

# P118F

## *TUBE-ICE<sup>®</sup> MACHINE SERVICE MANUAL*

SERIAL NUMBER

*HENRY VOGT MACHINE CO.*

*P.O. BOX 1918  
LOUISVILLE, KENTUCKY 40201 U.S.A.*

**MID & LARGE MACHINE WARRANTY REGISTRATION/START-UP REPORT**  
**MUST COMPLETE AND RETURN TO INITIATE WARRANTY**

Machine Model No. \_\_\_\_\_ Serial No. \_\_\_\_\_

Installed at: \_\_\_\_\_ ( ) \_\_\_\_\_  
 Company Name Phone  
 Address City State Zip

Installed by: \_\_\_\_\_ ( ) \_\_\_\_\_ / /  
 Company Name Phone Date  
 Address City State Zip

Describe any damage to machine/repairs made: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Start up by: \_\_\_\_\_ ( ) \_\_\_\_\_ / /  
 Company Name Phone Date  
 Address

Name of person starting up machine: \_\_\_\_\_

**PRE START-UP CHECK**

**CHECK**

- ☐ Service Manual on hand
- ☐ Machine room suitable 50°F minimum, 110°F maximum
- ☐ Proper power supply, actual voltage \_\_\_\_\_ (machine not running)
- ☐ Compressor crankcase heater on 12 hour minimum
- ☐ Necessary hand valves opened as required
- ☐ Solenoid valve stems in auto position
- ☐ System leak checked/tight
- ☐ Auxiliary equipment overloads wired into control circuit
- ☐ Compressor oil level \_\_\_\_\_ (1/4 glass min.)
- ☐ All water distributors in place (visually inspected)
- ☐ Water supply and drain lines installed and connected properly
- ☐ Compressor, pump, cutter and other motor direction of rotation correct
- ☐ Make-up water float valve adjusted properly
- ☐ Hour meter in control panel connected

**OPERATION CHECK**

Machine charged with refrigerant lbs. \_\_\_\_\_ Actual voltage \_\_\_\_\_ (machine running)  
 Ambient temp. \_\_\_\_\_ °F Fan cycles On \_\_\_\_\_ Off \_\_\_\_\_ Tower water in \_\_\_\_\_ °F out \_\_\_\_\_ °F  
 Comp motor RLA \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ Actual \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
 Pump RLA \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ Actual \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
 Cutter motor RLA \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ Actual \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
 Suction pressure end of freezing \_\_\_\_\_, end of harvest \_\_\_\_\_ Discharge pressure end of freezing \_\_\_\_\_, end of harvest \_\_\_\_\_  
 Evaporator/suction line frost \_\_\_\_\_ Receiver liquid level operating \_\_\_\_\_

| Test Cycle | Water Temp | Freeze Time Min/Sec | Harvest Time Min/Sec | First Ice Out Min/Sec | All Ice Out Min/Sec | Avg. Hole Size | Ice Lb. Per Harvest | Ice Lb. Per Day |
|------------|------------|---------------------|----------------------|-----------------------|---------------------|----------------|---------------------|-----------------|
| #1         |            |                     |                      |                       |                     |                |                     |                 |
| #2         |            |                     |                      |                       |                     |                |                     |                 |
| #3         |            |                     |                      |                       |                     |                |                     |                 |
| #4         |            |                     |                      |                       |                     |                |                     |                 |

Note: Ice lb. per day can be found by:  $\frac{\text{ice lb. per harvest}}{(\text{freeze time} + \text{harvest time})} \times 1440$

The machine operated satisfactorily for \_\_\_\_\_ continuous hours. Date \_\_\_\_\_

Comments \_\_\_\_\_  
 \_\_\_\_\_

Installer signature \_\_\_\_\_ End user signature \_\_\_\_\_  
 Please return to: Tube-Ice Division, Henry Vogt Machine Co., P.O. Box 1918, Louisville, KY 40201

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# VOGT® MODELS HE100, P118 & P18XFT TUBE-ICE® MACHINE BASIC PRODUCT WARRANTY

90017

The Henry Vogg Machine Co. hereinafter referred to as SELLER, warrants every Vogg Tube-Ice® Machine Model HE100, P118F and P18FXT to be free from defects in material and workmanship, if properly installed, maintained and operated under normal use for a period of 24 months from date of original installation or 24 months from date of shipment from SELLER'S plant if SELLER does not have an accepted start-up form on file.

SELLER'S obligation under this warranty shall be strictly limited, at SELLER'S option, to: (i) repairing or furnishing replacement parts on an exchange basis, F.O.B. Louisville, Kentucky, without charge to the PURCHASER or original end-user, hereinafter referred to as PURCHASER; or (ii) issuing written authorization for PURCHASER or others to replace or repair, without charge to PURCHASER, those parts proven defective upon examination by SELLER; or (iii) in discharge of SELLER'S maximum liability herewith, refunding all monies paid by PURCHASER to SELLER for the product and, at discretion of SELLER, having the product removed and returned to SELLER at PURCHASER'S expense. All transportation charges relative to corrective work, defective parts or replacement parts shall be borne by PURCHASER. PURCHASER shall give SELLER immediate notice upon discovery of any defect. The undertaking of repairs or replacement by PURCHASER or its agents without SELLER'S written consent shall relieve SELLER of all responsibility herewith.

Any alteration in material or design of SELLER'S product or component parts thereof by PURCHASER or others without written authorization by SELLER voids all obligations of SELLER regarding the product and any associated warranty herein stated or implied.

*SELLER'S sole liability shall be exclusively as set forth herein, and SELLER shall not be liable for any incidental or consequential damages due to its breach of any warranty herein contained, or otherwise. Without limitation to the foregoing, in no event shall SELLER be liable for the loss of the product or for the loss of use of any other product, process, plant, equipment, or facilities of the PURCHASER whether partially or wholly due to defects in material and/or workmanship and/or design of SELLER'S product, and in no event shall SELLER be liable for removal of appurtenances or incidentals such as connections, pipework and similar items of obstruction or for any cost brought about by the necessity of removing the product from its point of installation.*

SELLER makes no warranty of any kind whatsoever, express or implied, other than as specifically stated herein; and there are no warranties of merchantability and/or fitness for a particular purpose which exceed the obligations and warranties specifically stated herein.

## FIVE-YEAR EXTENDED WARRANTY

At the termination of the two year component warranty period above, SELLER hereby extends this warranty for three years to cover **COMPRESSORS AND CUTTER ASSEMBLIES, EXCLUDING THE CUTTER BEARINGS AND DRIVE TRAINS**. The five year compressor parts warranty shall not apply when the Tube-Ice® machine is installed or modified with a condenser or a heat reclaim device other than those sold by SELLER unless SELLER has accepted modifications for specific installations in writing. *The extended warranty, as it applies to the COMPRESSOR covers only those machines installed in THE UNITED STATES OF AMERICA AND ITS TERRITORIES.*

## LIFETIME WARRANTY\*

This component warranty is further extended for the life of the machine to cover the **EVAPORATOR (FREEZER), FRAME, CIRCULATING WATER TANK AND REFRIGERANT RECEIVER, EXCLUDING GAGE GLASS ASSEMBLIES AND VALVES**. Damage to evaporator tubes as a result of expansion caused by re-freezing of ice or corrosion damage due to water quality is specifically excluded.

These extensions of warranty apply only to **VOGT® TUBE-ICE® MACHINE MODELS HE100, P118 and P18FXT** for the exclusive benefit of the PURCHASER or original end user, as defined above. All other obligations, terms and conditions of the Basic Product Warranty apply to the Extended Warranty.

\* "Lifetime" is defined as 25 years.

*Vogg® and Tube-Ice® are registered trademarks of Henry Vogg Machine Co., 1000 West Ormsby Ave., Louisville, Kentucky 40210*

## A BRIEF HISTORY OF OUR COMPANY

Henry Vogt Machine Co. was founded as a small machine shop in Louisville, Kentucky in 1880. Today it is one of the world's leading producers of ice-making equipment.

In 1938, VOGT built the first TUBE-ICE machine and revolutionized the ice-making industry. Our first "sized-ice" machine quickly replaced the old can-ice plants, which required much hard labor and large amounts of floor space for freezing, cutting, and crushing ice by hand.

## VOGT ENERGY-SAVING TUBE-ICE MACHINES ARE COST EFFECTIVE

Today VOGT TUBE-ICE machines enjoy a well-earned reputation as the most energy efficient, dependable ice-making equipment in the world.

Using as little as one-half to one-third the energy required by competitors' ice makers, TUBE-ICE machines produce the same amount of ice--in restaurants, sports arenas, packing plants, and wholesale operations around the globe--at great savings.

In addition, TUBE-ICE machines are renowned for their long life, giving many customers more than 35 years of dependable service. Ask someone who owns one.

## PREVIEW

All the skill in engineering and fabrication that we've learned in over a century of experience is reflected in the TUBE-ICE machine. Since VOGT introduced TUBE-ICE machines in 1938, the process of making TUBE-ICE ice has been widely recognized as the most economical means of production. The machine's economic and reliable operation have been proven over and over again in a network of varied types of installations throughout the world.

Furnished with your machine is the CERTIFICATE OF TEST--the report of operating data which is a record of the unit's satisfactory operation at our factory test floor. It is evidence of our desire to deliver to you "the finest ice making unit ever made."

This manual is designed to assist you in the installation, start-up, and maintenance of your unit. Your TUBE-ICE machine will give you a lifetime of service when you install it, maintain it, and service it properly.

Please read your manual carefully before attempting installation, operation, or servicing of this professionally-designed piece of equipment.

If you have additional questions, please call your distributor.

## SPECIAL PRECAUTIONS TO BE OBSERVED WHEN CHARGING REFRIGERATION SYSTEMS

Only technically qualified persons, experienced and knowledgeable in the handling and operation of refrigerant systems should perform the operations described in this manual. It is illegal to vent CFC and HCFC refrigerants into the atmosphere. Follow all federal and local regulations when handling these refrigerants.

Safety goggles should be worn during refrigerant handling, charging, or transfer operations.

If a refrigeration system is being charged from refrigerant cylinders, disconnect each cylinder when empty or system is fully charged. A gauge should be installed in the charging line to indicate refrigerant cylinder pressure. The cylinder may be considered empty of liquid R-22 when gauge pressure is 40 pounds or less and there is no frost on the cylinder. Close the refrigerant charging valve and cylinder valve before disconnecting cylinder. Loosen union in refrigerant charging line slowly to make sure refrigerant pressure between cylinder valve and charging valve is relieved. Follow all federal and local regulations when transferring, recovering, recycling, or reclaiming refrigerants.

**CAUTION:** IMMEDIATELY CLOSE SYSTEM CHARGING VALVE AT COMMENCEMENT OF DEFROST OR THAWING CYCLE IF REFRIGERANT CYLINDER IS CONNECTED. NEVER LEAVE A REFRIGERANT CYLINDER CONNECTED TO SYSTEM EXCEPT DURING CHARGING OPERATION. FAILURE TO OBSERVE EITHER OR THESE PRECAUTIONS CAN RESULT IN POSSIBLE OVERFILLING OF THE REFRIGERANT CYLINDER AND CAUSING IT TO RUPTURE BECAUSE OF PRESSURE FROM EXPANSION OF THE LIQUID REFRIGERANT.

Always store cylinders containing refrigerant-22 in a cool place. They should never be exposed to temperatures higher than 140°F and should be stored in a manner to prevent abnormal mechanical shocks.

It is not recommended that refrigerant be transferred from a refrigeration system into a cylinder. If such a transfer is made, the refrigerant cylinder must be weighed continuously to assure contents do not exceed net weight specified by cylinder manufacturer or any applicable code requirements.

### IMPORTANT SAFETY NOTICE

This information is intended for use by individuals possessing adequate backgrounds of electrical, refrigeration, and mechanical experience. Any attempt to repair major equipment may result in personal injury and property damage. The manufacturer or seller cannot be responsible for the interpretation of this information, nor can it assume any liability in connection with its use.

### INSPECTION

As soon as you receive your machine, inspect it for any damage. If damage is suspected, note it on the shipper's papers (i.e., the trucker's Bill of Lading). Immediately make a separate written request for inspection by the freight line's agent. Any repair work or alteration to the machine without the permission of the Henry Vogt Machine Co. can void the machine's warranty.

The machine was shipped with a full charge of R-22 stored in the receiver. Visually check all lines for mechanical damage which may have developed during shipment. Prior to opening valves, check all the joints with a Halogen Leak Detector. All leaks should be reported to the Henry Vogt Machine Co. to obtain authorization for repair.

### MACHINE ROOM

The machine must be located inside a suitable building and must not be subjected to ambient temperatures below 50°F. Heat radiation from other sources (sunlight, furnaces, condenser, etc), or unusual air currents, may affect the operation of the machine and should be avoided. The electrical components of the TUBE-ICE machine are rated NEMA 1. Therefore, the machine should not be located in a hazardous area, or be sprayed with water.



# VOGT P118F RATINGS

## 10 HP Compressor

60 Hz

| Makeup Water Temp. Deg.F | Model P118F-1.5"                     |                                  |                                |                  | Model P118F-1.25"                    |                                  |                                |                  | Model P118F-1.0"                     |                                  |                                |                  |
|--------------------------|--------------------------------------|----------------------------------|--------------------------------|------------------|--------------------------------------|----------------------------------|--------------------------------|------------------|--------------------------------------|----------------------------------|--------------------------------|------------------|
|                          | Capacity Tons/day (2000 lbs/ 24 hrs) | Water Cooled Efficiency KWH/ Ton | Air Cooled Efficiency KWH/ Ton | Makeup Water GPM | Capacity Tons/day (2000 lbs/ 24 hrs) | Water Cooled Efficiency KWH/ Ton | Air Cooled Efficiency KWH/ Ton | Makeup Water GPM | Capacity Tons/day (2000 lbs/ 24 hrs) | Water Cooled Efficiency KWH/ Ton | Air Cooled Efficiency KWH/ Ton | Makeup Water GPM |
|                          |                                      |                                  |                                |                  |                                      |                                  |                                |                  |                                      |                                  |                                |                  |
| 90                       | 4.1                                  | 67.32                            | 79.45                          | 0.85             | 4.2                                  | 65.71                            | 77.56                          | 0.88             | 4.6                                  | 60.33                            | 71.20                          | 0.95             |
| 85                       | 4.3                                  | 64.37                            | 75.97                          | 0.89             | 4.4                                  | 62.73                            | 74.03                          | 0.92             | 4.8                                  | 57.35                            | 67.68                          | 1.00             |
| 80                       | 4.5                                  | 61.68                            | 72.79                          | 0.93             | 4.6                                  | 60.00                            | 70.81                          | 0.96             | 5.1                                  | 54.65                            | 64.50                          | 1.05             |
| 75                       | 4.7                                  | 59.04                            | 69.68                          | 0.97             | 4.8                                  | 57.50                            | 67.86                          | 1.00             | 5.3                                  | 52.57                            | 62.04                          | 1.09             |
| 70                       | 4.9                                  | 56.62                            | 66.82                          | 1.02             | 5.0                                  | 55.20                            | 65.15                          | 1.04             | 5.5                                  | 50.64                            | 59.77                          | 1.14             |
| 65                       | 5.1                                  | 54.65                            | 64.50                          | 1.05             | 5.2                                  | 53.33                            | 62.94                          | 1.08             | 5.7                                  | 48.85                            | 57.65                          | 1.18             |
| 60                       | 5.2                                  | 52.82                            | 62.34                          | 1.09             | 5.4                                  | 51.59                            | 60.88                          | 1.12             | 5.9                                  | 47.18                            | 55.68                          | 1.22             |
| 55                       | 5.4                                  | 51.59                            | 60.88                          | 1.12             | 5.5                                  | 50.41                            | 59.49                          | 1.14             | 6.0                                  | 46.00                            | 54.29                          | 1.25             |
| 50                       | 5.5                                  | 50.41                            | 59.49                          | 1.14             | 5.6                                  | 49.29                            | 58.17                          | 1.17             | 6.2                                  | 44.88                            | 52.96                          | 1.28             |
| 45                       | 5.6                                  | 49.29                            | 58.17                          | 1.17             | 5.7                                  | 48.21                            | 56.90                          | 1.19             | 6.3                                  | 43.64                            | 51.50                          | 1.32             |
| 40                       | 5.7                                  | 48.21                            | 56.90                          | 1.19             | 5.9                                  | 47.18                            | 55.68                          | 1.22             | 6.5                                  | 42.46                            | 50.11                          | 1.35             |

Notes:

1. Makeup water is average flow and includes 25% blowdown. Peak flow rate is 15 GPM. When water quality is good, machine can be operated with 5% to 10% blowdown.
2. For crushed ice ratings, multiply capacity by 1.04 and efficiency by 0.96.
3. Condenser water flow is based on pulldown at 30°F SST, 105°F SDT.
4. Ratings are at 90°F ambient for ice machine and for condenser.
5. For air-cooled machines above 90°F ambient, deduct 4% in capacity for each 5°F.
6. For water-cooled machines above 85°F EWT, deduct 4% in capacity for each 5°F.
7. A 1.25" WRV (water regulating valve) is standard. Consult factory if lower condenser water pressure drop is required.
8. Capacity shown is the average for model. Individual machines may vary up to 5% above or below depending on field conditions.
9. Ratings are subject to change without notice.

| Condenser Water      |                     |          |                  |  |
|----------------------|---------------------|----------|------------------|--|
| Entering Water Deg.F | Leaving Water Deg F | Flow GPM | Cond. & WRV PSID |  |
| 85                   | 95                  | 39       | 23               |  |
| 80                   | 95                  | 26       | 11               |  |
| 75                   | 95                  | 20       | 5                |  |
| 70                   | 95                  | 16       | 4                |  |
| 65                   | 95                  | 13       | 3                |  |
| 60                   | 95                  | 11       | 2                |  |
| 55                   | 95                  | 10       | 2                |  |
| 50                   | 95                  | 9        | 2                |  |

APRIL 1993

# VOGT P118F RATINGS

## 15 HP Compressor

50 Hz

| Makeup<br>Water<br>Temp.<br>Deg.F | Model P118F-1.5"                              |  |  |                        | Model P118F-1.25"                             |  |  |                        | Model P118F-1.0"                              |  |  |                        |
|-----------------------------------|---|--|--|------------------------|---|--|--|------------------------|---|--|--|------------------------|
|                                   | Capacity<br>Tons/day<br>(2000 lbs/<br>24 hrs) | Water<br>Cooled<br>Efficiency<br>KWH/<br>Ton | Air<br>Cooled<br>Efficiency<br>KWH/<br>Ton | Makeup<br>Water<br>GPM | Capacity<br>Tons/day<br>(2000 lbs/<br>24 hrs) | Water<br>Cooled<br>Efficiency<br>KWH/<br>Ton | Air<br>Cooled<br>Efficiency<br>KWH/<br>Ton | Makeup<br>Water<br>GPM | Capacity<br>Tons/day<br>(2000 lbs/<br>24 hrs) | Water<br>Cooled<br>Efficiency<br>KWH/<br>Ton | Air<br>Cooled<br>Efficiency<br>KWH/<br>Ton | Makeup<br>Water<br>GPM |
|                                   |   |  |  |                        |   |  |  |                        |   |  |  |                        |
| 90                                | 4.3   | 64.71  | 76.37                                      | 0.89                   | 4.4   | 63.16  | 74.54                                      | 0.91                   | 4.8   | 57.98  | 68.43                                      | 0.99                   |
| 85                                | 4.5   | 61.88  | 73.03                                      | 0.93                   | 4.6   | 60.33  | 71.20                                      | 0.95                   | 5.0   | 55.14  | 65.08                                      | 1.04                   |
| 80                                | 4.7   | 59.29  | 69.97                                      | 0.97                   | 4.8   | 57.68  | 68.07                                      | 1.00                   | 5.3   | 52.57  | 62.04                                      | 1.09                   |
| 75                                | 4.9   | 56.79  | 67.02                                      | 1.01                   | 5.0   | 55.31  | 65.28                                      | 1.04                   | 5.5   | 50.55  | 59.66                                      | 1.14                   |
| 70                                | 5.1   | 54.44  | 64.25                                      | 1.06                   | 5.2   | 53.08  | 62.64                                      | 1.08                   | 5.7   | 48.68  | 57.45                                      | 1.18                   |
| 65                                | 5.3   | 52.57  | 62.04                                      | 1.09                   | 5.4   | 51.30  | 60.55                                      | 1.12                   | 5.9   | 46.98  | 55.44                                      | 1.22                   |
| 60                                | 5.4   | 50.78  | 59.93                                      | 1.13                   | 5.6   | 49.60  | 58.53                                      | 1.16                   | 6.1   | 45.36  | 53.53                                      | 1.27                   |
| 55                                | 5.6   | 49.60  | 58.53                                      | 1.16                   | 5.7   | 48.46  | 57.20                                      | 1.19                   | 6.2   | 44.23  | 52.20                                      | 1.30                   |
| 50                                | 5.7   | 48.46  | 57.20                                      | 1.19                   | 5.8   | 47.38  | 55.92                                      | 1.21                   | 6.4   | 43.16  | 50.94                                      | 1.33                   |
| 45                                | 5.8   | 47.38  | 55.92                                      | 1.21                   | 6.0   | 46.35  | 54.70                                      | 1.24                   | 6.6   | 41.95  | 49.50                                      | 1.37                   |
| 40                                | 6.0   | 46.35  | 54.70                                      | 1.24                   | 6.1   | 45.36  | 53.53                                      | 1.27                   | 6.8   | 40.83  | 48.19                                      | 1.41                   |

Notes:

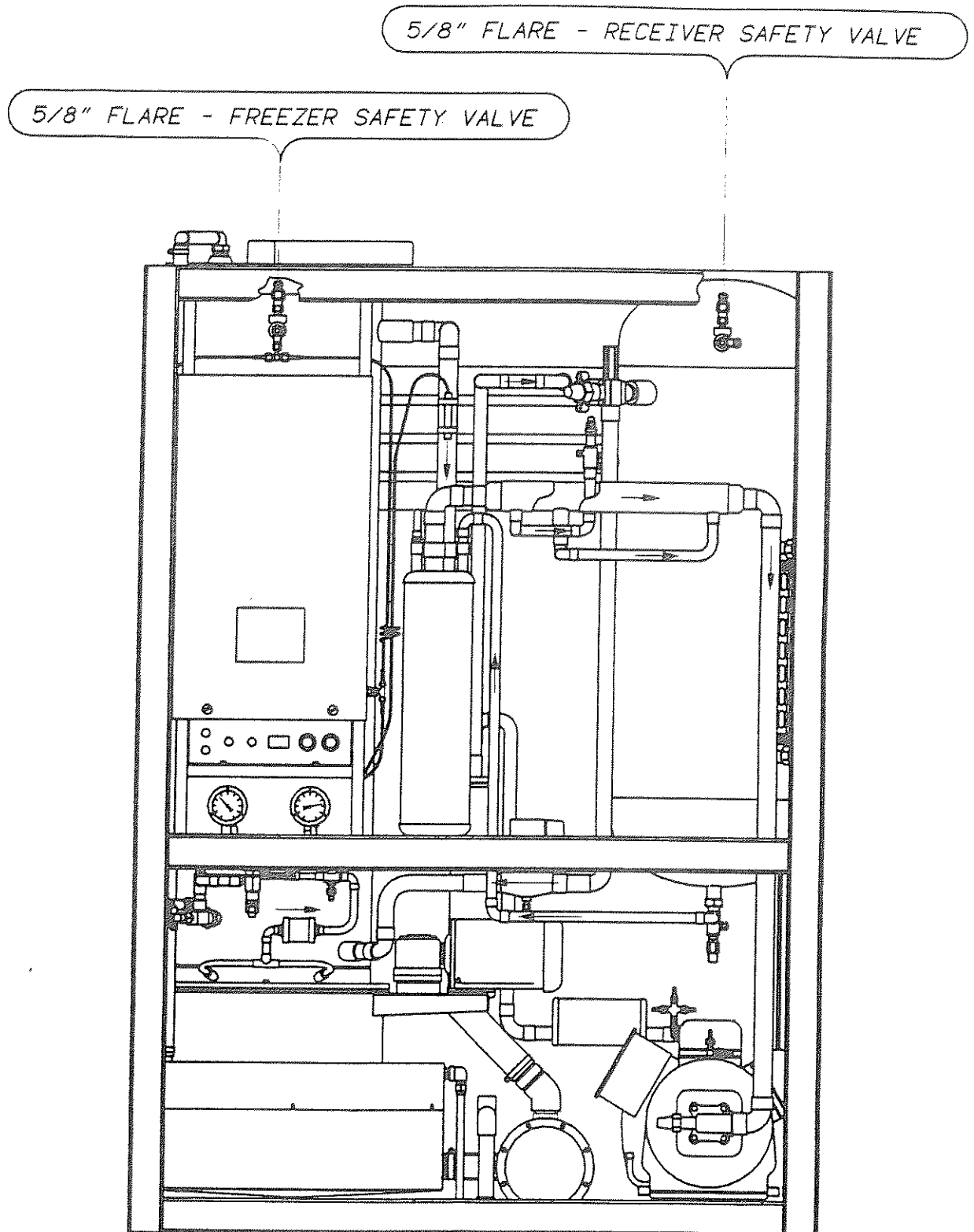
1. Makeup water is average flow and includes 25% blowdown. Peak flow rate is 15 GPM. When water quality is good, machine can be operated with 5% to 10% blowdown.
2. For crushed ice ratings, multiply capacity by 1.04 and efficiency by 0.96.
3. Condenser water flow is based on pulldown at 30°F SST, 105°F SDT.
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6. For water-cooled machines above 85°F EWT, deduct 4% in capacity for each 5°F.
7. A 1.25" WRV (water regulating valve) is standard. Consult factory if lower condenser water pressure drop is required.
8. Capacity shown is the average for model. Individual machines may vary up to 5% above or below depending on field conditions.
9. Ratings are subject to change without notice.

| Condenser Water            |                           |             |                        |
|----------------------------|---------------------------|-------------|------------------------|
| Entering<br>Water<br>Deg.F | Leaving<br>Water<br>Deg.F | Flow<br>GPM | Cond.<br>& WRV<br>PSID |
| 85                         | 95                        | 43          | 30                     |
| 80                         | 95                        | 29          | 13                     |
| 75                         | 95                        | 21          | 5                      |
| 70                         | 95                        | 17          | 4                      |
| 65                         | 95                        | 14          | 3                      |
| 60                         | 95                        | 12          | 2                      |
| 55                         | 95                        | 11          | 2                      |
| 50                         | 95                        | 10          | 2                      |

APRIL 1993

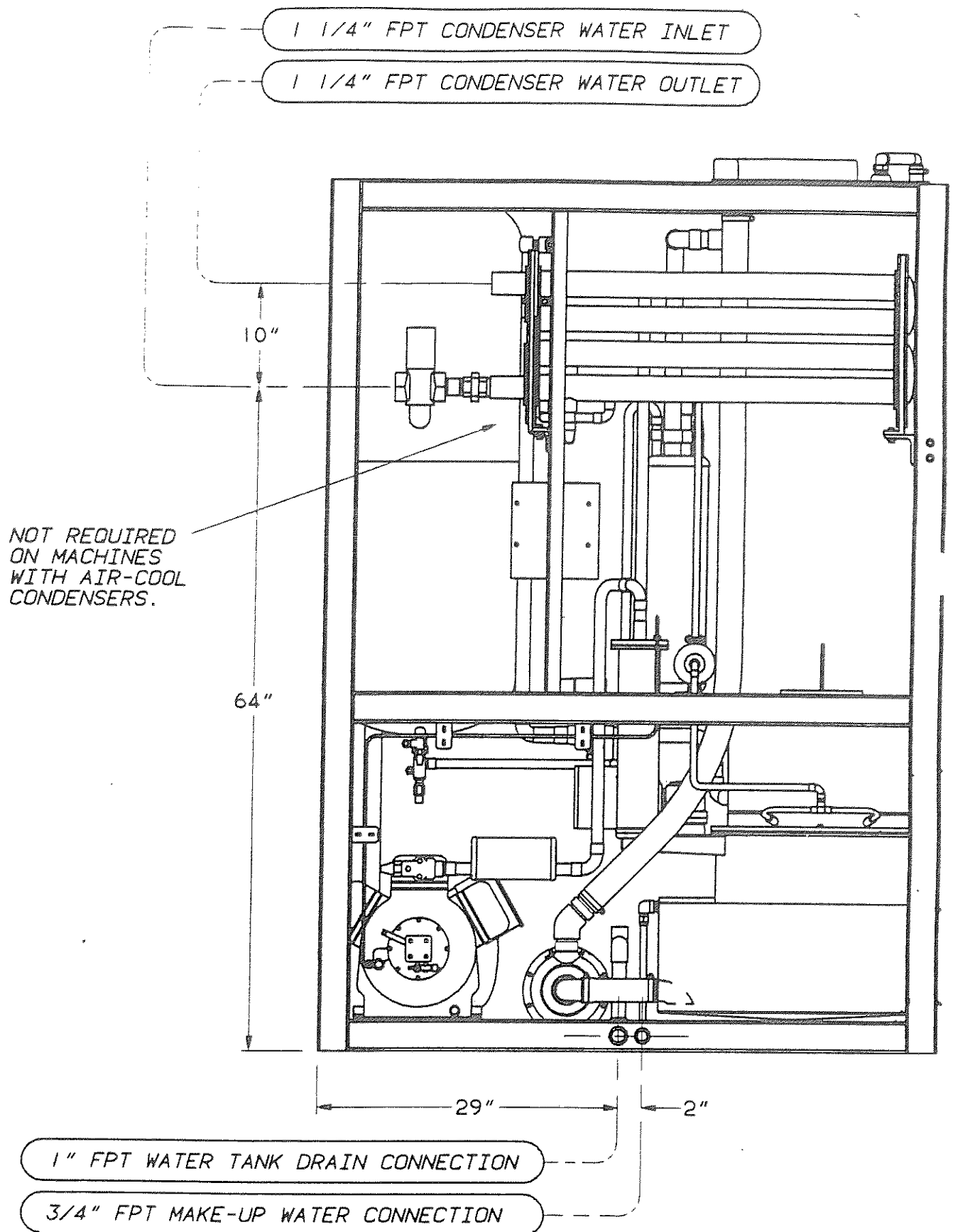
# SAFETY VALVES

SAFETY VALVES LOCATED ON ICE MACHINE MUST BE VENTED TO THE ATMOSPHERE IN SUCH A MANNER TO COMPLY WITH LOCAL AND NATIONAL CODES.



FRONT VIEW

# WATER AND DRAIN CONNECTIONS



### COOLING TOWER (FOR WATER COOLED MACHINES ONLY)

When selecting a cooling tower, careful attention must be given to operating wet bulb condition. It is advisable to check with your local cooling tower distributor for their recommendations based on actual operating conditions in your area. An average wet-bulb of 78°F is typical in the U.S., but many localities have designed wet-bulbs as low as 72°F or as high as 82°F.

Tower water pump must be capable of delivering the required volume of water through the condensers. Due to cooling tower location and pressure drop through water lines and water regulating valves, the pump must be sized for each installation.

The condenser water inlets are 1 1/4" F.I.P. connection located in each condenser head.

The selection of a water recovery system must be done on an individual unit basis with particular emphasis on local wet bulb conditions. The size of the water pump will vary considerably with the location of the cooling tower, size of the tower and the location of the machine to cooling tower; but it must be capable of delivering the required water quantity at the inlet to the condenser.

P.D. = Pressure drop through condensers (PSIG), multiply P.D. by 2.31 to obtain feet of head for pump sizing.

The water piping for the cooling tower and the installation of the pump must be in accordance with the manufacturer's instructions.

Water treatment for the prevention of scale, slime and algae build-up inside the condenser tubes is recommended. It is suggested that local chemical treatment supplier be contacted to arrange this form of preventative maintenance.

Condenser water outlets (1 1/4") may be piped to a recovery system or a drain, as the case may be.

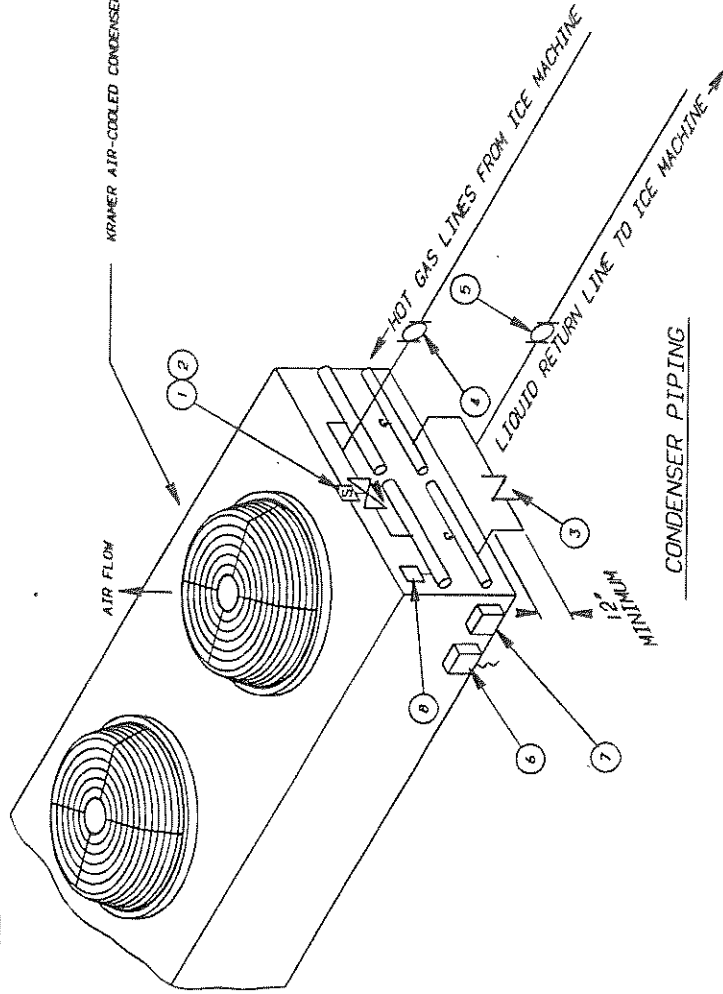
Local plumbing codes should be checked and complied with.

