (MAIN SENSOR)		BRIDGE "B" (RESET SENSOR)		RESET OF SETPOINT "A"		JUMPER TO PIN CONNECTIONS			
						J3	J4	J5	J6
Winter	Summer	Winter	Summer	Winter	Summer				
D.A.	R.A.	D.A.		Reverse	Direct	JC5	JC6	COM	+6.2
R.A.	D.A.	D.A.		Direct	Reverse	JC6	JC5	COM	+6.2
D.A.	R.A.	R.A.		Direct	Reverse	JC5	JC6	+6.2	COM
R.A.	D.A.	R.A.		Reverse	Direct	JC6	JC5	+6.2	COM
D.A.		D.A.	R.A.	Reverse	Direct	COM	+6.2	JC5	JC6
R.A.		D.A.	R.A.	Direct	Reverse	+6.2	COM	JC5	JC6
D.A.		R.A.	D.A.	Direct	Reverse	COM	+6.2	JC6	JC5
R.A.		R.A.	D.A.	Reverse	Direct	+6.2	COM	JC6	JC5

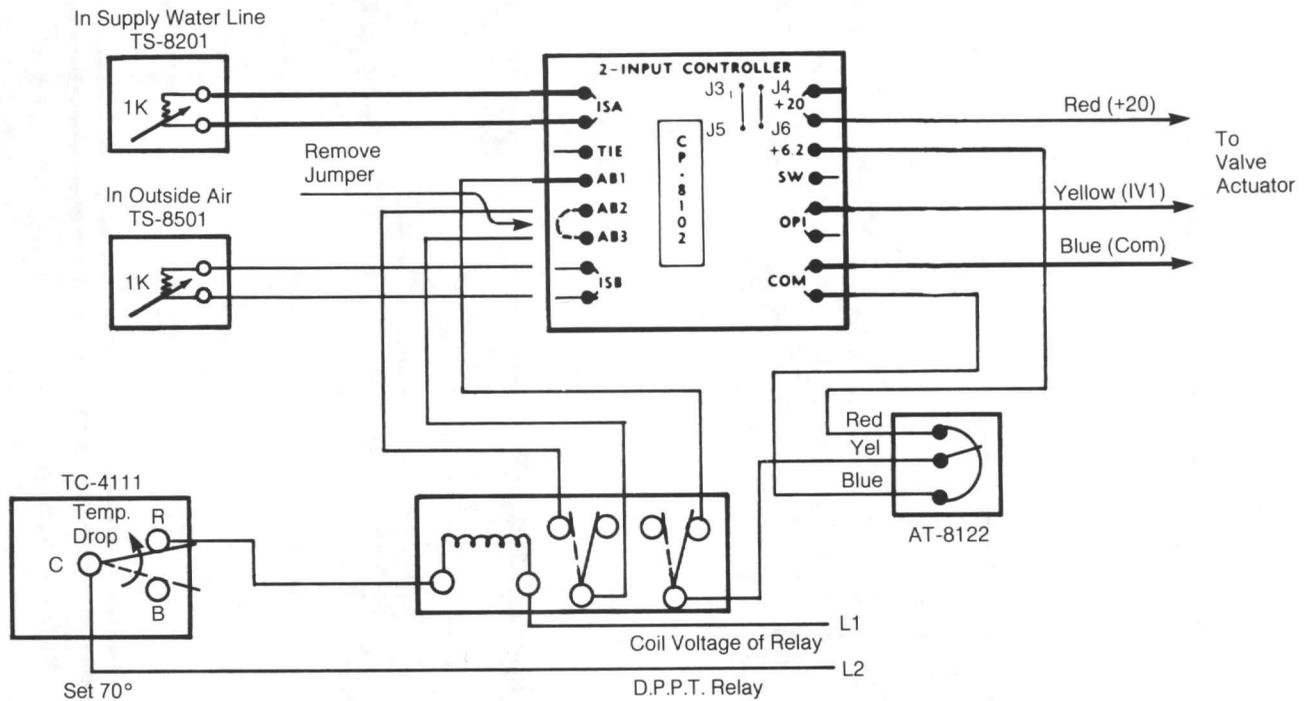


Table 7. Typical Reset Schedule

Outside Air Temp. (°F)	Water Temperature (°F)
70°	110°
0°	140°
Above 70°	85°

Outside air temperature reset of supply water temperature with fixed temperature of 85°F with outside air temperature of 70°F.

Setpoint "A": 110°F

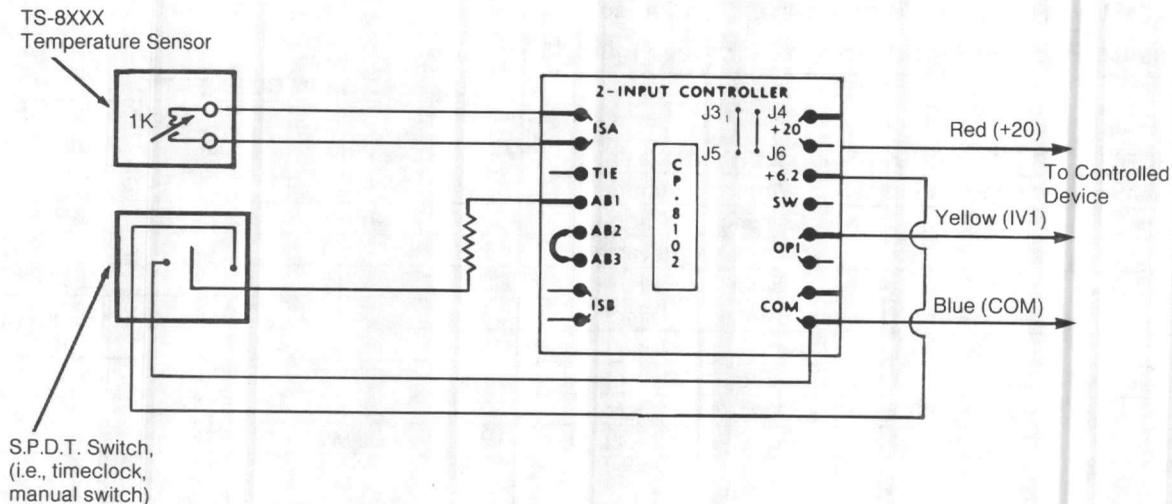
Setpoint "B": 70°F

Ratio Adjustment: 2.33

Throttling Range: 10°F

AT-8122: Set 45°F for S.P. of 85 where O.A. is above 70°F. Relay is energized with outside air temperature below 70°.

Figure 15. Outside Air Temperature Reset of Hot Water with Fixed Temperature with Outside Air Temperature Above Selected Value



Resistor (5, 10, 15, 20°F offset) use AD-8969-201 kit.

Offsetting setpoint for Direct Acting Controller:

Raise, connect resistor to +6.2 terminal.

Lower, connect resistor to COM terminal.

Offsetting setpoint for Reverse Acting Controller:

Raise, connect resistor to COM terminal.

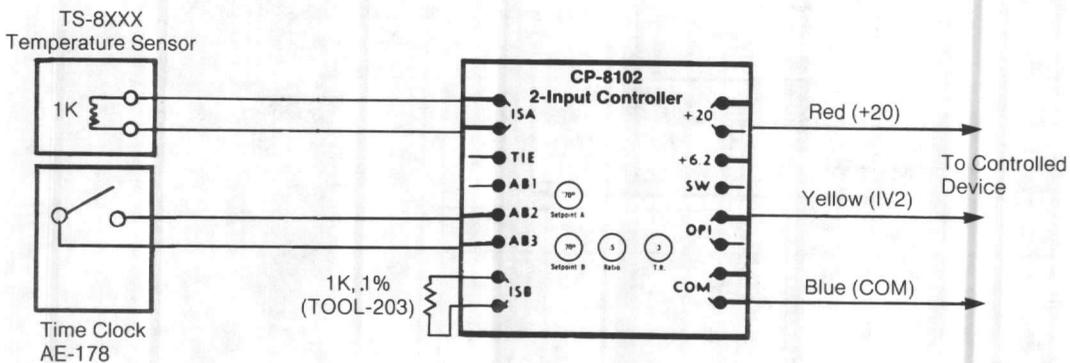
Lower, connect resistor to +6.2 terminal.

NOTE

Standard two conductor twisted wire should be used if remote switching is employed.

Resistor must always be located at stat.

Figure 16. Setpoint Offset



Install 1000 ohm 1% (TOOL-203) resistor in ISB. Install AE-178 7 day time clock. Set setpoint "B" as desired for night setback.

Table 8.

Setpoint "B"	Night Setback
70°F (21.1°C)	No Setback
65°F (18.3°C)	5°F (2.8°C) Setback
60°F (15.6°C)	10°F (5.6°C) Setback
55°F (12.8°C)	15°F (8.3°C) Setback

Figure 17. Night Setback

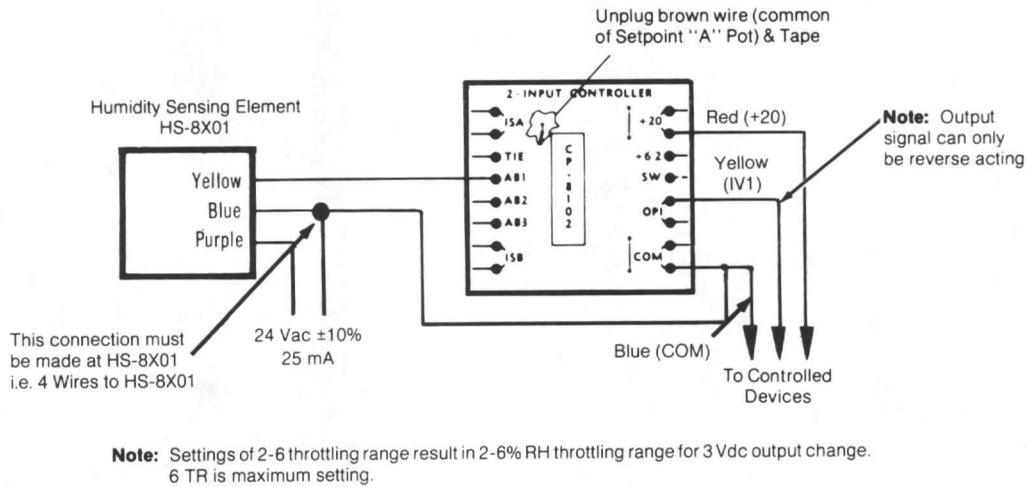


Figure 18. Humidity Control

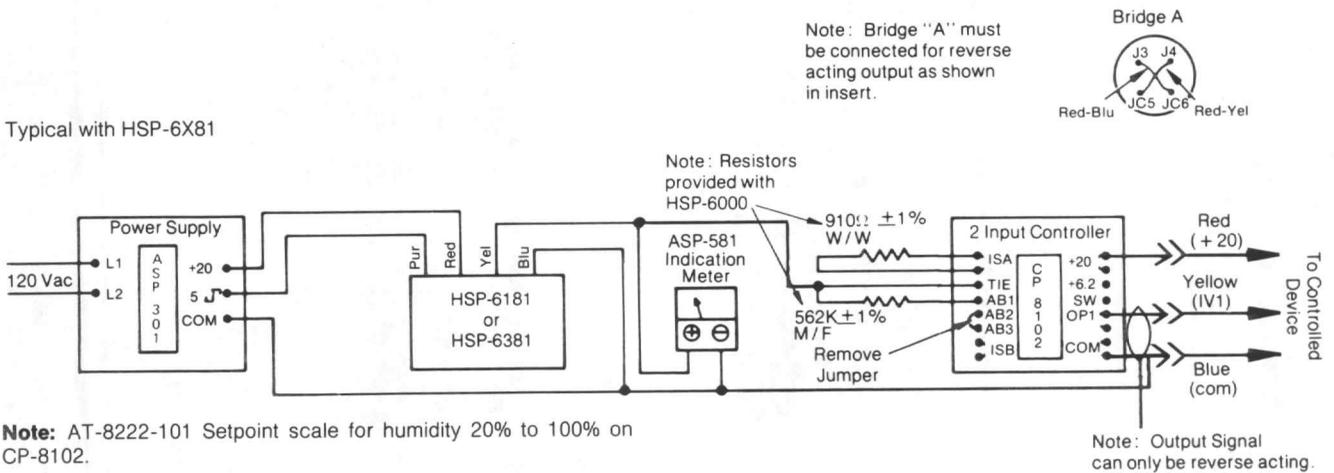


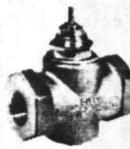
Figure 19. Humidity Control & Indication

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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

2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 1. Select **Valve Body** including **P Code** (Valve Size, Cv Rating, Port Code) or select **Valve Assembly** with correct Input Signal (see Table 3 also) less Actuator Code (XXX) including the **P Code** (Size, Cv Rating, Port Code). (See Pages 331-335 for Valve Sizing.)

APPLICATION			
Chilled or Hot Water 281°F Max. 35 psig Steam		Hot Water 300°F Max. 100 psig Steam	Hot Water 366°F Max. 150 psig Steam
Screwed	Flanged	Screwed	
			

	Size	1/2"–2"	2-1/2"–4"	1/2"–2"	1/2"–2"
	Normally Open Valves	Valve Body	VB-9213-0-4-P	VB-9213-0-5-P	VB-9253-0-4-P
Valve Assembly 2-15 Vdc Input, System 8000		VS-9213-XXX-4-P	VS-9213-35X-5-P	VS-9253-XXX-4-P	VS-9273-XXX-4-P
Valve Assembly, Built-in System 8000 Controller		VS-9213-35X-4-P	VS-9213-35X-5-P	VS-9253-35X-4-P	VS-9273-35X-4-P
2-Position SPST Valve Assembly		VA-9213-2XX-4-P	—	VA-9253-2XX-4-P	VA-9273-2XX-4-P
Normally Closed Valves	Valve Body	VB-9223-0-4-P	VB-9223-0-5-P	VB-9263-0-4-	VB-9283-0-4-P
	Valve Assembly 2-15 Vdc Input, System 8000	VS-9223-XXX-4-P	VS-9223-35X-5-P	VS-9263-XXX-4-P	VS-9283-XXX-4-P
	Valve Assembly, Built-in System 8000 Controller	VS-9223-35X-4-P	VS-9223-35X-5-P	VS-9263-35X-4-P	VS-9283-35X-4-P
	2-Position SPST Valve Assembly	VA-9223-2XX-4-P	—	VA-9263-2XX-4-P	VA-9283-2XX-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 **VS-9223-212-4-8**
- 2. Valve Body **VB-9223-0-4-8**
- Actuator **MP-5210-500**
- Linkage **AV-600**

■ **Valve Body** Data less P Code (Size, Cv Rating, Port Code) or **Valve Assembly** less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)

■ **P Code** (Size, Cv Rating, Port Code)

■ **Actuator or Actuator Code (XXX)** for Valve Assemblies

■ **Valve Linkage**

Material	Flow Type	Equal %	Equal %	Equal %	Equal %
	Body	Bronze	Cast Iron	Bronze	Bronze
	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 Cone			
	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°)

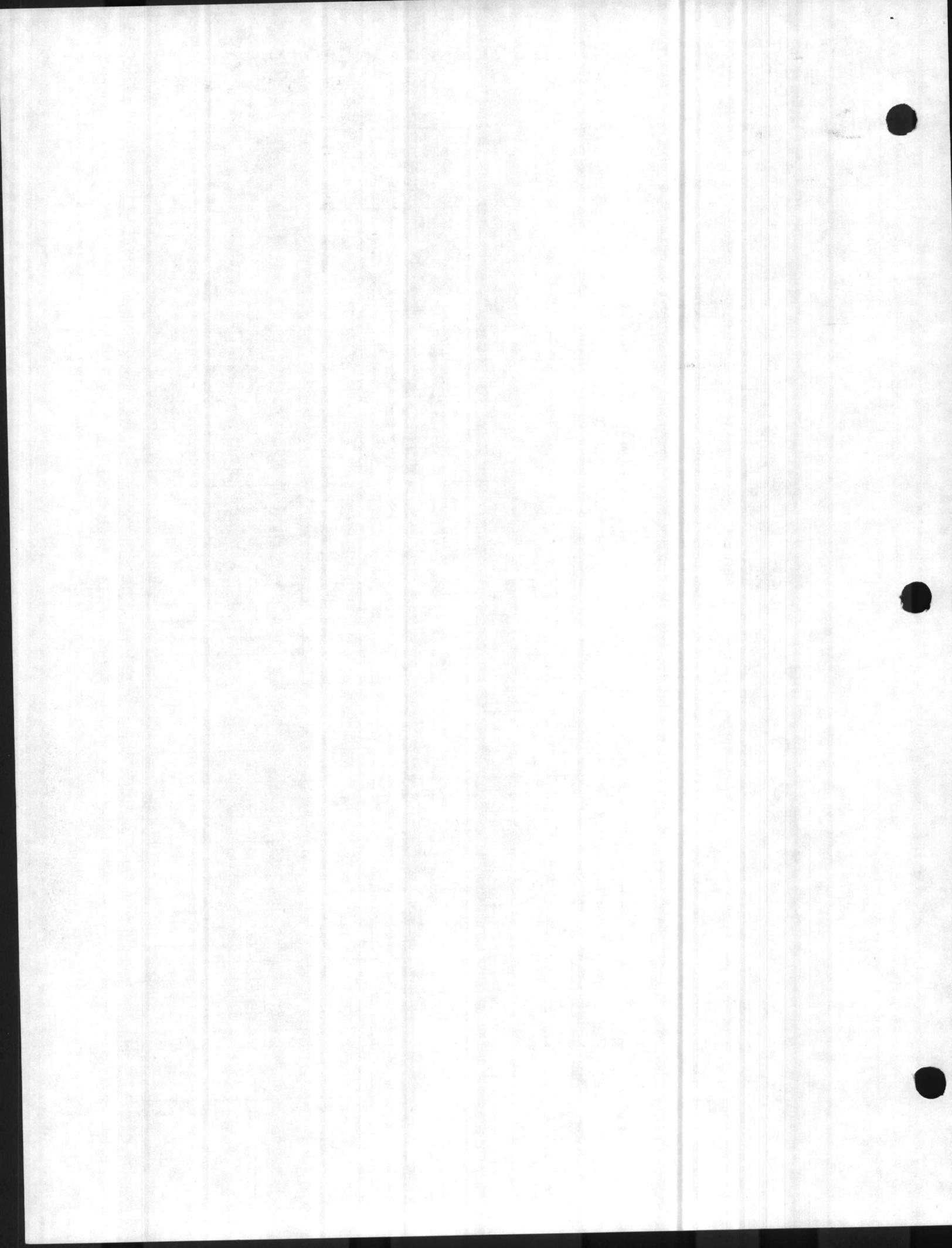
TO SELECT A PORT CODE (P)

P Code	Valve Size	Cv		
-1**	1/2"	0.4	0.4	0.4
-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	1-1/4"	16.0	16.0	16.0
-10	1-1/2"	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	

*Maximum recommended differential pressure in full open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected.

NOTE: Do not exceed close-off rating.

**NOTE: Factory assemblies are not available for 2-position applications using reduced port valve bodies.



2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 2. Select **Actuator Type** or **Actuator Code (XXX)** series with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select **Valve Linkage**.

Input Signal							
Valve Linkage 1/2" — 1-1/4" Valve					AV-600	AV-600	—
Valve Linkage 1/2" — 2" Valve					—	—	AV-430
Valve Linkage 2-1/2" — 4" Valve					—	—	AV-495
Actuator Code (XXX)					2XX	2XX	35X
Actuator Code					MA-521X-XXX	MP-5X1X	MS-8XX1X-XXX
Normal Position	Factory Avail. Valve Assembly	Valve Body	P Code	Size	CLOSE-OFF PRESSURE RATING*		
Normally Open	VA-9213-2XX-4-P VA-9253-2XX-4-P VA-9273-2XX-4-P VS-9213-XXX-4-P VS-9253-XXX-4-P VS-9273-XXX-4-P	VB-9213-0-4-P VB-9253-0-4-P VB-9273-0-4-P	-1-2-3-4	1/2"	180	190	
			-5-6	3/4"	75	85	
			-7-8	1"	40	45	
			-9	1-1/4"	25	30	
			-10	1-1/2"			65
			-11	2"			35
Normally Open	VS-9213-35X-5-P	VB-9213-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6
Normally Closed	VA-9223-2XX-4-P VA-9263-2XX-4-P VA-9283-2XX-4-P VS-9223-XXX-4-P VS-9263-XXX-4-P VS-9283-XXX-4-P	VB-9223-0-4-P VB-9263-0-4-P VB-9283-0-4-P	-1-2-3-4	1/2"	250	220	
			-5-6	3/4"	140	90	
			-7-8	1"	75	50	
			-9	1-1/4"	45	30	
			-10	1-1/2"			65
			-11	2"			35
Normally Closed	VS-9223-35X-5-P	VB-9223-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6

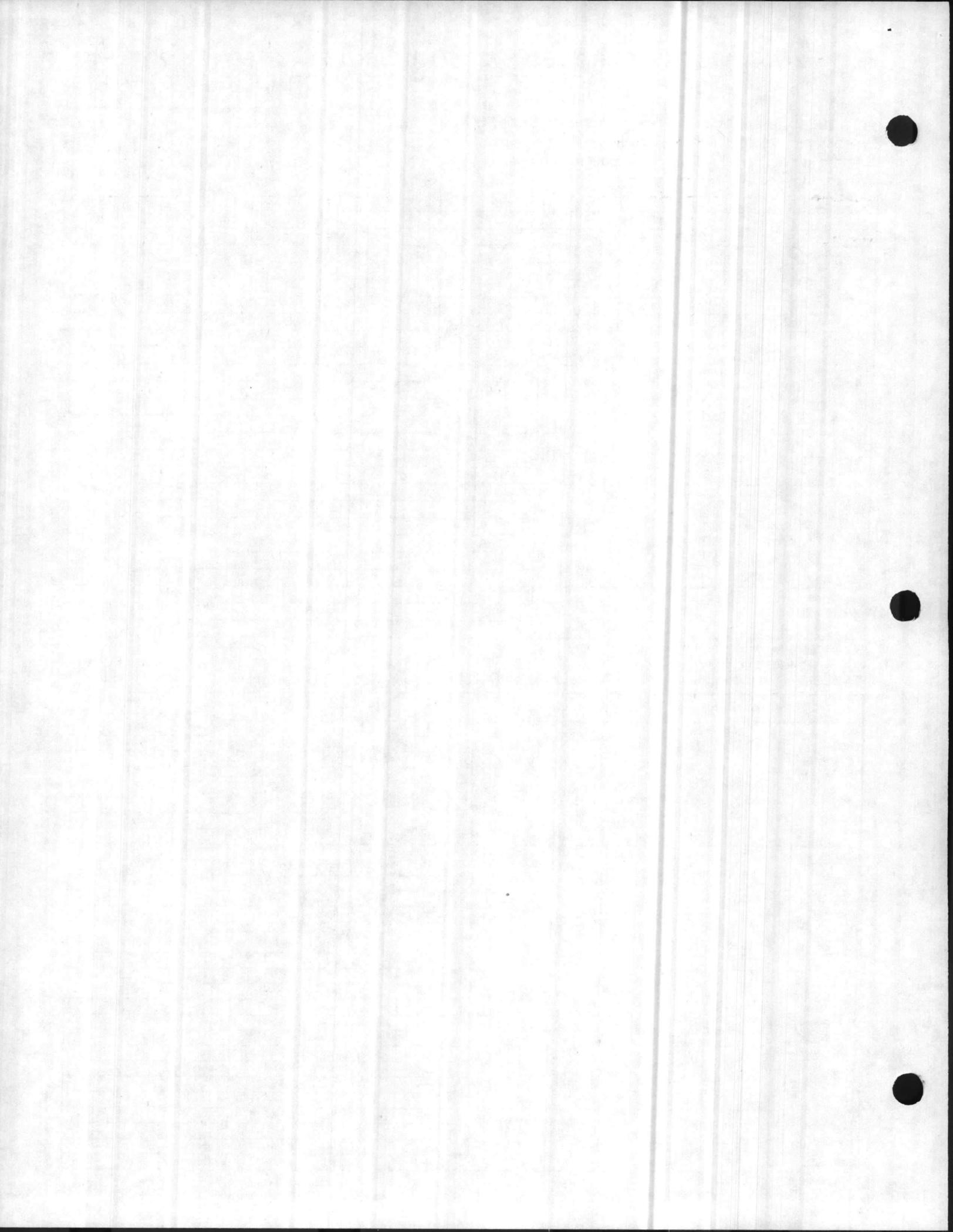
*Close-off pressure ratings apply when valves are installed with pressure under the seat.

**Certain models have built-in controller.

TABLE 3. Select exact **Actuator** or **Actuator Code (XXX)** if Factory Assembly is available.

Input Signal	Wiring Figure No.	Voltage Vac 50/60 Hz	VA	Aux. Switch	Actuator Part No.	Actuator Code (XXX) For Factory Available Assy			
Two-position SPST	See Figure 1 on Page 336	24	18	No	MA-5213	201			
		24		Yes	MA-5213-500	202			
		120		No	MA-5210	211			
		120		Yes	MA-5210-500	212			
		208		No	MA-5212				
		208		Yes	MA-5212-500				
		240		No	MA-5211	221			
		240		Yes	MA-5211-500	222			
		2-15 Vdc, System 8000. Stroke occurs 6-9 Vdc approx., Non-positive positioning		See Figure 12 on Page 339	24	18	No	MP-5213	201
					24		Yes	MP-5213-500	202
120	No		MP-5210		211				
120	Yes		MP-5210-500		212				
208	No		MP-5212						
208	Yes		MP-5212-500						
240	No		MP-5211		221				
240	Yes		MP-5211-500		222				
2-15 Vdc, System 8000, start 6 Vdc factory set, Adjustable 2-12 Vdc, 3 Vdc span, Positive positioning	See Figure 12 on Page 339		24		18		No	MP-5413	243
			120				No	MP-5410	240
		208	No	MP-5412					
		240	No	MP-5411		241			
	See Figure 12 on Page 339	24	36	No	MS-83013	351			
		120	37	No	MS-83010	353			
		120	37	Yes	MS-83010-500				
		240	39	No	MS-83011				
Built-in System 8000 controller, Uses TS-8XXX sensor	See Figure 19 on Page 343	120	37	No	MS-84110	354			
		120	37	No	MS-84110-011*				
		120	37	Yes	MS-84110-500				
		24	36	No	MS-84113				

*Includes TS-8201-105 sensor.



2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 4. Dimensions

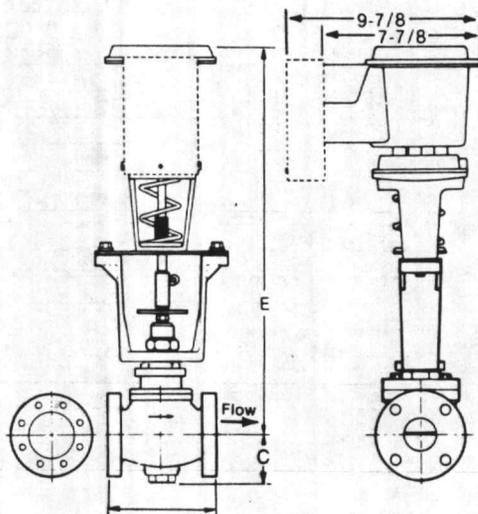
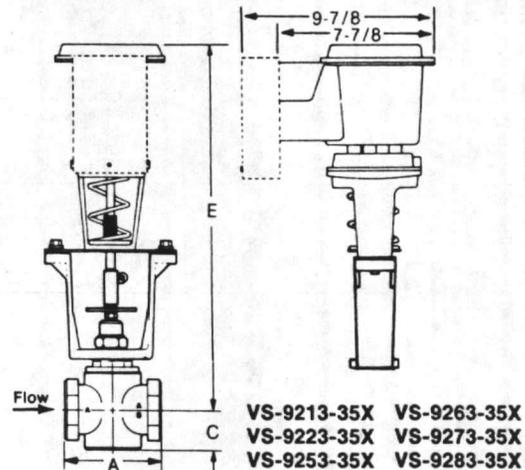
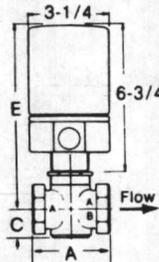
Part Number	DIMENSIONS (Inches)					
	Size	Valve Body			Actuator Series	
		A	B	C	200*	350
VA-9213-2XX-4-P	1/2"	3		1	8-3/16	
VA-9253-2XX-4-P	3/4"	3-5/8		1-3/8	8-11/16	
VA-9273-2XX-4-P	1"	4-5/8		1-1/2	9	
VS-9213-XXX-4-P	1-1/4"	4-5/8		1-5/8	9	
VS-9253-XXX-4-P	1-1/2"	6-1/8		2-1/2		19-1/8
VS-9273-XXX-4-P	2"	6-1/8		2-1/2		19-1/8
VS-9213-35X-5-P	2-1/2"	8-1/2		3-1/2		19-13/16
	3"	9-1/2		3-3/4		20-3/16
	4"	11-1/2		4-1/2		21-7/16
VA-9223-2XX-4-P	1/2"	3		1-7/16	8-3/16	
VA-9263-2XX-4-P	3/4"	3-5/8		1-3/4	8-11/16	
VA-9283-2XX-4-P	1"	4-5/8		2	9	
VS-9223-XXX-4-P	1-1/4"	4-5/8		2	9	
VS-9263-XXX-4-P	1-1/2"	6-1/8		3-3/16		18-5/8
VS-9283-XXX-4-P	2"	6-1/8		3-3/16		18-5/8
VS-9223-35X-5-P	2-1/2"	8-1/2		4-1/8		19-7/16
	3"	9-1/2		4-1/8		19-13/16
	4"	11-1/2		5-1/16		20-7/16

*Add 21/32" (52 mm) to the "E" dimension for a valve assembly using an AV-601 linkage extension that must be purchased separately.

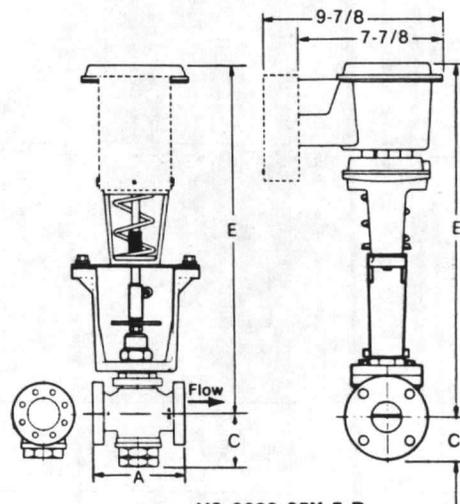
Dimensions in inches (metric conversion 25.4 mm = 1 inch)

NOTE: Allow 3 inches clearance above actuator for removal. Mount MA/MP-5XXX actuators above the valve body at 45° from vertical on steam applications.

VS-9213-2XX VA-9213-2XX
 VS-9223-2XX VA-9223-2XX
 VS-9253-2XX VA-9253-2XX
 VS-9263-2XX VA-9263-2XX
 VS-9273-2XX VA-9273-2XX
 VS-9283-2XX VA-9283-2XX

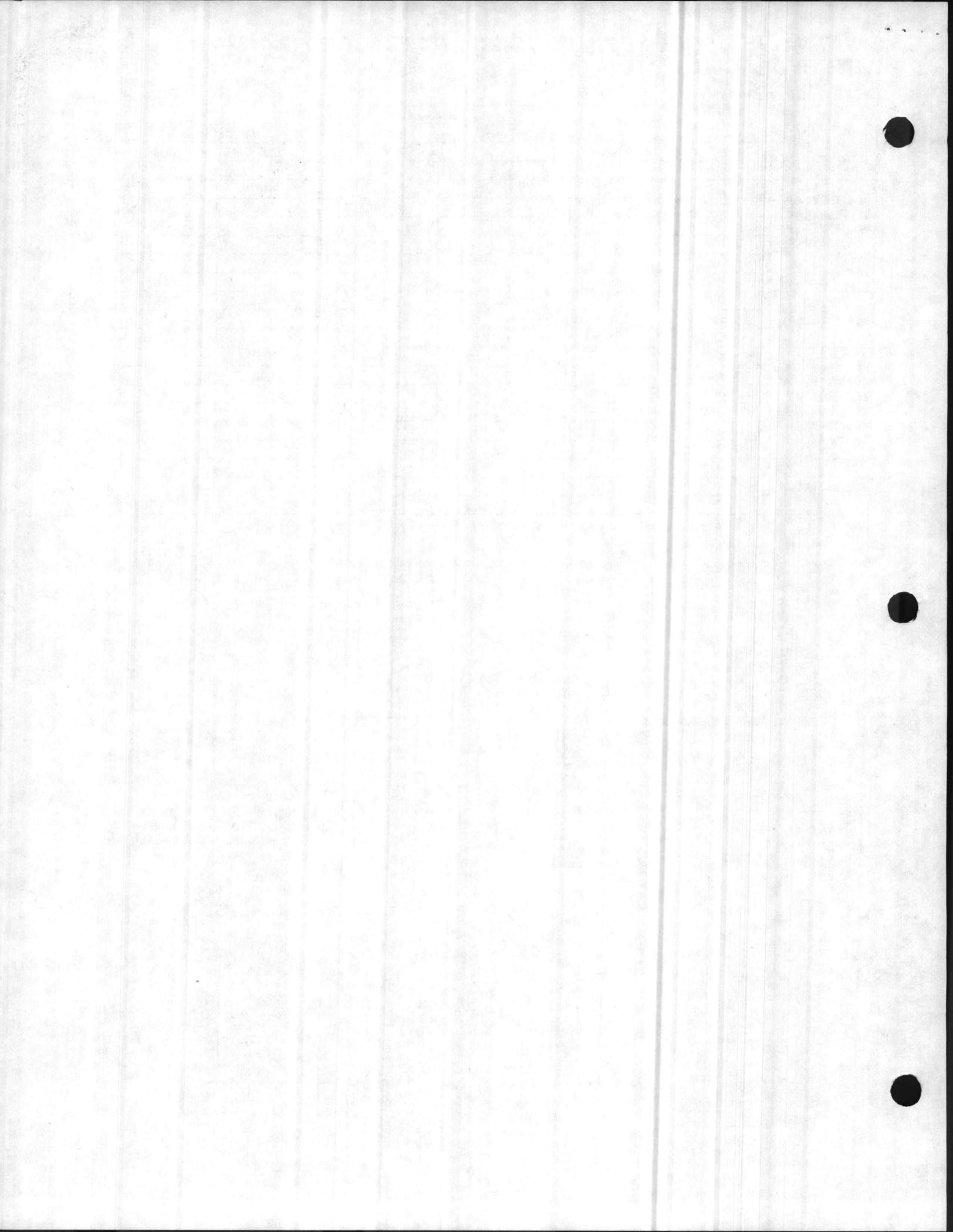


VS-9213-35X-5-P



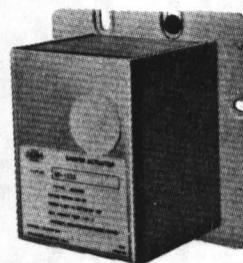
VS-9223-35X-5-P

See Flange Detail Table on following page



APPLICATION

For floating control of small dampers which do not require the return to normal position upon power interruption. Typically, the actuator is used with terminal units in VAV systems and with mixing boxes in constant volume double duct systems.



MF-1233 Series

SPECIFICATIONS

Control Type: Reversible floating.

Control Circuit: Three wire, provided by SPDT floating switch with a neutral center. This switching action is available with the PF-300 Series air flow controllers, compatible with the input requirements of the MF-1233 actuator.

Input:

Volts, 24(+10%, -15%)

Hz, 50/60

Full Load Amps, .160

Torque: 20 lb.-in.(2.3 N-m). The damper must withstand 35 lb.-in.(4.0 N-m) of torque if the travel is less than the fixed actuator stroke as set by the internal torque switches.

Maximum Damper Size:

Parallel, 11.2 ft²(1.0 m²)

Opposed, 14.4 ft²(1.3 m²)

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) velocity.

Output Shaft:

Rotation, 90°(+5, -0°). Factory set CCW end. Torque switches limit travel in CW and CCW directions, reducing the need for travel adjustment and preventing over stress on dampers.

Construction, Hollow.

No Load Timing: 3 min. 45 sec. nominal.

Auxiliary Switch: Adjustable SPDT, see table for models.

Auxiliary Potentiometer: 15K ohm .33 watts, see table for models.

FCC: Complies with Class B testing according to the rules and regulations of part 15 radio frequency devices (including television), sub part J, computing devices.

Ambient Limits: Operating, Shipping and Storage

Temperature, -40 to 140°F(-40 to 60°C).

Humidity, 5 thru 95% non-condensing.

Vibration, Not more than .3"(7.6 mm) at a frequency of 200 cycles/seconds.

Atmosphere, Avoid locations where corrosive fumes/- vapors, abrasive dust or explosive conditions are present.

Connections: Coded screw terminals that will accept up to 16 gauge wire.

Case: Galvanized steel.

Mounting: Any position on a vibration free area. The actuator mounts over a 1/2"(12.7 mm) diameter damper shaft [min. length 1-1/8"(29 mm)].

Crank arm and damper rod mounting applications require ordering separately AM-165 mounting kit, AM-125-XXX damper rod, AM-122, AM-132 connectors and damper shaft crank arm.

Dimensions: 5-1/8" high x 5-1/4" wide x 3-1/4" deep (130 mm x 133 mm x 83 mm).

Part Number	SPDT Aux. Switches (Adj)*	Aux. Pot. 15K ohm .33 watt
MF-1233	None	None
MF-1233-001	1	None
MF-1233-002	2	None
MF-1233-010	None	1
MF-1233-012	2	1

* 5 amps @ 24V DC/AC 50/60 Hz, Pilot Duty 100 VA. Switches have gold contacts suitable for dry circuit switching.

OPTIONS

None.

ACCESSORIES

- AM-111 Crank arm for 5/16"(7.9 mm) diameter damper shaft
- AM-112 Crank arm for 3/8"(9.5 mm) diameter damper shaft
- AM-113 Crank arm for 1/2"(12.7 mm) diameter damper shaft
- AM-115 Crank arm for 7/16"(11.1 mm) diameter damper shaft
- AM-122 Linkage connector, straight type
- AM-125 5/16"(7.9 mm) diameter x 20"(508 mm) damper rod
- AM-132 Linkage connector, ball type
- AM-165 Mounting kit, includes crank arm, 1/2"(12.7 mm) diameter shaft and bearing mounting bracket

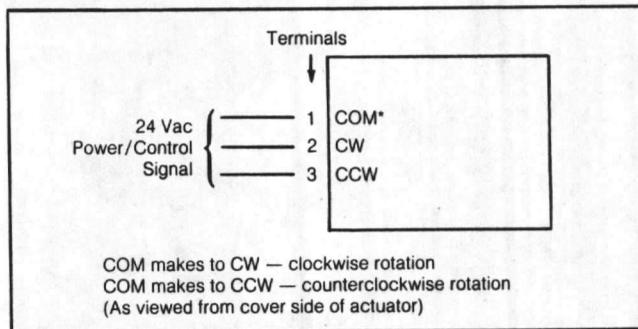
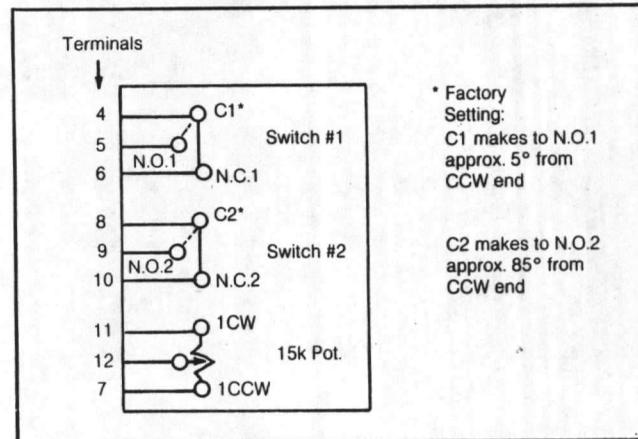


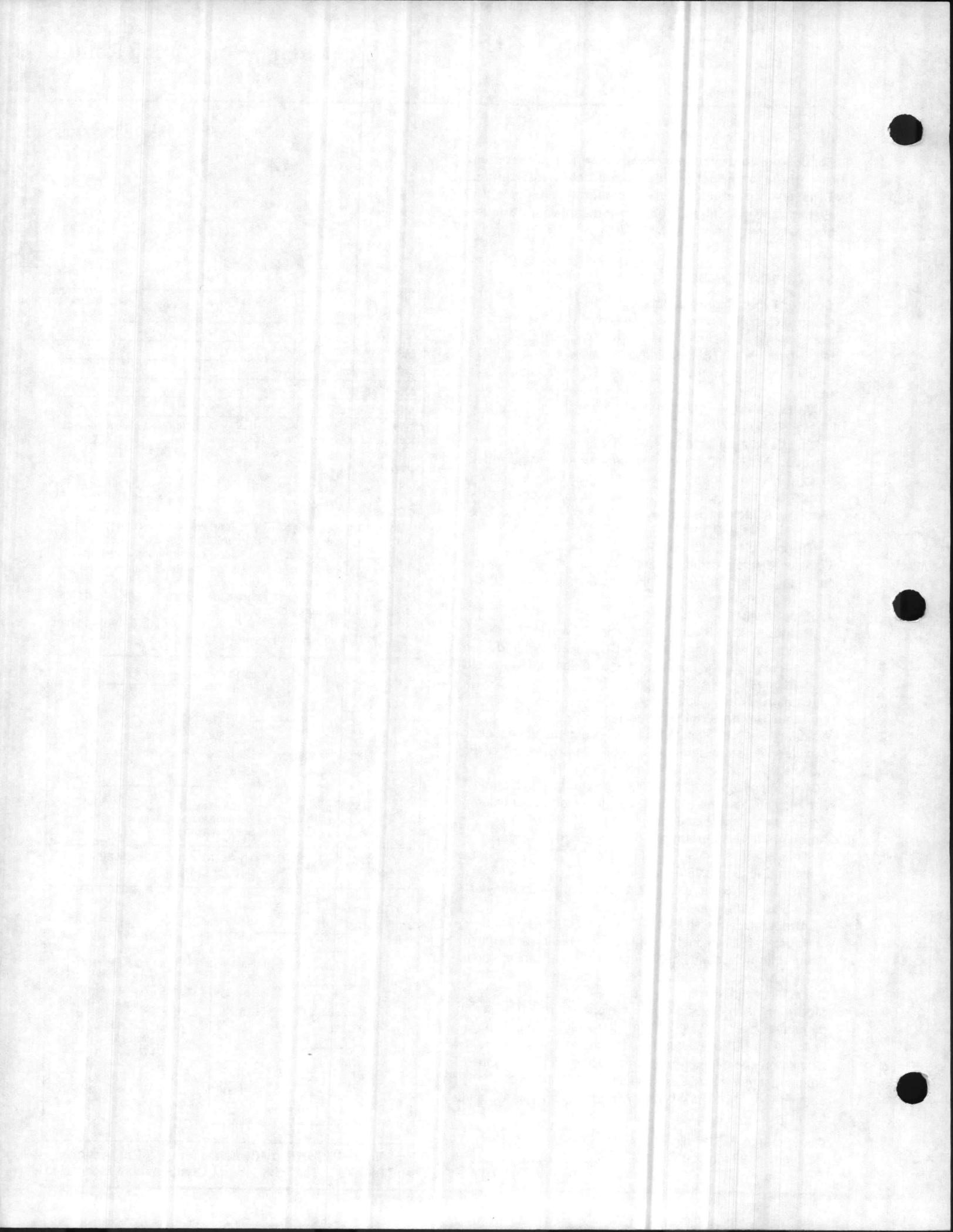
Figure 1. Switching Action and Terminals. Typical of All Models



* Factory Setting: C1 makes to N.O.1 approx. 5° from CCW end

C2 makes to N.O.2 approx. 85° from CCW end

Figure 2. Auxiliary Switches and 15k Pot. Action and Terminals, See Table for Aux. Components & Model Nos.





General Instructions

TC-1100 Series, TCR-1101 Two-Position Electric Room Thermostats

APPLICATION

For low or line voltage on-off control of fan coils, fans, motor starters, contactors, two-position electric actuators.

SPECIFICATIONS

Sensing Element: Bimetal.

Differential: 2°F (1°C).

Electrical Switch: Snap action SPDT.

Ratings: See Table 3.

Connections: Color coded 6" (152 mm) leads.

Cover: Beige plastic as standard.

Locations: NEMA Type 1 indoor only.

Mounting: Flush or surface 2 × 4 switch box or directly to wall (24 volt only).

Dimensions: 4-3/8" high × 2-7/8" wide × 1-5/8" deep (111 mm × 73 mm × 41 mm).

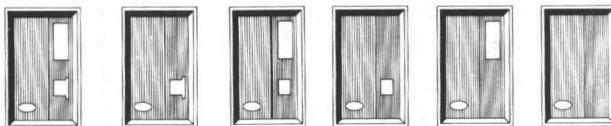
Anticipators Are Recommended:

Parallel for cooling. Series or parallel for heating.

OPTIONS

Add "dash-number" (-XXX) suffix to base part number for desired option. For metal covers, specify TC2-110X-XXX.

Anticipators: All thermostats mounted on concrete walls, or other wall surfaces that change temperature slowly, have reduced response time to changes in space temperature. Response time is further reduced for thermostats with guards that restrict air flow over the thermostat. Anticipators are recommended on thermostats that are subjected to restricted air flow conditions and in small spaces intended for human occupancy, i.e., hotel guest rooms and offices.

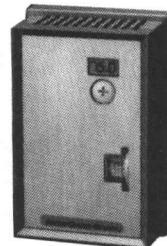


* Standard	-400	-401††	-402††	-403††	-404††
** -116	-410	-411††	-412††	-413††	-414††
		* °F (°C)	** °C		

- 500 parallel heat or cooling anticipation 24V standard cover
- 501 parallel heat or cooling anticipation 120V standard cover
- 502 parallel heat or cooling anticipation 240V standard cover
- 601 10°F night depression 120V standard cover
- 602 10°F night depression 24V standard cover ††5/64" Allen screw
- 603 10°F night depression 240V standard cover used to secure cover.

ACCESSORIES

- AE-170 Series Electric time clock
- AT-61 Series Brushed bronze cover plates (except TCR-1101)
- AT-82 Series Digital thermometer cover kit (except TC2-110X)
- 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-1100 Series Thermostat guards
- TOOL-11 Calibration wrench
- TOOL-13 Contact burnishing tool



TC-110X with
Digital Thermometer
Kit Installed

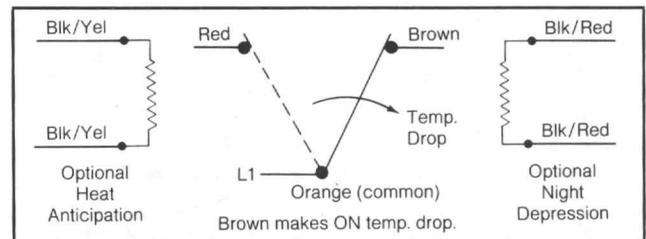
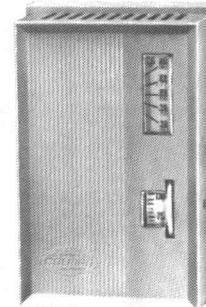


Figure 1. Switch Action and Lead Identification

TABLE 1. SPECIFICATIONS

Part Number	Setpoint Dial Range*		Cover Configurations
	Standard & -40X °F (°C)**	-116 & -41X °C	
TC-1101	55 to 85 (13 to 29)	13 to 29	See Options
TC-1102	45 to 75 (7 to 23)	7 to 23	
TC-1103	75 to 105 (24 to 40)	24 to 40	
TCR-1101	55 to 85 only	—	One Blank Cover Insert & One Cover Insert with Control Dial Cutout***

* Dial stop pins included to limit setpoint range.

** Dual marked (except TCR-1101).

*** One (1) 5/64" Allen head screw and 5/64" Allen wrench for securing cover to thermostat base included along with standard single slotted screw.

TABLE 2. AGENCY APPROVALS†

Configuration	UL	CSA
Metal Case (TC2-110X)	No	Yes
Plastic Cover (TC-110X)	Yes	No
Heat Anticipation or Night Depression (-500 or -600 Series)	No	No

TABLE 3. MAXIMUM ELECTRICAL RATINGS

Switch Action	Full Load Amps		Locked Rotor Amps		Pilot Duty (VA)
	24/120 Vac	240 Vac	24/120 Vac	240 Vac	
Make for Heating	4.4 Orange to Brown Lead	2.2 Orange to Brown Lead	26.4 Orange to Brown Lead	13.2 Orange to Brown Lead	40 @ 24 Vac
Make for Cooling	3.0 Orange to Red Lead	1.5 Orange to Red Lead	18 Orange to Red Lead	9 Orange to Red Lead	210 @ 120/240 Vac

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 diagrams
- Tools (not provided):
 - Volt-ohm meter
 - Appropriate screwdriver for mounting screws and terminal connections
- Appropriate accessories
- Mounting screws, two (2) provided for securing to a 2 x 4 conduit box

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Make all connections in accordance with the wiring diagram, and in accordance with national and local electrical codes. Class I wiring is required unless all circuits to contacts are powered from a Class II source. *Use copper conductors only.*
3. Do not exceed ratings of the device.

Mounting

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.

CAUTION

Do not locate the thermostat near sources of heat or cold, such as lamps, motors, sunlight or concealed ducts or pipes, or where there is a danger of electrocution (i.e., shower rooms).

The thermostat is designed for service in any normally encountered human environment. Avoid locations where excessive vibration, moisture, corrosive fumes or vapors are present. NEMA Type 1 covers are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

Thermostats with guards that restrict air flow must have heating or cooling anticipation.

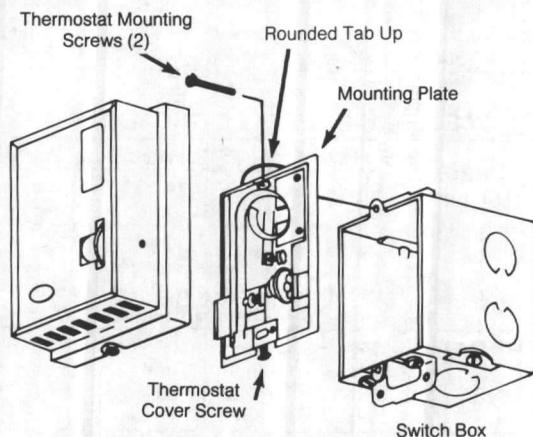


Figure 2. Thermostat Mounting

Procedure

1. Pull all wires.
2. Make electrical connections to thermostat. (Typical heat anticipation and night depression wiring diagrams are shown in Figures 6 through 8.)
3. Remove thermostat cover and fasten thermostat to box or wall.
4. Attach thermostat cover.

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 or by using a voltmeter between the proper sides of the switch.

1. Run the setpoint dial to a temperature above ambient. This should cause the thermostat to make a circuit between orange and brown leads.
2. Turn the setpoint dial setting down below ambient. This should cause the thermostat to make a circuit between orange and red leads.

CALIBRATION (See Figure 3)

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

1. Turn off control power and power to night depression circuit, where applicable.
2. Set setpoint dial to correspond to actual stable room temperature, as read from an accurate thermometer.
3. Remove thermostat cover. 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 (red) contact, with a small screwdriver, turn calibration screw counterclockwise (looking at head of screw) until blade makes to right (brown) contact.

NOTE

Each complete turn of screw changes calibration approximately 15°F (8°C).

Now turn screw very slowly clockwise until blade just makes the left (red) contact. Thermostat is now properly calibrated.

If contact blade is originally made to the right (brown) contact, turn calibration screw slowly clockwise until element just makes the left (red) contact. Thermostat is now properly calibrated.

5. Replace thermostat cover.
6. Turn on control power.
7. Recheck calibration about 30 minutes later to be sure heat from handling of or breathing on bimetal element did not result in an erroneous setting.

HEAT ANTICIPATION (See Figures 6 and 7)

Heat anticipation, series or parallel, is recommended for:

- Systems with excess heating capacity that can cause objectionable space temperature swings.
- Thermostats mounted on walls (i.e., concrete) that change temperature slowly and/or have insufficient air flow over the device.

COOLING ANTICIPATION (See Figure 8)

Parallel cooling anticipation is recommended for:

- Cooling anticipations where current draw exceeds 1 ampere. Cooling lockout (self heat of the thermostat causing over cooling of the space) can occur on these applications.
- Systems with excess cooling capacity that can cause objectionable space temperature swings.
- Thermostats mounted on walls (i.e., concrete) that change temperature slowly and/or have restricted air flow over the device.

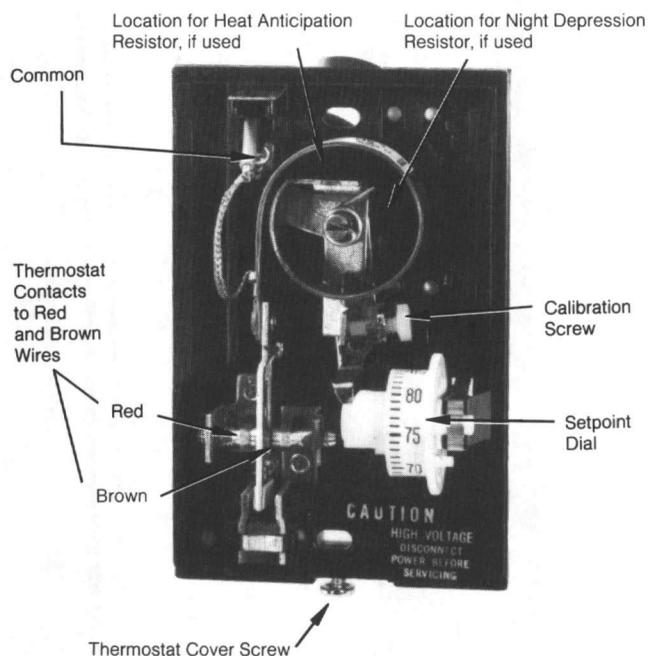


Figure 3.

CONCEALED CONTROL DIAL

Knurled Dial Removal (See Figure 4)

1. Remove thermostat cover.
2. Secure the control dial with hand so that the dial will not rotate.
3. Place needle nose pliers at knurled ring of the control dial at the points where the knurled ring is attached to the control dial.
4. Twist the pliers at each knurled ring attachment point until the entire knurled ring of the control dial is removed.

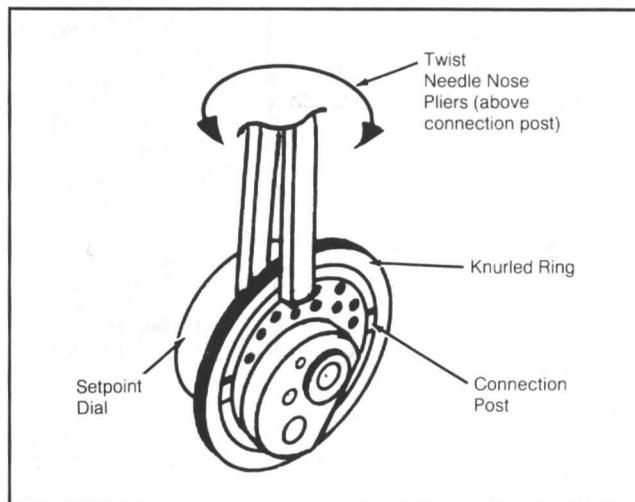


Figure 4. Knurled Dial Removal

LIMIT CONTROL DIAL RANGE

Dial Stop Pin Insertion — Included with Mounting Plate (See Figure 5)

1. Remove thermostat cover.
2. Secure the control dial with hand so that the dial will not rotate.
3. Place a dial stop pin in the jaws of a needle nose pliers.
4. Insert the dial stop pin in the appropriate hole on either (or both) side(s) of the control dial to restrict dial rotation.

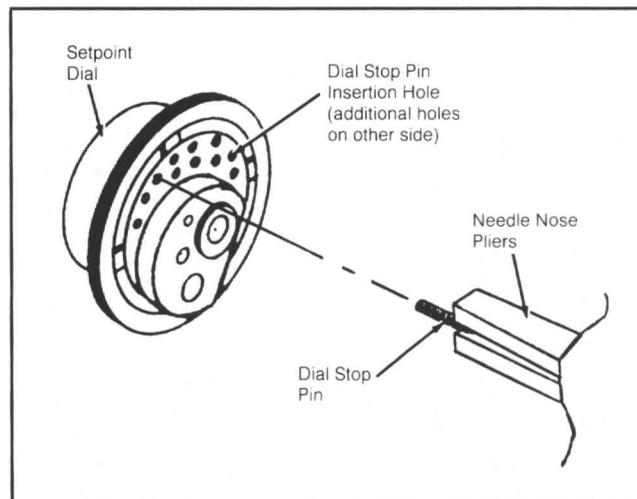


Figure 5. Dial Stop Pin Insertion

MAINTENANCE

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

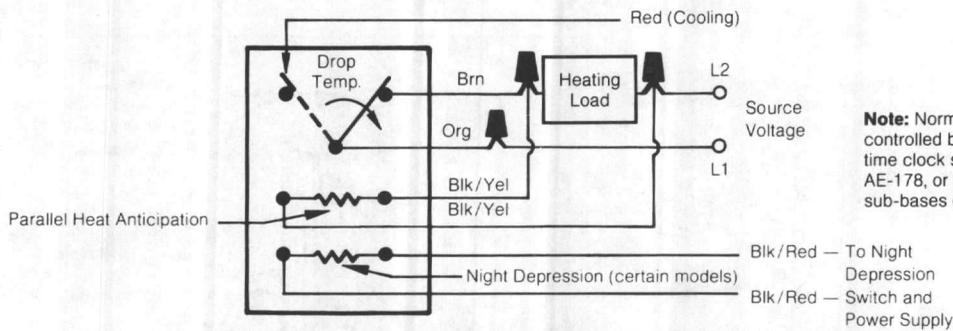
Open areas at bottom and around base of thermostat should be kept clean and free from obstructions to allow proper flow of air. If switch contacts need cleaning, this may be done with TOOL-13 (burnishing tool).

NOTE

Thermostat may require calibration after cleaning the contacts.

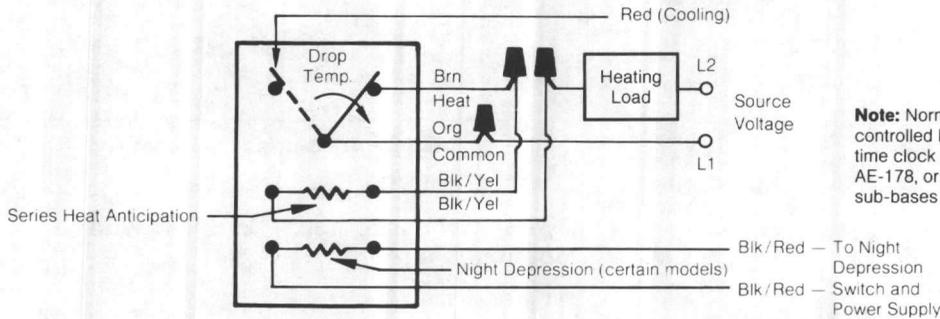
REPAIR

These thermostats are not field repairable. Replace a defective thermostat with a functional unit.



Note: 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).

Figure 6. Typical of Parallel Heat Anticipation (heater size determined by voltage) with or without Night Depression



Note: 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).

Figure 7. Typical of Series Heat Anticipation (heater size determined by ampere rating of load) with or without Night Depression

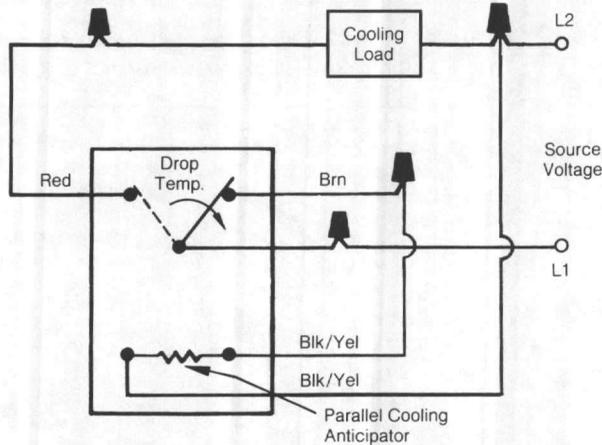
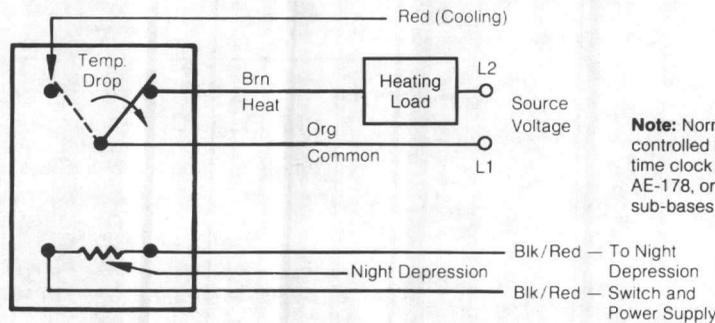


Figure 8. Typical of Parallel Cooling Anticipation (anticipator size determined by voltage)



Note: 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).

Figure 9. Typical Night Depression

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ENVIRONMENTAL CONTROLS DIVISION

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General Instructions

MA-5200 and MA-5300 Series Two-Position Actuators MP-5200 Series Proportional Actuators

DEVICE INFORMATION

Identification

This General Instruction Sheet is concerned with all MA and MP-5200-0-0-2 and MA-5330 Series Actuators. Actuators with the part number suffix "-500" have a built-in adjustable SPDT switch. When working with actuators manufactured before this series, refer to replacement section below.

Pre-Installation

MA and MP-5210 Series: These actuators, two position and proportional, respectively, are supplied without additional linkage or hardware. AV-600 valve linkage and appropriate valve body or AM-601 damper linkage must be ordered separately.



Figure 1. AV-600, Valve Linkage

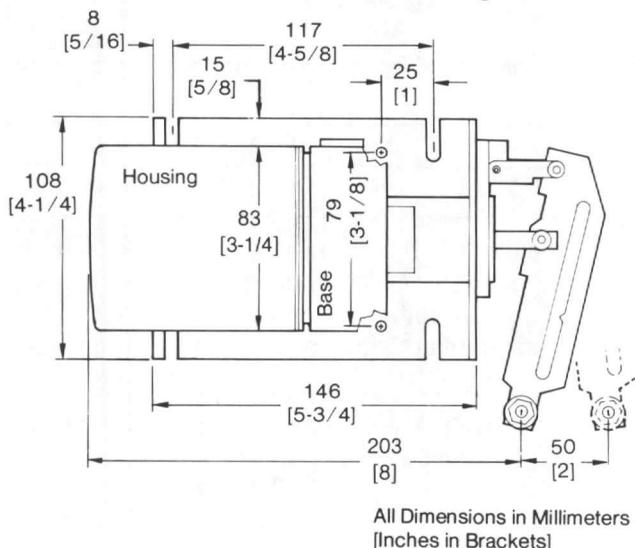
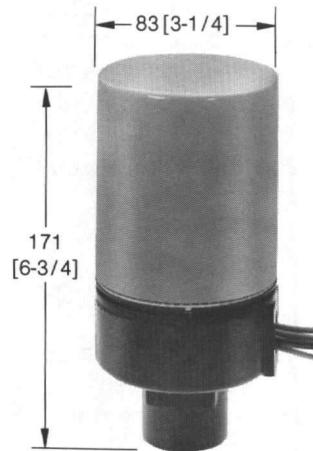


Figure 2. AM-601 Damper Linkage

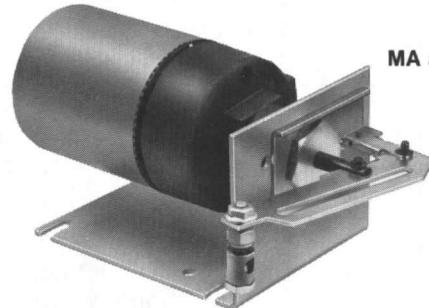


MA and MP-5210 Series



MA and MP-5210 Series
AV-600 and Valve Body

NOTE: Allow 76mm [3"] above actuator for removal



MA-5330 Series and MP-5220 Series

MA-5330 Series and MP-5220 Series: These actuators, two position and proportional, respectively, are supplied with AM-601 damper linkage. Also required for installation will be four 1/4-inch diameter bolts or other fasteners to mount the actuator. Additional hardware normally required for linking the damper would be:

- AM-132—balljoint connector for damper crank arm
- AM-122—straight connector for damper crank arm
- AM-125—8 mm (5/16-inch) link rod x 508 mm (20-inch)
- AM-111 thru 115—damper shaft crank arms

When actuators have the optional auxiliary switch, a Tool-12 adjusting wrench is available for adjustment.

Before mounting the device check for dents, bent parts and signs of oil leakage. Also check supply voltage against requirements, shown below:

Part Number	Voltage Requirements 50/60 Hz (Vac) Input: 10 watts
MA-MP-5XX0	120
MA-MP-5XX1	240
MA-MP-5XX2	208
MA-MP-5XX3	24

INSTALLATION

Requirements

These actuators will operate correctly in any position and are unaffected by normally encountered environmental conditions. Ambient temperature limitations: For MA Series, minimum is -17°C (0°F) and maximum is 60°C (140°F). For MP-5220 Series, minimum is -28°C (-20°F) and maximum is 60°C (140°F).

Procedure

CAUTION

Do not twist or exert any force on actuator housing during installation. Either turn the base by hand or if necessary use 1-5/8" open end wrench on flats provided on the base.

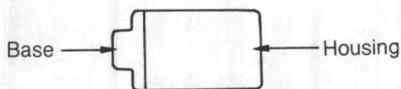


Figure 3

1. Before installing the device, check to be sure that it operates properly.

MP (proportional) actuators. These actuators require the proper input voltage (Figure 4) and a control voltage of 1 to 15 Vdc. The actuator with the proper valve or damper linkage should go from retract to extend position as the control voltage goes from approximately 6 to 9 Vdc. For this checkout step, the AD-8301 manual positioner may be used to supply the control voltage.

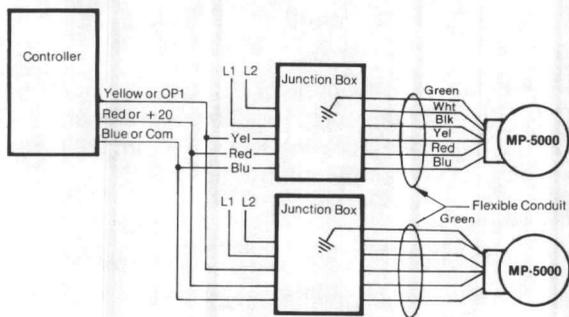


Figure 4. MP Wiring

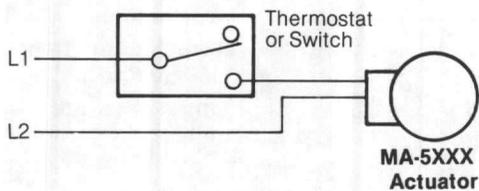


Figure 5. MA Wiring

MA (two position) actuators: When the proper ac voltage (Figure 5) is applied, the actuator motor should run causing the actuator to extend.

2. Install and connect the device physically.

- a. Damper actuators: Position actuator and mark mounting holes using the actuator bracket as a template.

The best position for the actuator is with the actuator crank arm and the crank arm on the driven shaft, at a 90° angle to the linkrod at mid-stroke. It may be necessary to swivel the actuator linkage to arrive at the best mounting location.

Allow adequate working space to wire the actuator into the system.

Drill mounting holes for the appropriate 1/4-inch diameter mounting fasteners and mount the actuator. The actuator must be mounted firmly enough to prevent excessive actuator movement under normal damper loading. If there is excessive actuator movement, the damper may not fully open or fully close.

- b. Valve actuators: Remove as required the valve body from the actuator by loosening the 1-5/8-inch flange nut.

Pipe the valve body into the system. Note: Be sure that the actual flow is in the same direction as the arrows on the valve body indicate. Allow 76mm (3 inches) above the actuator case for reattachment and removal.

Reattach the actuator to the valve body as required.

3. Wire the actuator into the system.

Low voltage units wired to NEC codes may use Class Two wiring. Wire line voltage units wired to NEC codes.

Actuator Voltage (Vac)	Wire Size (GA)	Maximum Two Wire Run Meters (Feet)
24	14	91.5 (300)
	12	146.3 (480)
120	14	1067 (3500)
208/240	14	1829 (6000)

To determine the allowable maximum run for multiple actuator wiring, divide the maximum run shown above for a given wire size and voltage by the number of actuators on that run.

Use wire nuts on power leads from a Class A power source. Power lead colors are shown as follows: Black — common to all voltages that follow. White — for 120 Vac. Black with blue tracer — for 24 Vac. Black with brown tracer — 208 Vac. White with black tracer — 240 Vac. A green grounding wire is provided. All leads are 1.2 m (4 feet).

MP (proportional) actuators:

NOTE

System 8000 controllers can control a maximum of two (2) MP-5200 Series Actuators. AD-8101 adaptors can be added as shown in EN-111 to control two additional MP-5200 Series per adaptor.

Actuator wires are connected as shown in **(Figure 4)**. Barber-Colman approved, three conductor twisted 18 AWG wire has 600 volt PVC insulation and should be used from the controller. This twisted wire can be put in the same conduit with power wiring to the actuator. Also acceptable is any three wire (18 ga.) cable with Class I lead insulation in conduit separate from line voltage **(Figure 4)**.