THE FOLLOWING CRITERIA SHOULD BE FOLLOWED  
WHEN INSTALLING AIR-COOLED CONDENSERS:

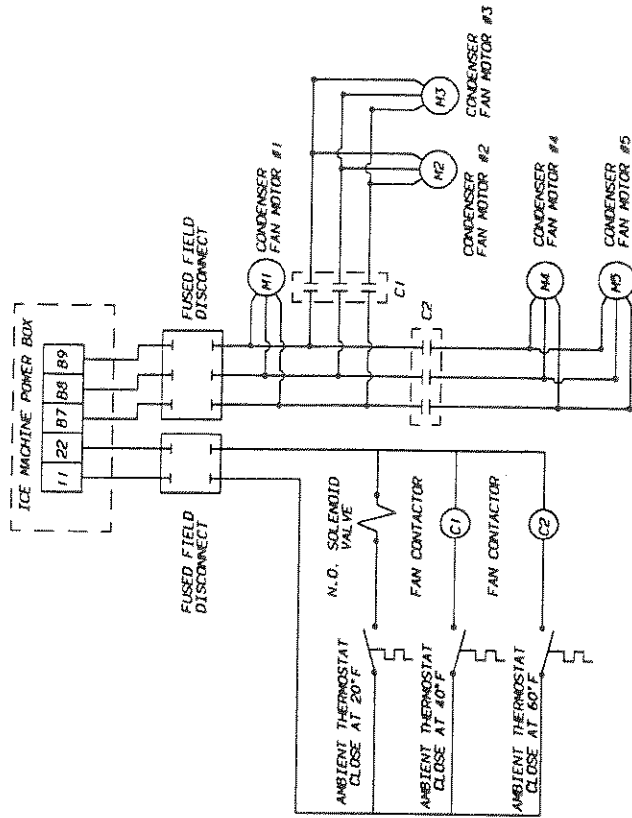
1. Condenser should be installed with vertical air flow.
2. Condenser should be mounted with legs resting on a surface no lower than the top of TUBE-ICE machine for ideal operation.
3. All piping should be done in accordance with "The Safety Code For Mechanical Refrigeration" (ANSI B9.1) and the "Code For Pressure Piping" (ANSI B31.1) as well as all applicable local and national codes.
4. Piping to and from condenser should be sized according to the information on Page 11.
5. Horizontal runs in discharge line should slope away from the TUBE-ICE machine at the rate of 1/4" per foot.
6. A trap should be installed at the base of vertical risers in the discharge line. The width of these traps should be kept to a minimum required by standard wrought copper fittings.
7. Head pressure controls (such as Alco's headmaster) are not to be utilized with TUBE-ICE machines. Unauthorized installations will void all warranties.
8. When condenser may be exposed to sub-zero temperatures, one of two methods must be used to maintain normal head pressures and provide warm returning liquid from the condenser:
  - a. Use a condenser with a 50/50 coil split and isolate half the condenser in cold weather using a solenoid valve, check valve, and thermostat. See VOGT drawing B-57451. This is the preferred method.
  - b. Protect condenser from effects of prevailing wind with enclosure per VOGT drawing B-52283.

In severe cases, such as ambient temperatures below 0°F and wind in excess of 15 mph, it may be necessary to both split the coil and provide an enclosure.
9. The installer must provide a disconnect switch adjacent to the condenser.
10. Electrical connections between the condenser and the TUBE-ICE machine require minimum #12 GA. wire size.
11. Local electrical code must be checked for wiring method.
12. Refer to Drawing B-57451 for more detailed instructions:
13. After machine is operating, it will be necessary to add enough R-22 to fill the liquid line installed. The approximate amount of refrigerant to be added is shown in Table "C".
14. Insulate discharge and liquid lines with 1/2" thick Armaflex insulation or equal.

| REVISION RECORD |      |      |    |    |
|-----------------|------|------|----|----|
| NO              | DATE | FROM | TO | BY |
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|                 |      |      |    |    |



KRAMER AIR-COOLED CONDENSERS (#HDD-311 VOGT #12A 2115K31/10000, 60HZ)  
(#HDD-361 VOGT #12A 2115K36/10000, 50HZ)



FACTORY CONDENSER WIRING

NOTE: ALL WIRES TO BE 14 AWG  
THIN, THIN, OR THIN

INSTALLATION DATA

| PARTS FURNISHED BY CUSTOMER |  |                                 | VOGT PART NUMBER |  | QTY. |
|-----------------------------|--|---------------------------------|------------------|--|------|
| REF.                        | DESCRIPTION  |                                 |                  |  |      |
| 1                           | NORMALLY OPEN SOLENOID VALVE - 1 3/8" OD                   | 12A-4200A11020000               |                  |  | 1    |
| 2                           | WEATHERPROOF SOLENOID COIL 208/230 VOLT                    | 12A-210900A000000               |                  |  | 1    |
| 3                           | CHECK VALVE - 1 1/8" OD                                    | 12A-4200B09010000               |                  |  | 1    |
| 4                           | INLET BALL VALVE - 1 3/8" OD                               | 12A-4200G09020000               |                  |  | 1    |
| 5                           | OUTLET BALL VALVE - 1 1/8" OD                              | 12A-4200G09020000               |                  |  | 1    |
| 6                           | THERMOSTAT WITH RAINPROOF ENCLOSURE                        | 12A-2117605000000               |                  |  | 2    |
| 7                           | FUSED DISCONNECTS PER LOCAL CODE<br>(NOT SUPPLIED BY VOGT) | (G.E.) #16221RM 30 AMP, 2 POLE  |                  |  | 1    |
|                             |  | (G.E.) #164321RM 30 AMP, 3 POLE |                  |  | 1    |
| 8                           | RELIEF VALVE 400 PSIG                                      | 12A-4200L02010000               |                  |  | 1    |
|                             | FAN #1 CONTACTOR (C1)                                      | 12A-7516E06000000               |                  |  | 1    |
|                             | CONTACTOR ENCLOSURE (NEMA 3R)                              | 12A-7512E13000000               |                  |  | 1    |
|                             | FUSE BLOCK (2 POLE)  | 12A-7502E02000000               |                  |  | 1    |
|                             | FUSES (TYPE AGC, FAST ACTING) 2.5 AMP                      | 12A-75 04E10000000              |                  |  | 2    |
|                             | COIL INLET SIZE  | 1 3/8"                          |                  |  |      |
|                             | COIL OUTLET SIZE   | 1 1/8"                          |                  |  |      |
|                             | HOT GAS LINE SIZE FROM ICE MACHINE                         | 1 3/8" OD                       |                  |  | 1    |
|                             | LIQUID RETURN LINE SIZE TO ICE MACHINE                     | 1 1/8" OD                       |                  |  | 1    |
|                             | MISCELLANEOUS FITTINGS AND TUBING                          | AS REQUIRED                     |                  |  |      |

PART NO.

DWN. BY LOGSDON

CKD. BY

RLSD. BY

DATE 07/16/96

SCALE NONE

HENRY VOGT MACHINE CO  
LOUISVILLE, KY.

1118F CONDENSER PIPING AND WIRING.  
50/50 COIL SPLIT FOR  
KRAMER #HDD-311 AND #HDD-361  
AIR-COOLED CONDENSERS

DRG. NO. E-80139

### AIR-COOL CONDENSER SIZING

P118F-60 Hz. TUBE-ICE machine . . . . . Kramer Trenton Model #DD-311  
P118F-50 Hz. TUBE-ICE machine . . . . . Kramer Trenton Model #DD-361

Condenser selection based on 30°F suction temperature and 105° condensing temperature with 15°F T.D.

### CONDENSER HEAT REJECTION

Kramer Trenton Model #DD-311 . . . . . 181.200  
Kramer Trenton Model #DD-361 . . . . . 193.250

### REFRIGERANT LINE SIZES

All air-cooled Model P118F TUBE-ICE machines are shipped with rota-lock type connections on the machine and extra fittings for field installation of air-cooled condenser.

Discharge line size from machine to condenser . . . . . 1 3/8" O.D.

Liquid return line size from condenser to receiver . . . . . 1 1/8" O.D.

Each above line size is based on use of type "L" copper tubing at maximum equivalent distance of 100 feet. The above line sizes are based on ambient air temperatures of 90°F. If machine is installed in a location with warmer conditions, use next larger tubing size for liquid lines.

### EQUIVALENT FEET DUE TO FRICTION

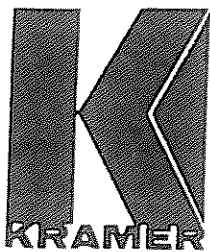
| <u>Copper tubing type "L"</u>                   | <u>1 1/8" O.D.</u> | <u>1 3/8" O.D.</u> | <u>1 5/8" O.D.</u> |
|---|--------------------|--------------------|--------------------|
| Globe valve (open)                              | 28                 | 36                 | 42                 |
| Angle valve (open)                              | 15                 | 18                 | 21                 |
| Close return bend                               | 6                  | 9                  | 10                 |
| 90° turn through tee                            | 6                  | 8                  | 9                  |
| Tee (straight through or sweep elbow)           | 2                  | 2.5                | 3                  |
| 90° elbow or reducing tee<br>(straight through) | 3                  | 4                  | 4                  |

### REFRIGERANT COMPENSATION FOR LIQUID LINE LENGTH

| <u>Line Size</u> | <u>Liquid Line Length</u> |             |             |             |             |             |             |             |              |
|------------------|---------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
|                  | <u>20FT</u>               | <u>30FT</u> | <u>40FT</u> | <u>50FT</u> | <u>60FT</u> | <u>70FT</u> | <u>80FT</u> | <u>90FT</u> | <u>100FT</u> |
| 1 1/8" O.D.      | 4.5                       | 6.7         | 9.0         | 11.2        | 13.5        | 15.7        | 17.8        | 20.1        | 22.4         |
| 1 3/8" O.D.      | 6.8                       | 10.2        | 13.7        | 17.1        | 20.5        | 23.9        | 27.3        | 30.7        | 34.1         |

Above charts show approximate pounds of refrigerant to be added to machine compared to length (feet) of liquid line.

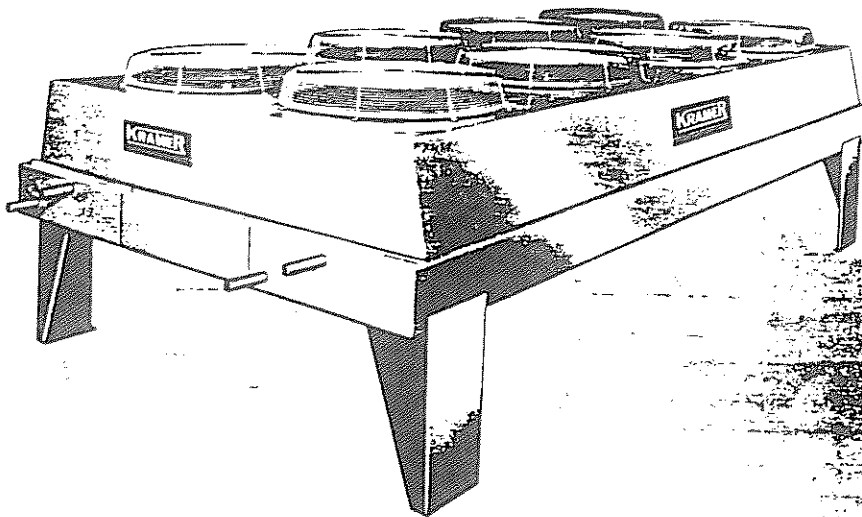




# DIRECT DRIVE UNICON®

AIR COOLED CONDENSERS

SUBMITTAL - 11G  
November 1990  
SUPERSEDES U-686F



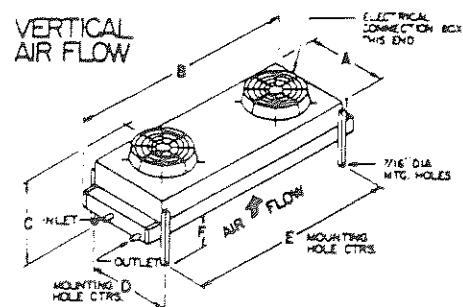
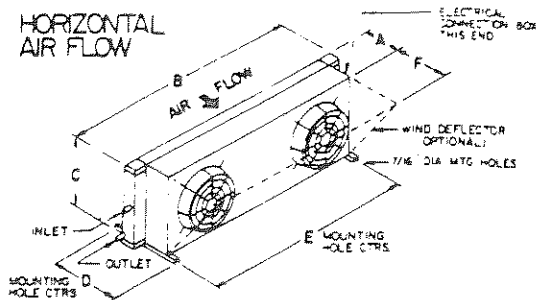
## SPECIFICATIONS

| MODEL NO. | PERFORMANCE DATA AT 30° T.D. †, +40° EVAPORATING TEMPERATURE |           |       |        |      |              |                                   |      |                 |     |                 |       |
|-----------|--|-----------|-------|--------|------|--------------|-----------------------------------|------|-----------------|-----|-----------------|-------|
|           | CONDENSER CAPACITY<br>BTU/HR AT THE EVAP.                    |           | CFM   | FAN(S) |      |              | FAN MOTOR(S) RATING 208/230 VOLT* |      |                 |     |                 |       |
|           | R-12<br>R-502**  | R-22      |       | NO.    | DIA. | TIP<br>SPEED | HP                                | RPM  | 1 PH.<br>MTRS.* |     | 3 PH.<br>MTRS.* |       |
|           |  |           |       |        |      |              |                                   |      | FLA             | LRA | FLA             | LRA   |
| DD-30     | 27,100   | 28,500    | 2800  | 1      | 20   | 5500         | 1/8                               | 1050 | 2.0             | 3.2 | —               | —     |
| DD-40     | 41,000   | 43,000    | 2700  | 1      | 20   | 5500         | 1/8                               | 1050 | 2.0             | 3.2 | —               | —     |
| DD-60     | 64,000   | 67,200    | 5000  | 1      | 30   | 8400         | 1/3                               | 1075 | 2.5             | 7.0 | —               | —     |
| DD-100    | 99,000   | 104,000   | 9800  | 2      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 3.6             | 13.2  |
| DD-130    | 132,000  | 138,000   | 9500  | 2      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 3.6             | 13.2  |
| DD-190    | 191,000  | 200,000   | 15500 | 3      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 5.4             | 19.8  |
| DD-230    | 228,000  | 239,400   | 15000 | 3      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 5.4             | 19.8  |
| DD-260    | 264,000  | 277,200   | 14000 | 3      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 5.4             | 19.8  |
| DD-310    | 310,000  | 319,300   | 22500 | 5      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 9.0             | 33.0  |
| DD-360    | 360,000  | 378,000   | 22000 | 5      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 9.0             | 33.0  |
| DD-410    | 413,000  | 433,700   | 20500 | 5      | 24   | 7200         | 1/2                               | 1140 | —               | —   | 9.0             | 33.0  |
| DD-530    | 533,000  | 559,700   | 34000 | 5      | 30   | 9000         | 3/4                               | 1140 | —               | —   | 17.0            | 60.0  |
| DD-590    | 594,000  | 623,700   | 33000 | 5      | 30   | 9000         | 3/4                               | 1140 | —               | —   | 17.0            | 60.0  |
| DD-660    | 660,000  | 693,000   | 32500 | 5      | 30   | 9000         | 3/4                               | 1140 | —               | —   | 17.0            | 60.0  |
| DD-790    | 786,000  | 825,300   | 31000 | 5      | 30   | 9000         | 3/4                               | 1140 | —               | —   | 17.0            | 60.0  |
| DD-910    | 913,000  | 958,700   | 65300 | 8      | 30   | 9000         | 3/4                               | 1140 | —               | —   | 27.2            | 96.0  |
| DD-1010   | 1,010,000  | 1,057,400 | 63600 | 8      | 30   | 9000         | 3/4                               | 1140 | —               | —   | 27.2            | 96.0  |
| DD-1150   | 1,154,000  | 1,211,700 | 58100 | 8      | 30   | 9000         | 3/4                               | 1140 | —               | —   | 27.2            | 96.0  |
| DD-1360   | 1,360,000  | 1,428,000 | 79500 | 10     | 30   | 9000         | 3/4                               | 1140 | —               | —   | 34.0            | 120.0 |
| DD-1550   | 1,550,000  | 1,627,000 | 72600 | 10     | 30   | 9000         | 3/4                               | 1140 | —               | —   | 34.0            | 120.0 |

†T.D. = Condensing temperature minus entering air temperature.  
All Motors have inherent protection.  
All Motors suitable for 50 Hz.  
All Models UL listed.