MA (two position) actuators: These are wired as shown with the thermostat or switch device controlling the off-on status of the actuator motor **(Figure 5)**.

4. Finish the damper actuator mechanical hook-up. After wiring, assemble the straight connector, linkrod, balljoint connector, and damper shaft crank arm as shown **(Figure 6)**.

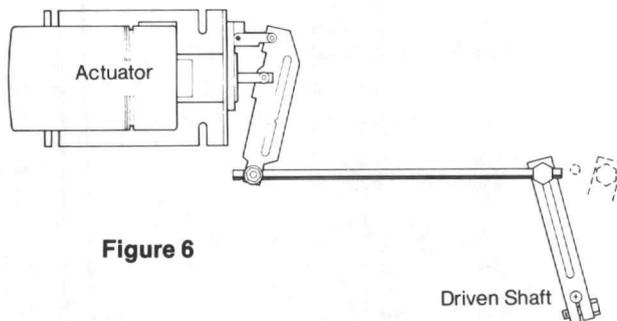


Figure 6

Tighten both the actuator connector to the linkrod and the damper crank arm to the damper shaft. Both crank arms should be approximately 90° to the linkrod at midstroke. Normally dampers are linked to full heat with the actuator retracted.

By extending and retracting the actuator the actuator crank arm will rotate 80°. (See Number 1 above.)

Determine the proper radius on the damper shaft crank arm to fully open and close the damper.

Tighten down the connector to the damper crank arm and the linkrod.

The installation is now complete.

Auxiliary Switch

Hydraulic actuators may be ordered with a built-in adjustable SPDT auxiliary switch **(Figures 7 and 8)**. This switch must be ordered as part of the actuator and cannot be field installed. Note: For MP Series actuators only, the switch common wire is internally connected to the black power lead. Because of this, the switch must be wired to control the same voltage

as the actuator itself. Switch rating is 10 amperes at 120/240 Vac. Leads are 1.2m (4 feet).

The switch's brown wire is normally open and the orange wire is normally closed. The switching point is adjustable over the entire actuator stroke and is factory set to occur at the retracted end. Use Tool-12 to adjust the switch point.

CHECKOUT

The actuator is now installed and should run properly when the system is energized. The following checks can be easily performed to see if the device is operational.

MP Series Actuators: First, the actuator motor should run continually when power is applied. If the motor is not running, something is wrong with either actuator or the supply voltage. Second, the damper or valve should go from full heat to full cool shaft extended as the control signal goes approximately from 6 to 9 Vdc, as measured between yellow and blue leads.

NOTE

At very low ambient temperature (around minus 20°F) the actuator may run slowly until the oil warms up. This condition may exist for 30 minutes.

MA Series Actuators: When the proper voltage is supplied to the actuator, the actuator motor should run, causing the actuator shaft to extend.

If the actuator fails to function properly, refer to the section on repairs.

RUN/ADJUST

No adjustments are made at the actuator. All adjustments are made at the controller.

Theory of Operation

See Figures 6 and 7. The permanently sealed oil filled case (1) contains a movable hydraulic piston assembly (2) and an electric pump (3) for the hydraulic system. The pump generates a fluid pressure which is transmitted to the top of the piston. Opposing the hydraulic force is the spring of the valve or damper linkage.

MA Series Actuators: The electric pump (3) is powered by the input supply voltage and runs whenever the voltage is applied. When power is removed, the oil flows back through the pump by means of check valve (6) and the actuator retracts.

MP Series Actuators: The electric pump (3) is powered by the input supply voltage and runs continuously. An unregulated, unfiltered power supply (4) is powered by a transformer winding from the pump motor winding. The

power supply produces 20 Vdc which powers the controller. The controller returns a 1 to 15 Vdc control voltage to the actuator transducer (5). This controls the internal pressure and the resultant actuator action.

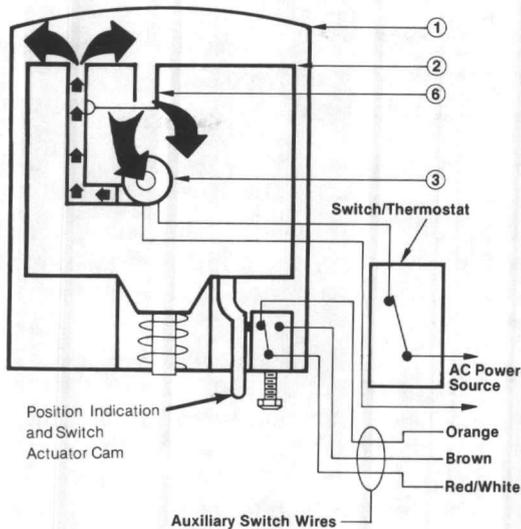


Figure 7. MA Series Actuator

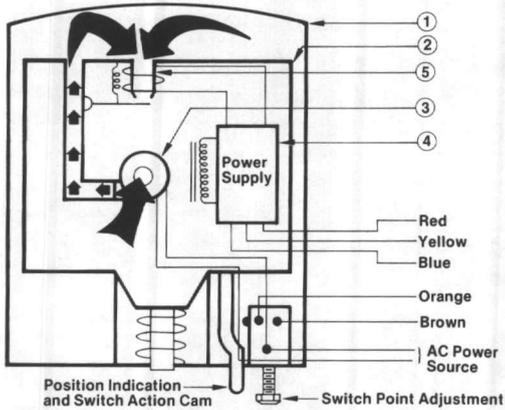


Figure 8. MP Series Actuator

MAINTENANCE

The power unit of the actuator is sealed in oil and requires no maintenance.

REPAIR

MA Series Actuators:

1. Check the actuator by applying the proper supply voltage.
2. The motor should run when power is applied; if not, the actuator is defective and should be replaced.
3. The actuator should extend; if it does not, check the mechanical linkage. Either the mechanical linkage prevents proper action or the actuator is defective.
4. If the linkage moves properly, but the actuator does not extend, replace the actuator.
5. If applying power causes the actuator to perform correctly, the actuator and linkage are functional and the wiring and thermostat should be checked.

MP Series Actuators: Repairs to this device consist mainly of checking the unit wiring and replacement of the

power supply. Other field repairs are not recommended. Use the procedure below to locate a malfunction.

1. The actuator motor should run continually. If it does not run, check the supply voltage and the unit wiring.
2. Voltage between the blue (-) and the red (+) leads should be 20 (+2, -3) Vdc.

NOTE

Only when connected to 8000 controller, adaptor or AD-8969-611.

3. Input voltage on the blue (-) and yellow (+) wires should be between 1 and 15 Vdc. If it is not, refer to EN-111 for service information.

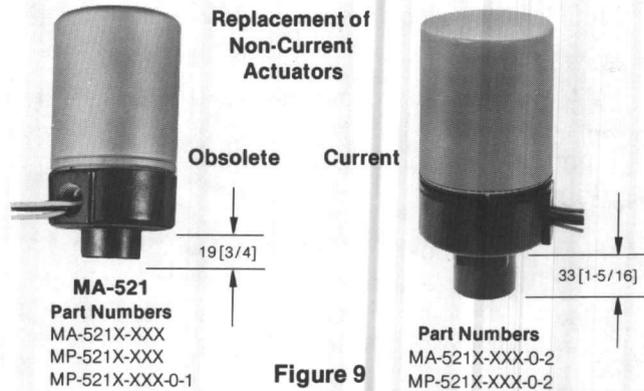


Figure 9

Obsolete or Current Damper Linkage

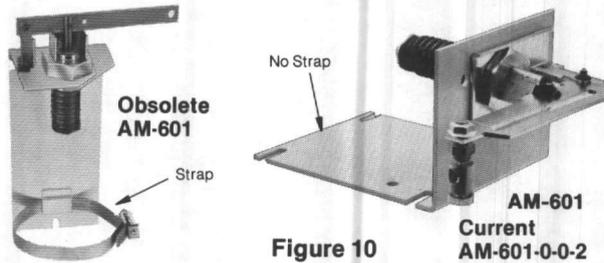


Figure 10

Obsolete Valve Linkages or AV-600 Linkage

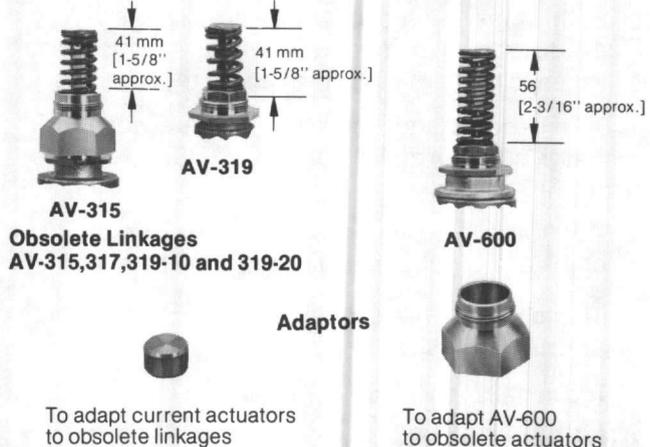


Figure 11

NOTE: When replacing MP-521X-XXX with MP-521X-XXX-0-2 consult EN-111, Section C.1.2.

Barber-Colman Company

ENVIRONMENTAL CONTROLS DIVISION

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APPLICATION

Power supply will provide stable, well regulated 20 Vdc and 5 volt square wave supply for HSP-6181 or HSP-6381 humidity transmitter.

SPECIFICATIONS

DC Output: 20 Vdc ± 1 , 100 mA rating.

Vac Supply: 5 Vac square wave, 0.1 mA rating.

For one HSP-6X81.

Power Requirements: 120 Vac, 6.5 watts.

Environment:

Ambient Temperature Limits,

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

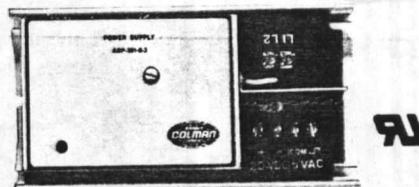
Operating 40 to 140°F (4 to 60°C).

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

Locations, NEMA Type 1 indoor only.

Connections: Coded screw terminals.

ASP-301



Cover: Aluminum.

Mounting:

Unit is provided with plastic track for panel mounting.

Dimensions: 4" high \times 7-1/2" wide \times 3" deep
(102 mm \times 191 mm \times 76 mm).

ACCESSORIES

AD-8912 12" (305 mm) enclosure

APPLICATION

Temperature, pressure 0 to 100% or humidity transmitter indicating meters for use with TSP, PP or HSP transmitters.

SPECIFICATIONS

Accuracy: 2% with 1-1/2% repeatability.

Movement: 1 to 11 Vdc except ASP-584 which has 0 to 10 Vdc movement.

Construction: Plastic cover, black with clear face.

Environment:

Ambient Temperature Limits,

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

Operating 40 to 140°F (4 to 60°C).

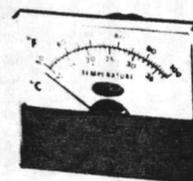
Humidity, 5 to 95% RH, non-condensing.

Locations, NEMA Type 1 indoor only.

Connections: Coded screw terminals.

Mounting: Local or remote. See mounting layout dimensions.

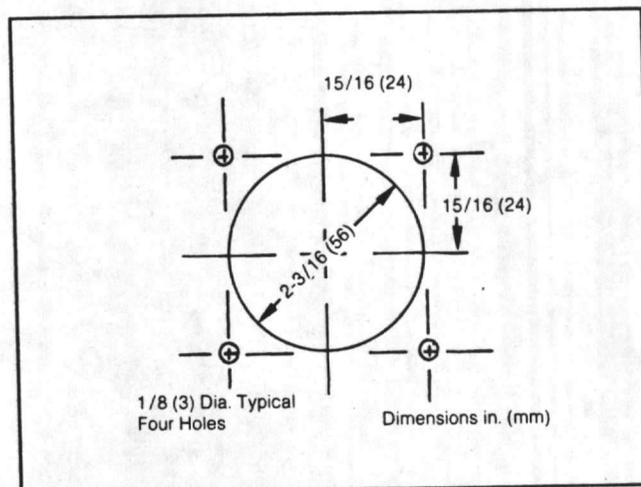
Dimensions: 2-3/4" high \times 3-1/4" wide \times 1-1/8" deep
(70 mm \times 83 mm \times 29 mm). 2-1/2" (64 mm) scale. See mounting layout dimensions.

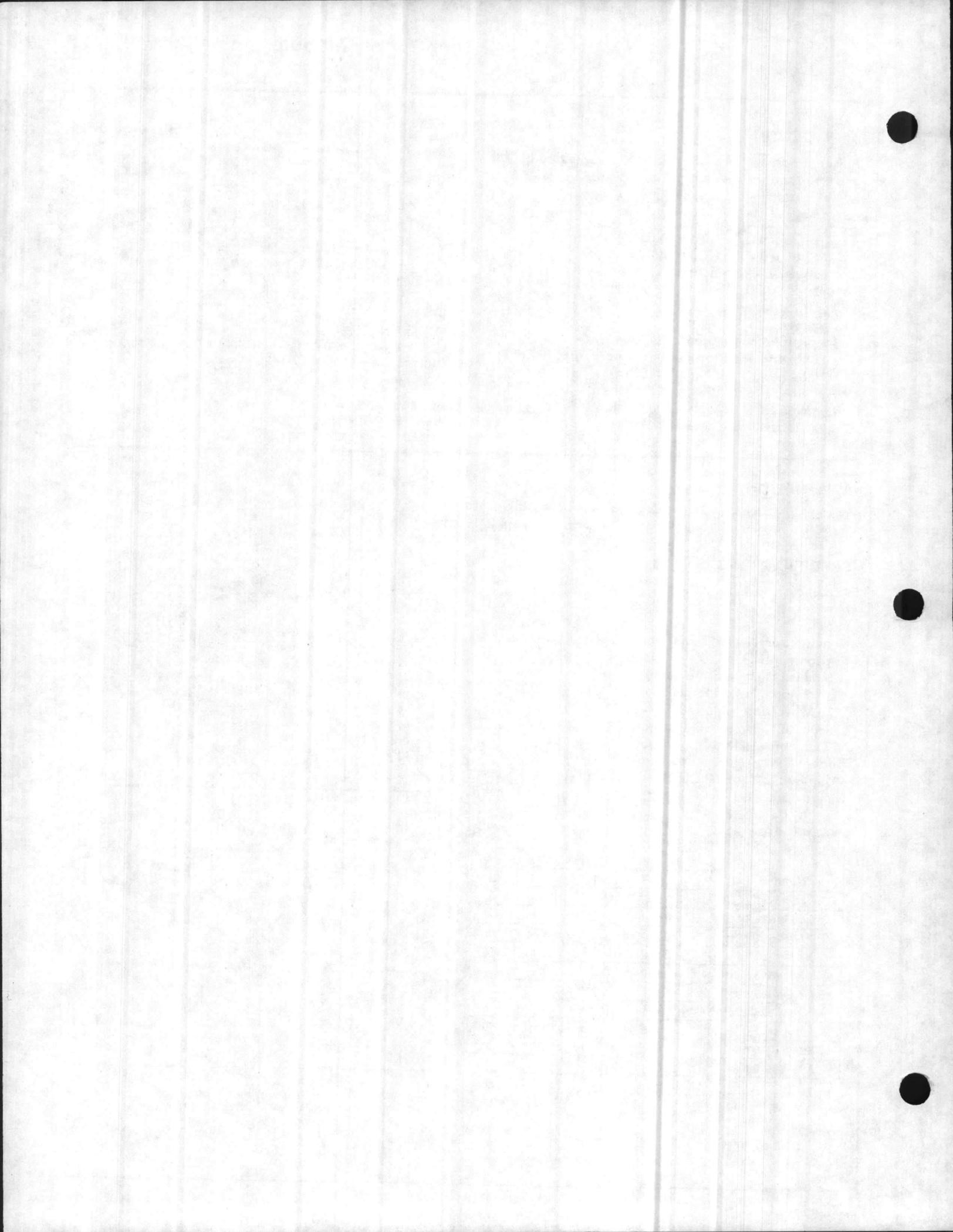


ASP-521 shown

ASP-521
ASP-522
ASP-561
ASP-562
ASP-563
ASP-581
ASP-584 Series
ASP-589-015
ASP-589-060

Part Number	Scale Range Dual Marked	
	°F	°C
ASP-521	50 to 100	10 to 38
ASP-522	30 to 80	1 to 26
ASP-561	-40 to 160	-40 to 71
ASP-562	0 to 200	-17 to 93
ASP-563	40 to 240	4 to 116
ASP-581	20 to 80% RH	
ASP-584	0 to 100%	
ASP-584-101	0 to 100% Closed-Open	
ASP-589-015	0 to 1-1/2" (0 to 3.8 cm) H ₂ O	
ASP-589-060	0 to 6" (0 to 15.2 cm) H ₂ O	







Solid State Humidity Transmitters

**TYPE: HSP-6181 (Room)
HSP-6381 (Duct)**

GENERAL INFORMATION

These wide range, solid state humidity transmitters produce a linear 1–11 VDC output signal in response to changes in the measured variable. They are normally used in conjunction with a solid state two-input controller (CP-8102) for control and indication of variables in air conditioning systems. The transmitters may also be used with appropriate meter and a DC power supply for indication only. Also, the linear 1–11 VDC output signal can be used for humidity indication in automation consoles.

SPECIFICATIONS

Ambient: *70 to 80°F for $\pm 3\%$ R.H. accuracy.

***NOTE:** HSP humidity transmitter will operate in ambient temperatures from 45 to 120°F. However, ambient variations result in approximately 1% error per 5°F ambient variation (direct-acting) above or below 75°F.

Range: 20 to 80 $\pm 3\%$ R.H.

Output:** 1 to 11 VDC, direct-acting. Impedance is approximately 17 ohms.

****NOTE:** Table 1 shows the correct transmitter output voltages that will be experienced over the entire 60% span at various points of R.H.

TABLE 1 % RH VS OUTPUT VOLTAGE

% RH	20	25	30	35	40	42	44	46	48	50	52	54	56	58	60	65	70	75	80
DC Volts	1.0	1.83	2.67	3.50	4.33	4.67	5.00	5.33	5.67	6.0	6.33	6.67	7.0	7.33	7.67	8.50	9.33	10.17	11.0

Power Requirements: (Room or Duct Type)

20 VDC $\pm 1/2$ volt regulated at 26 milliamps, 5 volt square wave AC at 0.1 milliamp.

Wire Size: Wire size for transmitter run to local panel is not critical for distances up to 250ft. No. 18 low voltage cable is suitable. Refer to Table 2.

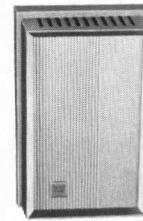


Figure 1. HSP-6181 Room Humidity Transmitter

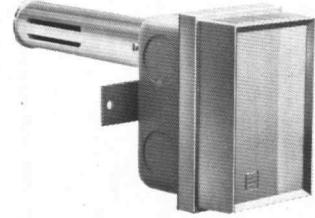


Figure 2. HSP-6381 Duct Humidity Transmitter

ADJUSTMENTS

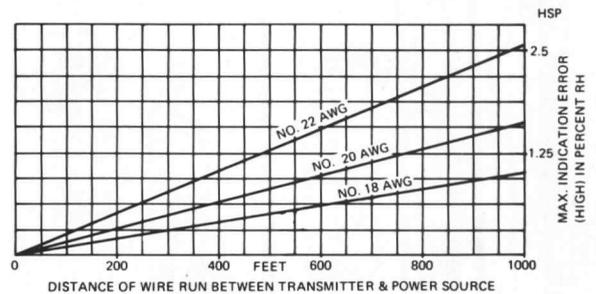
All humidity transmitters are factory calibrated and should not require any field calibration. Refer to EN 111 for service.

CONSTRUCTION

Room Type: (Figure 1) These transmitters consist of a solid state amplifier and built-in wide range resistance sensing element on a printed circuit board, with suitable housing for wall installation containing factory set span and calibration adjustments. Setpoint adjustment on control applications is made at the two-input controller (CP-8102).

Duct Type: (Figure 2) These transmitters consist of a solid state amplifier and built-in wide range resistance sensing element on a printed circuit board with suitable housing for duct installation containing factory set span and calibration adjustments. Setpoint adjustment on control applications is made at the two-input controller (CP-8102).

TABLE 2. INDICATOR ERROR VS. WIRE LENGTH



CALIBRATION

1. Apply +20 VDC (red and blue leads) and 5 volt square wave (purple and blue leads) to the HSP-6000. Apply +20 VDC to terminals +20 and COM of the CP-8102.
2. Adjust the CP-8102 setpoint A dial to agree with ASP-500 Series meter indicator reading. Set throttling range on the CP-8102 to 3°F.
3. Connect a VOM (10,000 ohms per volt) to OP1 and COM terminals of CP-8102. Adjust bridge A calibration potentiometer until a CP-8102 output of 7.5 VDC is obtained.
4. System calibrated.

SERVICE

1. Check wiring per wiring diagram.
2. Measure +20 VDC supply using a VOM (10,000 ohms per volt) between +20 and COM of both the HSP-6000 and CP-8102.
3. Connect a VOM between OP1 and COM of CP-8102. A 1 to 15 VDC output reading should be obtained by rotating setpoint A from fully CCW to CW position.
4. Consult EN 111 for additional information.

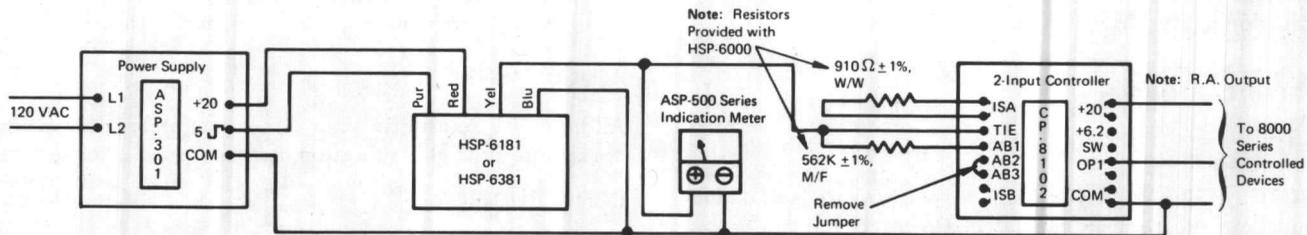


Figure 3

Barber-Colman Company
CONTROLS DIVISION

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



General Instructions

HC-101, HC-101-404, HC-201 Electric Controller Room and Duct Humidistat Two-Position

APPLICATION

For low or line voltage on-off control of humidifiers, dehumidifiers, valves, solenoid valves, compressors, relays, etc.

SPECIFICATIONS

Control Dial Settings: See Table 1.

Humidity Sensing Element: Nylon ribbon.

Differential: See Table 1.

Environment:

Ambient Temperature Limits, See Table 1.

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

Atmosphere, NEMA 1, indoor location only.

Electrical Switch: Snap-acting SPDT.

Ratings, See Table 2.

Connections: See Table 1.

Cover: See Table 1.

Mounting:

HC-101, Flush or surface switch boxes or, for 24V only, directly to wall.

HC-201, In any position on the outside surface of return air duct.

Dimensions: See Table 1.

OPTIONS

For metal covers, specify HC2-101, HC2-101-404.

ACCESSORIES

For HC-101 only

- AT-504 Aux. mounting base
- AT-505 Wall box cover plate
- AT-546 Aux. mounting base
- AT-1103 Wire guard
- AT-1104 Cast guard
- AT-1105 Plastic guard
- AT-1155 Plastic guard
- AT-1165 Plastic guard



HC-101



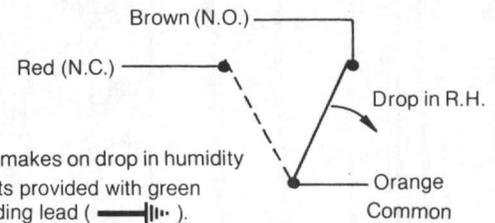
HC-101-404



†Only models with metal covers are CSA certified.



HC-201



Switch Action and Terminal Identification

TABLE 1. SPECIFICATIONS

Part No.	Description	Scale Range % RH	Differential % RH	Ambient Limits °F (°C)		Connections	Cover	Dimensions inches (mm)
				Operating	Shipping & Storage			
HC-101 HC-101-404*	Room	10 to 90	5	40 to 125 (4 to 52)	-40 to 140 (-40 to 60)	6" (150 mm) Color Coded Leads	Beige Plastic	4-3/8 × 2-7/8 × 1-5/8 (111 × 73 × 41)
HC-201	Duct	15 to 95	5	40 to 125 (4 to 52)	-40 to 140 (-40 to 60)	Coded Screw Terminals	Metal	4-3/4 × 6-1/2 × 2-1/4 (121 × 165 × 57)

*Internal lock setpoint, blank cover and lock cover screw.

TABLE 2. ELECTRICAL RATINGS

AC Volt 50/60 Hz	FLA	LRA	Resistive Amps	Pilot Duty VA
24	—	—	8	60
120	7.2	43.2	8	345
240	3.6	21.6	8	345

INSTALLATION

HC-101 models require upright mounting on a flat vertical surface. Locate the unit where it will be exposed to unrestricted circulation of air, which represents the average humidity of the controlled space.

Avoid locations where excessive moisture, corrosive fumes, vibration or high ambient temperatures are present.

PROCEDURE

Unit may be installed on either a flush switch box, or a surface switch box, or directly on a wall (for the 24 volt applications only).

1. Pull the required wires.
2. Make all electrical connections in accordance with job wiring diagram and in compliance with national and local electrical codes.
3. To install, cover must be removed. Pull dial knob off, loosen screw and remove cover.
4. Mount with Number 6 screws provided for switch box mounting. Different screws are required for wall mounting.
5. Re-install cover, tighten screw and replace dial knob. For **HC-101-404** model, before re-installing cover, turn the dial plate to desired setting and if locked dial setting is required, tighten dial lock screw (see Figure 4).

All dimensions in inches with millimeters in brackets

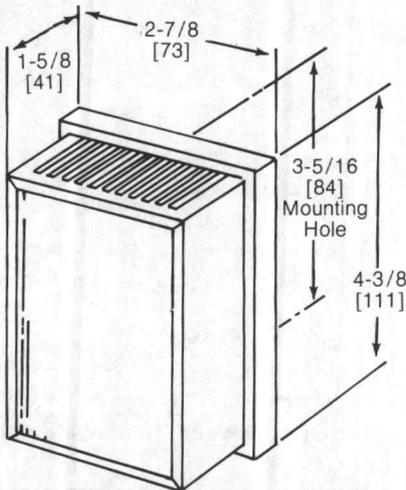


Figure 1. HC-101 Room Type Mounting Dimensions

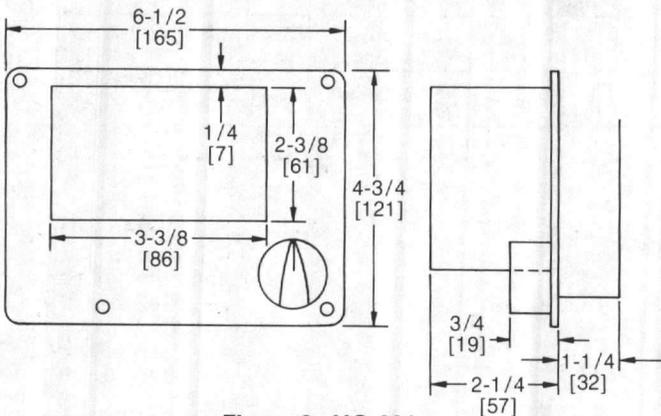


Figure 2. HC-201

HC-201 may be mounted in any position on the outside surface of the return air duct where it is exposed to freely circulating air (horizontal mounting is preferred).

Avoid locations where excessive moisture, corrosive fumes, vibration or high ambient temperatures are present.

PROCEDURE

See Figure 3 for template dimensions for mounting.

1. Remove adhesive from the back of mounting template and press template to desired mounting location on duct.
2. Drill the four mounting holes as indicated on template, using No. 30, 1/8 inch (3 mm) diameter drill.
3. Cut out center portion of duct as outlined on template.
4. Using mounting screws provided, mount to the duct.
5. Make all electrical connections in accordance with job wiring diagram and in compliance with national and local electrical codes.
6. Turn dial knob to desired setting. If locked dial setting is desired, remove dial knob, tighten the dial lock screw and replace knob (see Figure 3).

REPAIR

Field repair of the humidistat is NOT recommended. Units are factory calibrated and field calibration should not be required or attempted. If system does not function properly and the malfunction is traced to the humidistat, it should be replaced.

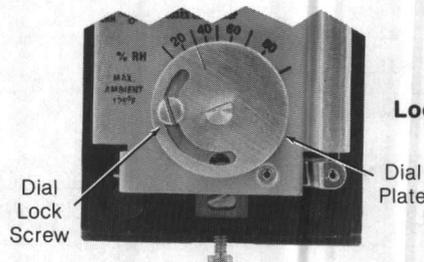
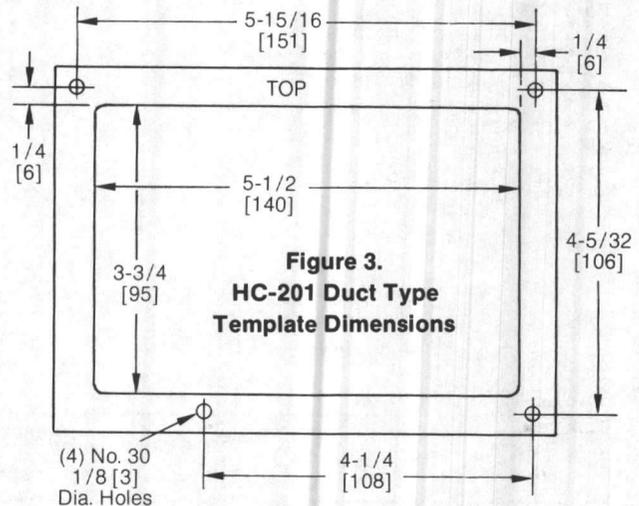


Figure 4. Locking Dial Feature

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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

2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 1. Select **Valve Body** including **P Code** (Valve Size, Cv Rating, Port Code) or select **Valve Assembly** with correct Input Signal (see Table 3 also) less Actuator Code (XXX) including the **P Code** (Size, Cv Rating, Port Code). (See Pages 331-335 for Valve Sizing.)

		APPLICATION			
		Chilled or Hot Water 281°F Max. 35 psig Steam	Hot Water 300°F Max. 100 psig Steam	Hot Water 366°F Max. 150 psig Steam	
		Screwed	Flanged	Screwed	
					
Normally Open Valves	Size	1/2"–2"	2-1/2"–4"	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 2-15 Vdc Input, System 8000	VS-9213-XXX-4-P	VS-9213-35X-5-P	VS-9253-XXX-4-P	VS-9273-XXX-4-P
	Valve Assembly, Built-in System 8000 Controller	VS-9213-35X-4-P	VS-9213-35X-5-P	VS-9253-35X-4-P	VS-9273-35X-4-P
	2-Position SPST Valve Assembly	VA-9213-2XX-4-P	—	VA-9253-2XX-4-P	VA-9273-2XX-4-P
Normally Closed Valves	Size	1/2"–2"	2-1/2"–4"	1/2"–2"	1/2"–2"
	Valve Body	VB-9223-0-4-P	VB-9223-0-5-P	VB-9263-0-4-	VB-9283-0-4-P
	Valve Assembly 2-15 Vdc Input, System 8000	VS-9223-XXX-4-P	VS-9223-35X-5-P	VS-9263-XXX-4-P	VS-9283-XXX-4-P
	Valve Assembly, Built-in System 8000 Controller	VS-9223-35X-4-P	VS-9223-35X-5-P	VS-9263-35X-4-P	VS-9283-35X-4-P
	2-Position SPST Valve Assembly	VA-9223-2XX-4-P	—	VA-9263-2XX-4-P	VA-9283-2XX-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 **VS-9223-212-4-8**
- 2. Valve Body **VB-9223-0-4-8**
- Actuator **MP-5210-500**
- Linkage **AV-600**

■ Valve Body Data less P Code (Size, Cv Rating, Port Code) or Valve Assembly less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)

■ P Code (Size, Cv Rating, Port Code)

■ Actuator or Actuator Code (XXX) for Valve Assemblies

■ Valve Linkage

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 Cone			
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°)

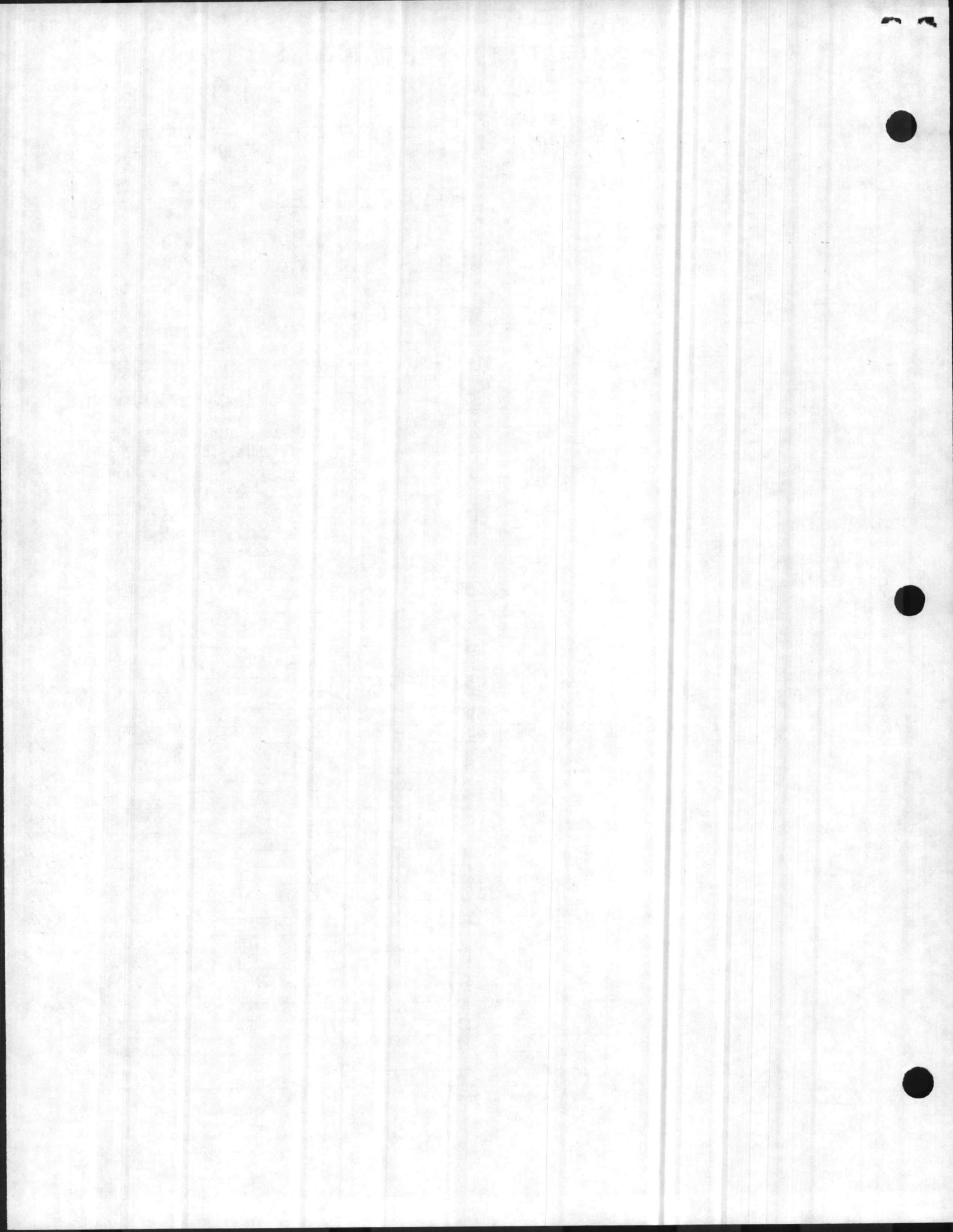
TO SELECT A PORT CODE (P)

P Code	Valve Size	Cv			
-1**	1/2"	0.4		0.4	0.4
-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	1-1/4"	16.0		16.0	16.0
-10	1-1/2"	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		

*Maximum recommended differential pressure in full open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected.