\*\* (R-502 Capacity = R-12 x 1.03).  
\*Motors on Models DD-100 and larger available for 460V. Specify on order.  
Average for 460V is one-half of 230V amperage.

Specifications and dimensions subject to change without notice.  
For verified dimensions required for roughing-in or construction purposes, contact Kramer.



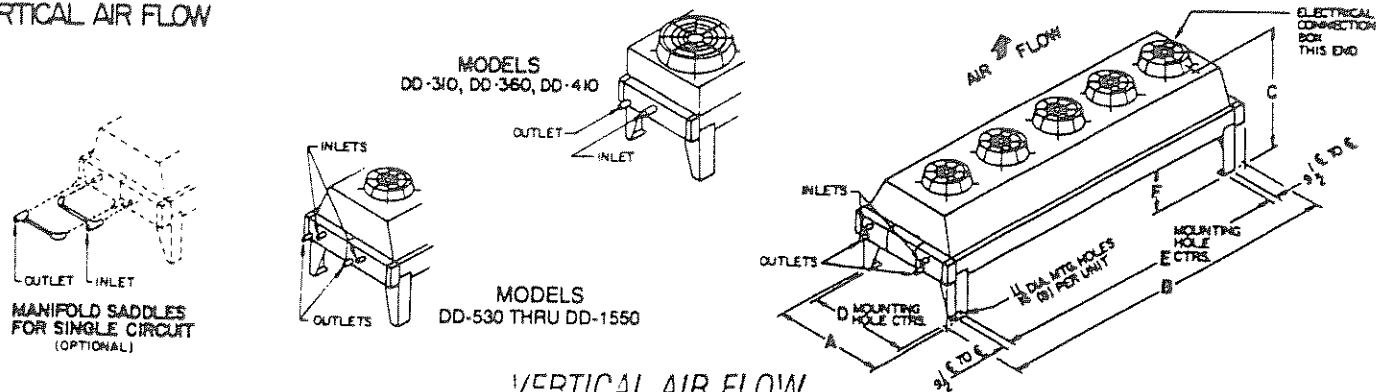
## HORIZONTAL AIR FLOW

| DIMENSIONS AND FITTINGS |                               |        |        |        |        |        |                 |        |                      |
|-------------------------|-------------------------------|--------|--------|--------|--------|--------|-----------------|--------|----------------------|
| MODEL NO.               | DIMENSIONS - INCHES (APPROX.) |        |        |        |        |        | FITTINGS - O.D. |        | APPROX. NET WT. LBS. |
|                         | A                             | B      | C      | D      | E      | F      | INLET           | OUTLET |                      |
| DD-30                   | 14                            | 41     | 25-3/8 | 16-1/2 | 34-1/2 | 27     | 7/8             | 7/8    | 75                   |
| DD-40                   | 14                            | 41     | 25-3/8 | 16-1/2 | 34-1/2 | 27     | 7/8             | 5/8    | 80                   |
| DD-60                   | 15                            | 45-1/2 | 37-5/8 | 29     | 37     | 37-1/2 | 7/8             | 5/8    | 150                  |
| DD-100                  | 15                            | 66     | 40-1/8 | 29     | 54     | 37-1/2 | 1-1/8           | 7/8    | 250                  |
| DD-130                  | 17-3/8                        | 66     | 40-1/8 | 29     | 54     | 37-1/2 | 1-1/8           | 7/8    | 265                  |
| DD-190                  | 17-3/8                        | 105    | 40-1/8 | 29     | 94     | 38-1/4 | 1-3/8           | 7/8    | 370                  |
| DD-230                  | 17-3/8                        | 105    | 40-1/8 | 29     | 94     | 38-1/4 | 1-3/8           | 1-1/8  | 400                  |
| DD-260                  | 19-3/8                        | 105    | 40-1/8 | 29     | 94     | 38-1/4 | 1-5/8           | 1-1/8  | 520                  |

## VERTICAL AIR FLOW

| DIMENSIONS AND FITTINGS (LEGS ARE SHIPPED DISASSEMBLED) |                               |        |        |        |    |        |                 |        |                      |
|---|-------------------------------|--------|--------|--------|----|--------|-----------------|--------|----------------------|
| MODEL NO.   | DIMENSIONS - INCHES (APPROX.) |        |        |        |    |        | FITTINGS - O.D. |        | APPROX. NET WT. LBS. |
|   | A                             | B      | C      | D      | E  | F      | INLET           | OUTLET |                      |
| DD-60   | 38-7/8                        | 45-1/2 | 36-1/8 | 37-7/8 | 37 | 16-1/8 | 7/8             | 5/8    | 150                  |
| DD-100  | 41-3/8                        | 66     | 36-1/8 | 40-3/8 | 54 | 16-1/8 | 1-1/8           | 7/8    | 250                  |
| DD-130  | 41-3/8                        | 66     | 36-1/8 | 40-3/8 | 54 | 13-3/4 | 1-1/8           | 7/8    | 265                  |
| DD-190  | 41-3/8                        | 105    | 36-1/8 | 40-3/8 | 94 | 13-3/4 | 1-3/8           | 7/8    | 370                  |
| DD-230  | 41-3/8                        | 105    | 36-1/8 | 40-3/8 | 94 | 13-3/4 | 1-3/8           | 1-1/8  | 400                  |
| DD-260  | 41-3/8                        | 105    | 36-1/8 | 40-3/8 | 94 | 11-3/4 | 1-5/8           | 1-1/8  | 520                  |

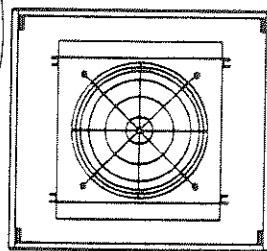
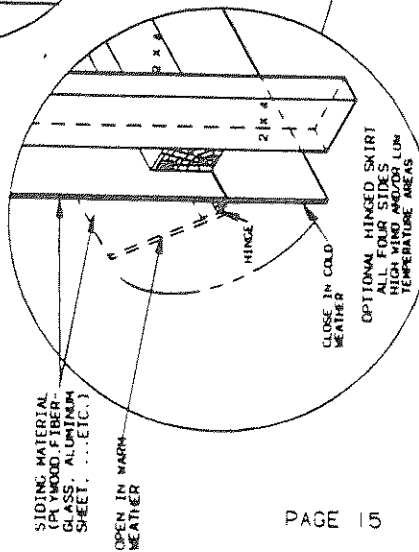
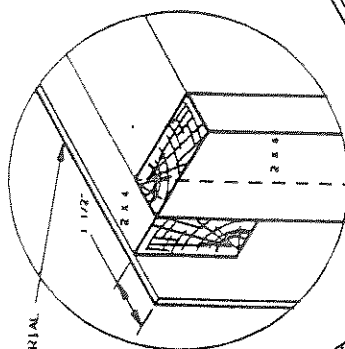
## VERTICAL AIR FLOW



## VERTICAL AIR FLOW

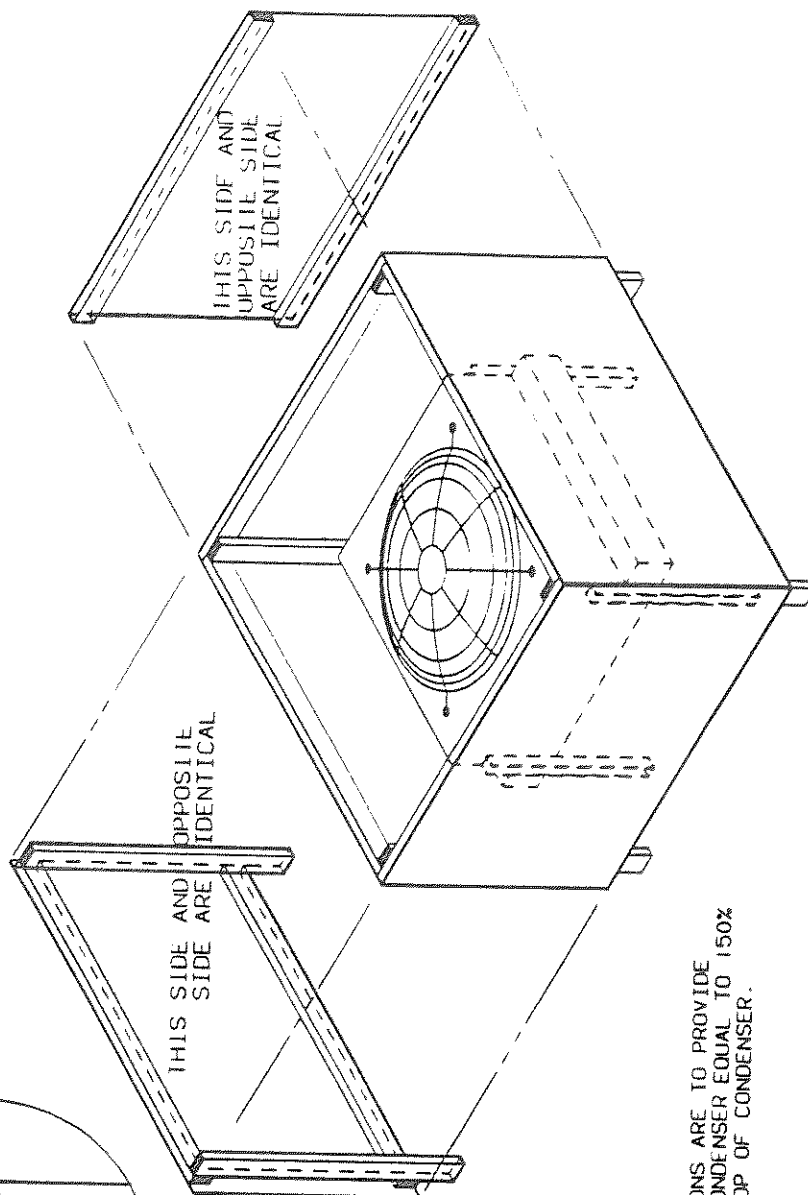
| DIMENSIONS AND FITTINGS (LEGS ARE SHIPPED DISASSEMBLED) |                               |         |        |        |         |        |                 |           |                              |        |                      |
|---|-------------------------------|---------|--------|--------|---------|--------|-----------------|-----------|------------------------------|--------|----------------------|
| MODEL NO.   | DIMENSIONS — INCHES (APPROX.) |         |        |        |         |        | FITTINGS - O.D. |           | MANIFOLD SADDLES (OPTIONAL)* |        | APPROX. NET WT. LBS. |
|   | A                             | B       | C      | D      | E       | F      | INLET           | OUTLET    | FITTINGS - I.D.              |        |                      |
|   |                               |         |        |        |         |        |                 |           | INLET                        | OUTLET |                      |
| DD-310  | 28-3/4                        | 180-1/8 | 41-5/8 | 27     | 147-5/8 | 14-5/8 | (1) 1-5/8       | (1) 1-1/8 | —                            | —      | 610                  |
| DD-360  | 28-3/4                        | 180-1/8 | 41-5/8 | 27     | 147-5/8 | 14-5/8 | (1) 1-5/8       | (1) 1-5/8 | —                            | —      | 660                  |
| DD-410  | 28-3/4                        | 180-1/8 | 41-5/8 | 27     | 147-5/8 | 14-5/8 | (1) 2-1/8       | (1) 1-1/8 | —                            | —      | 750                  |
| DD-530  | 57                            | 180-1/8 | 45-5/8 | 55-1/4 | 147-5/8 | 14-5/8 | (2) 1-5/8       | (2) 1-1/8 | 2-1/8                        | 1-3/8  | 1020                 |
| DD-590  | 57                            | 180-1/8 | 45-5/8 | 55-1/4 | 147-5/8 | 14-5/8 | (2) 1-5/8       | (2) 1-1/8 | 2-1/8                        | 1-3/8  | 1175                 |
| DD-660  | 57                            | 180-1/8 | 45-5/8 | 55-1/4 | 147-5/8 | 14-5/8 | (2) 1-5/8       | (2) 1-1/8 | 2-1/8                        | 1-3/8  | 1200                 |
| DD-790  | 57                            | 180-1/8 | 45-5/8 | 55-1/4 | 147-5/8 | 14-5/8 | (2) 2-1/8       | (2) 1-1/8 | 2-5/8                        | 1-5/8  | 1500                 |
| DD-910  | 85-1/4                        | 180-1/8 | 56-1/2 | 83-1/2 | 147-5/8 | 25-1/2 | (2) 2 1/8       | (2) 1-3/8 | 2-5/8                        | 1-5/8  | 1635                 |
| DD-1010   | 85-1/4                        | 180-1/8 | 56-1/2 | 83-1/2 | 147-5/8 | 25-1/2 | (2) 2-1/8       | (2) 1-3/8 | 2-5/8                        | 1-5/8  | 1965                 |
| DD-1150   | 85-1/4                        | 180-1/8 | 56-1/2 | 83-1/2 | 147-5/8 | 25-1/2 | (2) 2-1/8       | (2) 1-3/8 | 2-5/8                        | 1-5/8  | 2260                 |
| DD-1360   | 85-1/4                        | 222-1/2 | 56-1/2 | 83-1/2 | 190-1/8 | 25-1/2 | (2) 2-5/8       | (2) 1-5/8 | 3-1/8                        | 2-1/8  | 2900                 |
| DD-1550   | 85-1/4                        | 222-1/2 | 56-1/2 | 83-1/2 | 190-1/8 | 25-1/2 | (2) 2-5/8       | (2) 1-5/8 | 3-1/8                        | 2-1/8  | 3100                 |

| REVISION |      |      |
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| NO.      | DATE | FROM |
|          |      |      |



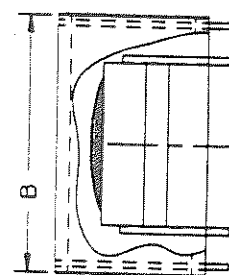
PLAN

"A" AND "B" DIMENSIONS ARE TO PROVIDE OPEN SPACE AROUND CONDENSER EQUAL TO 150% TIMES THE AREA OF TOP OF CONDENSER.

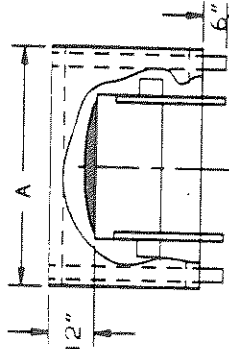


NOTE :

BOTH CONDENSER AND ENCLOSURE MUST BE SECURELY FASTENED TO BUILDING. MATERIALS SELECTION AND FASTENING TO BE DETERMINED BY OTHERS. REINFORCEMENTS TO SUITE LOCAL CONDITIONS TO BE DETERMINED BY OTHERS. THIS DRAWING TO CONVEY GENERAL POSITIONING AND RELATIVE SIZE ONLY.



SIDE



FRONT

FIGURE 7

|          |         |        |                      |
|----------|---------|--------|----------------------|
| DWN. BY  | CORPER  | 11 NRY | ENCLOSURE MACHINE CO |
| CHK. BY  | CAC     |        | LOUISVILLE, KY       |
| RLSD. BY |         |        |                      |
| DATE     | 1/25/83 |        |                      |
| SCALE    | NONE    |        |                      |

ENCLOSURE  
FOR AIR COOLED CONDENSER IN WINDY  
AND/OR LOW TEMPERATURE INSTALLATIONS  
ON TUBE-ICE MACHINES  
Dwg. No. B52283

## DESCRIPTION OF MACHINE

The VOGT Model P118F and P218F TUBE-ICE machines are similar as far as component parts such as freezers, receivers, cutter/tank assemblies, compressors, related line sizes, valves, and operation are concerned.

The difference between the two is that there is twice as many of the above mentioned component parts in a P218F as a P118F.

The Models P118F and P218F are completely piped, wired, and operational tested, and are available as either "water cooled" or "air-cooled" machines. Air-cooled condensers are shipped separately.

## PRINCIPLE OF OPERATION

The TUBE-ICE machine operates in a cycle that consists of two periods, a "FREEZE PERIOD" and a "HARVEST PERIOD". The ice is made during the "FREEZE PERIOD" and is discharged during the "HARVEST PERIOD".

The operation of the machine is controlled by the "ON-OFF" toggle switch located inside the control panel.

The "ICE-CLEAN" toggle switch must always be set in the "ICE" position during normal ice making operation. It is set in the "CLEAN" position only when the equipment is to be cleaned, as outlined in the "CLEANING POSITION" instructions attached to the machine.