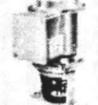
NOTE: Do not exceed close-off rating.

**NOTE: Factory assemblies are not available for 2-position applications using reduced port valve bodies.



2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 2. Select **Actuator Type** or **Actuator Code (XXX)** series with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select **Valve Linkage**.

							
Input Signal					Two-Position SPST	2-15 Vdc System 8000	2-15 Vdc System 8000**
Valve Linkage 1/2" — 1-1/4" Valve					AV-600	AV-600	—
Valve Linkage 1/2" — 2" Valve					—	—	AV-430
Valve Linkage 2-1/2" — 4" Valve					—	—	AV-495
Actuator Code (XXX)					2XX	2XX	35X
Actuator Code					MA-521X-XXX	MP-5X1X	MS-8XX1X-XXX
Normal Position	Factory Avail. Valve Assembly	Valve Body	P Code	Size	CLOSE-OFF PRESSURE RATING*		
Normally Open	VA-9213-2XX-4-P VA-9253-2XX-4-P VA-9273-2XX-4-P VS-9213-XXX-4-P VS-9253-XXX-4-P VS-9273-XXX-4-P	VB-9213-0-4-P VB-9253-0-4-P VB-9273-0-4-P	-1-2-3-4	1/2"	180	190	
			-5-6	3/4"	75	85	
			-7-8	1"	40	45	
			-9	1-1/4"	25	30	
			-10	1-1/2"			65
			-11	2"			35
Normally Open	VS-9213-35X-5-P	VB-9213-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6
Normally Closed	VA-9223-2XX-4-P VA-9263-2XX-4-P VA-9283-2XX-4-P VS-9223-XXX-4-P VS-9263-XXX-4-P VS-9283-XXX-4-P	VB-9223-0-4-P VB-9263-0-4-P VB-9283-0-4-P	-1-2-3-4	1/2"	250	220	
			-5-6	3/4"	140	90	
			-7-8	1"	75	50	
			-9	1-1/4"	45	30	
			-10	1-1/2"			65
			-11	2"			35
Normally Closed	VS-9223-35X-5-P	VB-9223-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6

*Close-off pressure ratings apply when valves are installed with pressure under the seat.

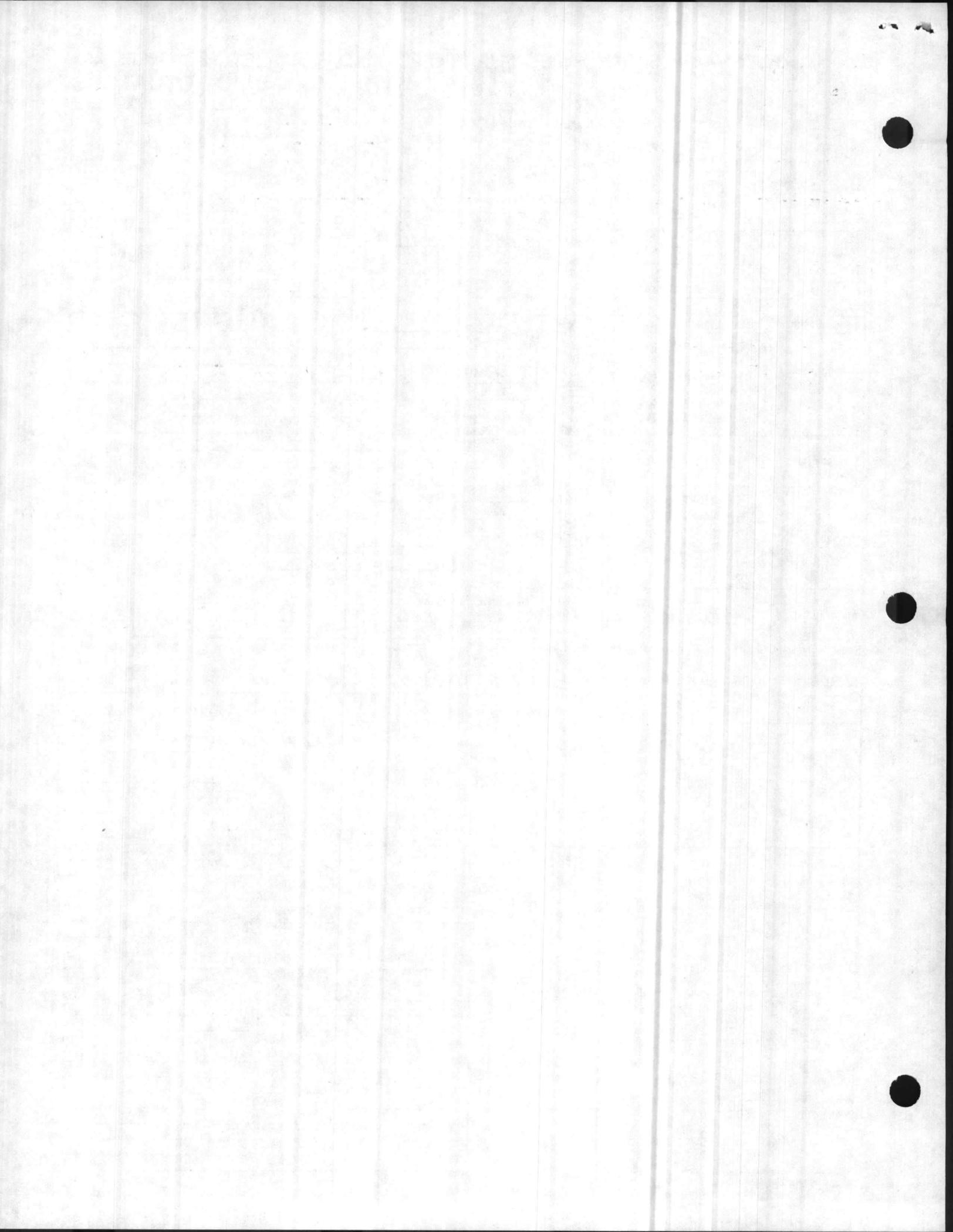
**Certain models have built-in controller.

TABLE 3. Select exact **Actuator** or **Actuator Code (XXX)** if Factory Assembly is available.

Input Signal	Wiring Figure No.	Voltage Vac 50/60 Hz	VA	Aux. Switch	Actuator Part No.	Actuator Code (XXX) For Factory Available Assy
Two-position SPST	See Figure 1 on Page 336	24	18	No	MA-5213	201
		24		Yes	MA-5213-500	202
		120		No	MA-5210	211
		120		Yes	MA-5210-500	212
		208		No	MA-5212	
		208		Yes	MA-5212-500	
		240		No	MA-5211	221
		240		Yes	MA-5211-500	222
2-15 Vdc, System 8000, Stroke occurs 6-9 Vdc approx., Non-positive positioning	See Figure 12 on Page 339	24	18	No	MP-5213	201
		24		Yes	MP-5213-500	202
		120		No	MP-5210	211
		120		Yes	MP-5210-500	212
		208		No	MP-5212	
		208		Yes	MP-5212-500	
		240		No	MP-5211	221
		240		Yes	MP-5211-500	222
2-15 Vdc, System 8000, start 6 Vdc factory set, Adjustable 2-12 Vdc, 3 Vdc span, Positive positioning	See Figure 12 on Page 339	24	18	No	MP-5413	243
		120		No	MP-5410	240
		208		No	MP-5412	
		240		No	MP-5411	241
	See Figure 12 on Page 339	24	36	No	MS-83013	351
		120	37	No	MS-83010	353
		120	37	Yes	MS-83010-500	
		240	39	No	MS-83011	
See Figure 12 on Page 339	240	39	Yes	MS-83011-500		
	120	37	No	MS-84110	354	
	120	37	No	MS-84110-011*		
	120	37	Yes	MS-84110-500		
Built-in System 8000 controller, Uses TS-8XXX sensor	See Figure 19 on Page 343	24	36	No	MS-84113	

*Includes TS-8201-105 sensor.

VALVES



2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 4. Dimensions

Part Number	DIMENSIONS (Inches)					
	Size	Valve Body			Actuator Series	
		A	B	C	200*	350
VA-9213-2XX-4-P	1/2"	3		1	8-3/16	
VA-9253-2XX-4-P	3/4"	3-5/8		1-3/8	8-11/16	
VA-9273-2XX-4-P	1"	4-5/8		1-1/2	9	
VS-9213-XXX-4-P	1-1/4"	4-5/8		1-5/8	9	
VS-9253-XXX-4-P	1-1/2"	6-1/8		2-1/2		19-1/8
VS-9273-XXX-4-P	2"	6-1/8		2-1/2		19-1/8
VS-9213-35X-5-P	2-1/2"	8-1/2		3-1/2		19-13/16
	3"	9-1/2		3-3/4		20-3/16
	4"	11-1/2		4-1/2		21-7/16
VA-9223-2XX-4-P	1/2"	3		1-7/16	8-3/16	
VA-9263-2XX-4-P	3/4"	3-5/8		1-3/4	8-11/16	
VA-9283-2XX-4-P	1"	4-5/8		2	9	
VS-9223-XXX-4-P	1-1/4"	4-5/8		2	9	
VS-9263-XXX-4-P	1-1/2"	6-1/8		3-3/16		18-5/8
VS-9283-XXX-4-P	2"	6-1/8		3-3/16		18-5/8
VS-9223-35X-5-P	2-1/2"	8-1/2		4-1/8		19-7/16
	3"	9-1/2		4-1/8		19-13/16
	4"	11-1/2		5-1/16		20-7/16

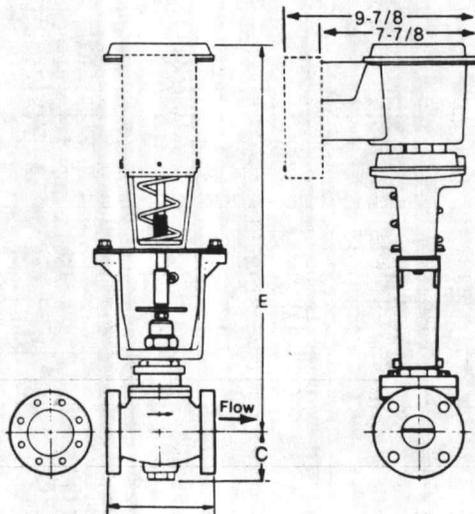
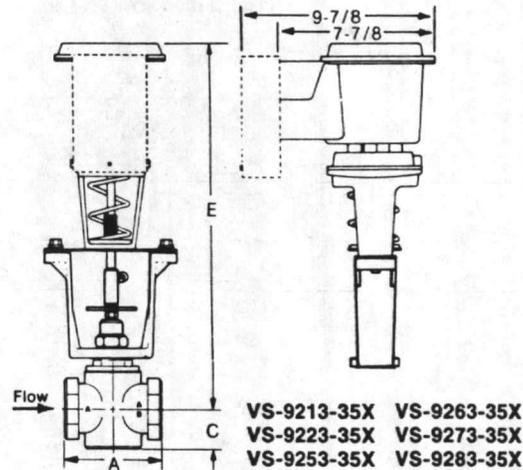
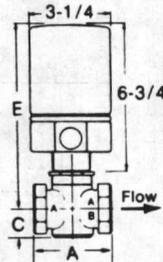
*Add 21/32" (52 mm) to the "E" dimension for a valve assembly using an AV-601 linkage extension that must be purchased separately.

Dimensions in inches (metric conversion 25.4 mm = 1 inch)

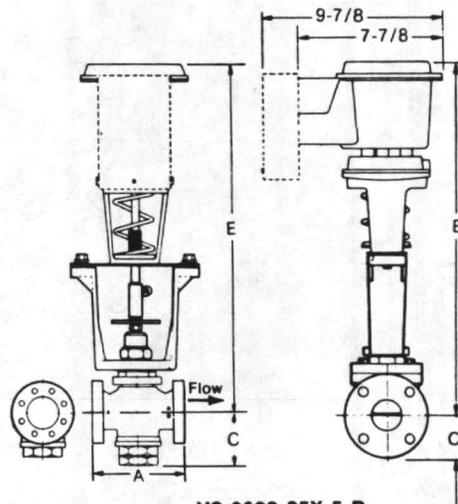
NOTE: Allow 3 inches clearance above actuator for removal. Mount MA/MP-5XXX actuators above the valve body at 45° from vertical on steam applications.

VALVES

- VS-9213-2XX VA-9213-2XX
- VS-9223-2XX VA-9223-2XX
- VS-9253-2XX VA-9253-2XX
- VS-9263-2XX VA-9263-2XX
- VS-9273-2XX VA-9273-2XX
- VS-9283-2XX VA-9283-2XX

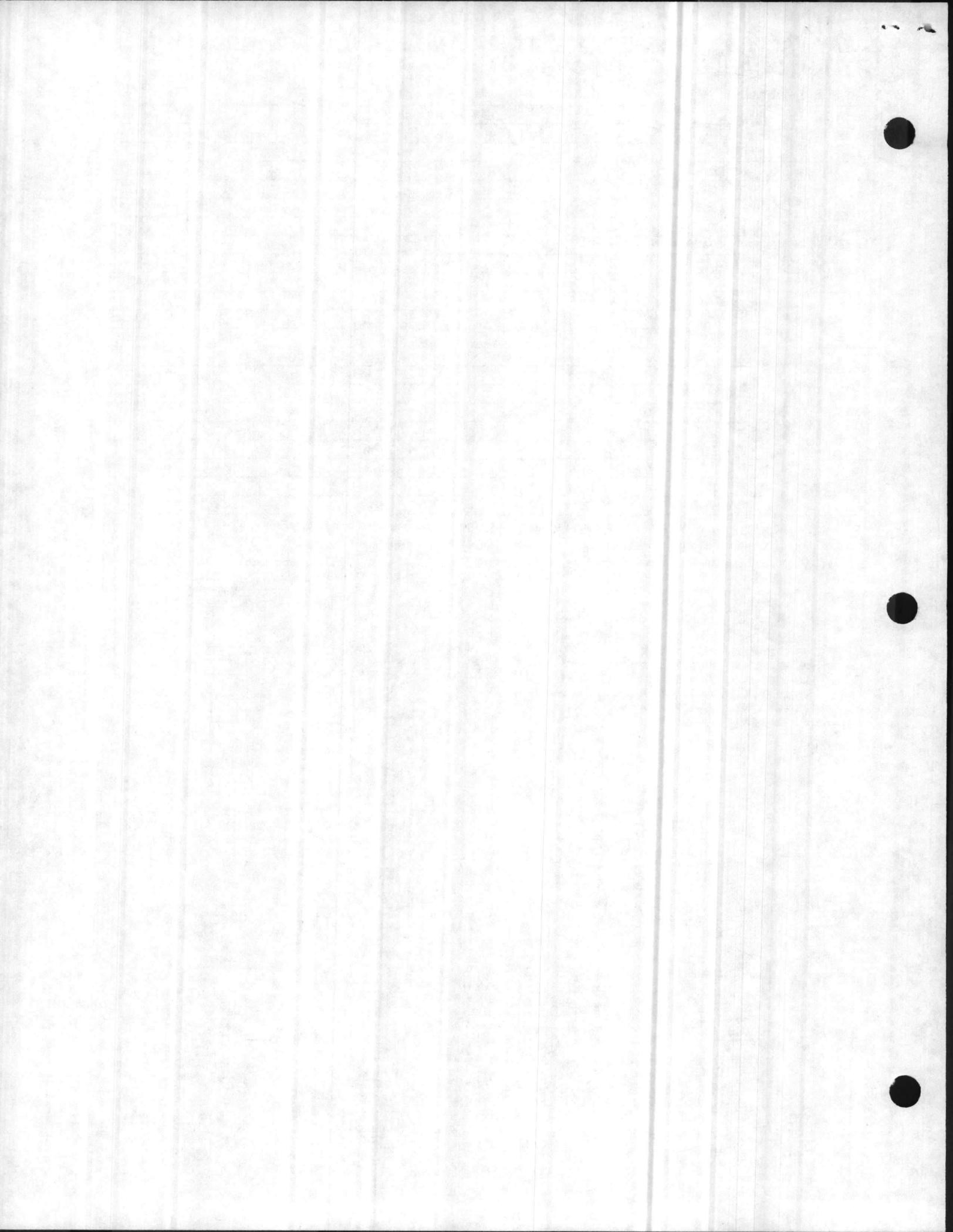


VS-9213-35X-5-P



VS-9223-35X-5-P

See Flange Detail Table on following page





General Instructions

TF-1111 Floating Neutral Center Electric Room Thermostat

APPLICATION

Room thermostat for floating control of MF-1233 series actuators.

SPECIFICATIONS

Setpoint Dial Range*: 55 to 85°F (13 to 29°C)

Sensing Element: Bimetal.

Control Span: 4°F (2°C).

Anticipation: Heating and cooling, factory installed resistors.

Electrical Switch: SPDT floating off.

Ratings: For use with MF-1233 only.

Connections: Color coded 6" leads.

Cover: Beige plastic as standard.

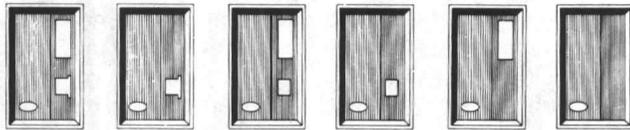
Mounting: Flush or surface 2 x 4 switch box or directly to wall.

Dimensions: 4-3/8" high x 2-7/8" wide x 1-5/8" deep
(111 mm x 73 mm x 41 mm).

*Dual marked, dial stop pins included to limit setpoint range.

OPTIONS

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



Standard -400 -401++ -402++ -403++ -404++

++ 5/64" Allen screw used to secure cover.

ACCESSORIES

- AT-101 Lock cover kit
- AT-104 Dial stop pins (Note: pins included with each unit)
- 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

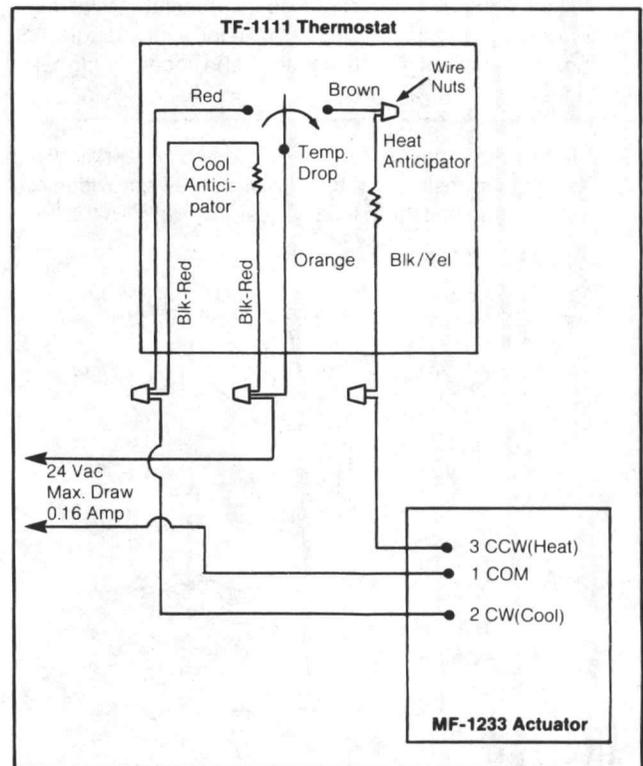
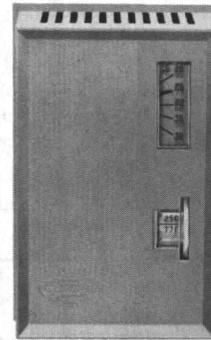


Figure 1. Switch Action and Typical Wiring

INSTALLATION

Requirements

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. The minimum recommended air velocity over the thermostat is 10 feet per minute.

CAUTION

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.)

CAUTION

Make electrical connections to thermostat. Make all connections in accordance with the job wiring diagram and in compliance with national and local electrical codes.

2. Remove thermostat cover by loosening cover screw and fasten thermostat to switch box with screws provided or to wall (obtain fasteners locally). See Figure 2.
3. Attach thermostat cover.

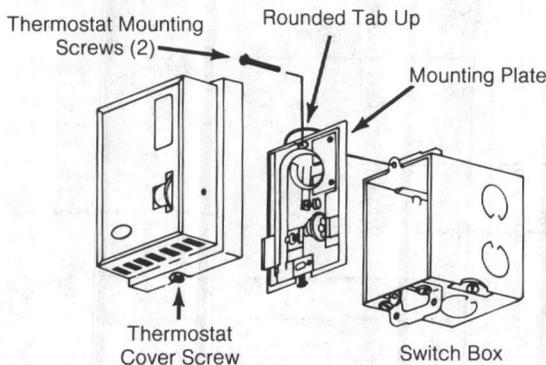


Figure 2. Installation

CHECKOUT

After installing a thermostat, make an initial check of the switching action. Verify the switch action by using a voltmeter between the proper sides of the switch.

1. Run the setpoint dial to a temperature above ambient. This should cause the thermostat to make a circuit between orange and brown leads.
2. Slowly turning the setpoint dial setting to a lower temperature will first break the circuit between orange and brown leads. The contact blade will be in a neutral position between the two contacts (not making a circuit to either contact). Turning the setpoint further down to a lower temperature will cause the thermostat to make a circuit between orange and red leads.

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. Turn off control power.
2. Set temperature dial to the room temperature, as read from an accurate thermometer.
3. Remove cover. 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 (red lead) contact, use a 1/8-inch blade screwdriver to turn calibration screw counterclockwise (looking at head of screw) until blade floats between contacts.

Note: Each complete turn of screw changes calibration approximately 15°F. If contact blade is originally made to the right (brown lead) contact, turn calibration screw slowly clockwise until element floats between contacts. Thermostat is now properly calibrated.

5. Replace thermostat cover.
6. Turn on control power.
7. Recheck calibration after 4 hours to be sure heat from handling did not result in erroneous setting.

MAINTENANCE

Be sure that the air convection holes in the thermostat cover do not become clogged or covered. This causes improper temperature sensing.

After long periods of continual use, it may become necessary to clean the contacts of any excess contact build-up. Before proceeding, be sure that either the electrical connections to the thermostat are disengaged or that the power to the circuit is broken. Now clean the contacts using Tool-13 contact burishing tool.

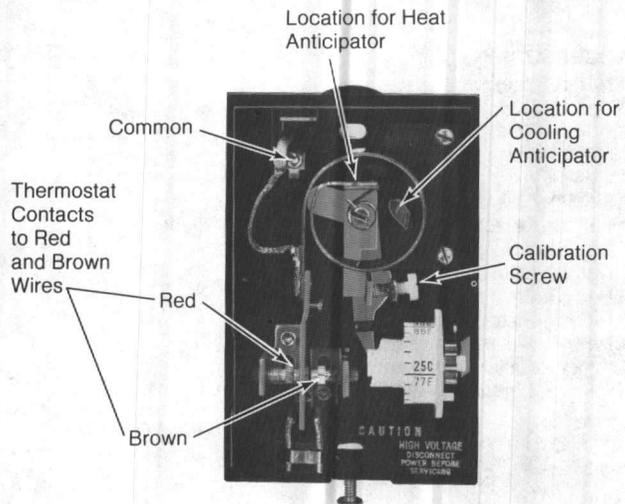


Figure 3. Thermostat Less Cover

REPAIR

The thermostat should not be field repaired. 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

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



MULTISTAGE THERMOSTATS AND SUBBASES FOR CONVENTIONAL SYSTEMS

INSTRUCTIONS

INSTALLATION INSTRUCTIONS FOR THE TRAINED SERVICE TECHNICIAN

APPLICATION

The HH07AT Thermostats provide 24 to 30 Vac control for conventional heating/cooling systems as follows.

HH07AT	170	172	174	176	177
Heating Stages	2	2	1	—	2
Cooling Stages	1	2	1	1	1

The HH93AZ Subbases provide wiring terminals, system and fan switching, and mounting bases for HH07AT Thermostats as follows.

HH93AZ MODEL	SWITCH POSITIONS	
	SYSTEM	FAN
178, 179, 180, 184	HEAT-OFF-COOL	AUTO-ON
170	NONE	NONE
176, 177, 189	OFF-HEAT-AUTO-COOL	AUTO-ON
172	OFF-HEAT-AUTO-COOL	NONE
190	OFF-COOL	LO-HI-CONT.

OPERATION

On a 2-heat thermostat, the two stages of heat "make" sequentially as the temperature drops. "Make" refers to the mercury switch initiating a call for heat or cool.

There is about 2 F [1.1 C] between stages so that the second stage makes only when the first stage can't handle the load. This is the interstage differential.

The LED indicators are light emitting diodes on the subbase which light up when something specific happens within the system.

Up to 4 of the LEDs listed below may be included on your subbase. When an LED lights up, refer to this list for the meaning.

FILTER—clogged filter needs replacement.

LOCKOUT—system is shut down; needs maintenance.

CHECK—system needs to be checked. See heating system instructions for specific meaning.

SERVICE—see heating system instructions for specific meaning.

LEDs are not field replaceable or addable.

INSTALLATION

WHEN INSTALLING THIS PRODUCT. . .

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

MOUNTING THE SUBBASE

The thermostat subbase can be mounted on a vertical outlet box, horizontal outlet box, or directly on the wall.

1. If you must mount the subbase on a vertical outlet box, order Part No. 193121A Adapter Assembly (Fig. 1). The assembly includes an adapter ring, two screws, and a cover plate to cover marks on the wall. Install the ring and cover plate on the vertical outlet box.

CAUTION

1. Disconnect power supply to prevent electrical shock or equipment damage.
2. Run wires as close to the subbase as possible. To prevent interference with the thermostat linkage, keep wire length to a minimum. Push excess wire back into the hole, and plug hole to prevent drafts from affecting thermostat operation.
3. Do not overtighten thermostat captive mounting screws as damage to subbase threads may result.
4. Do not short across coil terminals on relay. This may burn out the heat anticipator.

LOCATION

Install the thermostat about 5 ft [1.5 m] above the floor in a well-circulated area of average temperature.

Do not install the thermostat where it may be affected by—

- drafts, or dead spots behind doors and in corners.
- hot or cold air from ducts.
- radiant heat from sun or appliances.
- concealed pipes and chimneys.
- unheated (uncooled) areas behind the thermostat, such as an outside wall.

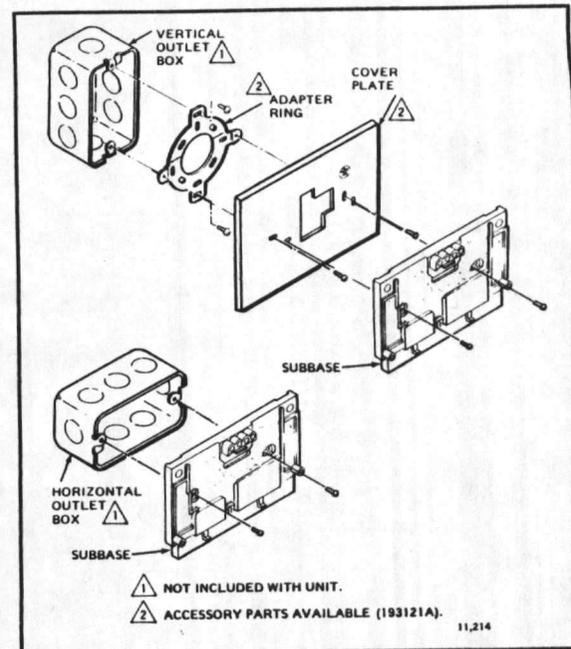
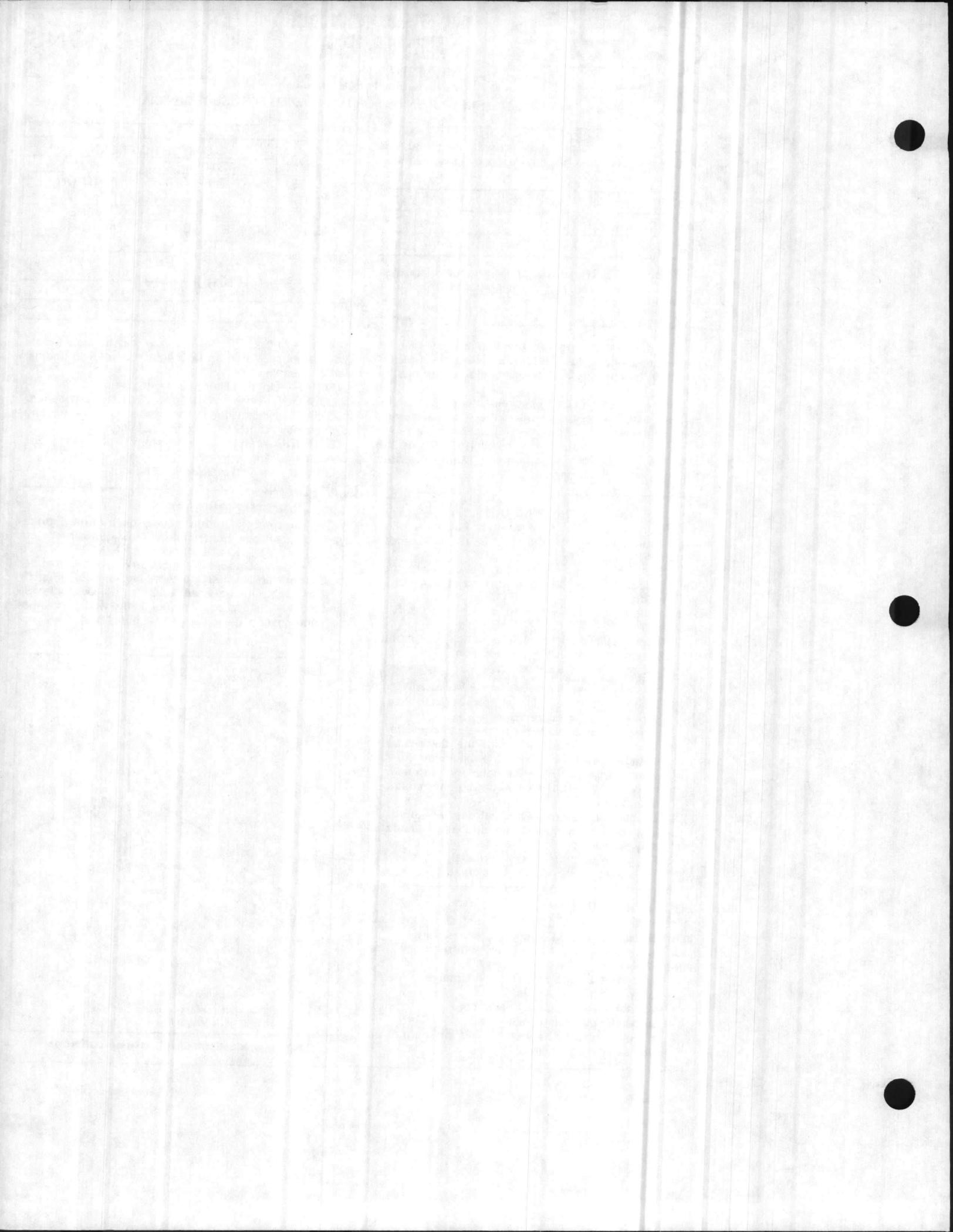


Fig. 1—Installation of subbase on outlet box.



For a wall installation, hold subbase in position and mark holes for anchors (Fig. 2). Wall anchors must be obtained from local hardware store. Take care that the wires do not fall back into the wall opening. Set subbase aside. Drill four 3/16 in. [4.8 mm] holes and gently tap anchors into the holes until flush with the wall.

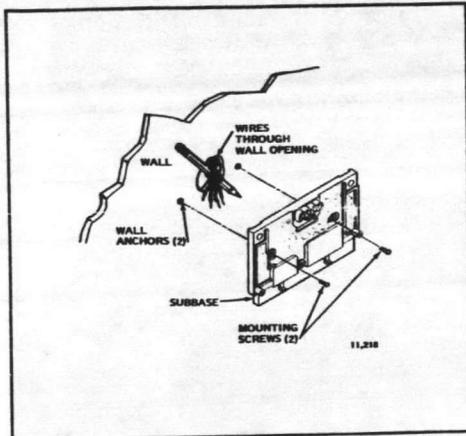


Fig. 2—Installation of subbase on wall.

2. Pull wires through the cover plate (if used) and subbase cable opening (Fig. 3).
3. Secure the cover plate (if used) and subbase with the screws provided. Do not fully tighten the subbase screws.
4. Level the subbase using a spirit level, as shown in Fig. 3, and firmly tighten subbase mounting screws. The subbase mounting holes provide for minor out-of-level adjustments.

IMPORTANT

A subbase incorrectly leveled will cause the temperature control to deviate from set point.

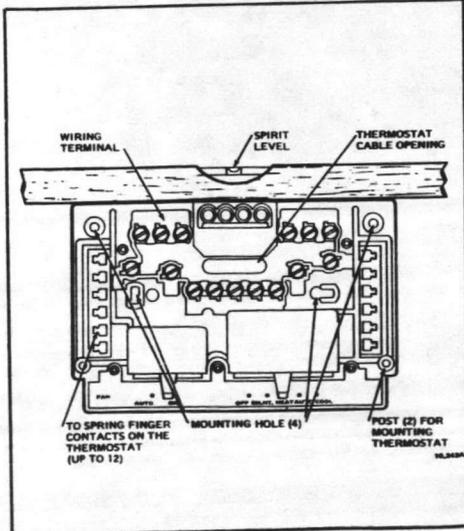


Fig. 3—Leveling the subbase.

WIRING THE SUBBASE

All wiring must comply with local electrical codes and ordinances. Follow equipment manufacturer's wiring instructions when available. To wire subbase, proceed as follows:

1. Connect system wires to the subbase as shown in Figs. 4-13. A letter code is near each terminal for identification. The terminal barrier permits straight or conventional wraparound wiring connections (Fig. 14).