Drawings B-56713 and B-56714 illustrate the piping diagram of the refrigerant and water system of the TUBE-ICE machine, with numbers for easy reference.

The freezer (2) is a shell and tube type vessel. During the freezing period, water is constantly recirculated through the vertical tubes of the freezer by a centrifugal pump (6). Make-up water is maintained by a float valve (12) in the water pan (7). During the freezing period, the solenoid valve (20), sometimes referred to as the "A" valve, is open. Solenoid valve (18), sometimes referred to as the "D" valve, is closed.

Refrigerant gas from the top of freezer passes through the suction accumulator heat exchanger (88), heat exchanger (13), to the compressor (3), which discharges it through the oil separator (14) into the condenser (15), through the liquid side of the heat exchanger (13) and into the receiver (15R).

Any entrained oil in the discharge gas is returned to the compressor crankcase by the oil separator. Liquid refrigerant from the receiver flows through the suction accumulator heat exchanger (88), the drier (46), the strainer (43), the thawing chamber (16) of the freezer, the "A" solenoid valve (20), cap the tube and expansion valve (17), and into the freezer; thereby completing the freezing cycle.

At the end of the freezing period, thawing is started by action of the pressure switch (56) in the control panel. Solenoid valve (18) opens and "A" valve (20) is closed. The water pump is stopped and the ice cutter is started. Hot gas from the receiver is discharged into the freezer through valve (18); thereby thawing the ice which drops on the rotating cutter for sizing. The thawing cycle is terminated by action of the thawing timer.

#### FREEZE PERIOD

The TUBE-ICE is frozen inside the stainless steel tubes in each freezer by the direct application of refrigerant to the shell side (outside) of the tubes. The ice is produced from constantly recirculating water during the "FREEZE PERIOD" down each tube.

#### HARVEST PERIOD

The freezer's harvest cycle is controlled by a thawing timer and a control relay after it has been initiated by the freezer pressure.

When a control relay is energized to start a harvest period of the freezer, the water pump and liquid valve are de-energized and the cutter motor, thawing valves, and thawing timer are energized.

The ice should release in approximately 15 seconds to drop onto the rotating cutter for sizing and discharge through the opening in the water pan. The length of the harvest period (usually three minutes) should be set for at least 30 seconds longer than the time required to harvest the entire discharge of ice. If it should become necessary to change the length of the harvest period, adjust the timer to increase or decrease the length of the harvest period as required.

At the completion of the time period set on the thawing timer, the control relay is de-energized and the freezer switches back to the "FREEZE CYCLE".

See Drawing B-57420 on Page 16 for more detail of thawing timer.

|     |      |      |
|-----|------|------|
| NO. | DATE | REV. |
|     |      |      |

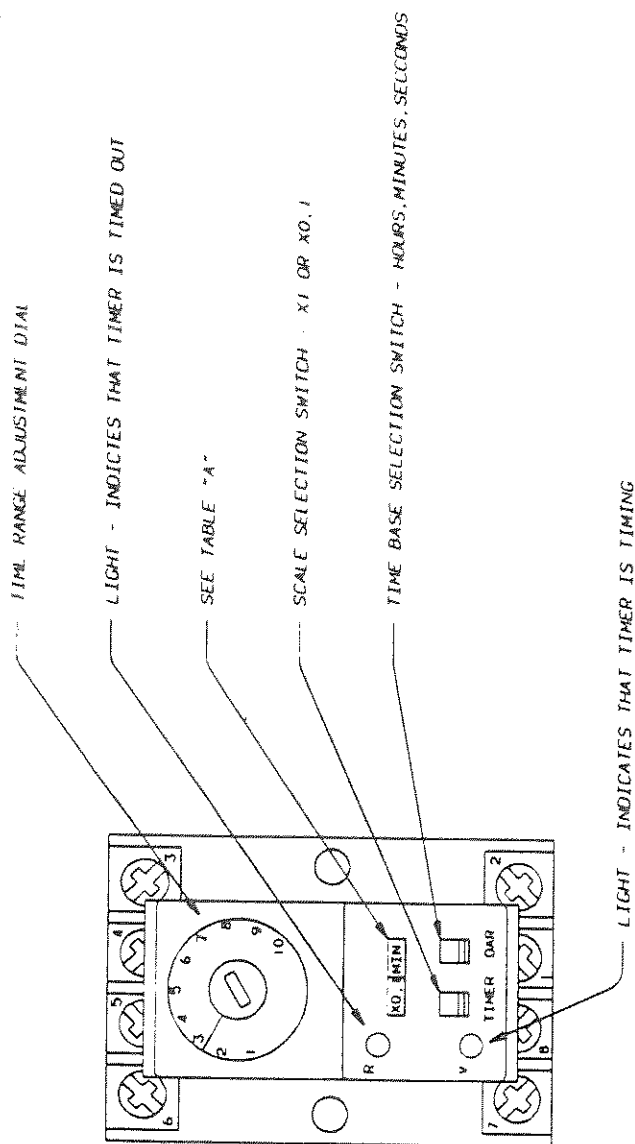
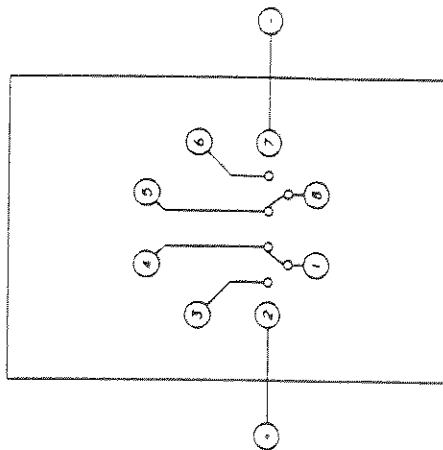


TABLE "A"

| TIMER SETTING OPTIONS      | TIMER SETTING USAGE |
|----------------------------|---------------------|
| X0.1 SEC = 0 TO 1 SECOND   | NOT USED            |
| X1 SEC = 1 TO 10 SECONDS   | DELAY TIMER         |
| X0.1 MIN = 0.1 TO 1 MINUTE | DELAY TIMER         |
| X1 MIN = 1 TO 10 MINUTES   | THAWING TIMER       |
| X0.1 HRS = 0.1 TO 1 HOUR   | NOT USED            |
| X1 HRS = 1 TO 10 HOURS     | AUTOMATIC RESTART   |



WIRING DIAGRAM

NOTE: THIS TIMER IS USED IN VARIOUS FUNCTIONS OF THE TUBE ICL MACHINE.  
 CHECK TABLE "A" FOR USAGE AND SETTING COMPARISONS.  
 ( VOGT #12A 750JL22000000 ) TIMER  
 ( VOGT #12A-750JL22010000 ) TIMER BASE

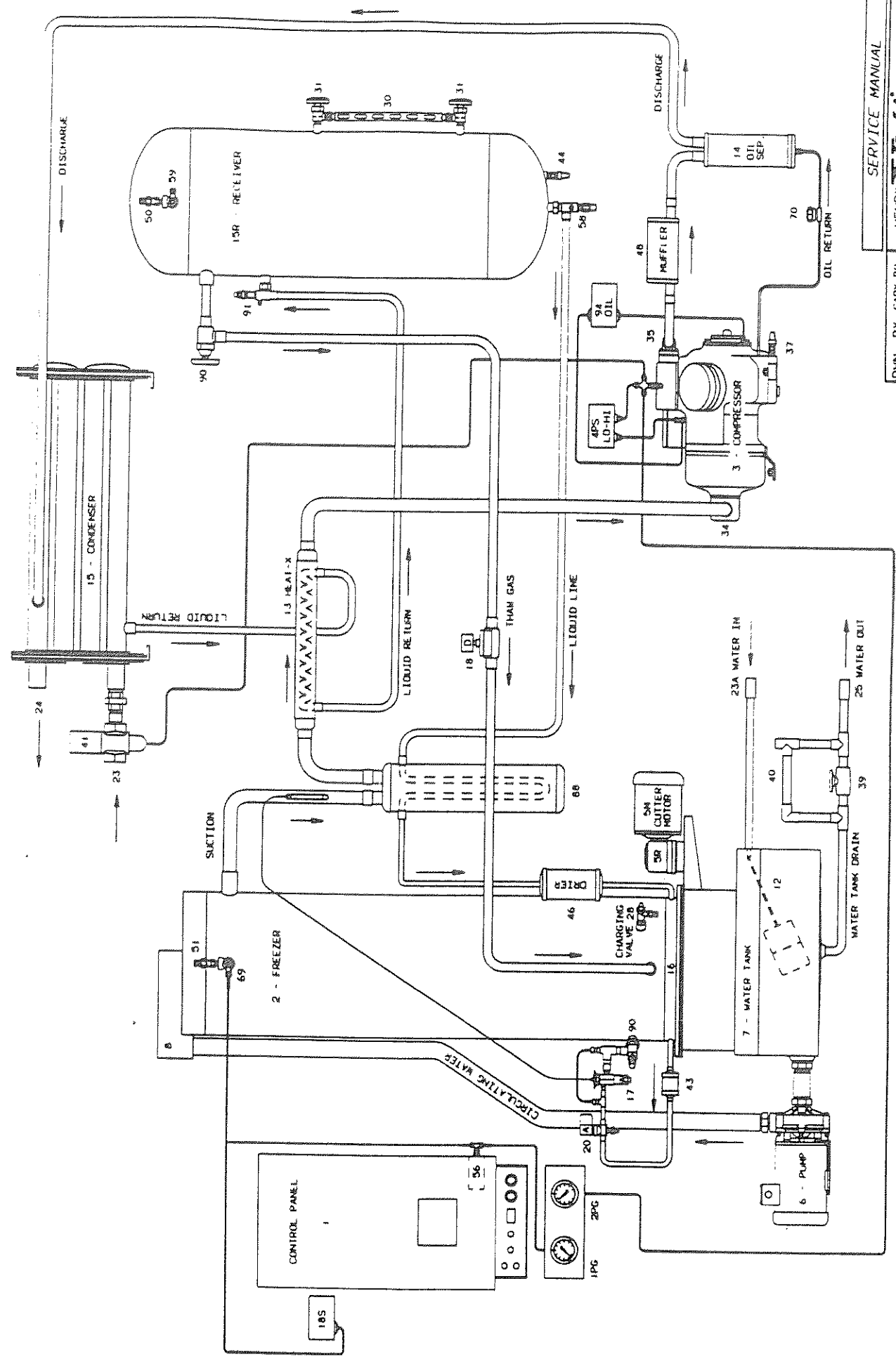
|                   |                   |
|-------------------|-------------------|
| SERVICE MANUAL    |                   |
| OWN. BY T. BLOCK  | HENRY MACHINE CO. |
| CHKD. BY DWS 2392 | LOUISVILLE, KY    |
| RLSD. BY GMB      | TIMER DATA        |
| DATE 01/30/92     | DRG. NO. B-57420  |
| SCALE             |                   |

|     |      |      |    |    |    |
|-----|------|------|----|----|----|
| NO. | DATE | FROM | TO | BY | LN |
|     |      |      |    |    |    |

- 1 - CONTROL PANEL
- 1PG - SUCTION PRESSURE GAUGE
- 2PG - DISCHARGE PRESSURE GAUGE
- 2 - FREEZER
- 3 - COMPRESSOR
- 4PS - DUAL HIGH/LOW PRESSURE SWITCH
- 5M - CUTTER MOTOR
- 5R - GEAR REDUCER
- 6 - WATER PUMP
- 7 - WATER TANK ( INCLUDES CUTTER ASSEMBLY )
- 8 - WATER DISTRIBUTING CHAMBER
- 12 - MAKE-UP WATER FLOAT VALVE
- 13 - HEAT-EXCHANGER
- 14 - OIL SEPARATOR
- 15 - CONDENSER
- 15R - RECEIVER
- 16 - THAWING CHAMBER
- 17 - EXPANSION VALVE
- 18 - THAWING GAS SOLENOID VALVE "D"
- 18S - THAWING GAS PRESSURE SWITCH
- 20 - LIQUID FEED SOLENOID VALVE "A"
- 23 - CONDENSER WATER INLET (WATER-COOLED MACHINES ONLY) 1 1/4" FPT
- 23A - MAKE-UP WATER INLET CONNECTION, 3/4" FPT
- 24 - CONDENSER WATER OUTLET (WATER-COOLED MACHINES ONLY) 1 1/4" FPT
- 25 - WATER TANK DRAIN CONNECTION (1" FPT)
- 28 - REFRIGERANT CHARGING VALVE
- 30 - RECEIVER SIGHT GLASS
- 31 - GAGE GLASS STOP VALVE
- 34 - COMPRESSOR SUCTION SERVICE VALVE
- 35 - COMPRESSOR DISCHARGE SERVICE VALVE
- 37 - OIL CHARGING / DRAIN VALVE
- 39 - WATER TANK DRAIN VALVE
- 40 - AUTOMATIC WATER TANK BLOWDOWN
- 41 - CONDENSER WATER REGULATOR (WATER-COOLED MACHINES ONLY)
- 41A - CONDENSER PRESSURE CONTROL (AIR-COOLED MACHINES ONLY)
- 43 - STRAINER
- 44 - RECEIVER DRAIN VALVE
- 46 - FILTER DRIER
- 48 - MUFFLER
- 50 - RECEIVER SAFETY VALVE
- 51 - FREEZER SAFETY VALVE
- 53 - COLD WEATHER SOLENOID VALVE "X" (AIR-COOLED MACHINES ONLY)
- 55 - DISCHARGE LINE STOP VALVE FOR AIR-COOL MACHINES
- 56 - FREEZERPRESSURE SWITCH
- 58 - LIQUID OUTLET VALVE
- 59 - RECEIVER PURGE VALVE
- 69 - FREEZER PRESSURE STOP VALVE
- 70 - OIL RETURN STOP VALVE
- 88 - ACCUMULATOR / HEAT EXCHANGER
- 90 - THAWING GAS STOP VALVE
- 91 - RECEIVER LIQUID RETURN STOP VALVE
- 94 - COMPRESSOR OIL PRESSURE SAFETY CONTROL
- 101 - CHECK VALVE

|   |                |
|---|----------------|
| HENRY VOGEL MACHINE CO.<br>LOUISVILLE, KY |                |
| P118F / P218F                             | NUMERICALATURE |
| DRG. NO. B-56760                          |                |
| OWN. BY TINKLE                            | CKD. BY        |
| RLSD. BY GMB 4/59J                        | DATE 12-04/90  |
| SCALE                                     | NONE           |

| REVISION |      |          |    |
|----------|------|----------|----|
| NO       | DATE | FROM     | BY |
| 1        |      | REVISION | WJ |



| SERVICE MANUAL                               |           |       |                |
|--|-----------|-------|----------------|
| DWN. BY                                      | GARY BU.  | HENRY | LOUISVILLE, KY |
| CRD. BY                                      |           |       |                |
| RLSD. BY                                     | 008 41991 |       |                |
| DATE   | 11 17 90  |       |                |
| SCALE  | NONE      |       |                |
| P118A / P218B WATER COOLED PIPING SYSTEMATIC |           |       |                |
| DRG. NO. B-567                               |           |       |                |