NOTE: If using thermostat model HH07AT174 with single-stage heat and cool, use wiring diagram to correspond with subbase, disregarding reference to H2 and C2 switches, W2 and Y2 terminals.

2. Firmly tighten each terminal screw.
3. Fit wires as close to the subbase as possible. Push excess wire back into hole.
4. Plug hole with nonflammable insulation to prevent drafts from affecting the thermostat.

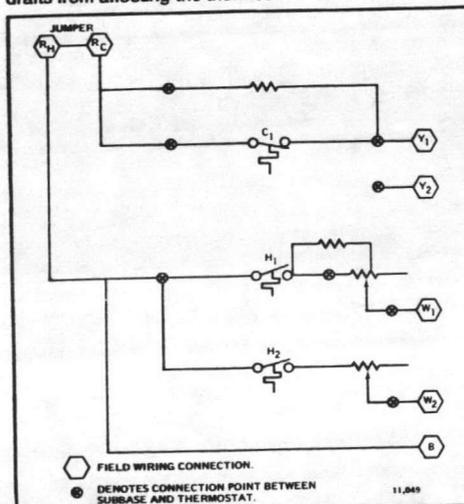


Fig. 4—Internal schematic and typical hookup of Carrier HH93AZ170 Subbase with HH07AT170 Thermostat.

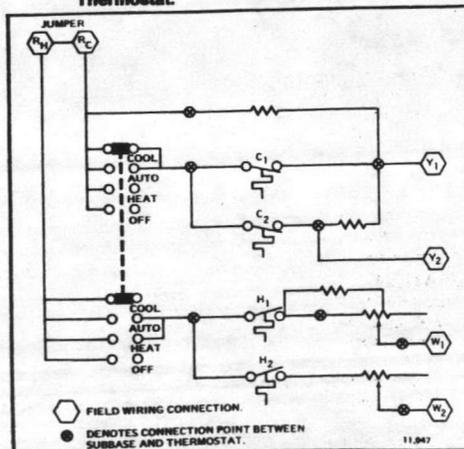


Fig. 5—Internal schematic and typical hookup of Carrier HH93AZ172 Subbase with HH07AT172 Thermostat.

CALIBRATION

THERMOSTAT

Thermostats are accurately calibrated at the factory. THEY DO NOT HAVE PROVISION FOR FIELD CALIBRATION.

THERMOMETER

1. Remove thermostat cover by pulling up from the bottom of cover until it clears the base.
2. Set the cover on a table near an accurate thermometer.
3. After allowing 10 or 15 minutes for stabilization, compare the readings. If they are the same, replace cover and put system into operation. If they are different, recalibrate the thermostat thermometer, step 4.
4. Insert a small screwdriver in the thermometer shaft (Fig. 20) and turn it until the thermometers read the same. When the thermometer is calibrated, replace cover and place system into operation.

NOTE: Hand heat will offset the thermometer reading. After making each adjustment, wait 10 or 15 minutes for the thermometer to stabilize before comparing.

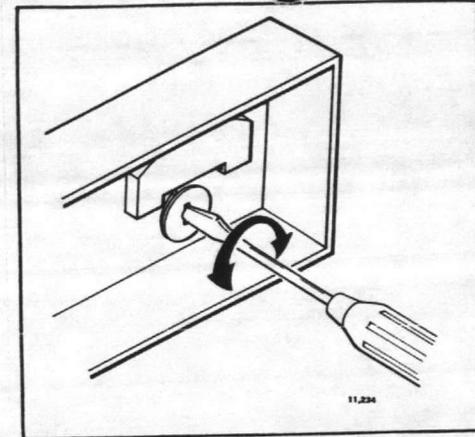
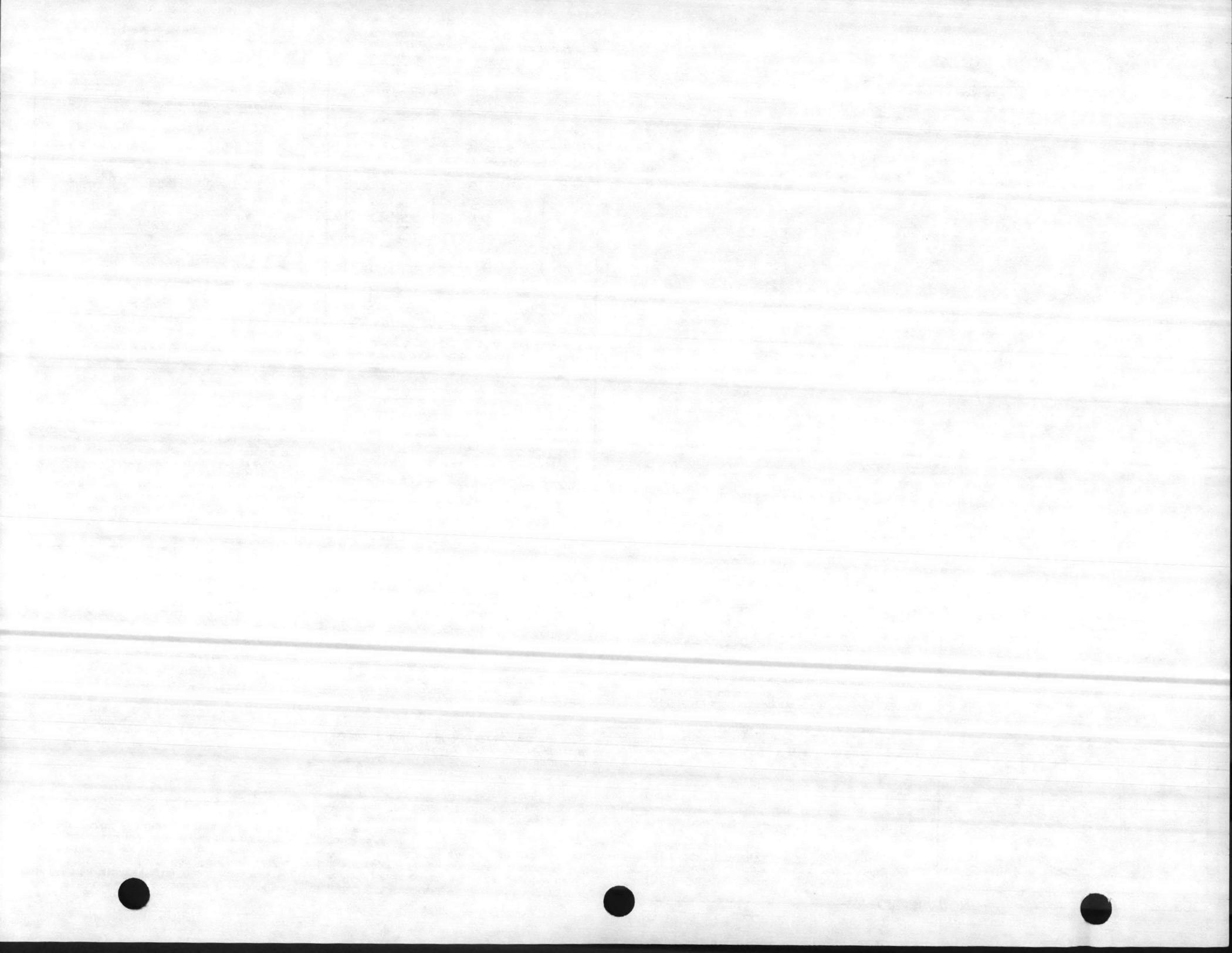


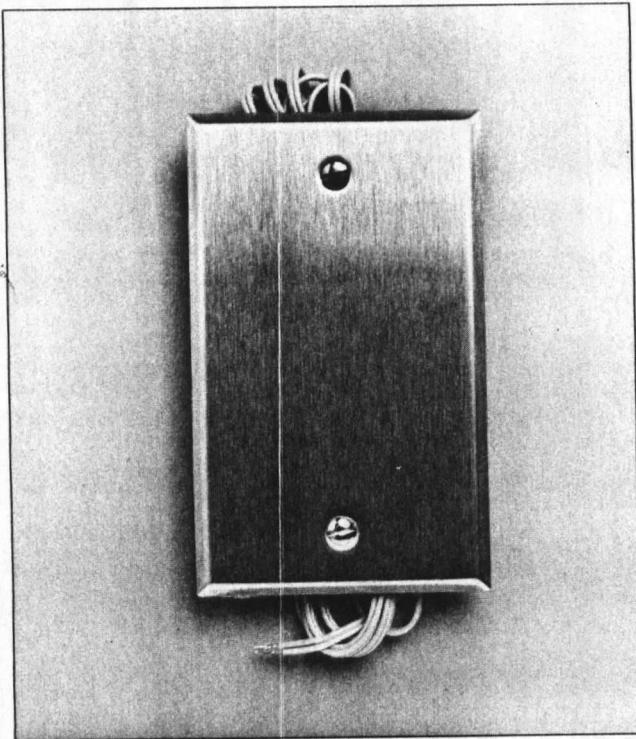
Fig. 20—Thermometer calibration.







Model ST-S◇ Stainless Surface Mount Sensor



General Information

The PreCon Stainless Steel Surface Mount Temperature Sensor provides precision, remote room temperature sensing for building automation systems and mechanical equipment room instrumentation. The active sensing element is highly stable, precision thermistor material accurate to within $\pm.36^{\circ}\text{F}$. Refer to controller literature for overall system accuracy within the specified operating range.

This material is ruggedized to provide moisture/vapor resistance, and is bonded to a 403 stainless steel plate. The back is properly insulated to reduce wall temperature influence. This sensor is meant for interior use only.

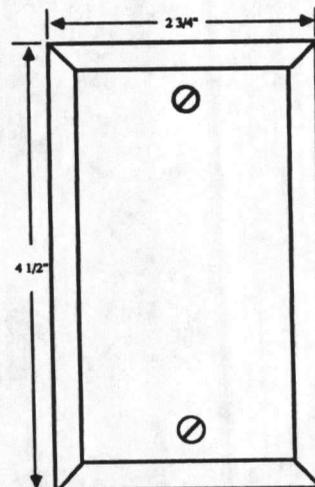
Application Considerations

ST-S◇

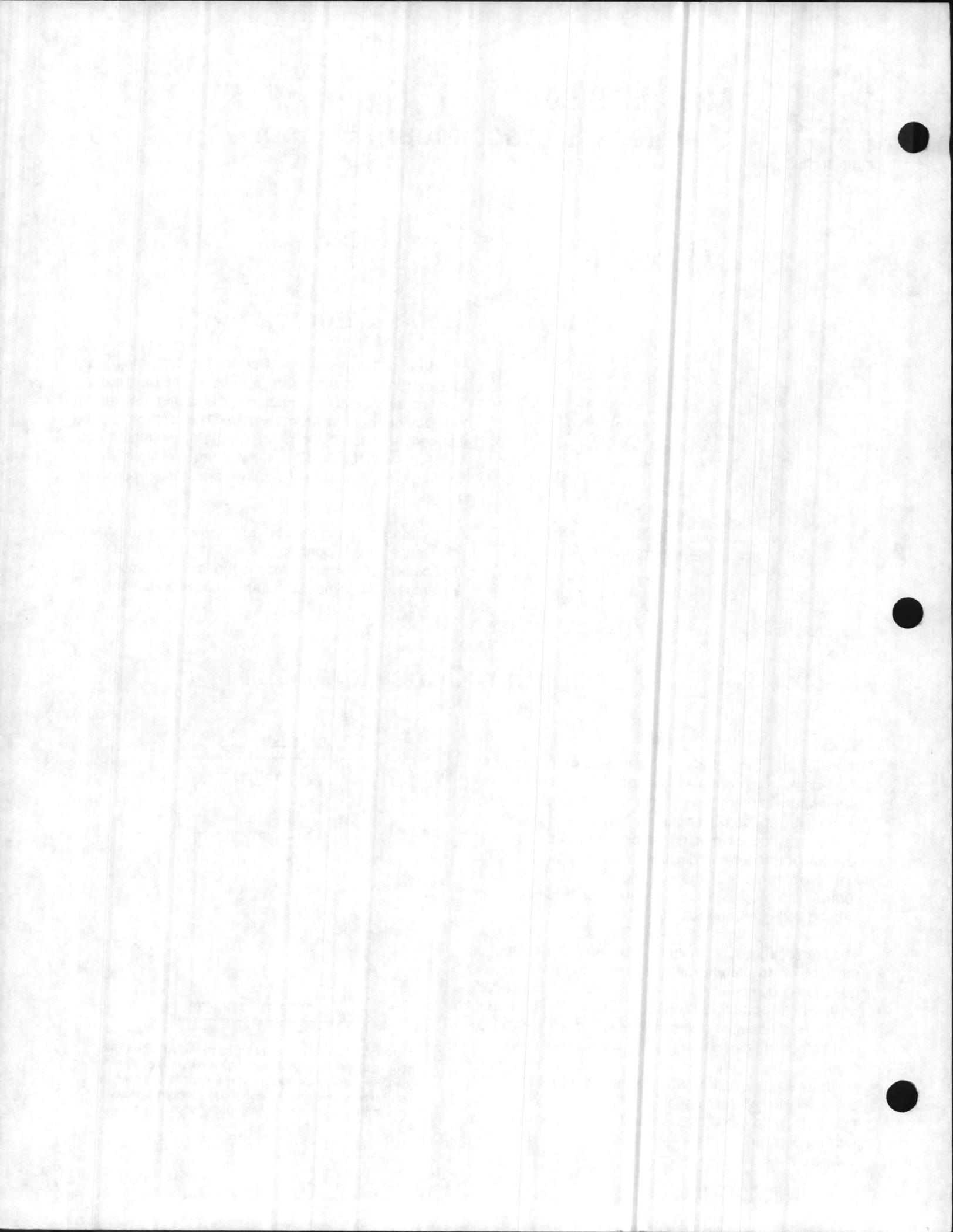
The Stainless Steel Surface Mount Sensor has an insulated back which reduces conductive influence of wall temperatures, yet allows significant convective influences to be sensed. Dampened response to drafts due to the opening or closing of doors to unconditioned spaces or refrigerated display cases, is provided by the high thermal-mass of the sensing plate. This prevents control system over-response, without necessitating anti-hunting software routines.

The sensor should be mounted approximately five feet off the floor, on an interior wall, away from any heat or cooling generating devices. This sensor is meant for interior use only, with an operating range of -30°F to 100°F . It is ideal for use in schools, or cold storage lockers, where vandalism or fork lifts can damage ordinary wall sensors.

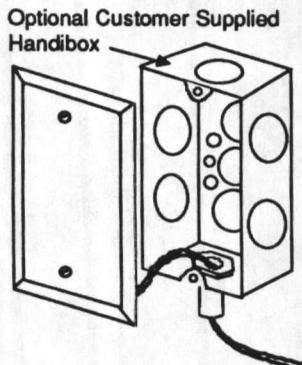
Security screws, option (XS), require special drivers, and are available where tamper-proofing is required beyond that already provided by the standard, featureless stainless steel plate.



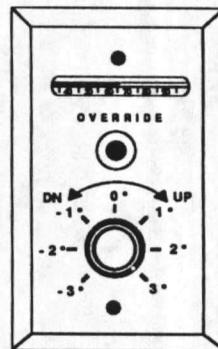
Horizontal or vertical mounting is permitted. The 6-32 screws supplied fit standard electrical boxes. Toggle bolts or other direct wall mount screws can be used where conduit is not required. Tighten down mounting screws, crushing foam gasketing, until plate edges just touch wall.



TYPICAL MOUNTING



Standard Stainless Surface Mount Sensor installed with optional customer supplied handibox.



Stainless Surface Mount Sensor with momentary switch, setpoint adjustment and thermometer options.

SPECIFICATIONS

- Thermistor Type:** Select the thermistor model appropriate for the controller system. Refer to page B25 for performance resistance/temperature data.
- Accuracy:** $\pm .36^{\circ}\text{F}$ from 32°F to 158°F (except 100,000 ohm, see page B25).
- Stability:** $.24^{\circ}\text{F}$ over 5 years.
- Basic Model:** Basic model comes with 8 feet of 22 gauge zipcord lead, stainless steel plate and two 6-32 screws.
- Wiring:** Make electrical connections to the sensor in accordance with the installation wiring diagram for the job and in accordance with national and local electrical codes. Use the full 8 foot lead furnished with the sensor. Crimp type butt splices or solder connections are recommended. (Do Not use wire nuts) Though the sensor itself does not require shielded cable, some controllers and microprocessors do; check with the controller supplier.

ORDERING INFORMATION

Select the required sensor model and add any required option codes

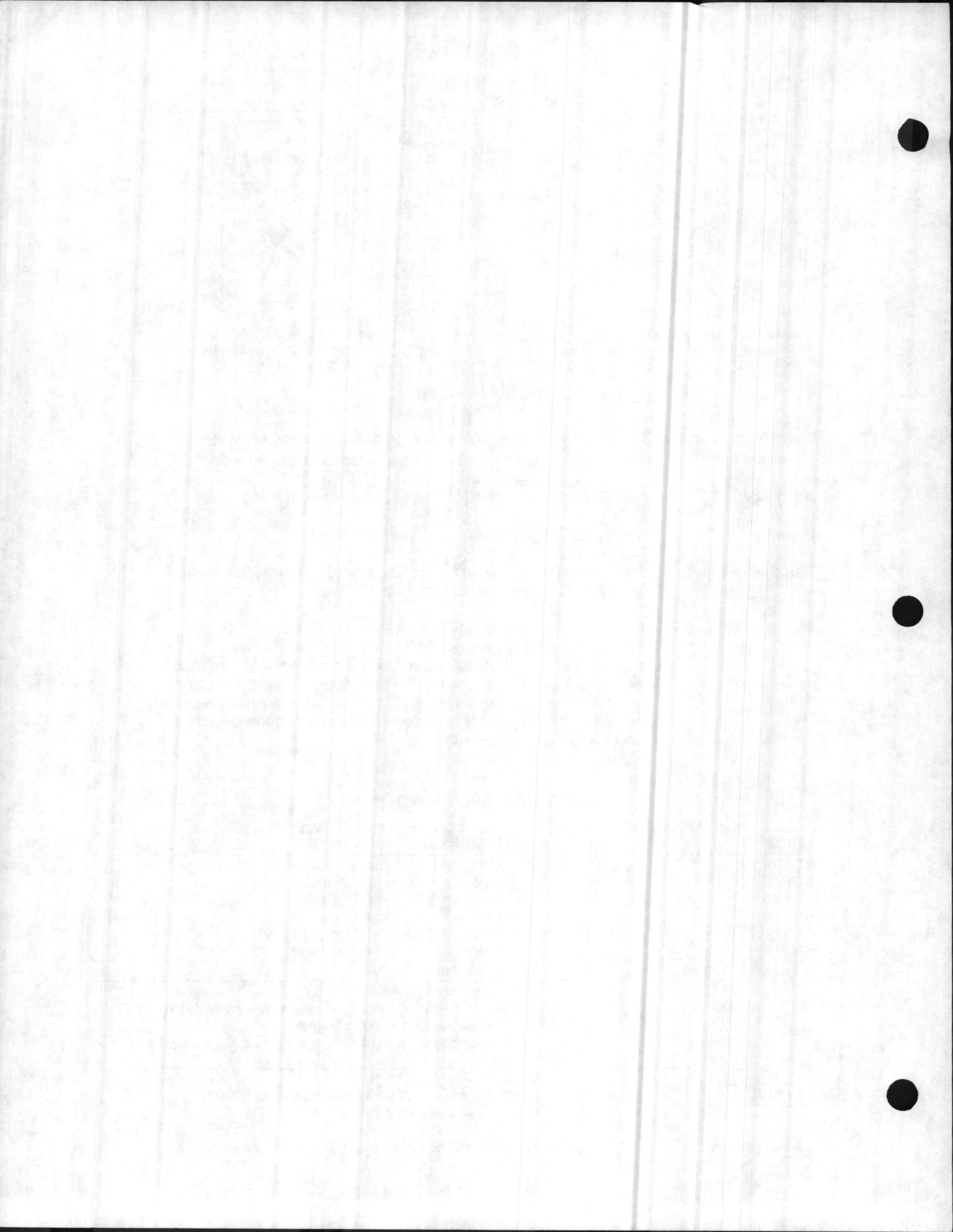
Model	Stainless Surface Mount Sensor	
ST-S3	10,000 ohm	Thermistor @ 77°F, Type III material
ST-S21	2,252 ohm	Thermistor @ 77°F, Type II material
ST-S22	3,000 ohm	Thermistor @ 77°F, Type II material
ST-S24	10,000 ohm	Thermistor @ 77°F, Type II material
ST-S27	100,000 ohm	Thermistor @ 77°F, Type II material
ST-S35	30,000 ohm	Thermistor @ 77°F, Type III material
	Code 1	Options
	XM	Momentary switch (wired normally open, 18" leads, 40° to 100°F)
	XA	Set point adjustment (single ratio potentiometer, 40° to 100°F)
	XT	Thermometer (mercury bulb type)
	XK	Customization (customer specified feature, i.e. custom logo)
	XS	Security screws

ST - S27 - XM

Example #1: 100,000 ohm Type II Stainless Surface Mount Sensor with momentary switch

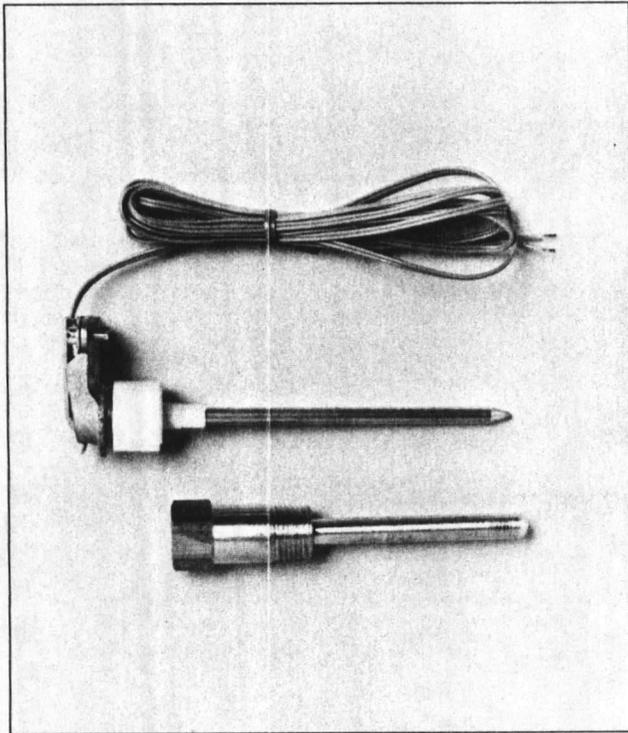
ST - S3

Example #2: 10,000 ohm Type III Stainless Surface Mount Sensor





Model ST-W◇ Immersion Sensor



General Information

The PreCon Immersion Temperature Sensor provides precision, remote temperature sensing for building automation systems, and mechanical equipment room instrumentation. The active sensing element is highly stable precision thermistor material accurate to within $\pm 0.36^\circ\text{F}$. Refer to controller literature for overall system accuracy within the specified operating range.

The sensing element is sealed with a temperature conductive compound, in a $4 \frac{7}{8}$ " stainless steel tube and brass fitting. A brass thermowell is the standard well provided with each sensor. A greenfield connector is factory installed for flexible connections typically used around vibrating refrigeration equipment. The tube assembly with greenfield fitting is removable from the thermowell for replacement without system draindown.

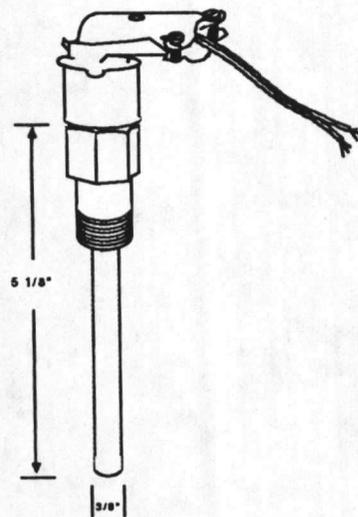
Application Considerations

ST-W◇

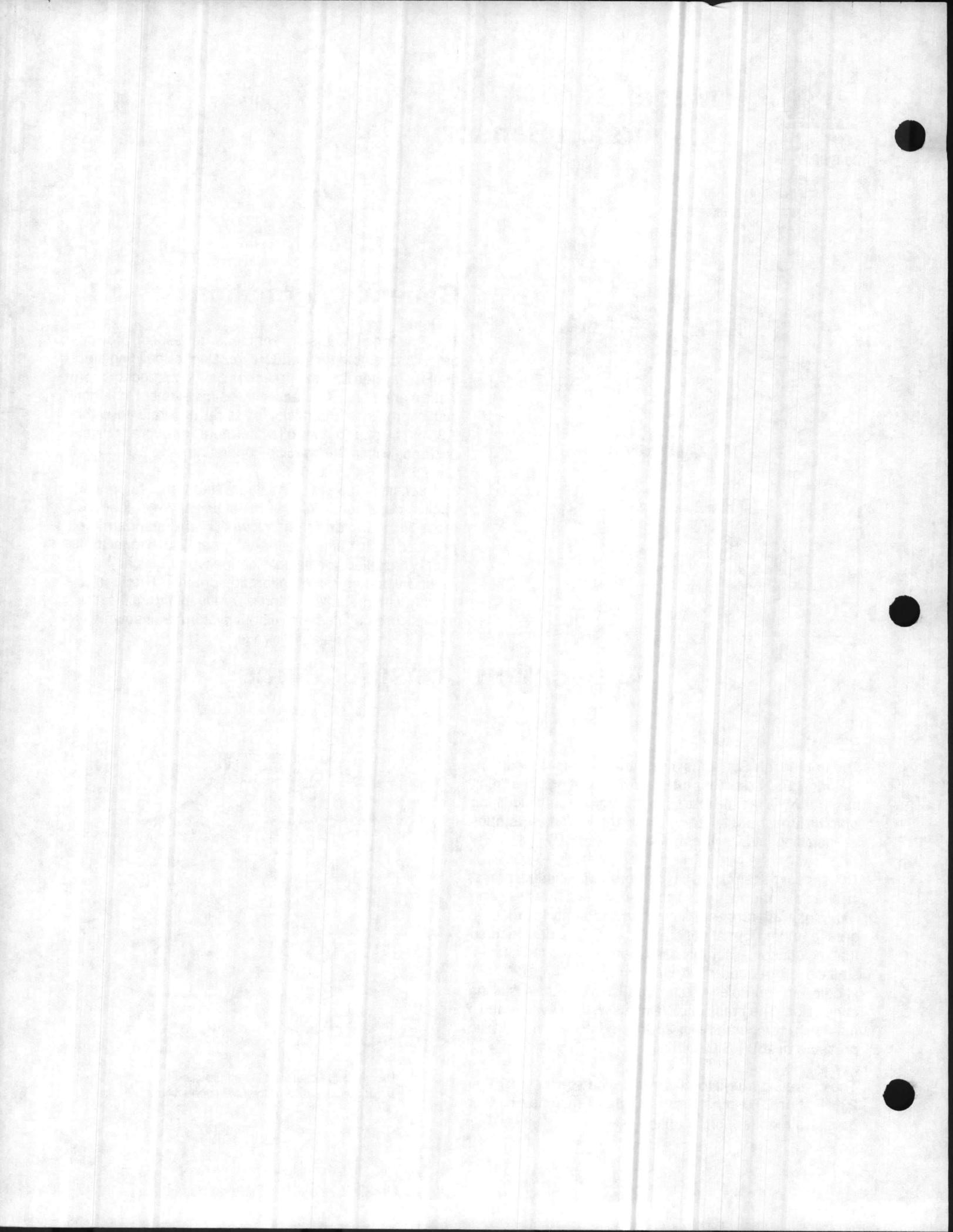
The Immersion Sensor is a moisture/waterproof sensor, featuring a 304 stainless tube and brass fitting. The fitting has $\frac{1}{2}$ " NPT female thread to accept a greenfield fitting which is furnished standard. It has $\frac{1}{8}$ " NPS male threads for installing into the thermowell.

The sensor assembly can be ordered with either a brass, or stainless thermowell. The thermowells are designed with close tolerances, eliminating the need for thermal grease under normal conditions. Each are designed so that the sensor assembly can be easily removed after installation if needed. The well screws into a $\frac{1}{2}$ " NPT saddle, or Thredolet® fitting, furnished by the installing contractor. The brass and stainless wells will withstand a maximum temperature of 250°F and a maximum static pressure of 250 PSIG.

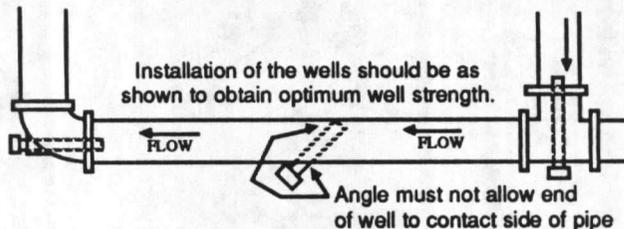
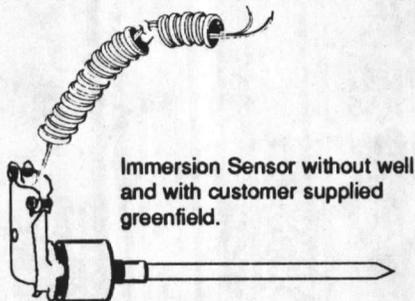
The operating range for this immersion sensor is 10°F to 230°F . For BTU measurement where matched sensor pairs are required, order option (XP).



Use the full, 8 foot lead length provided to avoid condensation at the field connection.



TYPICAL MOUNTING



SPECIFICATIONS

- Thermistor Type:** Select the thermistor model appropriate for the controller system. Refer to page B25 for performance resistance/temperature data.
- Accuracy:** $\pm 0.36^\circ\text{F}$ from 32°F to 158°F (except 100,000 ohm, see page B25).
- Stability:** $.24^\circ\text{F}$ over 5 years.
- Basic Model:** Basic model comes with 8 feet of 22 gauge zipcord lead, greenfield fitting, 4" stainless steel probe and brass well. If no well designation is given, a brass well will be provided.
- Wiring:** Make electrical connections to the sensor in accordance with the installation wiring diagram for the job and in accordance with national and local electrical codes. Use the full 8 foot lead furnished with the sensor. Crimp type butt splices or solder connections are recommended. (Do Not use wire nuts) Though the sensor itself does not require shielded cable, some controllers and microprocessors do; check with the controller supplier.

ORDERING INFORMATION

Select the required sensor model and add any required option codes

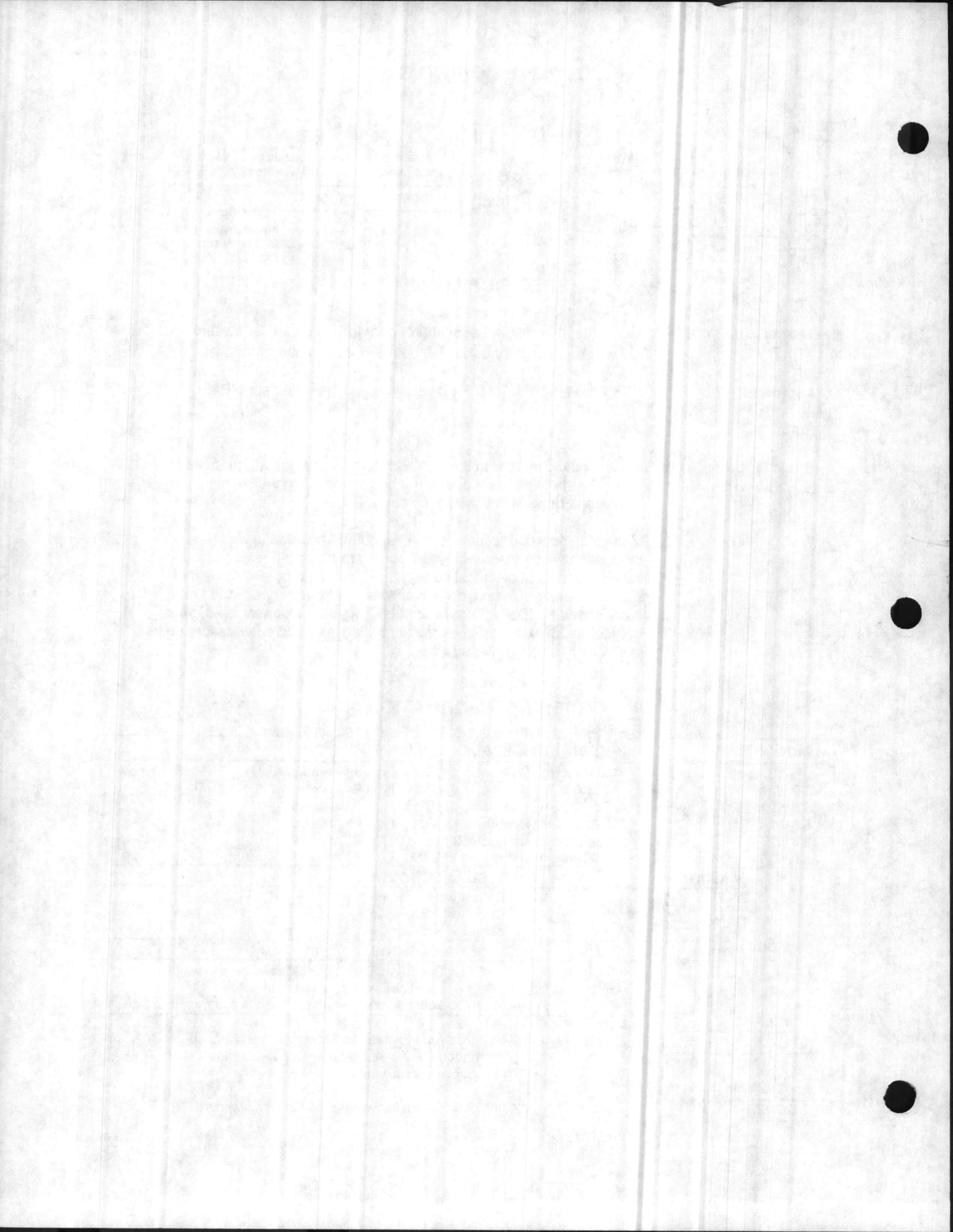
Model	Immersion Sensor	
ST-W3	10,000 ohm	Thermistor @ 77°F , Type III material
ST-W21	2,252 ohm	Thermistor @ 77°F , Type II material
ST-W22	3,000 ohm	Thermistor @ 77°F , Type II material
ST-W24	10,000 ohm	Thermistor @ 77°F , Type II material
ST-W27	100,000 ohm	Thermistor @ 77°F , Type II material
ST-W35	30,000 ohm	Thermistor @ 77°F , Type III material
	Code 1	Well Designation
	E	Sensor without well
	B	Brass well
	S	Stainless Steel well
	Code 2	Options
	XD	Special mounting of dual sensors with wells
	XH	Handibox housing (factory installed)
	XP	Matched sensor pair (shipped in pairs, matched to $\pm 1^\circ\text{F}$)

ST - W3 - S - XP

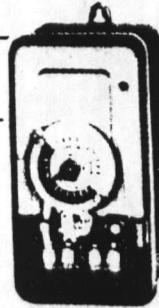
Example #1: 10,000 ohm Type III Immersion Sensor with a matched 10,000 ohm Type III Immersion Sensor and stainless steel wells

ST - W27

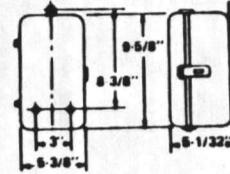
Example #2: 100,000 ohm Type II Immersion Sensor with standard brass well



4210 SERIES



**24 Hour Time Controls
Spring-Wound Carryover**



4210 Series

Same as 4010 series with spring-wound carry-over to take over during power failure, keeping control running until power resumes
 ● Carry-over has 10 hour reserve ● Only 2 hours wind-up required for each hour of power outage.

4210-S Series has Skip-A-Day feature.

4210-SZ Series has Astro Dial and Skip-A-Day features.

EDP No. 4988	Time Control Model No.	Switch Type	Switch Rating Per Pole				AC Line		Shipping Wgt.	Lbs.	Kg.
			Amp	Amp T	VA	HP	Volts	Hz			
21810	4210-S Series — Skip-A-Day										
	4213-00S	DPST	40	40	690	1	120	60	6	2.75	
21838	4214-20S	DPST	40	40	690	1	208-240	60	6	2.75	
21931	4214-27S	DPST	40	40	690	1	277	60	6	2.75	
21850	4215-00S	SPDT	40	40	690	1	120	60	6	2.75	
21878	4216-20S	SPDT	40	40	690	1	208-240	60	6	2.75	
	4210-SZ Series — Astro Dial — Skip-A-Day										
	4213-00SZ*	DPST	40	40	690	1	120	60	6	2.75	
	4214-20SZ*	DPST	40	40	690	1	208-240	60	6	2.75	
	4214-27SZ*	DPST	40	40	690	1	277	60	6	2.75	
	4215-00SZ*	SPDT	40	40	690	1	120	60	6	2.75	

Furnished with 1 set of Trippers. Additional Trippers — See page 30.
 *When ordering indicate city and state nearest installation.
 See 47210 Series for 4 pole switching.

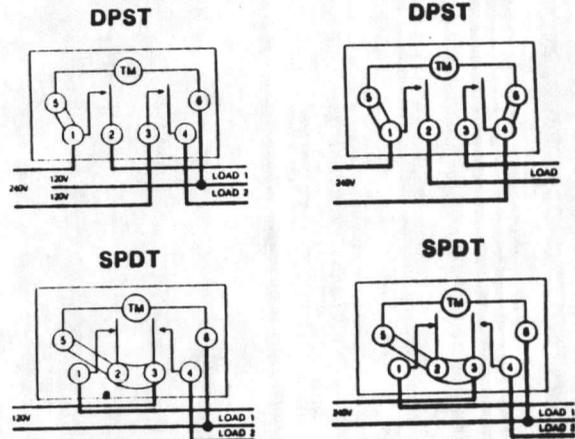
S — Skip-A-Day
 Z — Astro Dial

HOW TO SPECIFY

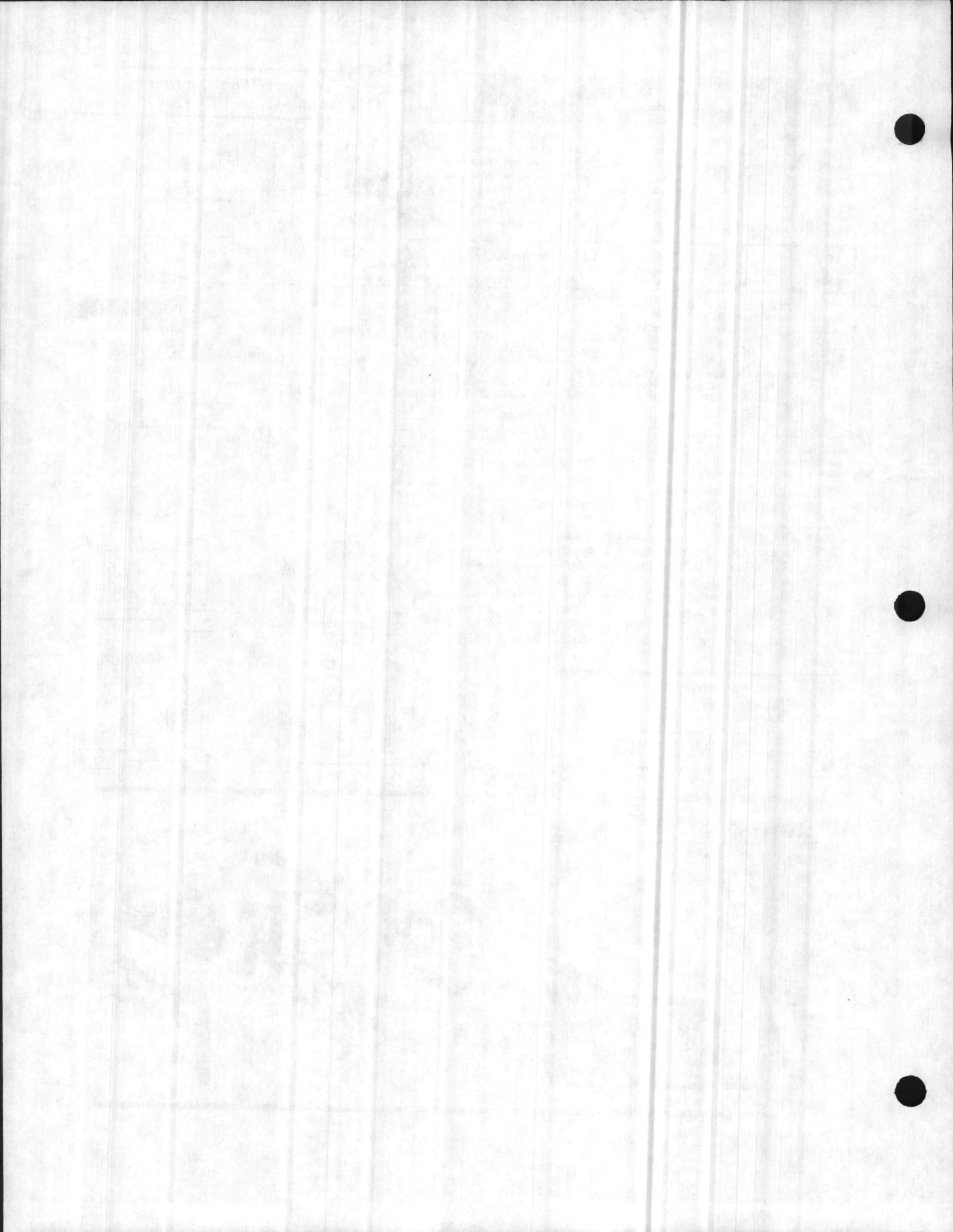
Installer shall furnish and install a Paragon (Model No. _____) Astro Dial control with (DPST or SPDT) switch. Control shall adjust for seasonal changes, turning ON lights automatically at sunset and permit OFF between 9:30 pm and 2:30 am or OFF at sunrise. Contacts to be rated at 40 amperes tungsten per pole up to 277 volts. Synchronous motor shall be independent of load switches. Springwound carry-over shall keep preset schedule on time for 10 hours during power outage, automatically rewinding after power is restored and exercised continuously under no mechanical load.

LETTER KEYS

- A — Available in 50 Hz Model
- I — Furnished with Indoor Case
- X — Available Bracket Mounted Unit
- M — This Model Movement Only
- O — Furnished with indoor/outdoor case



Connect with the pro!



WFS Paig. 2.1.18.3

P74 SERIES DIFFERENTIAL PRESSURE CONTROLS

Series P74 measures the pressure difference between two sources (supply and return lines). A change in pressure at either control element will reposition the switching mechanism to cause corrective action of supplementary control equipment.

Typical Applications Include:

- Pressure sensing on chillers, water cooled condensers, or heating systems for proof of flow.
- Lube oil protection for refrigeration compressors (same as the P28, but does not incorporate time delay).

— Positions M100 series motor actuated valves (P74JA-2).

Features Include:

- Field proven Pennswitch with completely enclosed contact mechanism.
 - Pressure differential setting easily changed without removing cover.
 - Universal mounting bracket supplied.
- TO ORDER: Specify Catalog Number only.



FOR ALL REFRIGERANTS EXCEPT AMMONIA

Catalog Number	Switch Action	Press. Diff. Range psig (kPa)	Pressure Connections	Electrical Ratings	Max. Bellows Pressure (Momentary) psig (kPa)	Bellows Material	Shipping Weight
P74AA-1	SPST Closes On Decreases In Press. Diff.	8 to 70 Adjustable (55 to 483)	3/8" Cap. with 1/4" Flare Nut	20 amp. 120 V AC 50/60 Hz	325 (2241)	Stainless Steel	2.4 lb. (1.1 kg.)
P74BA-1	SPST Opens On Decrease In Press. Diff.						
P74FA-1	SPDT (Snap-Action)	8 to 60 (55 to 414)	1/4" Male Flare	6 amp. 120 V AC 50/60 Hz	180 (1241)	Brass	
P74FA-5			1/4" FNPT				
P74JA-2	SPDT (Floating)		1/4" Male Flare	1 amp. 24 V AC 50/60 Hz			

Q15 ELECTRONIC IGNITION SYSTEMS

FOR NATURAL GAS FURNACES AND BOILERS

This solid state ignition control lights a pilot burner by spark. Pilot gas is ignited and burns during each running cycle (intermittent pilot). This system permits the main gas valve to open only when the pilot burner is proven to be lit. Applicable to all gas burning equipment using a proven pilot.

With its fast response to loss of flame, the Q15 is ideal for power vent or gravity vent equipment.

OFFERED ONLY THROUGH
JOHNSON CONTROLS
AUTHORIZED QUALIFIED ENERGY
CONSERVATION WHOLESALERS.

SPECIFICATIONS

Electrical Connections	Voltage	Regulator Pressure	Max. Operating Pressure	Valve Size	Ambient Temperature Limits
1/4" Male Quick Connects	25 V. 60 Hz	3" to 6" W.C. (0.7 to 1.5 kPa)	0.5 psig (3.4 kPa)	1/2" x 3/4" Includes a 3/4" to 1/2" Reducer	-40 to 150° F (-40 to 66° C)

Catalog Number	Ignition Type	Regulator Setting	Comments
Q15EAA-1	Automatic Reset	3.5 ± 0.2" @ 125,000 Btuh	—
Q15FAA-1	Automatic Reset	3.5 ± 0.2" @ 125,000 Btuh	Slow Opening Valve
*Q15GAA-1	Manual Reset	3.5 ± 0.2" @ 125,000 Btuh	100% Lockout

* 30 second trial for pilot gas ignition.

Features Include

- Saves gas energy. Pilot gas is on only during running cycle. No need to shut off pilot during summer air conditioning season.
- Flame detection system provides long life due to solid state components.
- Fast response-control recycles within 0.8 second from loss of flame.
- Eliminates most purge requirements.
- Fully automatic operation on demand for heat.
- Redundant gas valve.
- AGA & CGA design certified.

TO ORDER: Specify Catalog Number only.



Q60 Ignition Control



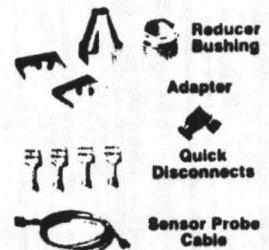
Y57 High Voltage Cable

Sensing Probe



Flame Rectification Extension

Spacers and Nut



Reducer Bushing

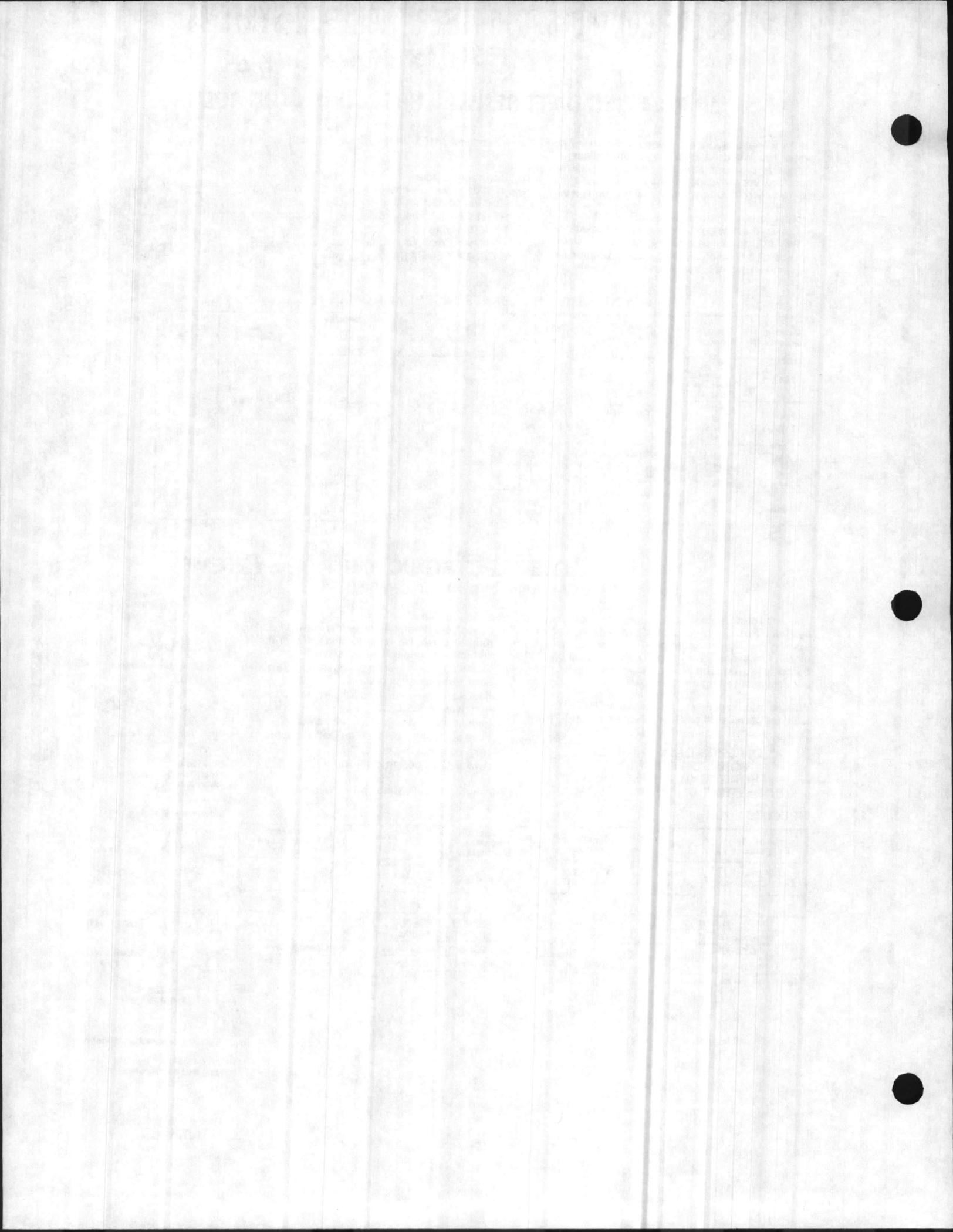
Adapter

Quick Disconnects

Sensor Probe Cable



Lighting Instruction Sticker
The Q15 MIZER system comes complete as shown



idc RH SERIES MIDGET POWER/GENERAL PURPOSE

R-1, R-6, R-3, R-4, R-5, R-6 part. 2.1.18.2

SPECIFICATIONS

Contact Material	Silver cadmium oxide (Ag CdO)
Contact Resistance	50 mΩ max (initial value)
Operate Time	SPDT(RH1), DPDT(RH2) 20 msec max . 3PDT(RH3), 4PDT(RH4) 25 msec max.
Release Time	SPDT(RH1), DPDT(RH2) 20 msec max . 3PDT(RH3), 4PDT(RH4) 25 msec max.
Power Consumption (Approx.)	SPDT(RH1) AC 1.1 VA (50 Hz), 1 VA (60 Hz), DC 0.8W DPDT(RH2) AC 1.4 VA (50 Hz), 1.2 VA (60 Hz), DC 0.9W 3PDT(RH3) AC 2 VA (50 Hz), 1.7 VA (60 Hz), DC 1.5W 4PDT(RH4) AC 2.5 VA (50 Hz), 2 VA (60 Hz), DC 1.5W
Insulation Resistance	100 MΩ min (measured at 500V DC megger)
Dielectric Strength	SPDT(RH1) Between live and non live parts 2000V AC, 1 minute Between contact circuit and operating coil 2000V AC, 1 minute Between contacts of the same pole 1000V AC, 1 minute DPDT(RH2), 3PDT(RH3), 4PDT(RH4) Between live and non-live parts 2000V AC, 1 minute Between contact circuit and operating coil 2000V AC, 1 minute Between contact circuits 1500V AC, 1 minute Between contacts of the same pole 1000V AC, 1 minute
Frequency Response	1800 operations/hour
Temperature Rise	Coil: 85 deg max . Contact 65 deg max.
Vibration Resistance	0 to 6g (55 Hz max)
Shock Resistance	SPDT(RH1), DPDT(RH2) 20g 3PDT(RH3), 4PDT(RH4) 10g
Operating Temperature	-22° to +158°F (-30°C to +70°C)
Weight (Approx.)	RH1 24g RH2 37g RH3 50g RH4 74g
Life Expectancy	Electrical 500,000 operations or more (120V AC, 10A)* Mechanical 50,000,000 operations or more

Note: * 200,000 operations or more (120V AC, 10A) in SPDT(RH1), 3PDT(RH3), 4PDT(RH4) types.

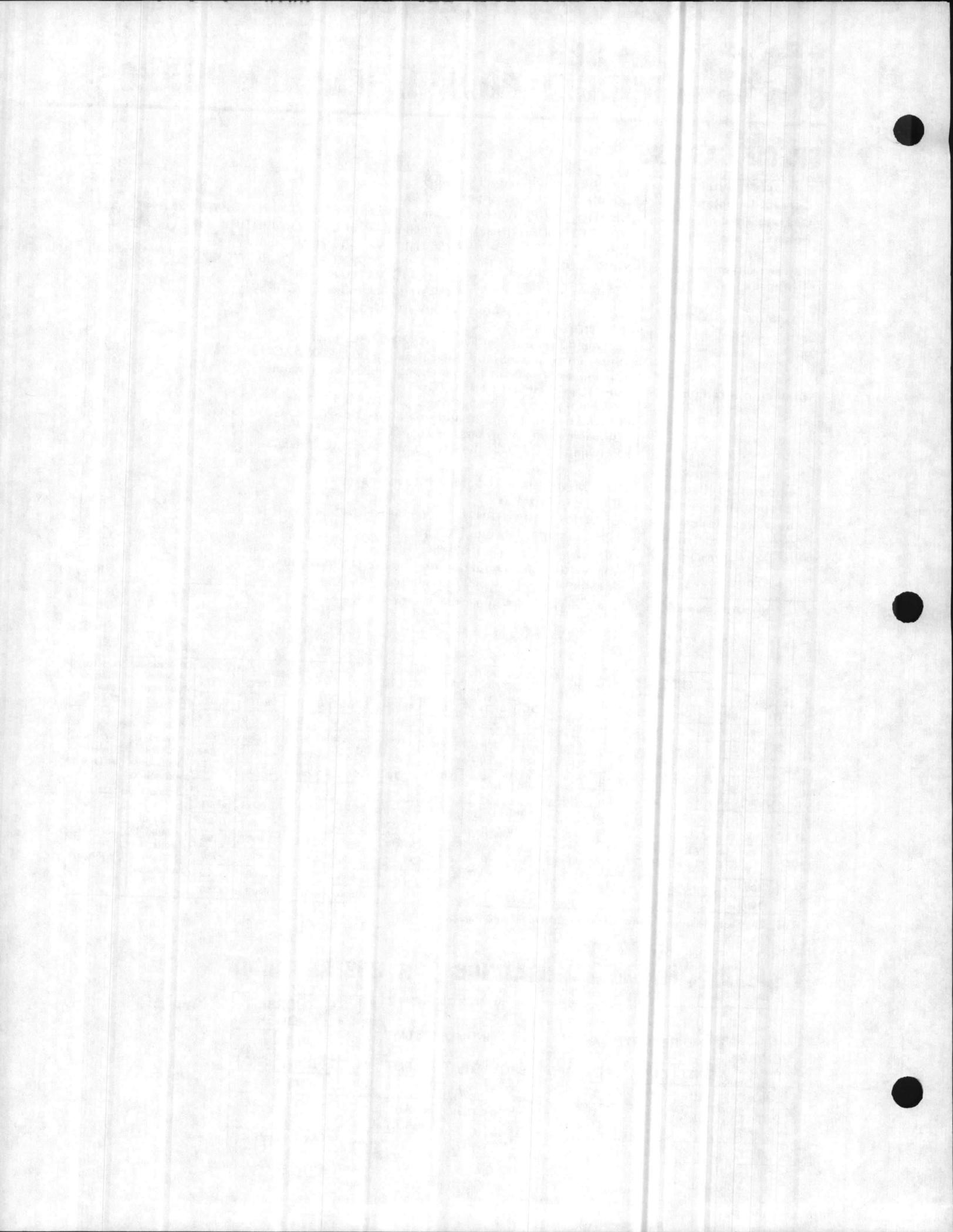
COIL RATINGS

Rated Voltage (V)	Rated Current (mA) ± 15% at 20°C								Coil Resistance (Ω) ± 10% at 20°C				Continuous Applied Voltage (Max.) 20°C	Pick up Voltage (min.) at 20°C	
	60 Hz				50 Hz				SPDT	DPDT	3PDT	4PDT			
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT							
AC	6V	150	200	280	330	170	238	330	387	18.8	9.6	6.0	5.4	110% of rated voltage without overheating	80% of rated voltage
	12V	75	100	140	165	86	118	165	196	76.8	40.5	25.3	21.2		
	24V	37	50	70	83	42	59.7	81	98	300	156.7	103	84.5		
	120V	7.5	11	14.2	16.5	8.6	12.9	16.4	19.5	7680	4280	2770	2220		
	*240V	—	5.5	7.1	8.3	—	6.5	8.2	9.8	—	15720	12110	9120		
DC		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT	110% of rated voltage without overheating	80% of rated voltage
	6V	128		150		240		250		47	40	25	24		
	12V	64		75		120		125		188	160	100	96		
	24V	32		36.9		60		62		750	650	400	388		
	48V	18		18.5		30		31		2660	2660	1600	1550		
110V	8.0		9.1		12.8		15		13800	12100	8600	7340			

Note: Rated voltages marked with * are not available for SPDT models.

CONTACT RATING UL RATINGS (RH1, RH2, RH3, RH4)

VOLTAGE (V)	RESISTIVE (A)				INDUCTIVE (A)				HORSE POWER	
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	3PDT
									DPDT	3PDT
120 AC	10	10	10	10	7	7	—	7.5	1/3	1/6
240 AC	10	10	—	7.5	7	7	6.5A/Pole 20A Total	5	1	1/3
30 DC	10	10	10	10	7	7	10	10	—	—



MIDGET POWER/GENERAL PURPOSE **iDEC**

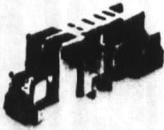
SOCKETS

UL Recognized
File No. E64245

CSA Certified
File No. 35144

For more details on sockets and dimensions, see p. 63 in socket section.

SNAP-MOUNT



SH1B-05
For: RH1B
*SY4S-02F1
*SFA-101
*SFA-202



SH2B-05
For: RH2B
*SY4S-02F1
*SFA-101
*SFA-202



SH3B-05
For: RH3B
*SH3B-05F1
*SFA-101



SH4B-05
For: RH4B
*SH4B-02F1
*SFA-101

PANEL MOUNT



SH1B-51
For: RH1B
*SY4S-51F1



SH2B-51
For: RH2B
*SY4S-51F1



SH3B-51
For: RH3B
*SY4S-51F1



SH4B-51
For: RH4B
*SY4S-51F1

P.C. MOUNT



SH1B-62
For: RH1B
*SY4S-51F1



SH2B-62
For: RH2B
*SY4S-51F1

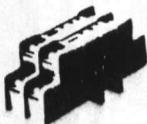


SH3B-62
For: RH3B
*SY4S-51F1



SH4B-62
For: RH4B
*SY4S-51F1

SURFACE MOUNT



SH2B-02
For: RH2B
*SY4S-02F1

MOUNTING RAIL

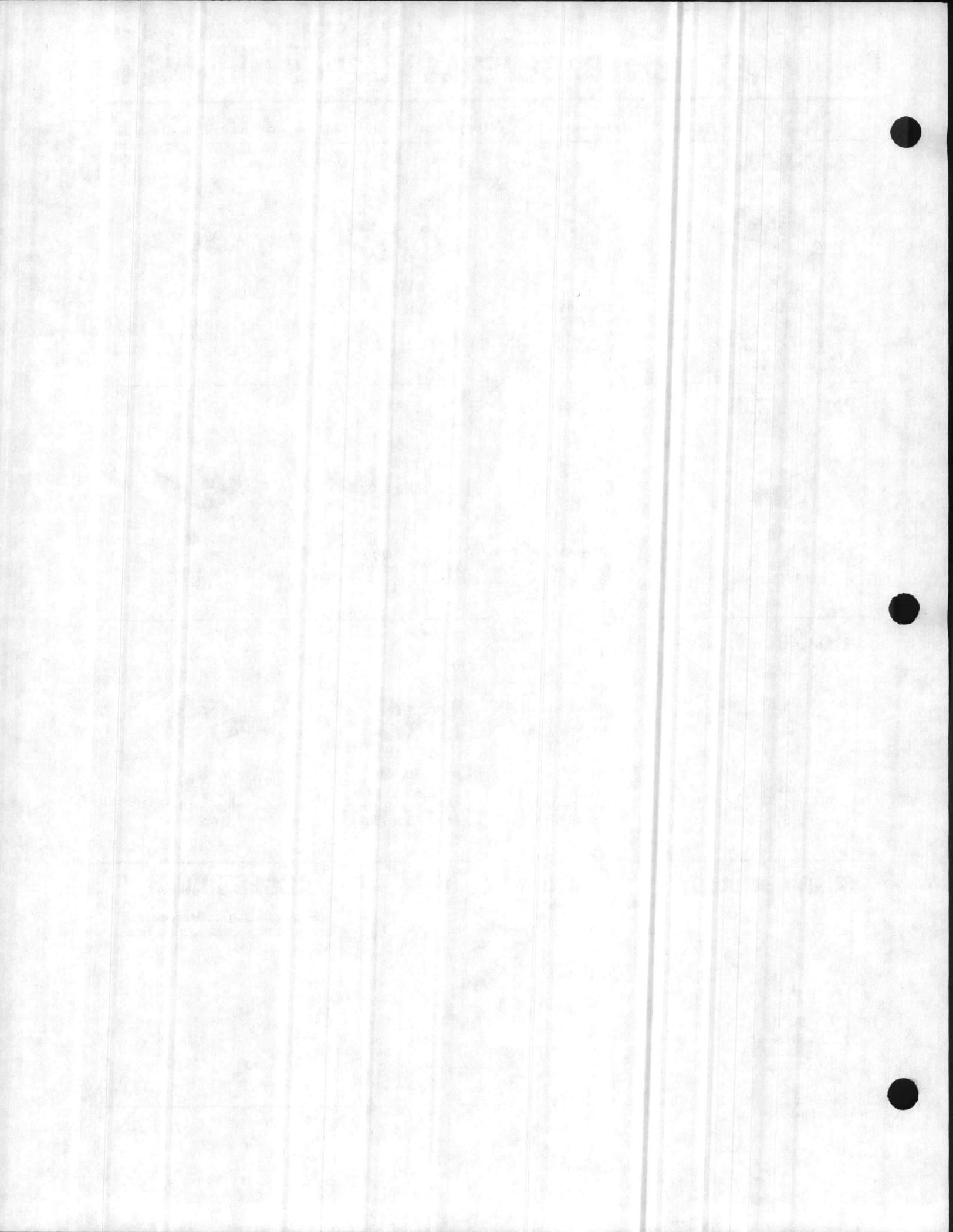


BND-1000
DIN/Screw Mount

ACCESSORIES

For more details on socket accessories, see p.70 in socket section under accessories guide.

*Indicates hold-down spring.





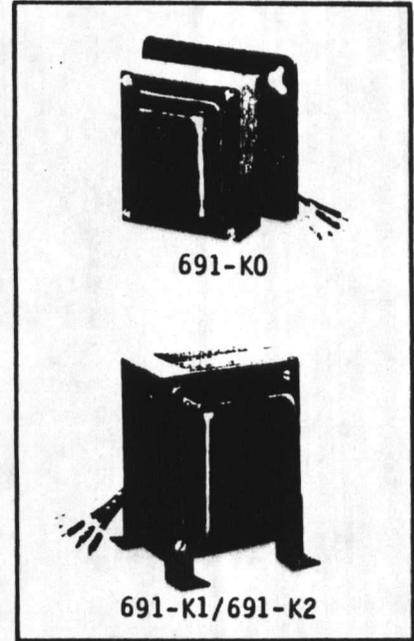
INTERFACE PRODUCTS

CONTROL TRANSFORMERS

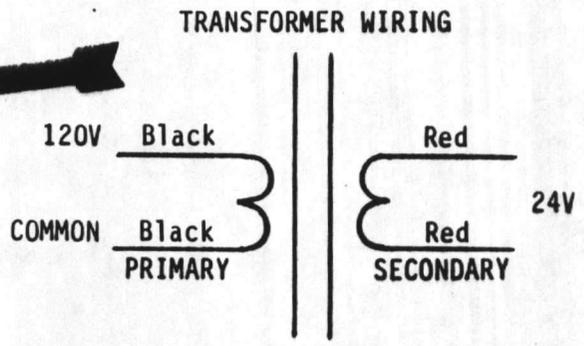
CONTROL TRANSFORMERS

- Model: 691-K0
 691-K1
 691-K2

Stepdown voltage transformers for use in temperature control systems. Transformers are specially designed to provide 24 volts AC control voltage from 120 volts AC primary supply. Transformers are provided with mounting feet for panel mounting.



MODEL	VA RATING	PRIMARY	SECONDARY
691-K0	40 VA	120 VAC	24 VAC
691-K1	100 VA	120 VAC	24 VAC
691-K2	170 VA	120 VAC	24 VAC



DISTRIBUTED BY

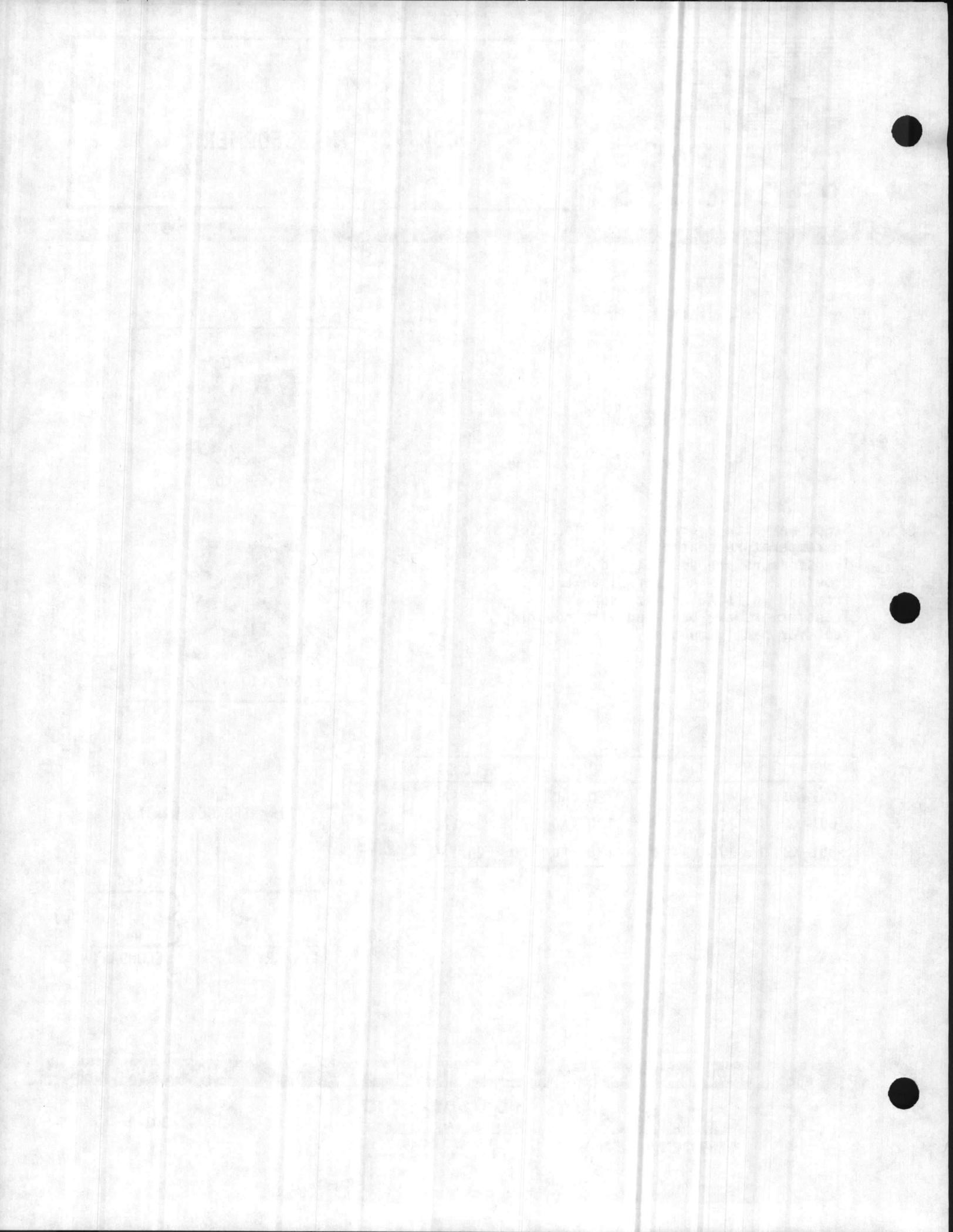
INFORMATION/ORDER

MANUFACTURED BY



901-382-4300
 KELE & ASSOCIATES
 P.O. BOX 34817
 DARTLETT TN 38104

41-201-1



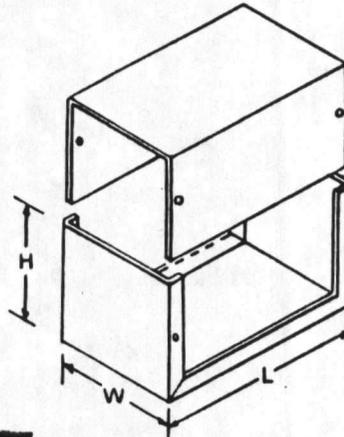
SMALL ENCLOSURES FOR RELAYS AND OTHER REMOTELY MOUNTED DEVICES

MINIBOXES

Design Features: .040 aluminum alloy. Two sections slip together and may be joined by either built-in snap lock or sheet metal screws (included).