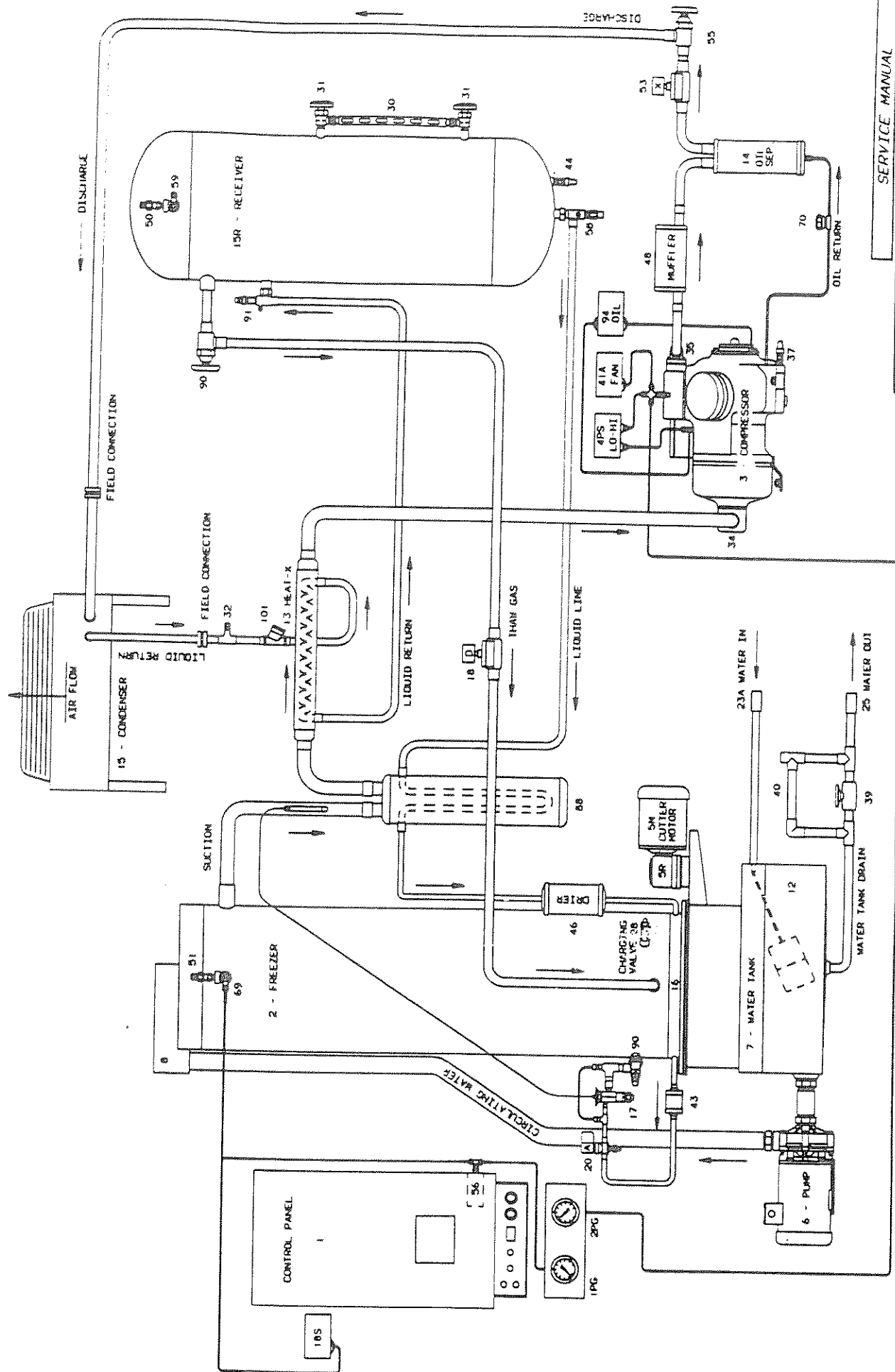
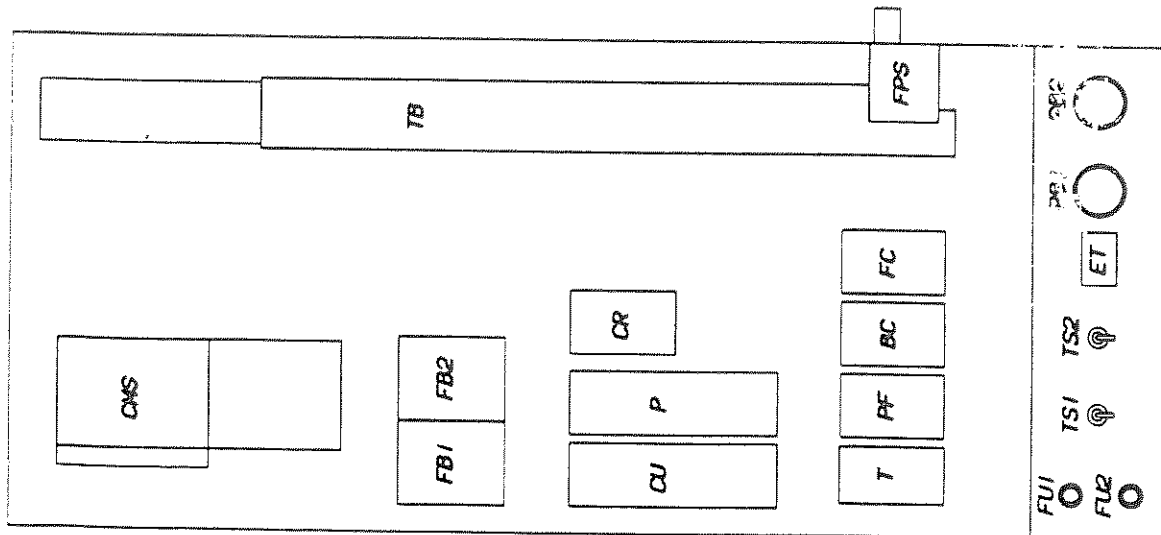


FIGURE 3

|  |
|--|
| (CMS) COMPRESSOR MOTOR CONTACTOR<br>PROVIDES POWER TO THE COMPRESSOR MOTOR. CONTINUOUSLY ENERGIZED DURING FREEZING AND THAWING. AUXILIARY CONTACTS PROVIDE POWER TO P, CU, T, A-SOLENOID, D-SOLENOID, AND FC.  |
| (FBI) FUSE BLOCK<br>SECONDARY PUMP/CUTTER MOTOR PROTECTION   |
| (FB2) FUSE BLOCK<br>AIR-COOLED CONDENSER FAN MOTOR PROTECTION.   |
| (CR) CONTROL RELAY<br>FOR MAKING AND BREAKING VARIOUS CIRCUITS CONCERNING FREEZING AND THAWING. ENERGIZED DURING THE THAW PERIOD.  |
| (CU) CUTTER MOTOR CONTACTOR WITH OVERLOAD RELAY<br>STOPS OPERATION OF CUTTER MOTOR IN THE EVENT OF A MECHANICAL OR ELECTRICAL MALFUNCTION RESULTING IN EXCESSIVE MOTOR AMPERES.  |
| (P) PUMP MOTOR CONTACTOR WITH OVERLOAD RELAY<br>STOPS OPERATION OF WATER PUMP MOTOR IN THE EVENT OF A MECHANICAL OR ELECTRICAL MALFUNCTION RESULTING IN EXCESSIVE MOTOR AMPERES.   |
| (PF) POWER FAILURE RELAY<br>STOPS THE MACHINE WHEN THERE IS A POWER FAILURE OR INTERRUPTION, OR THE HIGH/LOW PRESSURE SWITCH, OIL FAILURE PRESSURE SWITCH, PUMP OVERLOAD, CUTTER OVERLOAD, COMPRESSOR OVERLOAD OR THE CONTROL CIRCUIT FUSES FAIL. MACHINE MUST BE MANUALLY RESTARTED BY PUSHING START BUTTON IF THE STOP BUTTON WAS PUSHED, OR ANY OF THE SAFETIES TRIPPED, OR THERE WAS A POWER OUTAGE. |
| (T) THAWING TIMER<br>CONTROLS THE TIME OF THE THAWING PERIOD.  |
| (BC) BIN CONTROL RELAY<br>STOPS AND STARTS MACHINE OPERATION BY ACTION OF OPTIONAL BIN THERMOSTAT (BT).  |
| (FC) FAN CONTACTOR<br>CYCLES THE FAN MOTOR(S) OF AIR-COOLED CONDENSER "ON" AND "OFF". ACTIVATED BY THE CONDENSER PRESSURE SWITCH. (AIR-COOLED MACHINES ONLY)   |
| (TS1) ICE/CLEAN TOGGLE SWITCH<br>TWO POSITION TOGGLE SWITCH TO OPERATE MACHINE IN ICE MAKING MODE OR CLEAN MODE. WHEN IN CLEAN POSITION ONLY THE WATER PUMP WILL RUN, ALLOWING CLEANER TO BE CIRCULATED THROUGH THE FREEZER WITHOUT MAKING ICE.  |
| (TS2) ON/OFF TOGGLE SWITCH<br>TWO POSITION SWITCH USED TO STOP MACHINE AT THE END OF THE HARVEST AND RESTART THE MACHINE IN A FREEZE CYCLE.  |
| (ET) ELAPSED TIME INDICATOR<br>INDICATES HOURS OF MACHINE OPERATION. ENERGIZED WHEN COMPRESSOR IS OPERATING.   |
| (FBI1) STOP PUSH BUTTON (RED)<br>USED TO STOP MACHINE IMMEDIATELY.   |
| (FBI2) START PUSH BUTTON (GREEN)<br>FOR STARTING MACHINE OR MANUALLY HARVESTING. WILL INITIATE A HARVEST CYCLE WHENEVER PUSHED.  |
| (TB) TERMINAL BLOCK<br>NUMBERED FOR MULTIPLE WIRE CONNECTIONS AND EASE OF TROUBLESHOOTING.   |
| (FUI, FUI2) 2.5 AMP FUSES<br>OVERLOAD AND SHORT CIRCUIT PROTECTION FOR CRANKCASE HEATER AND THE CONTROL CIRCUIT.   |
| (FPS) FREEZER PRESSURE SWITCH<br>FOR REGULATING THE ICE THICKNESS BY SENSING FREEZER PRESSURE SWITCH AND INITIATING THE THAW PERIOD.   |
| (BT) BIN THERMOSTAT (OPTIONAL)<br>FOR AUTOMATIC STOPPING AND STARTING THE MACHINE, BASED ON THE ICE LEVEL IN THE STORAGE BIN.  |



|                    |                                  |
|--------------------|----------------------------------|
| SERVICE MANUAL     |                                  |
| OWN. BY T. BLOCK   | HENRY MACHINE CO. LOUISVILLE, KY |
| END. BY            | CONTROL PANEL LAYOUT             |
| RESD. BY GND 41693 | P118F TUBE-ICE MACHINES          |
| DATE 01/05/91      | DRG. NO. B-1-302                 |
| SCALE NONE         |                                  |

## CUTTER

To remove the cutter (21), if necessary, proceed as follows:

Shut down the appropriate freezer and shut down the exterior valve in the water inlet line to its water pan and drain pan and disconnect inlet water, drain, and pump lines.

Separate motor from the cutter drive reducer by removing four cap screws. Watch for shaft key when separating unit which must be installed in motor keyway when unit is re-assembled. It is not necessary to remove the reducer from its mounting plate on the water pan.

Remove the water tank, which contains the cutter, by unbolting it from freezer. It may then be taken to a work bench for removal of cutter assembly. This is held in place by three 3/8" cap screws, which fasten the cutter support to the side of the water pan. Before loosening these cap screws, remove the ice deflector and the cutter disc assembly.

If the cutter bearing (47) is badly worn, it should be replaced with a new one, which may be ordered from the factory. A 3/16" drive pin locks the bearing to the hub. It is suggested that a bearing be retained as a spare part to prevent a prolonged shutdown of the machine in the event of a bearing failure.

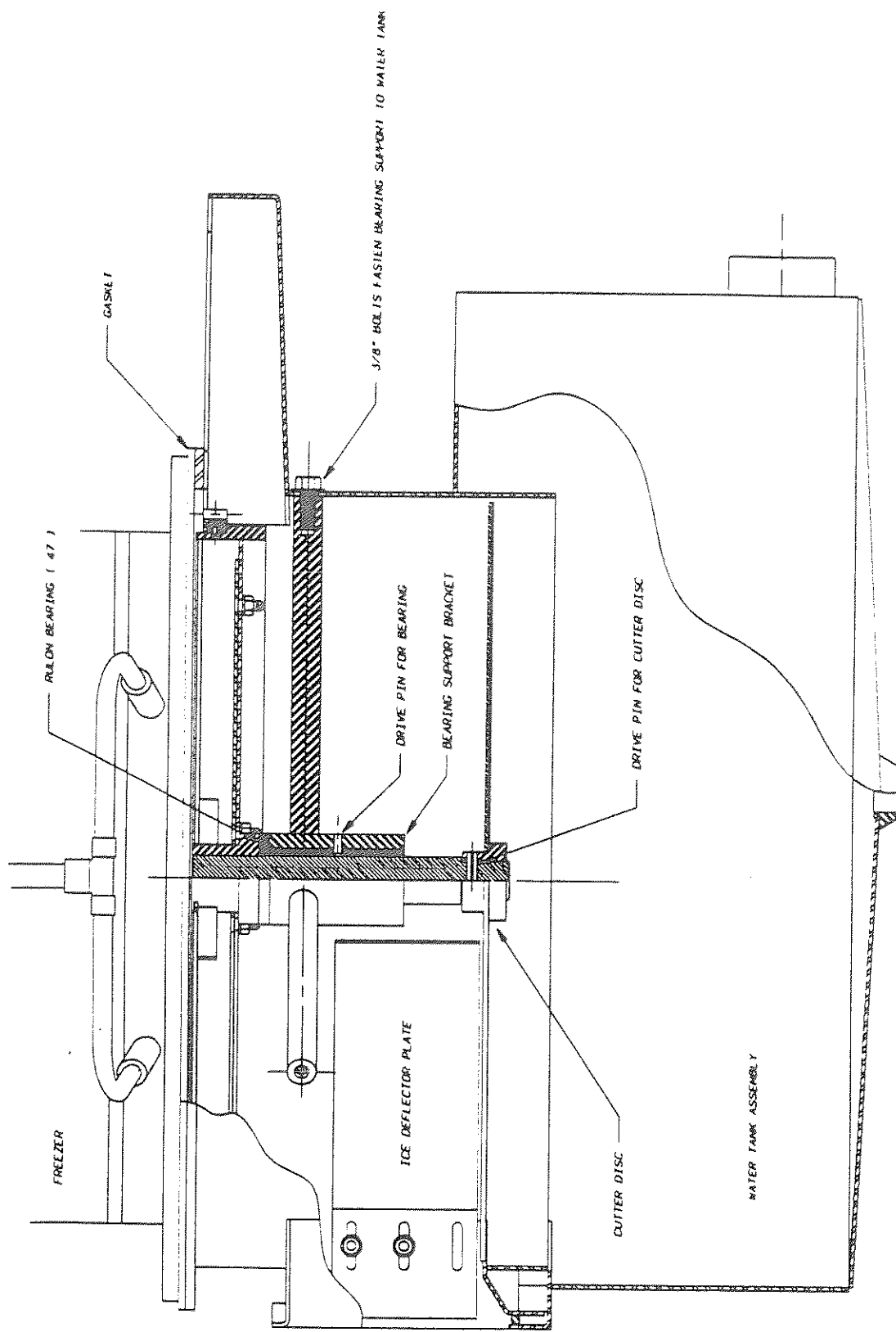
After pressing the new bearing in the cutter support it may be necessary to ream the I.D. to obtain free running clearance between bearing and cutter shaft. Use a 1 1/4" straight reamer for this application. Drill a 3/16" hole through the bearing and install the locking pin in the original hole in the hub.

The parts should be reassembled, reversing the procedure described for removal.

The cutter should be aligned in the tank so the top of the cutter is flush with the top of the tank and can be checked with a straight edge across the top of the tank. Vertical adjustment can be made with the 3/8" cap screws through the side of the tank. Also check the drive gear and ring gear alignment.

See Drawings B-56934 on Page 24 and B-56990 on Page 25.

NO. DATE FROM



NOTE: P118F AND P218F TUBES WILL HAVE A DIFFERENT STYLE WATER TANK AND ICE DEFLECTOR DOOR. THE ICE DEFLECTOR DOOR IS PINNED AND HINGED TO THE CENTER BEARING SUPPORT HUB.

| SERVICE MANUAL                                 |         |
|--|---------|
| OWN. BY  | GARY RO |
| CHKD. BY                                       |         |
| RLSD. BY                                       |         |
| DATE   | 3 27 91 |
| SCALE  | NONE    |
| HENRY MACHINE CO.<br>LOUISVILLE, KY            |         |
| P118F AND P218F<br>CUTTER/TANK ASSEMBLY DETAIL |         |
| DRG. NO. B-569                                 |         |

NOTE: MODEL P 12F WITH 1 1/2" TUBES WILL HAVE A POUND WATER TANK WITH A SWINGING DEFLECTOR DOOR INSTEAD OF WHAT IS SHOWN ON THIS DRAWING.

NO. DATE FROM BY OK

REVISION

# SERVICE MANUAL

HENRY MACHINE CO  
LOUISVILLE, KY.