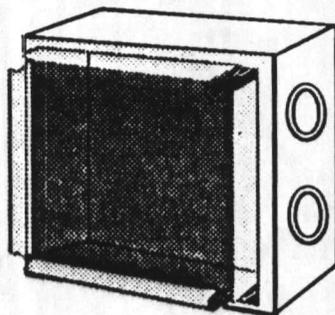
Bonus Features: Flanged sections assure proper shielding. Units can be used as separate housings or as part of larger assemblies. 3/4" knockout top & bottom

Finish: Natural & Aluminum



MODEL	L	W	H	WT
B-5	5	4	3	1/2
B-7	7	5	3	3/4

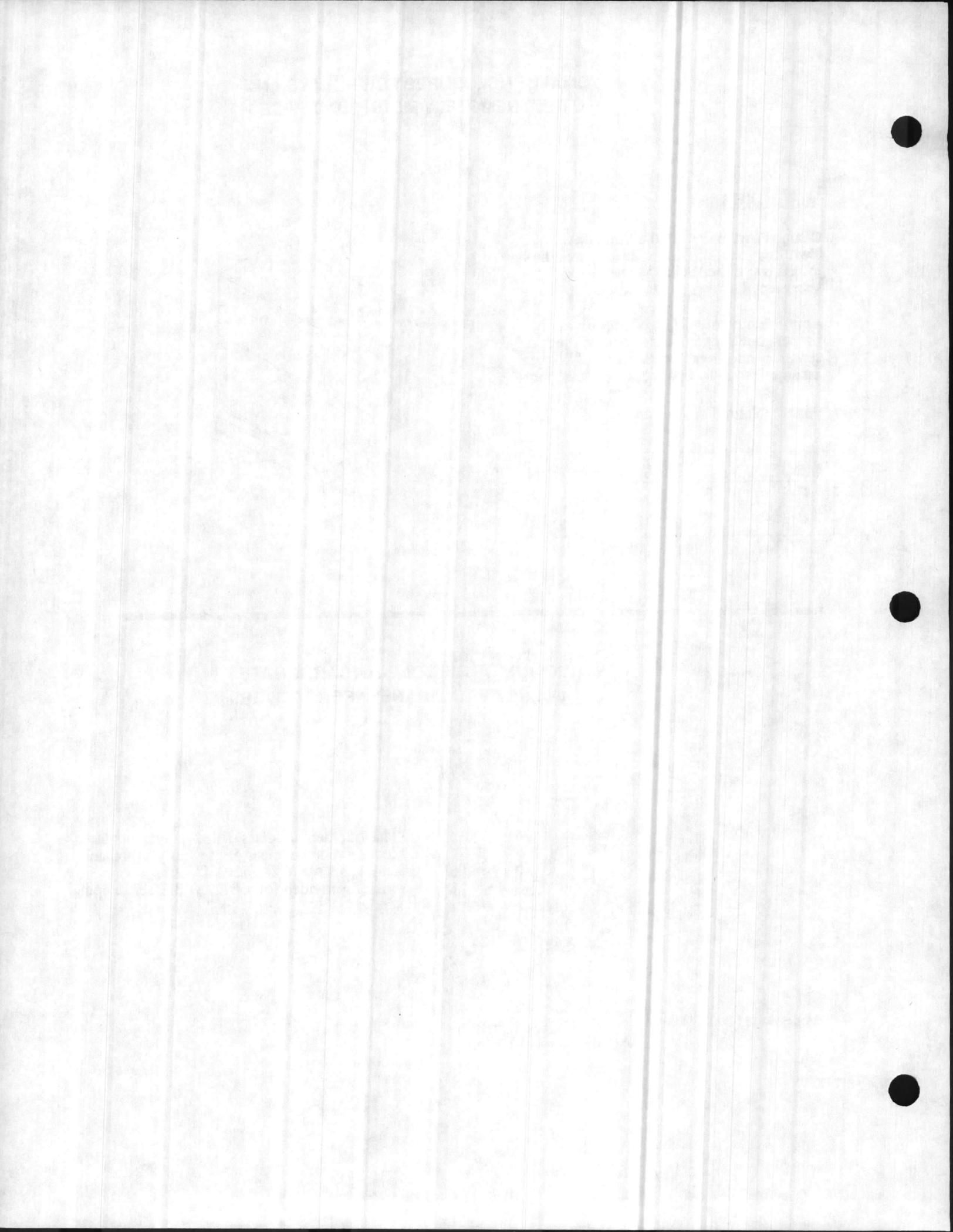
VYNCO JUNIOR SERIES POLYCARBONATE ENCLOSURE WITH TRANSPARENT COVER



NEMA 4X

- Base molded in glass filled polycarbonate
- Cover molded in clear or grey polycarbonate
- Knockouts for 1/2" and 3/4" hubs
- Bosses provided for 6BZ x 3/8" self-tapping screws

Model 14121-000 4.92" H x 4.92" W x 2.95" Deep



D-3, D-4, D-5
Para. 2.1.1

★ ★ PENN ★ ★ DAMPERS

AIR CONTROL DAMPERS

GENERAL DESCRIPTION

Parallel Blade and Opposed Blade dampers are designed using the modular concept to provide maximum quality and performance commensurate with economy and versatility. By utilizing this type of construction, features that were at one time "optional extras" now become standard features without adding to the cost of the air control damper.

The PBD-8 and OBD-8 dampers are specifically designed to operate in systems when the approach velocity does not exceed 2000 FPM and the static pressure differential does not exceed 4" WG.

MODELS AVAILABLE

Model PBD-8 parallel blade action
Model OBD-8 opposed blade action

OPTIONAL FEATURES

Thrust Bearings	Aluminum Blades
Nylon Bearings	2" Channel Frame
Enamel or Lacquer Finish	Concealed Linkage
Reinforced Corners	Sized to Order

SPECIFICATIONS

Frame: 16 gauge galvanized steel roll formed channel
5½" W x 1" H with pre-punched slotted
mounting holes - 7" O.C.

Blades: 16 gauge galvanized steel, maximum width 8";
blades 36" and longer furnished with reinforcing
cone; driven blade furnished with reinforcing
cone.

EFFICIENCY

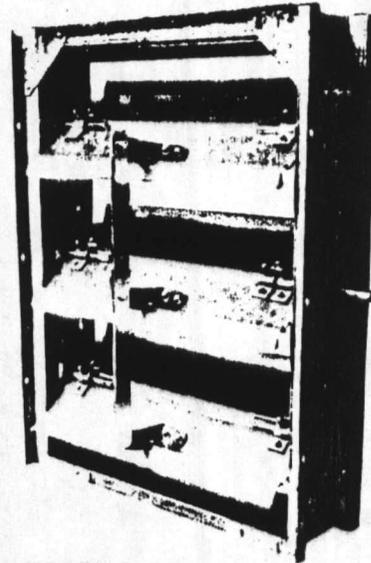
Refer to Figure 1

1. Dampers with blade edging of Penyltrene resilient sealing gasket, "... air loss through Models PBD-8 or OBD-8 will be less than 1% of the full flow rate when operating at pressure differentials under 4" WG ..."
Approach velocity 2000 FPM.

Supplementary Data Sheet

TO ENGINEERING BULLETIN PDR-77

MODEL PBD-8 OBD-8



MODEL PBD-8

Ext. Shafts: ½" diameter cadmium plated steel; 6" long with grip-lok flattened end.

Bearings: Precision machined oilite bronze, sleeve type

Side Seal: Stainless spring steel

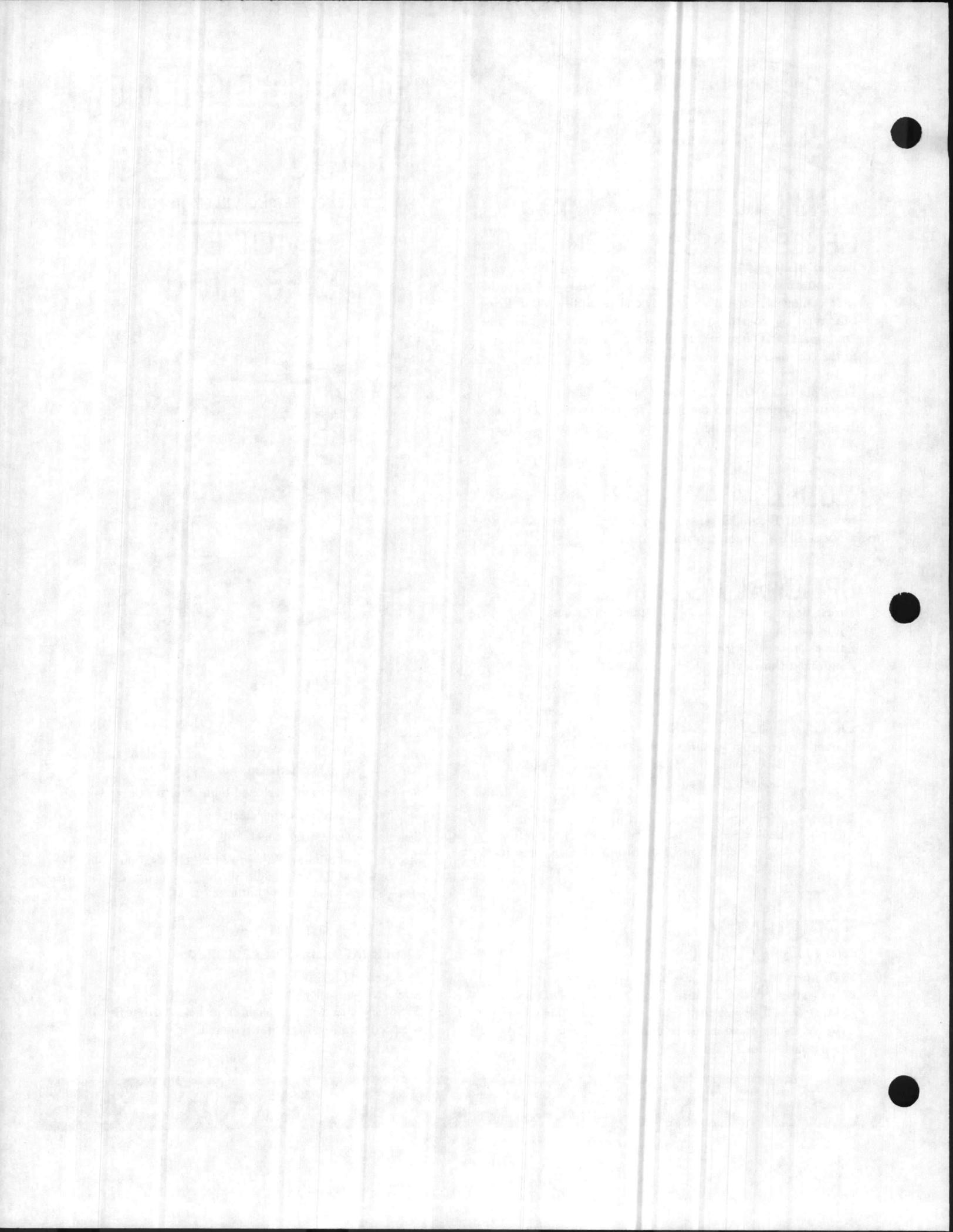
Finish: Galvanized Steel, Mill

Sizes: Minimum 12" W x 12" H; Maximum 48" W x 72" H, single section; ganging of damper sections allow unlimited sizes.

ORDER INFORMATION REQUIRED:

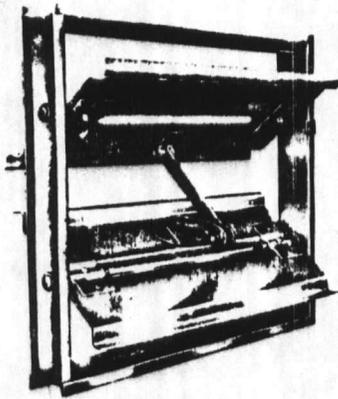
1. Specify Model No.
2. Specify quantity
3. Specify size, width x height in inches. Width is first digit.
4. Specify optional features required.

PENN VENTILATOR CO., INC.

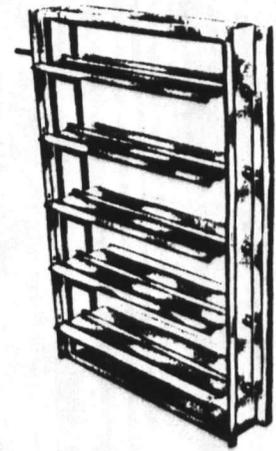
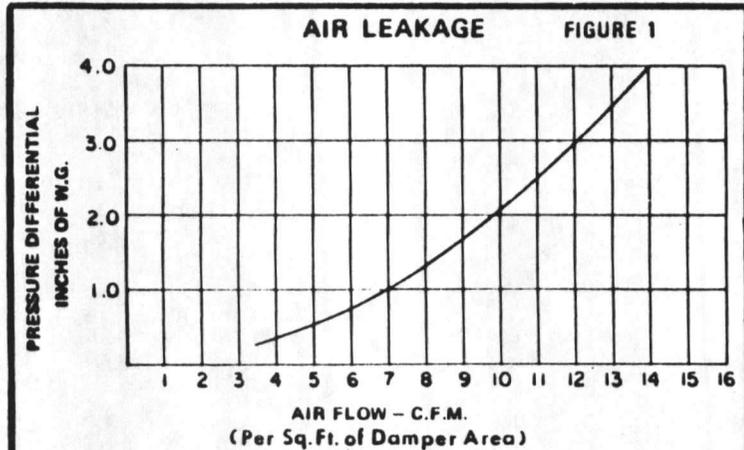


GENERAL SPECIFICATIONS

Parallel blade and Opposed blade dampers (PBD-8 and OBD-8) are engineered to provide the high performance required for the proper operation of HVAC systems. These dampers are designed for use in systems when the approach velocity does not exceed 2000 fpm and the pressure differential across the damper does not exceed 4" w.g.



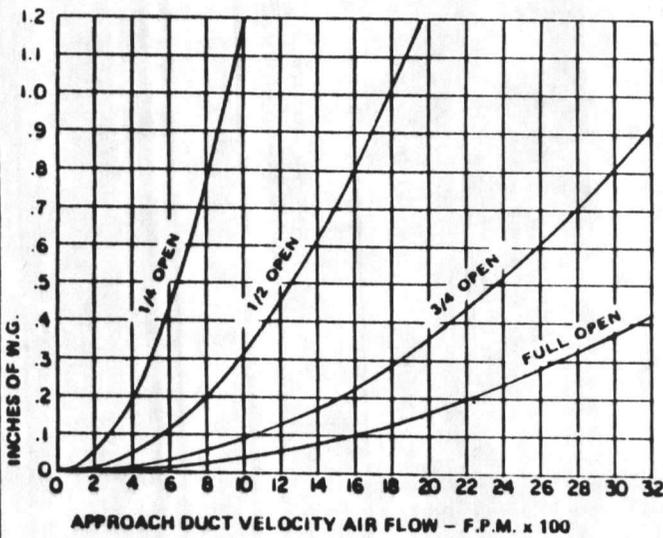
**Model OBD-8
STRAIGHT SIDE
2" CHANNEL FRAME
OPPOSED BLADE**



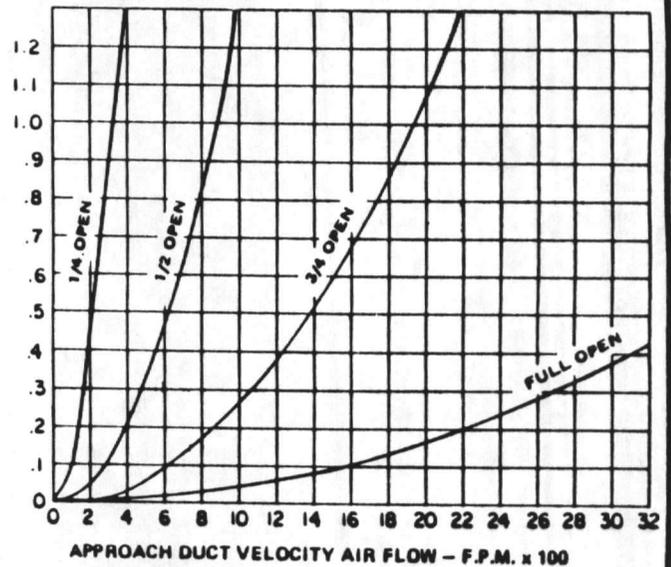
**Model PBD-8
CONCEALED LINKAGE
5" CHANNEL FRAME**

PRESSURE DROP

PARALLEL BLADE DAMPER - MODEL PBD-8



OPPOSED BLADE DAMPER - MODEL OBD-8



OPERATING TORQUE

NO AIR MOVEMENT - 3.10 IN. LBS. OF TORQUE PER SQ. FT. OF DAMPER FACE AREA.

DO NOT SELECT OPERATOR WITH LESS THAN 20 IN. LBS. FOR ANY SIZE OF DAMPER.



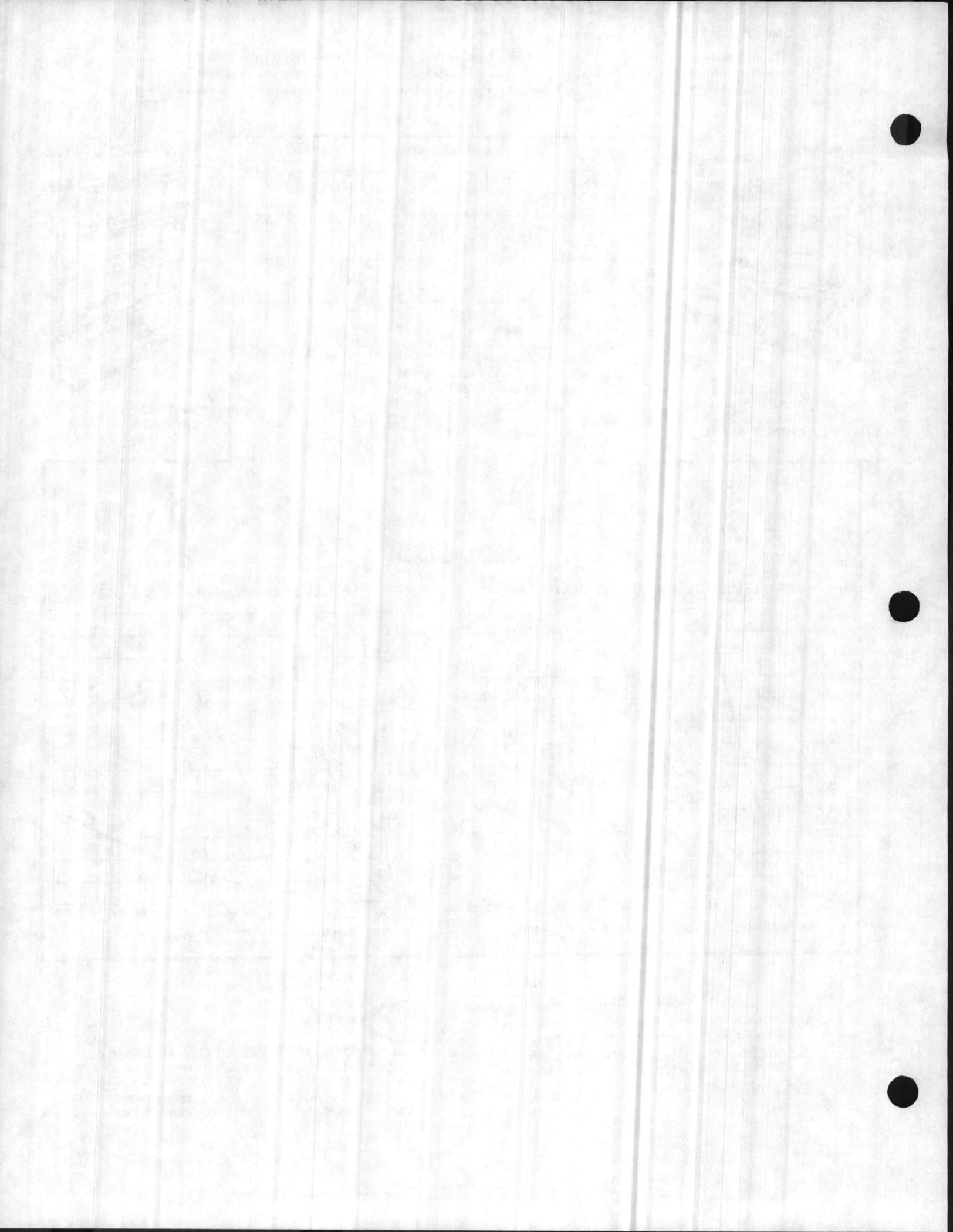
PENN VENTILATOR CO., Inc.

RED LION AND GANTRY ROADS
PHILADELPHIA, PA. U.S.A. 19115

TELEPHONE: (215) 464-8900

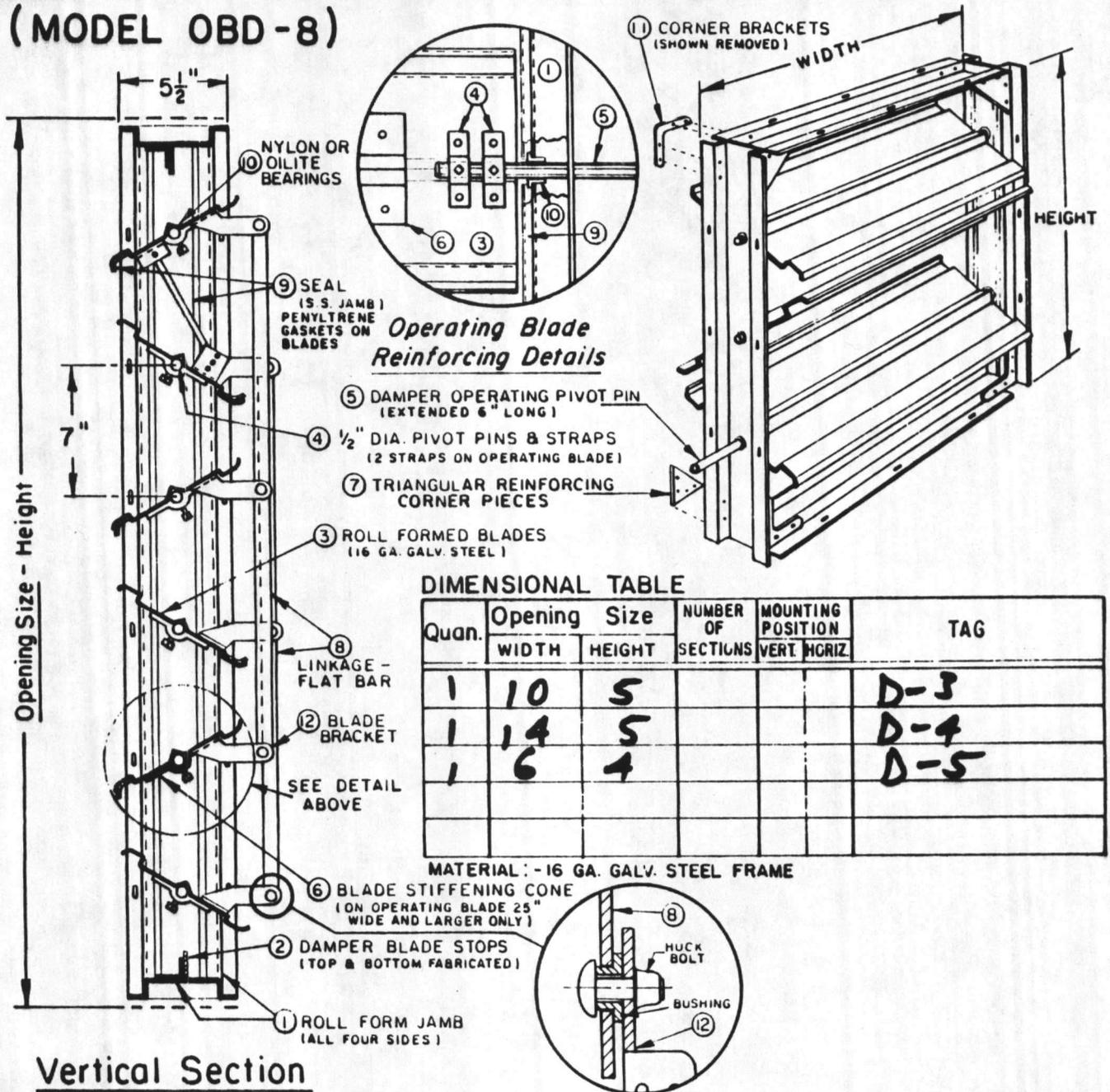
TELEX: 83-4545 (PENVENGEN PHA)





PENN AIR CONTROL MECHANICAL DAMPER

(MODEL OBD-8)



DIMENSIONAL TABLE

Quan.	Opening Size		NUMBER OF SECTIONS	MOUNTING POSITION		TAG
	WIDTH	HEIGHT		VERT.	HORIZ.	
1	10	5				D-3
1	14	5				D-4
1	6	4				D-5

MATERIAL: -16 GA. GALV. STEEL FRAME

NOTES: 1. SINGLE PANEL MAX. WIDTH 48", MAX. HEIGHT 72".

PROJECT:		ENGINEER:	
LOCATION:		CONTRACTOR:	
ARCHITECT:		SUB-CONTR.	
DRAWING NO.	REVISIONS		
DATE:	NO. 1		
DRAWN BY: B.G.	NO. 2		
CHK. BY:	NO. 3		

PENN VENTILATOR CO., Inc.
 RED LION AND GANTRY ROADS
 PHILADELPHIA, PA. U.S.A. 19115
 (AREA CODE 215) 484-9800 TELEX: 83-4545

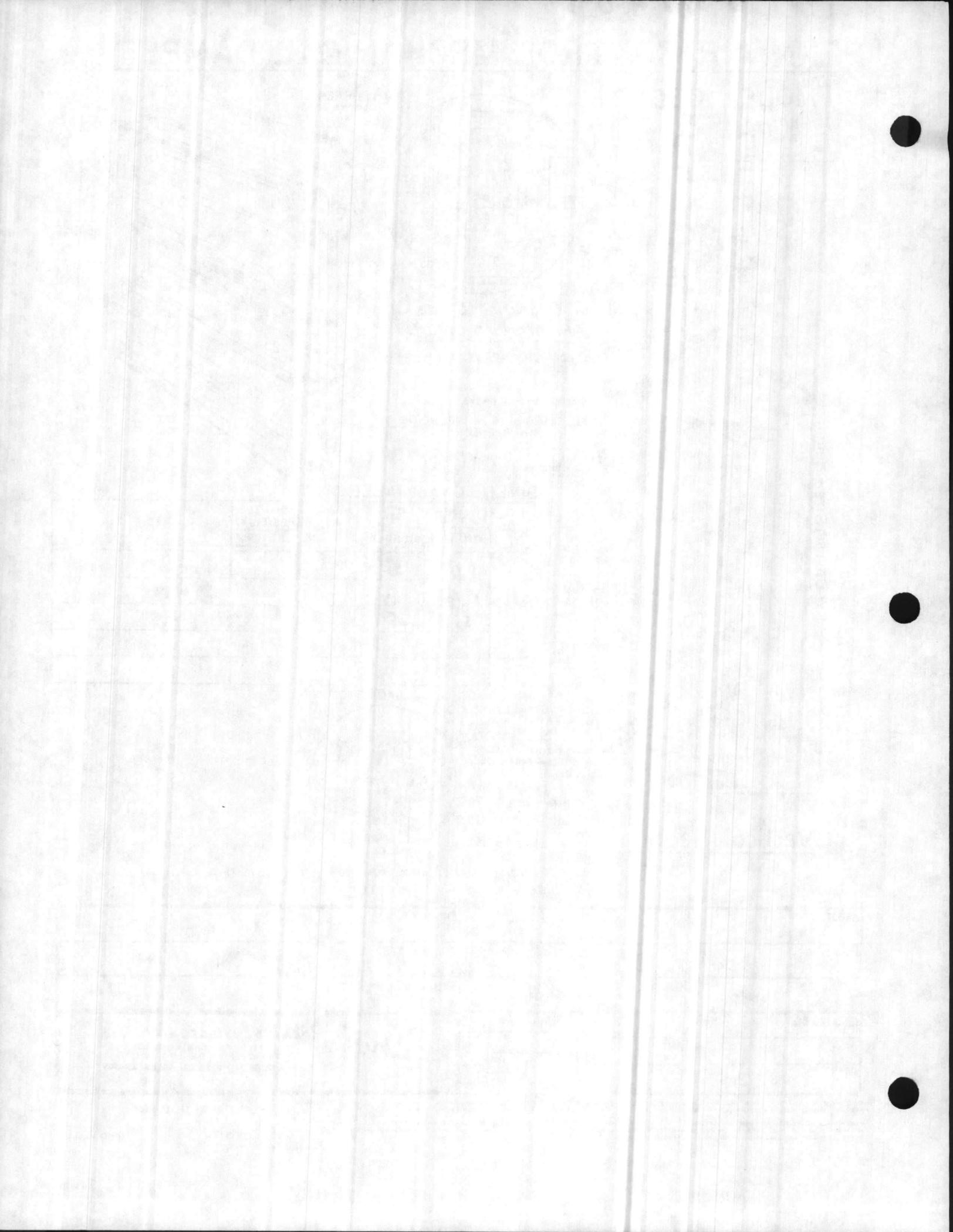
THIS DRAWING ILLUSTRATES OUR UNDERSTANDING OF ORDER REQUIREMENTS. WHEN APPROVED IT REPRESENTS DETAILS FOR FABRICATION AS SUCH PENN VENTILATOR WILL NOT BE RESPONSIBLE FOR REVISIONS IN THE FIELD OR OTHER CHANGES AFTER RELEASE FOR FABRICATION

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FORM MD-OBD-R4

PLATE 317A

LITHO IN U.S.A.



★ ★ PENN ★ ★

DAMPERS

LOW LEAKAGE AIR CONTROL DAMPERS

GENERAL DESCRIPTION

Parallel Blade and Opposed Blade dampers are designed using the modular concept to provide maximum quality and performance commensurate with economy and versatility. By utilizing this type of construction, features that were at one time "optional extras" now become standard features without adding to the cost of the air control damper.

The PBD-10 and OBD-10 dampers are specifically designed to operate in systems when the approach velocity does not exceed 2000 FPM and the static pressure differential does not exceed 4" WG.

MODELS AVAILABLE

Model PBD parallel blade action
Model OBD opposed blade action

OPTIONAL FEATURES

Thrust Bearings	Reinforced Corners
Nylon Bearings	Aluminum Blades
Enamel or Lacquer Finish	Sized to Order

SPECIFICATIONS

Frame: Roll formed and hat shaped channel, 5½" W x 1" H of 16 gauge galvanized steel with caulked frame corners for a better seal; and 7" O.C. pre-punched slotted holes in mounting flange for ease of multiple panel installation. Rack-free damper frame, maximum nominal height 48"; braced at the corners for squareness, rigidity and stability.

Blades: For improved performance, blades of 30" nominal maximum length and roll formed of vee-grooved 16 gauge galvanized steel, furnished with twin tight seals installed on top and bottom of blades providing a tighter closing damper, and a low leakage value of under 0.5% per square foot in the closed position at 4" W.G. static pressure.

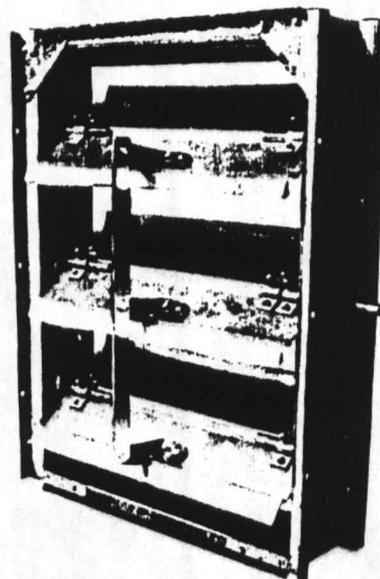
ORDER INFORMATION REQUIRED:

1. Specify Model No.
2. Specify quantity
3. Specify size, width and height in inches.
Width is first digit.
4. Specify optional features required.

LEAKLESS

Supplementary Data Sheet

MODELS: PBD-10 OBD-10



MODEL PBD-10

Ext. Shafts: ½" diameter cadmium plated steel; 9" operating shaft with welded positioning straps.

Bearings: Precision machined oilite bronze, sleeve type.

Finish: Galvanized steel, mill.

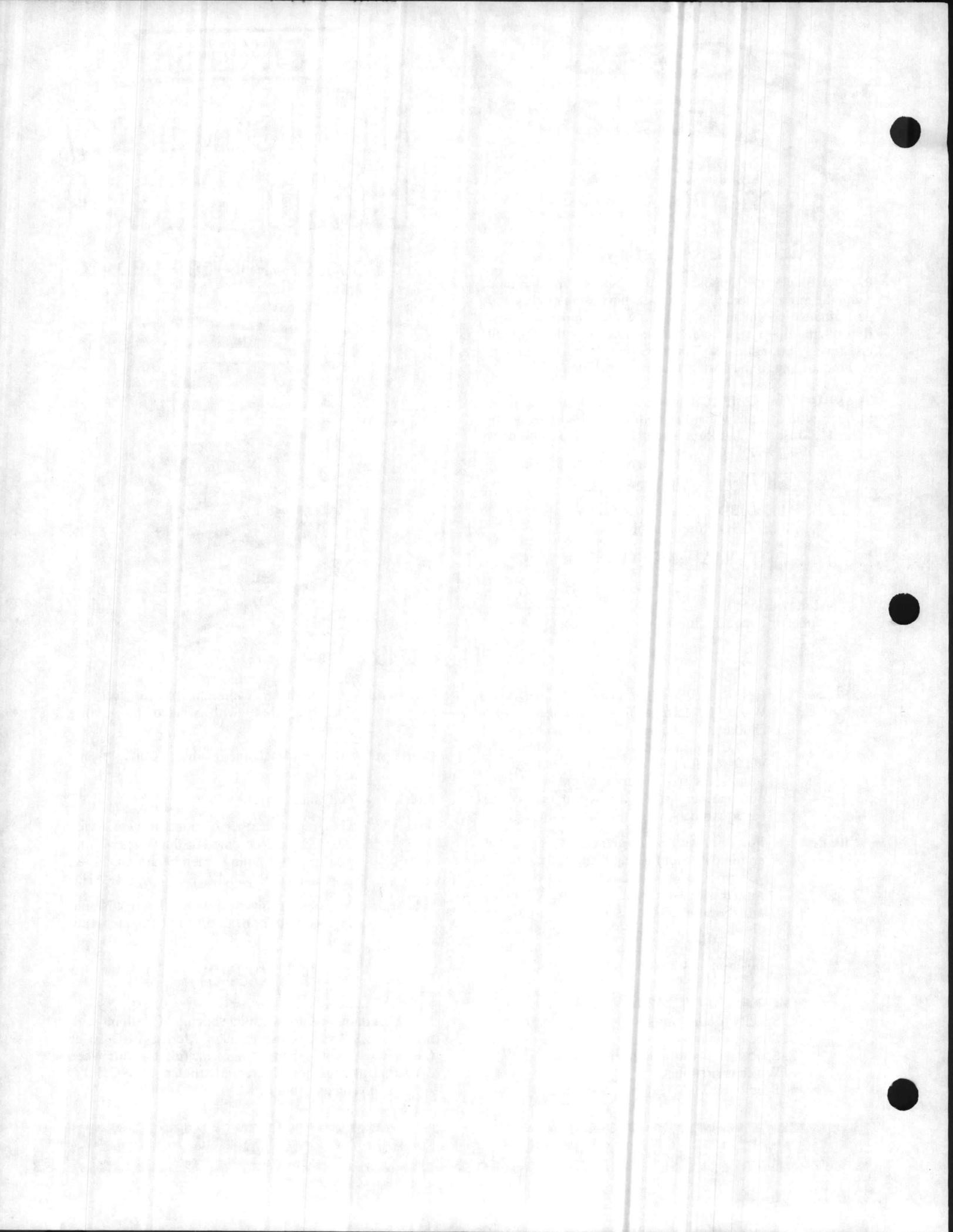
Sizes: Ganging of damper sections provide added flexibility to accommodate duct sizes without additional framing members; maximum nominal single panel size 30" W x 48" H.