CUTTER/TANK ASSEMBLY DETAIL

MODELS P118F AND P218F

DRG. NO. B-56990

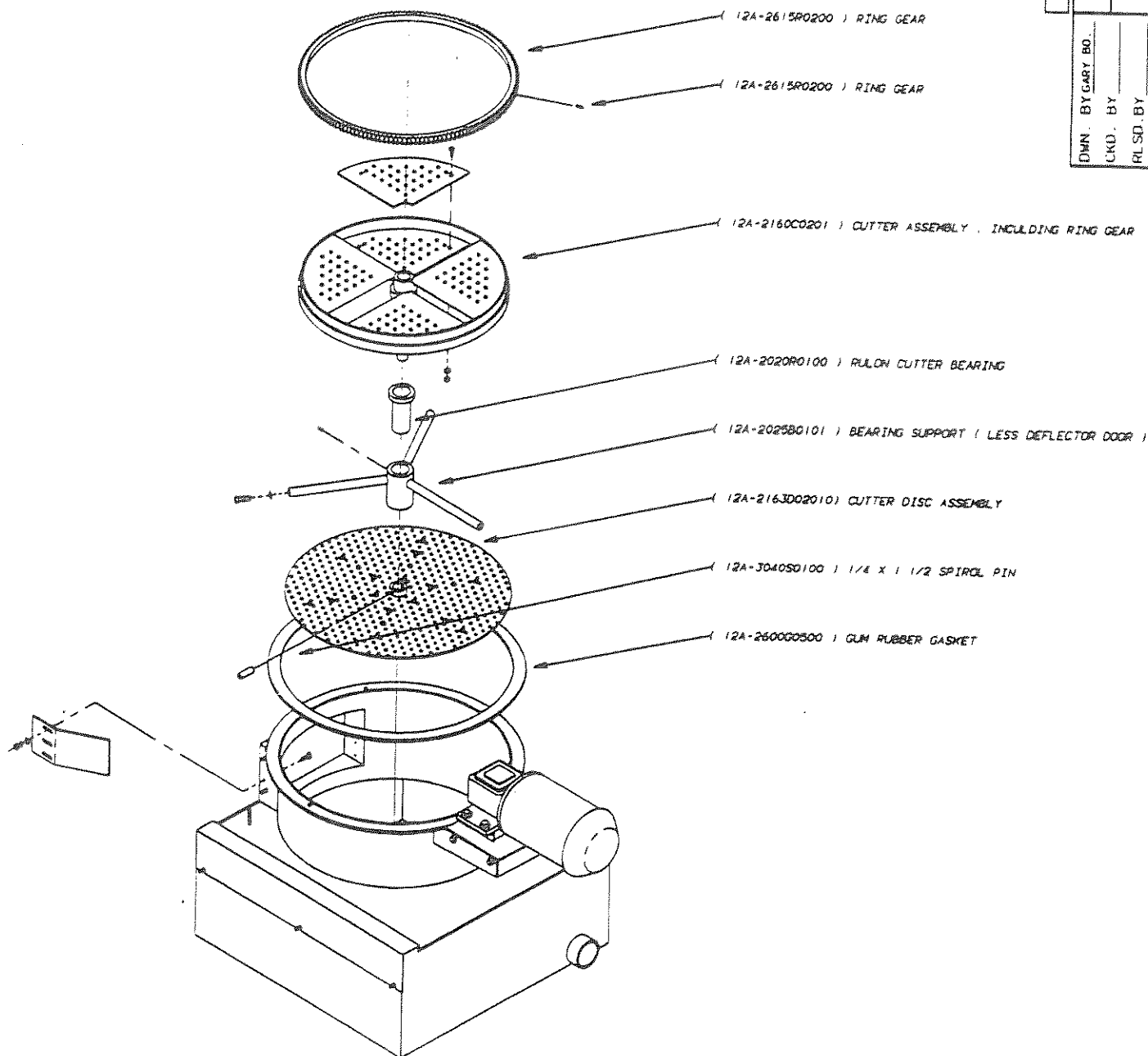
OWN. BY GARY BO.

CKD. BY

RLSD. BY

DATE 4-10-91

SCALE NINE



### REFRIGERANT CHARGE/START UP

Included with the machine is the required charge (approx. 260 lbs.) of Refrigerant 22, which has been isolated in the receiver (15R). Before shipment of the machine, the compressor service valves (34), (45), and the stop valves in the various lines to the condenser and receiver have been closed. These valves are tagged with instructions that the valves are to be opened prior to start-up of the machine. Before opening these valves it is advisable to check all joints for leaks which may have developed during shipment. If no leaks are present, a positive pressure should be on the freezer and receiver. They should indicate a pressure approximately equal to the ambient temperature.

If it should ever become necessary to add refrigerant to the system, charging valve (28) is provided for this purpose. Through this valve refrigerant can be added in liquid form. See **ADDING REFRIGERANT**. The compressor crankcase heater must be energized for a minimum of four hours prior to starting and running the compressor.

Set the "ICE/CLEAN" switch (TS-1) to the "CLEAN" position. Set the "ON/OFF" switch (TS-2) to the "ON" position and push the "START" button. This will allow only the water pump to run. If necessary to purge air from the pump, push the "STOP" button to stop the pump for a few seconds and start again by pushing the "START" button. When there is a good water level in the pumping tank and water is being circulated by the pump, set the "ICE/CLEAN" switch in the "ICE" position. This will start the compressor and the TUBE-ICE machine will be operating in a freezing cycle.

### ADDING REFRIGERANT

When charging machine, it is necessary for the following procedure to be followed:

1. Make connection between charging valve and refrigerant cylinder using hose or pipe suitable for R-22 service. See instruction card attached to cylinder for proper position of cylinder so machine can be charged with liquid.
2. Open valve on R-22 cylinder and purge air out of charging line at the charging valve connections
3. Open charging valve.
4. Refrigerant can be added only during the freeze cycle. The charging valve must be closed when the freezer is in a harvest.

See the "certificate" of test in the front of the manual for the approximate refrigerant charge for your machine.

### SHUTDOWN CYCLE

When the "SHUTDOWN" operation is initiated by the on/off toggle switch (TS2), the next freezer to go into a harvest period will be the first one to shut down.

When the last freezer to shutdown completes its harvest period, operation will cease.

### PUMPDOWN

To pump the refrigerant out of the freezer and into the receiver, the following procedure should be followed:

- a. Close the liquid stop valve (58) at the receiver.
- b. Open the water tank drain valve partially to allow a continuous flow of warm make-up water into the water tank and maintain a tank level.

After (thawing) one time, lock out the freezer pressure switch by the following method to prevent another thaw cycle.

Close the 1/4" valve (69) at the top of the freezer which will isolate the freezer pressure switch and keep it from pulling down and starting a "HARVEST CYCLE".

- c. Start machine and allow it to operate and thaw one cycle until low pressure switch stops the machine. (Adding warm water to pumping tank will aid in a more complete removal of refrigerant from the freezer. Do not exceed 80°F water temperature in the tank.)
- d. Close thawing gas line stop valve, compressor suction, and discharge service valve, as well as the stop valve in the oil return line.
- e. Open electrical disconnect switch.

### REFRIGERANT REMOVAL

To transfer the refrigerant charge from the machine into a separate container, proceed as instruction under "PUMPDOWN". This will isolate the refrigerant in the condenser and receiver.

Then connect a length of copper tubing or a charging hose to receiver drain valve and to an approved Refrigerant 22 storage container. Purge tubing or hose of air by allowing a small amount of refrigerant to escape.

Pack the storage container in ice and be sure that the container has a storage capacity in excess of the amount (weight) of refrigerant in the system. (CAUTION - DO NOT CHARGE IN EXCESS OF 80% OF CONTAINER'S VOLUME) Open the receiver drain valve and the storage container valve. When the pressure in the receiver is reduced to approximately 50 PSI, close the drain valve. Close storage container valve.

## MAINTENANCE

A careful inspection of the TUBE-ICE machines refrigeration system for leaks and correct operational functions at time of installation will start its long satisfactory life of service. In order to insure this degree of dependability, a systematic maintenance program is recommended. Therefore, the following schedule is suggested as a minimum.

### (A) DAILY

1. Check "ice-out" time (maintain 30 second free running after last ice is out).
2. Check clarity of ice produced and hole size.
3. Check compressor oil level.
4. Check refrigerant charge by observing operating level in receiver gage glass (30).

### (B) WEEKLY

1. Check system for leaks with suitable leak detector for the first four weeks of operation.
2. Check oil level and condition.
3. Check refrigerant level in receiver.

### (C) MONTHLY (In addition to weekly checks)

1. Check calibration and operation of all controls (high and low pressure switches, oil pressure switch, etc.)
2. Check cooling tower for scaling and algae (consult water treatment suppliers for corrective measures).
3. Check water distributors in freezer for scale accumulation.
4. Check water tank for solids to be removed.
5. Check all motor drive units (compressor, cutter and pump motors, cooling tower fan and pump, etc.) for abnormal noise and/or vibrations.



(D) YEARLY (In addition to weekly and monthly)

1. Check entire system for leaks (See "B").
2. Drain water from condenser and cooling tower and check condenser tubes. Check closely for damage by corrosion or scale.
3. Remove all rust from all equipment, clean, and paint.
4. Check all motors for shaft wear and end play.
5. Check operation and general condition of all electrical controls, relays, motor starters, and solenoid valves.
6. Check freezing time, ice release time, and ice out time.

### WATER TANK

The production of opaque ice usually indicate that the water in the water tank contains a concentrated amount of suspended or dissolved solids.

Remove cover plate. Open Drain Valve (39). Clean tank thoroughly by flushing out with a hose and scrubbing with a stiff brush. Fill the water tank with fresh water. Never use a carbon steel brush on the stainless steel, since this can initiate rust. Use a brush with fiber or stainless steel bristles.

When restarting the machine, be sure that the water pump is circulating water. It is possible that air may have collected in the pump impeller housing and the unit may have to be stopped and started several times to expel the air.

### DRIP PAN

If the machine is installed on a bin with a drip pan it is important to keep the drip pan free of any foreign materials and to keep the drain for this pan open. This drain MUST NOT run through the ice compartment of the bin.

### WATER COOLED CONDENSERS (Checking Operation)

How often condensers need cleaning depends on many variables, so it is impossible to recommend a schedule. Some will seldom need cleaning, others perhaps need cleaning once a year. In rare cases, cleaning is required several times a year.

Proper operation of cooling towers will increase the interval between cleaning considerably. The tower overflow rate should be checked frequently. If a tower is operated with insufficient overflow, nominal 1-1/2 to 3 GPH bleed depending on water quality, the resulting mineral concentration in the water can cause rapid and heavy fouling inside the condenser tubes, requiring excessively frequent cleaning. Also, these conditions often lead to severe corrosion.

Chemical additives, including those to stop algae and related growths, should be obtained only from a reputable, established supplier, and use specifically according to directions. Excessive treatment of the water can cause more harm than good; the condensers, pumps, piping, and the towers themselves may be damaged.

It is advisable to double check the system to make sure that fouling is actually causing the trouble. High head pressure alone does not mean a fouled condenser. The following possibilities should always be checked before cleaning is undertaken.

1. Non-condensables in system, or faulty head pressure gauge? Check standby pressures against refrigerant tables.
2. Incorrectly set, or defective, water regulator valve? Check its setting and operation.
3. Partly closed compressor discharge service valve? Check its setting. Stem should be backseated.
4. High water temperatures entering condenser? Check tower fan and system.

After the above possibilities have been eliminated, determine the temperature difference between the water leaving the condenser and the refrigerant condensing temperature (saturation temperature, from pressure-temperature chart, corresponding to head pressure). If this difference is more than 10°F, cleaning is indicated, because this difference indicates a good heat exchange is not being made. If this difference is less than 8°F, something other than a fouled condenser may be causing the high head pressure. In normal operation, this difference will stay between 5°F and 10°F regardless of water inlet temperature, when the water flow is regulated by a pressure operated water valve. If this difference is less than 5°F, restricted water flow, or a low pressure, is indicated. A restriction can occur with foreign matter in the condenser, but it is likely to be somewhere else in the system.

#### DRAINING WATER COOLED CONDENSER

Draining of water-cooled condenser is recommended in preparation for the winter cold, where units may be left exposed to ambient temperatures below 32°F. Theoretically, it is easy to drain a condenser. In practice, the problem can be complex.

Despite the fact that a condenser may have vent and drain fittings, the opening of these fittings is not sufficient for a natural gravity flow. Water will be retained in tube; due to (1) surface tension and (2) the normal curvature between tube supports. Our experience shows that as much as 20% of the water in the condenser can be retained. Whether water left in the tubes will cause damage during a freeze-up will be dependent upon how quickly the freeze occurs and the location of the water inside the condenser.

In the field it is recommended that the water covers be removed and tubes be blown out individually with air. Alternatively, a minimum of 25% ethylene glycol in the system will also prevent a freeze which can rupture the tubes.

#### CHEMICAL CLEANING OF WATER COOLED CONDENSER

The Henry Vogt Machine Co. makes no recommendation for any particular chemical preparation. The same chemical may not be effective for all situations.

**CAUTION:** THE FOLLOWING DIRECTIONS AND PRECAUTIONS SHOULD BE OBSERVED WHEN CLEANING IS UNDERTAKEN. THE WARRANTY ON CONDENSERS IS VOID IF THEY ARE DAMAGED BY IMPROPER CLEANING TOOLS OR METHODS. IF HARSH CHEMICALS ARE USED, BE SURE TO FOLLOW THE MANUFACTURERS RECOMMENDATIONS REGARDING SAFETY IN HANDLING THOSE SOLUTIONS. PARTICULARLY REGARDING SPLASH PROOF GOGGLES, RUBBER GLOVES, ETC.

- a. Use only preparations from an established, reliable source.
- b. Follow directions exactly, particularly regarding amounts to use, and flushing or neutralizing procedure after cleaning.
- c. Close the water stop valve. Remove the condenser water regulating valve (41).
- d. Circulate the solution through the condenser until it is considered clean.
- e. Flush the condenser according to directions.
- f. Install the water regulating valve and connecting piping.
- g. Open the water supply stop valve and check for leaks.

## MECHANICAL CLEANING OF WATER COOLED CONDENSER

### Part I.

1. Close the stop valve in the water supply line.
2. Drain the water from the condenser.
3. Remove water regulating valve (41) and attached piping to the condenser.
4. Remove the cover plate on the side of the frame to expose the condenser end plate.
5. Remove the nuts, water plates, and gaskets from both ends of the condenser. If the gasket does not lift off with the end plate, do not try to pry it off. The seal surface may be damaged, which would cause a water leak. To free a sticking gasket, replace the water plate and tap it on the outside face with a mallet or a block of wood. After a few taps, the gasket will spring free, and will then slip off with the water end plate.
6. Gaskets need only be rinsed in running water: rust, scale or dirt will not stick to the gasket material. A rag, or soft brush, is all that is required to remove any foreign matter.

### Part II.

The inside of the water end plates and the outer tube sheet surfaces should be cleaned with clear water and a rag or soft bristle brush. A worn paint brush is excellent.

These surfaces have been coated with a special material, which will give years of protection against corrosion, unless damaged. Never use a wire brush or a strong caustic on these surfaces.

Flush condenser tubes clear with water or a piece of rag on a stick or wire. In many cases this is all that is required. If the inside surfaces are smooth, even though discolored, further cleaning is not necessary. It is useless to try and get a bright copper surface on the inside of the tubes. They will discolor almost immediately in service, and the condenser has been designed with an adequate reserve for moderate fouling on these surfaces.

If, however, a rough coating remains inside the tubes after flushing and wiping, further cleaning is desirable. The color of this coating varies with water conditions, but roughness indicates cleaning tools should be used.

Any type tool to be considered should be tried first on a piece of copper tubing held in a vise or flare block. Nylon, brass or copper brushes are recommended. If any flakes of copper appear or if score marks are made inside the tube, the tool should not be used. Never use anything with sharp or rigid edges which could cut into the copper tubing.

A cleaning tool is available from VOGT, through your distributor. Ask for Part #12A-2055B01.

When using a cleaning tool, keep the inside of the tube wet and move the tool slowly from one end to the other while rotating it at a moderate speed. A hand drill brace is recommended. If an electric drill is used, a low speed attachment on a 1/4" size drill is preferred. Larger units are powerful enough to damage a tube, if for any reason, the cleaning tool should stick. After one or two passes in each tube, they should be flushed and inspected. Often this is enough, although some deposits require more. In any case, stop when a few places begin to show a copper color.

After cleaning, wipe all foreign matter from the tube sheets and studs. Reassemble as outlined on gasket installation instructions.

If the gasket seal ridge was damaged, and a replacement is not immediately available, water leaks can be stopped by removing the gasket, drying it, and applying a thin film of a non-hardening gasket sealer, such as Permatex #2, around the seal ridge. This film should be no thicker than the height of the ridge itself and about 3/16" wide. Then re-assemble.

If a new gasket is put on later, be sure to remove any grit or particles that stick to the sealer film on the tube sheet. It is not necessary to remove all traces of the sealer before installing a new gasket, as long as no particles that cut into the new gasket remain on the surface.

**WARNING:** ACID CAN CAUSE SERIOUS BURNS OR BLINDNESS. ALWAYS ADD ACID TO WATER FOR DILUTION. WEAR EYE AND BODY PROTECTION.

#### AIR-COOLED CONDENSER CLEANING

Visual inspection will indicate if dirt is accumulating and clogging the fin face of the condenser. A vacuum cleaner, compressed air or a brush may be used to remove any accumulation of loose dirt from the fin section of the condenser.

If fins have been damaged, they should be straightened with the proper fin comb.

#### LUBRICATION

Your VOGT TUBE-ICE machine is equipped with a low oil pressure safety switch to protect the compressor. However, this switch cannot fully do its job unless the following precautions are observed.