Side Seal: Stainless spring steel with cellular cushioning material for flexibility and a tighter jamb seal.

EFFICIENCY

Refer to Figure 1
LeakLess damper with twin blade edging of resilient sealing gasket, "... air loss through Models PBD-10 or OBD-10 will be less than 0.5% of the full flow rate when operating at pressure differentials under 4" WG ..."
Approach velocity 2000 FPM.

PENN VENTILATOR CO., INC.

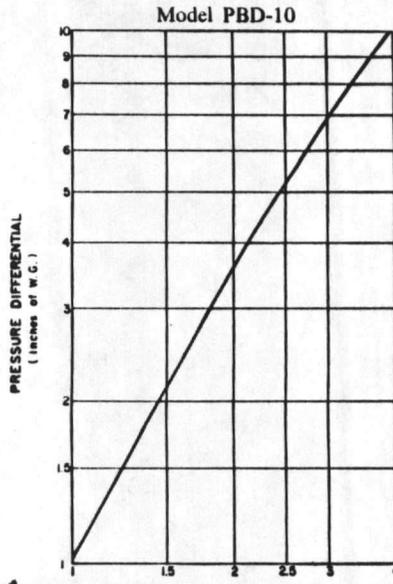
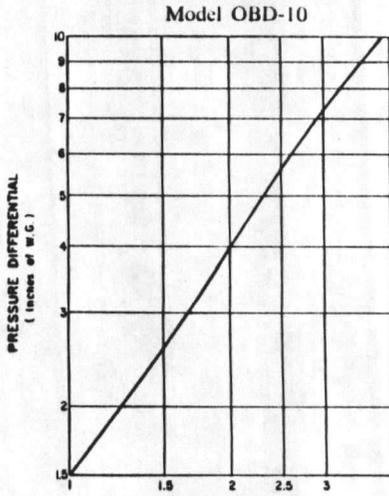


GENERAL SPECIFICATIONS

Parallel blade and opposed blade dampers (PBD-10 and OBD-10) are engineered to provide the high performance required for the proper operation of HVAC systems. These dampers are designed for use in systems when the approach velocity does not exceed 2000 fpm and the pressure differential across the damper does not exceed 4" w.g.

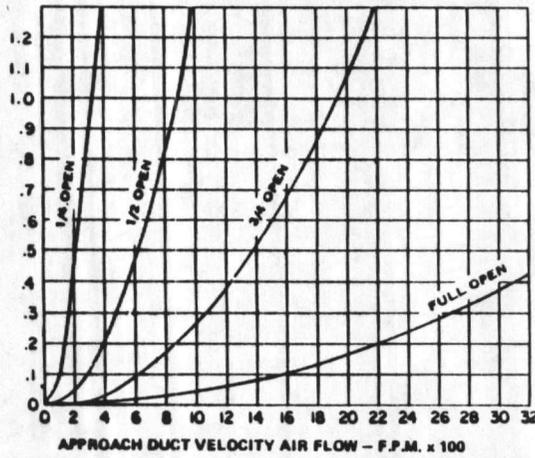
AIR LEAKAGE Figure 1

AIR FLOW - C.F.M.
(Per Sq. Ft. of Damper Area)

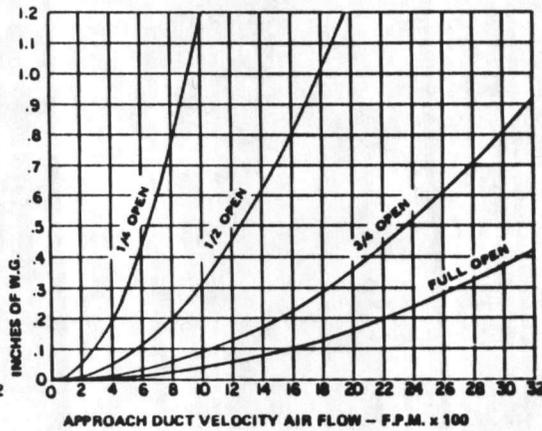


PRESSURE DROP

OPPOSED BLADE DAMPER - MODEL OBD-10



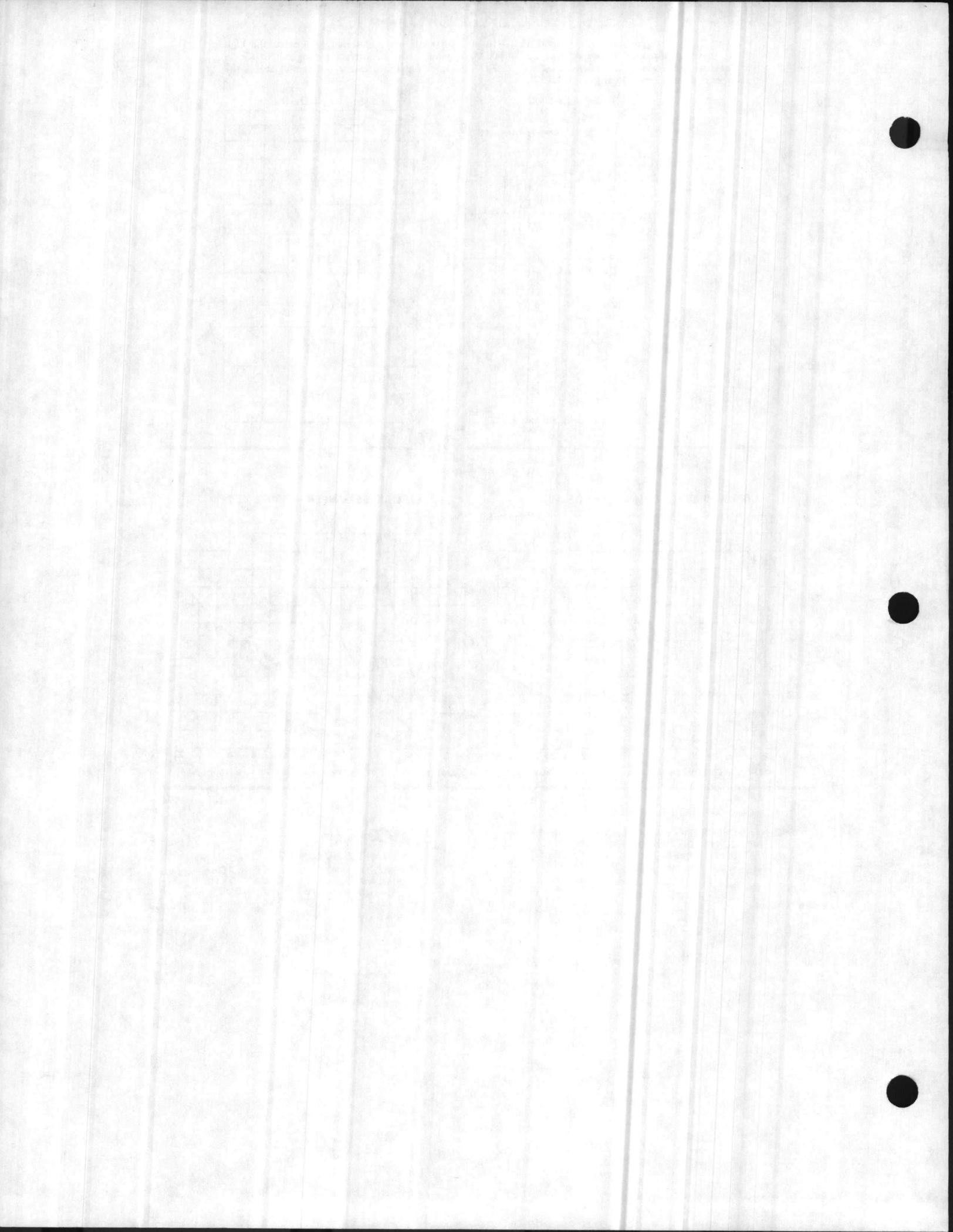
PARALLEL BLADE DAMPER - MODEL PBD-10



OPERATING TORQUE

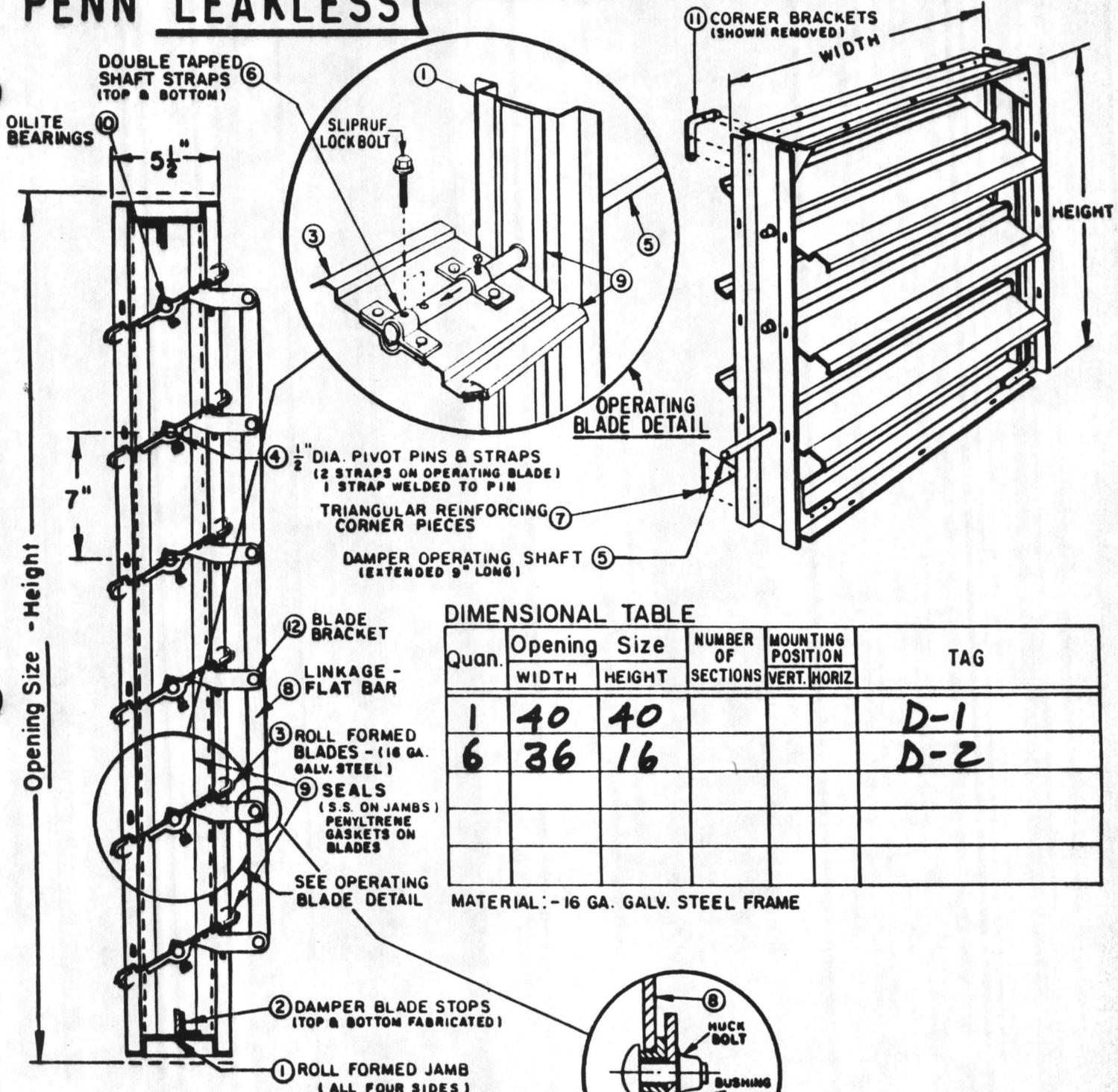
NO AIR MOVEMENT - 4.80 IN. LBS. OF TORQUE PER SQ. FT. OF DAMPER FACE AREA.
DO NOT SELECT OPERATOR WITH LESS THAN 20 IN. LBS. FOR ANY SIZE OF DAMPER.

PENN VENTILATOR CO., Inc.
RED LION AND GANTRY ROADS
PHILADELPHIA, PA. U.S.A. 19115
(AREA CODE 215) 464-8900
TELEX NO. 83-4545



PENN LEAKLESS

AIR CONTROL DAMPERS - PBD-10



DIMENSIONAL TABLE

Quan.	Opening Size		NUMBER OF SECTIONS	MOUNTING POSITION		TAG
	WIDTH	HEIGHT		VERT.	HORIZ.	
1	40	40				D-1
6	36	16				D-2

MATERIAL: - 16 GA. GALV. STEEL FRAME

Vertical Section

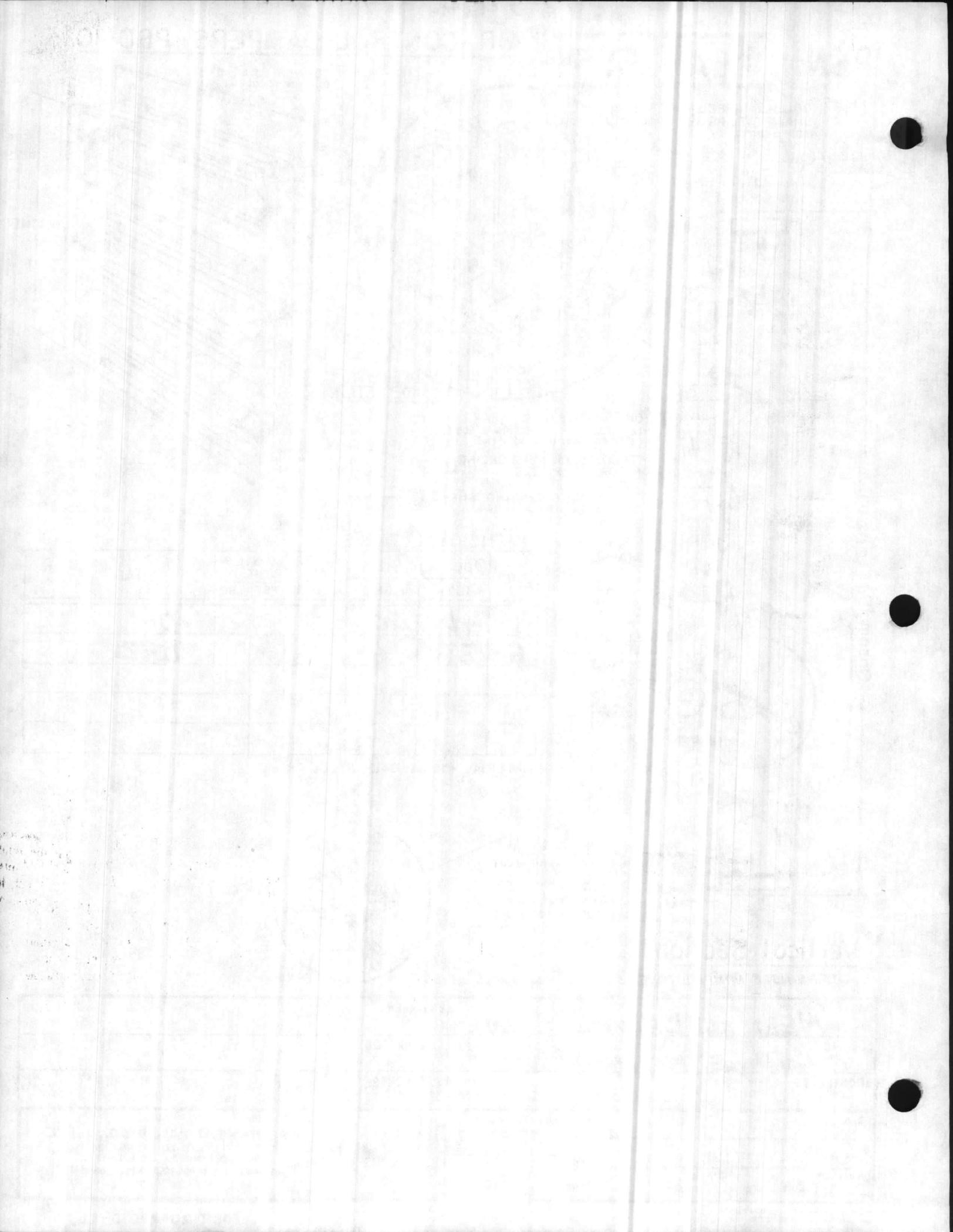
NOTE: SINGLE NOMINAL PANEL SIZE 30" WIDTH X 48" HEIGHT.

PROJECT: MEDICAL/DENTAL CLINIC		ENGINEER:
LOCATION: CAMP LEJEUNE		CONTRACTOR:
ARCHITECT:		SUB-CONTR.
DRAWING NO.	REVISIONS	
DATE:	NO. 1	
DRAWN BY: B.G.	NO. 2	
CHK. BY:	NO. 3	



PENN VENTILATOR CO., Inc.
 RED LION AND GANTRY ROADS
 PHILADELPHIA, PA. U.S.A. 19115
 (AREA CODE 215) 484-8800 TELEX: 83-4545

THIS DRAWING ILLUSTRATES OUR UNDERSTANDING OF ORDER REQUIREMENTS WHEN APPROVED IT REPRESENTS DETAILS FOR FABRICATION AS SUCH. PENN VENTILATOR WILL NOT BE RESPONSIBLE FOR REVISIONS IN THE FIELD OR OTHER CHANGES AFTER RELEASE FOR FABRICATION



AFS 222
AFS 262

APPLICATION

The AFS 222 and AFS 262 are general purpose airflow proving switches designed for HVAC and Energy Management applications. They may be used to sense positive, negative or differential air pressure.

GENERAL DESCRIPTION & OPERATION

The plated housing contains a diaphragm, a calibration spring and a snap-acting SPDT switch.

The sample connections located on each side of the diaphragm accept 1/4" OD tubing via the integral compression ferrule and nut.

An enclosure cover guards against accidental contact with the live switch terminal screws and the set point adjusting screw. The enclosure cover will accept a 1/2" conduit connection.

For additional application and technical information, please contact Cleveland Controls' Sensing Switch Sales.

MOUNTING (Figure 1)

Mount with diaphragm in any vertical plane.

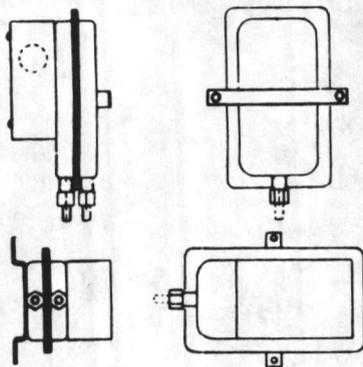


Fig. 1

Select a mounting location which is free from vibration. The AFS-222 must be mounted with the diaphragm in any vertical plane in order to obtain the lowest specified, operating set point. Avoid mounting with the sample line connections in the "up" position. Surface mount via the two 3/16" diameter holes in the integral mounting bracket. The mounting holes are 3-7/8" apart.

AIR SAMPLING CONNECTIONS (Figure 2)

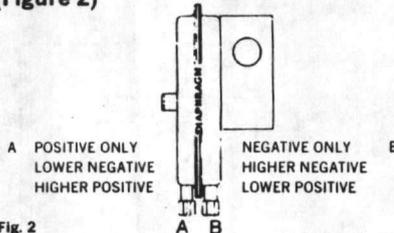


Fig. 2

CCI's AFS-222 is designed to accept sample lines of 1/4" OD tubing by means of ferrule and nut compression type connections.

Locate sampling probe a minimum of 1-1/2 duct diameters downstream from the air source. Install the sampling probe as close to the center of the airstream as possible.

A 1/4" adapter, suitable for slip-on flexible tubing, is available.

Refer to Figure 2 to identify the high pressure inlet (A) and the low pressure inlet (B), and connect the sample lines as follows:

POSITIVE PRESSURE ONLY: Connect the sample line to A; B remains open to the atmosphere.

NEGATIVE PRESSURE ONLY: Connect the sample line to B; A remains open to the atmosphere.

TWO NEGATIVE SAMPLES: Connect the higher negative sample to B; Connect the lower negative sample to A.

TWO POSITIVE SAMPLES: Connect the higher positive sample to A; Connect the lower positive sample to B.

ONE POSITIVE AND ONE NEGATIVE SAMPLE: Connect the positive sample to A; Connect the negative sample to B.

ELECTRICAL CONNECTIONS (Figures 3 & 4)

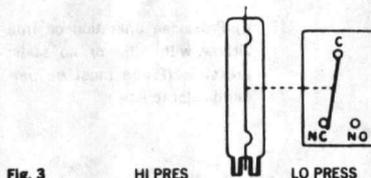


Fig. 3

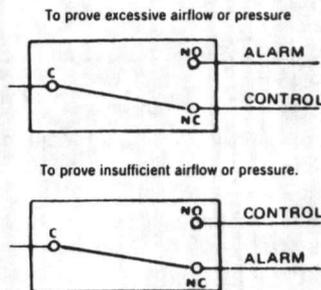
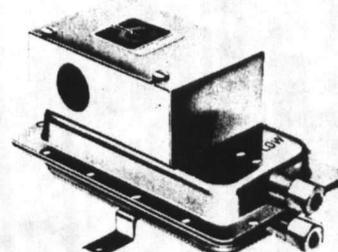


Fig. 4

Before pressure is applied to the diaphragm, the switch contacts will be in the normally closed (NC) position.

The snap switch has screw top terminals with cup washers.

Control and alarm functions are wired as shown in Figure 4.

FIELD ADJUSTMENT

From the lowest operating set point, several turns of the adjusting screw are necessary to engage the calibration spring. No change in set point will occur until the spring is engaged. For higher set points, continue turning the adjusting screw in a clockwise direction.

When adjusting, connect a manometer, parallel with the switch, so that the final operating set point can be noted for future reference. Also, once the adjustment is completed, the switch should be cycled a few times and the set point verified.

PRESSURE

AIR SENSING SWITCHES

AFS 222
AFS 262

SPECIFICATIONS FOR CCI MODEL AFS-222

AFS222 AND AFS 262

RANGE: AFS 262

.05 ± .02" to 2.0" w.c. (1.3 to
51.0 mm w.c.) (0 to 0.07 psi).
Adjustable.

SET POINT RANGE:

.05 ± .02" w.c. to 12.0" w.c. (1.27 ±
.508 mm w.c. to 304.8 mm w.c.)
(0 to .43 PSI)

CONTROL SET POINT:

Field Adjustable

"Operate Range":

.07" w.c. to 12.0" w.c. (1.778 mm w.c. to
304.8 mm w.c.)

"Release Range":

.04" w.c. to 11.2" w.c. (1.016 mm w.c. to
284.48 mm w.c.)

SWITCH DIFFERENTIAL:

Progressive, increasing from approxi-
mately .02 ± .01" w.c. at minimum set
point, to approximately .8" w.c. at
maximum set point. (±1 w.c. for the
AFS 262)

MAXIMUM PRESSURE:

½ PSI (0.03 bar)

OPERATING TEMPERATURE RANGE:

-40° to 180°F (-40.0° to 82.2° C)

LIFE:

100,000 cycles minimum at ½ PSI
maximum pressure each cycle and at
maximum electrical load.

ELECTRICAL RATING:

300 VA pilot duty at 115 to 277 VAC,
10A non-inductive 277 VAC, 60 Hz.

CONTACT ARRANGEMENT:

SPDT

ELECTRICAL CONNECTIONS:

Screw top terminals with cup washers.

SAMPLE LINE CONNECTIONS:

Ferrule and nut compression type
connectors will accept ¼" OD rigid
tubing.

APPROVAL AND RECOGNITION:

UL, FM, CSA

SHIPPING WEIGHT:

2 lbs.

ACCESSORIES:

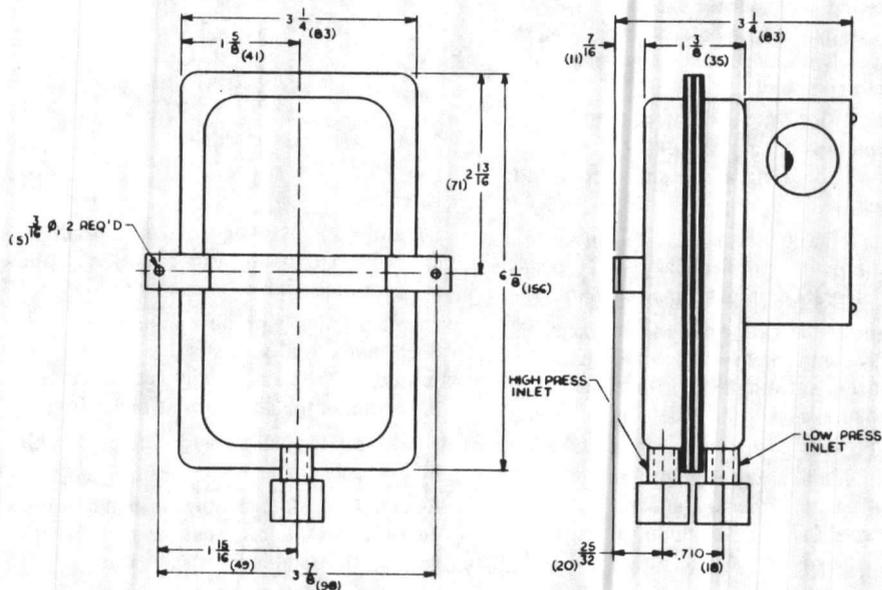
Slip-on, ¼" OD Tubing Adapter, suit-
able for slipping on flexible plastic
tubing, Part Number 18311.

Sample Line Probes

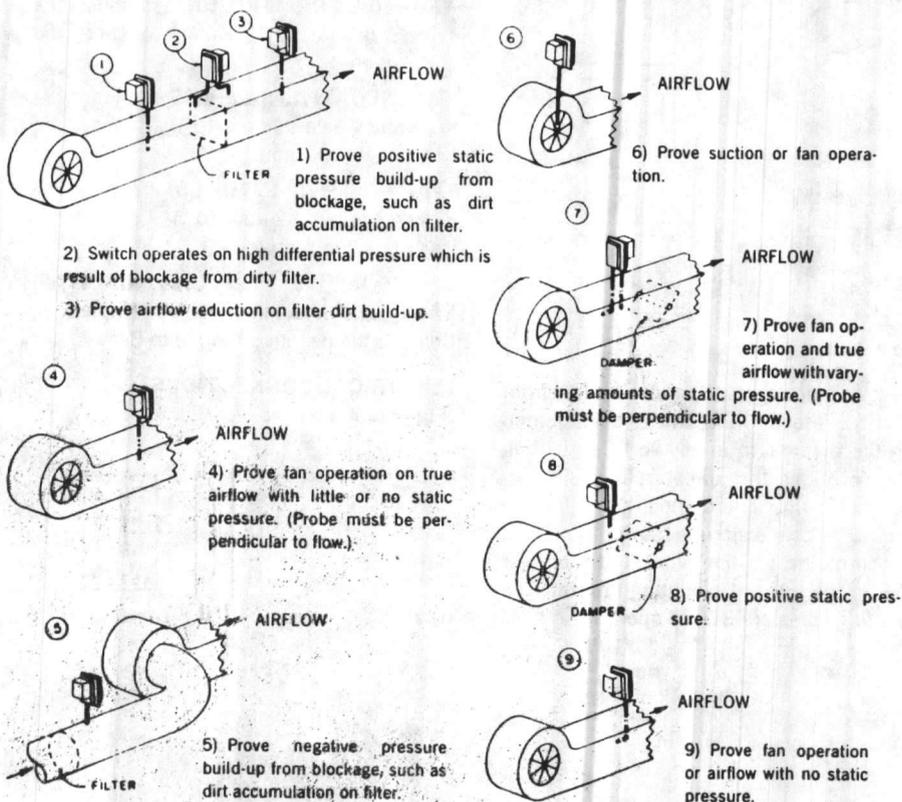
Orifice Plugs

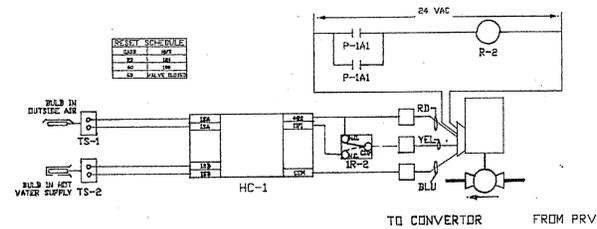
Call Factory

DIMENSIONS INCHES (MM)

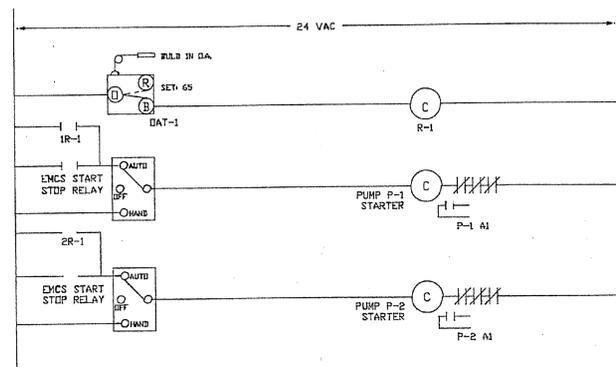


TYPICAL APPLICATIONS

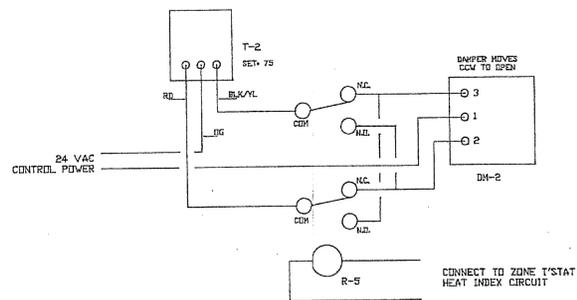




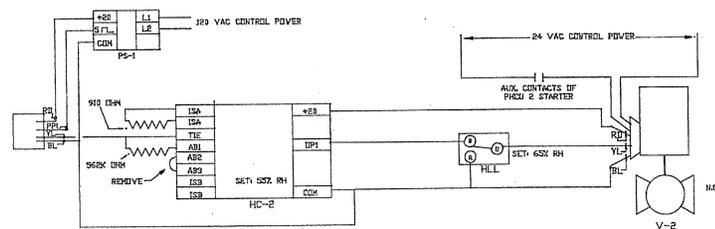
CONVERTOR CONTROL



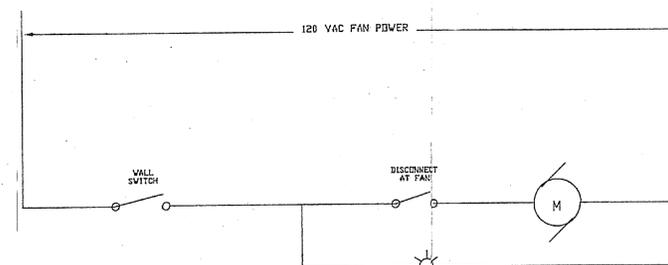
PUMP CONTROL



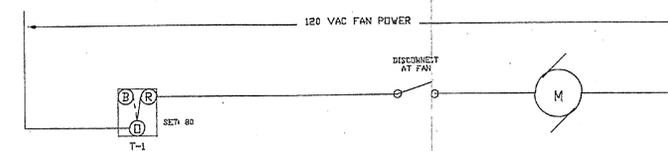
VAV CONTROLS RMS 003, 049, 135



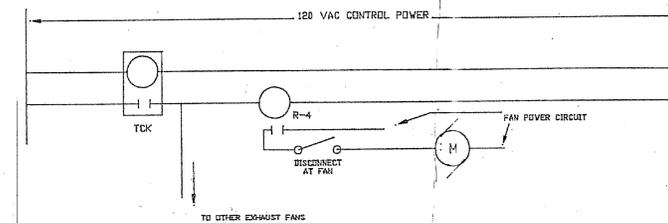
HUMIDIFIER CONTROL



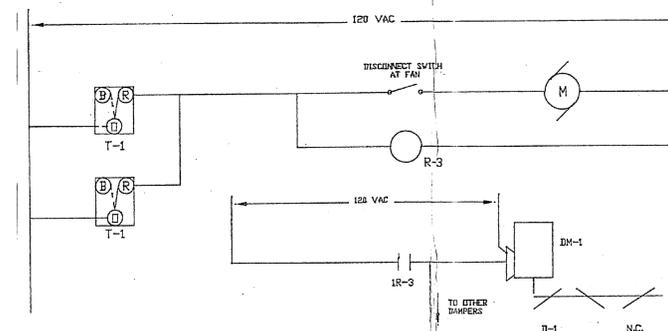
EX. FANS 3, 12, 17



EX. FANS 5, 6, 15, 21



EX. FANS 7, 11, 14, 16, 20



EX. FANS 8, 9, 22

5214 15971-1.4.2 A,F

TRIANGLE AUTOMATED CONTROLS, INC.
2716 DISCOVERY DRIVE
RALEIGH, NC. 27604

REVISIONS
DATE CHANGE
JOB: MEDICAL/DENTAL CLINIC CONTRACT# N62470-B-85-5214
LOCATION: CAMP LEJEUNE, N.C.
ARCHITECT: SIX ASSOCIATES INCORPORATED
ENGINEER: SIX ASSOCIATES INCORPORATED
CONTRACTOR: SNEEDEN INC.

DATE	DRAWN BY	CHECKED BY	DRAWING NUMBER
10/8/87	AJB	AJB	1 OF 2