#### COMPRESSOR

In starting and charging the unit, the oil sight glass (33) in the crankcase of the compressor should be watched carefully for the first hour to make certain the proper lubrication is being maintained. The oil may become low in the crankcase on an initial start-up, if the electrical current has been interrupted to the machine, thus de-energizing the compressor crankcase heater.

Before starting the machine again, the heater should be energized for a time period of at least two hours to evaporate refrigerant that may have condensed in the crankcase during the shutdown period. If level is low after start-up, it should begin to return after a short period of operation.

The oil level should be checked frequently, particularly during the start-up operation, to see that a sufficient amount of oil remains in the crankcase. While it is important to observe the oil splash during operation, the true level can be obtained only when the compressor is stopped. With the compressor idle, the oil level should be at a height of 1/3 to 2/3 of the sight glass, but never out of sight above it.

Although the machine was shipped with the oil charge which was originally added for the test operation, it may be found necessary to add some oil when or if new refrigerant is added to the system.

An oil pump should be used to force any oil that may be required into the system. Oil may be added to the compressor of all units through the oil drain valve. Air should be purged from the oil pump discharge line, by forcing some oil through the line before tightening the charging connection.

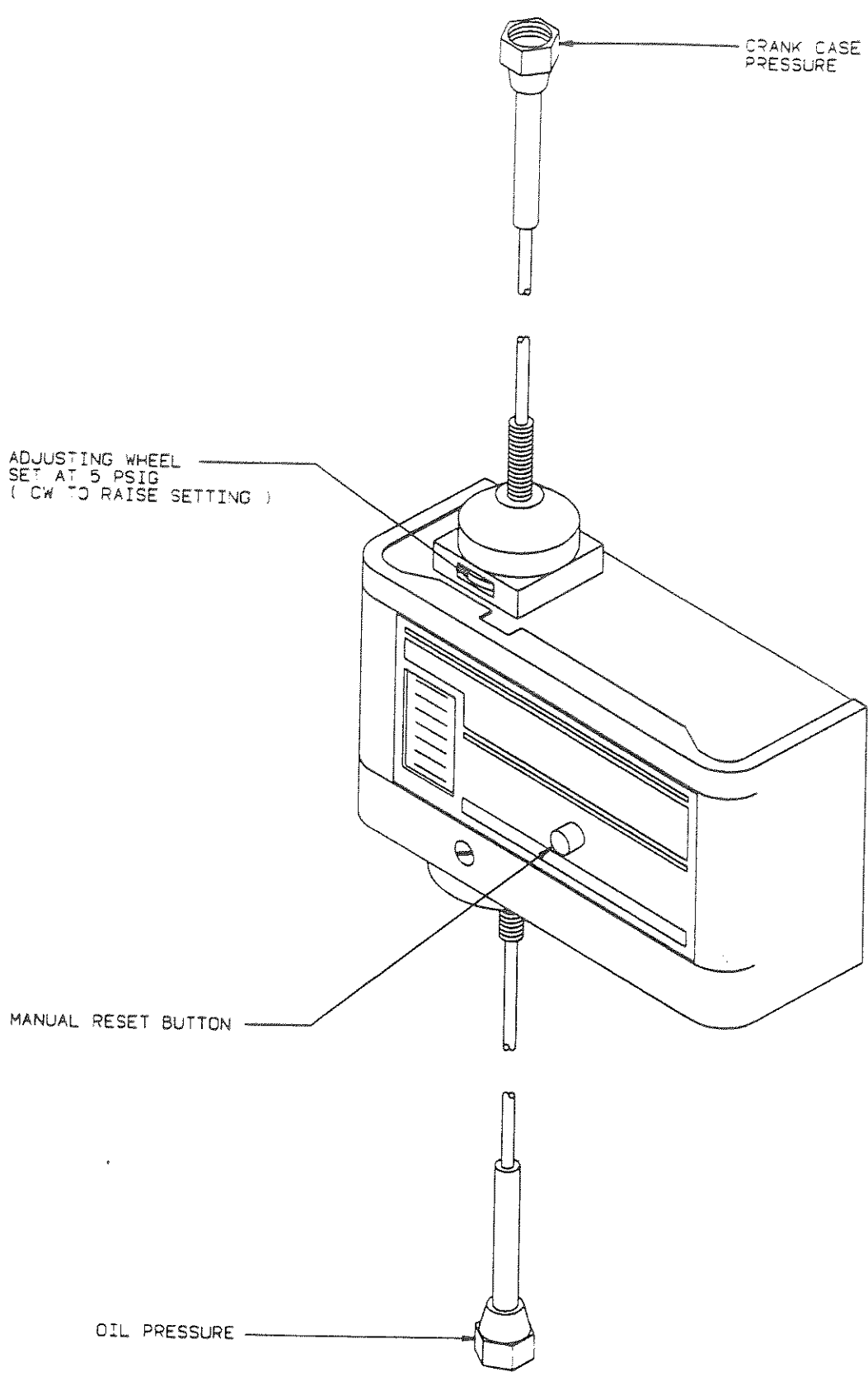
Use "Dual Inhibited Sunisco 3GS" (Viscosity 150), or equal.

### OIL PRESSURE SWITCH

The compressor is protected by a manual reset type low oil pressure safety switch which is set at 5 PSIG. The oil pressure switch has a built-in 60 second time delay. If the net oil pressure (pump pressure minus suction pressure equals net oil pressure) falls below the switch setting for a time period of 60 seconds, and the pressure does not increase at least 5 PSI above the setting during that 60 seconds, the switch contact will open and stop the machine. After a period of time the switch can be manually reset and the machine restarted. The compressor should not be operated under low oil pressure conditions.

If it is necessary to install a new oil pressure switch, see Drawing B-56996 on Page 34 for adjusting.

**CAUTION:** WHEN THIS SWITCH CAUSES THE MACHINE TO STOP, THE CAUSE SHOULD BE IDENTIFIED AND CORRECTED BEFORE RESUMING OPERATION.



|                  |                                     |
|------------------|-------------------------------------|
| PART NO.         |                                     |
| DESIGNED BY      | HENRY MACHINE CO.<br>LOUISVILLE, KY |
| CHKD. BY         | OIL PRESSURE SWITCH DETAIL          |
| PLSD. BY         | FOR                                 |
| DATE             | 11 APR 91                           |
| SCALE            | 1:1                                 |
| DRG. NO. B-56996 |                                     |

## SERVICING OPERATIONS

### ADJUSTABLE BLOWDOWN (for clearer ice)

A petcock is installed on the water pump to provide means for obtaining blowdown from the water pan during the freezing period. This supplements the blowdown that is discharged during the thawing period through the bypass piping connected to the drain of the water pan. (See "Automatic Blowdown," below.)

The petcock was set at the factory to discharge approximately three gallons of water in fifteen minutes. After installation it should be adjusted to the minimum rate required to maintain production of clear ice.

### AUTOMATIC BLOWDOWN (harvest cycle)

A patented feature of this machine is the automatic blowdown (40) which is provided to eliminate or reduce the necessity for frequent flushing or cleaning of the water tank (7) to remove accumulated salts or solids in the water as a result of the freezing action.

A principle of operation of the blowdown arrangement is a drain-bypass effect, which is initiated during each thawing period when the water pump is stopped and the water in the freezer tubes returns to the water tank, thereby raising the water level higher than the bypass piping (40) and causing a portion of the water to drain from the bottom of the tank.

The water level, controlled by the float valve (12), regulates the quantity of blowdown during the thawing period.

### FLOAT VALVE (make-up water)

The make-up float valve (12) maintains the proper pumping level in the water tank for ice making. The valve should be set to maintain a water level in the water tank during the freezing period, so that there will be a quantity of bypass or blowdown only during the thaw mode. The water level during the freeze mode should always be below the bypass piping to prevent excessive waste of cold water, resulting in loss of ice capacity.

If it should become necessary to clean the float valve, close the stop valve in the make-up water line to the machine and remove the float valve. After the valves have been cleaned and reinstalled, check to ascertain if the proper water level is being maintained.

It is advisable to install a large area strainer in the water supply line to protect the float valve from dirt or solids in the water which would necessitate frequent cleaning. A strainer of 40 mesh screen is usually satisfactory. This strainer should be checked and cleaned at least once a year.

VOGT Part Number #12A-4200H0402 - Float Valve  
#12A-4200HP02 - Valve Float Cylinder



## EXPANSION VALVE

The expansion valve was adjusted before shipment, and it is rarely necessary to change this setting.

If considerably less ice than shown on spec sheet is being produced per discharge, check the water supply, circulating water pump, water distributors, liquid line valves, refrigerant level, freezer pressure switch and all other avenues BEFORE changing the factory setting of the expansion valve.

The expansion valve should be adjusted by superheat during the freeze cycle. A few cycles should be checked before and after making adjustments. Use chart (Page 39) used to check and record superheat readings. During a freeze cycle, an ideal (or typical) pattern is shown on Page 40.

## SETTING SUPERHEAT

Attach service manifold or calibrated pressure gauge to charging valve No. 28.

Attach thermocouple to suction line at the point of remote bulb location. Note: A refrigeration type pocket thermometer with appropriate bulb clamp may be used. Thermocouple or thermometer must be insulated against the ambient.

Superheat will vary during freeze cycle. Setting should be as follows:

1" O.D. tubes, 7/8" O.D. ice cylinders, average superheat should be 10°F.

1-1/4" O.D. tubes, 1 1/8" O.D. ice cylinders, average superheat should be 10°F.

1-1/2" O.D. tubes, 1 3/8" O.D. ice cylinders, average superheat should be 8°F.

## CRUSHED ICE

For machines producing crushed ice, T.E.V. should be adjusted to 10°F superheat.

# Superheat

Heat added to the refrigerant vapor that causes its temperature to rise above its saturation temperatures.

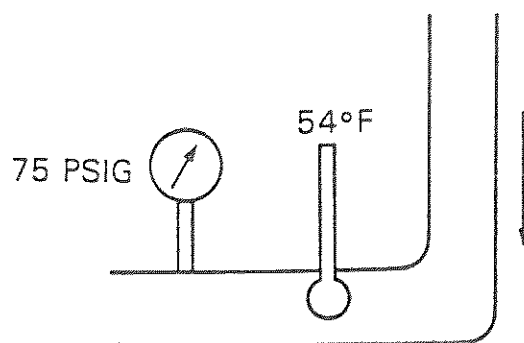
P/T charts do not apply — temperature rises without a rise in pressure.

## Superheated Refrigerant

Example: Conditions, R-22 — 75.0 PSIG  
Suction Line — 54°F

Line Temperature = 54°F  
P-T Chart at 75.0 PSIG = 44°F  
10°F

Coil operating at 10°F Superheat



TU--ICE MACHINE SUPERHEAT RECO.

|                  |    |                        |    |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|------------------|----|------------------------|----|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| MACHINE MODEL #  |    | LOCATION               |    | DATE      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| SERIAL #         |    | IXV MODEL #            |    | TECHNICAN |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| SUPER HEAT DEG.F |    | EVAPORATOR TEMPERATURE |    |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 18               | 47 | 47                     | 46 | 45        | 44 | 43 | 43 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 27 | 26 | 25 | 24 | 23 | 22 | 20 | 19 | 18 | 17 | 15 | 14 | 12 |
| 17               | 46 | 46                     | 45 | 44        | 43 | 42 | 42 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 26 | 25 | 24 | 23 | 22 | 21 | 19 | 18 | 17 | 16 | 14 | 13 | 11 |
| 16               | 45 | 45                     | 44 | 43        | 42 | 41 | 41 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 33 | 32 | 31 | 30 | 29 | 28 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 18 | 17 | 16 | 15 | 13 | 12 | 10 |
| 15               | 44 | 44                     | 43 | 42        | 41 | 40 | 40 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 28 | 27 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 17 | 16 | 15 | 14 | 12 | 11 | 9  |
| 14               | 43 | 43                     | 42 | 41        | 40 | 39 | 39 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 31 | 30 | 29 | 28 | 27 | 26 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 16 | 15 | 14 | 13 | 11 | 10 | 8  |
| 13               | 42 | 42                     | 41 | 40        | 39 | 38 | 38 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 27 | 26 | 25 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 15 | 14 | 13 | 12 | 10 | 9  | 7  |
| 12               | 41 | 41                     | 40 | 39        | 38 | 37 | 37 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 26 | 25 | 24 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 14 | 13 | 12 | 11 | 9  | 8  | 6  |
| 11               | 40 | 40                     | 39 | 38        | 37 | 36 | 36 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 28 | 27 | 26 | 25 | 24 | 23 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 13 | 12 | 11 | 10 | 8  | 7  | 5  |
| 10               | 39 | 39                     | 38 | 37        | 36 | 35 | 35 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 27 | 26 | 25 | 24 | 23 | 22 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 12 | 11 | 10 | 9  | 7  | 6  | 4  |
| 9                | 38 | 38                     | 37 | 36        | 35 | 34 | 34 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 26 | 25 | 24 | 23 | 22 | 21 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 11 | 10 | 9  | 8  | 6  | 5  | 3  |
| 8                | 37 | 37                     | 36 | 35        | 34 | 33 | 33 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 25 | 24 | 23 | 22 | 21 | 20 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 9  | 8  | 7  | 6  | 4  | 2  |
| 7                | 36 | 36                     | 35 | 34        | 33 | 32 | 32 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 24 | 23 | 22 | 21 | 20 | 19 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 9  | 8  | 7  | 6  | 5  | 3  | 1  |
| 6                | 35 | 35                     | 34 | 33        | 32 | 31 | 31 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 23 | 22 | 21 | 20 | 19 | 18 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 8  | 7  | 6  | 5  | 3  | 2  | 0  |
| 5                | 34 | 34                     | 33 | 32        | 31 | 30 | 30 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 22 | 21 | 20 | 19 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 7  | 6  | 5  | 4  | 2  | 1  | -1 |
| 4                | 33 | 33                     | 32 | 31        | 30 | 29 | 29 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 21 | 20 | 19 | 18 | 17 | 16 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 6  | 5  | 4  | 3  | 1  | 0  | -2 |
| 3                | 32 | 32                     | 31 | 30        | 29 | 28 | 28 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 20 | 19 | 18 | 17 | 16 | 15 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 5  | 4  | 3  | 2  | 0  | -1 | -3 |
| 2                | 31 | 31                     | 30 | 29        | 28 | 27 | 27 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 19 | 18 | 17 | 16 | 15 | 14 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 4  | 3  | 2  | 1  | -1 | -2 | -4 |
| 1                | 30 | 30                     | 29 | 28        | 27 | 26 | 26 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 18 | 17 | 16 | 15 | 14 | 13 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 3  | 2  | 1  | 0  | -2 | -3 | -5 |
| 0                | 29 | 29                     | 28 | 27        | 26 | 25 | 25 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 17 | 16 | 15 | 14 | 13 | 12 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 2  | 1  | 0  | -1 | -3 | -4 | -6 |
| SUCTION PSIG     | 54 | 53                     | 52 | 51        | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 |    |

MARK SUCTION PSIG & EVAP.TEMP AT 1 MINUTE INTERVALS. AVOID SHADED AREA.

NOTES:

| RECOMMENDED SUPERHEAT |         |                |
|-----------------------|---------|----------------|
| 118/218               |         |                |
|                       | MINIMUM | MAXIMUM TARGET |
| 1"                    | 7°      | 12°            |
| 1 1/4"                | 7°      | 12°            |
| 1 1/2"                | 6°      | 10°            |
| Cru. Ice              | 9°      | 11°            |

TUBLE MACHINE SUPERHEAT RECORD

|                 |    |                        |    |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
|-----------------|----|------------------------|----|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| MACHINE MODEL # |    | LOCATION               |    | DATE      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| SERIAL #        |    | TXV MODEL #            |    | TECHNICAN |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| SUPER HEAT DEGF |    | EVAPORATOR TEMPERATURE |    |           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| 18              | 47 | 46                     | 45 | 44        | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 17              | 46 | 45                     | 44 | 43        | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |   |
| 16              | 45 | 44                     | 43 | 42        | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |   |   |
| 15              | 44 | 43                     | 42 | 41        | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6 | 5 | 4 | 3 | 2 | 1 | 0 |   |   |   |
| 14              | 43 | 42                     | 41 | 40        | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5 | 4 | 3 | 2 | 1 | 0 |   |   |   |   |
| 13              | 42 | 41                     | 40 | 39        | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4 | 3 | 2 | 1 | 0 |   |   |   |   |   |
| 12              | 41 | 40                     | 39 | 38        | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3 | 2 | 1 | 0 |   |   |   |   |   |   |
| 11              | 40 | 39                     | 38 | 37        | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2 | 1 | 0 |   |   |   |   |   |   |   |
| 10              | 39 | 38                     | 37 | 36        | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1 | 0 |   |   |   |   |   |   |   |   |
| 9               | 38 | 37                     | 36 | 35        | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0 |   |   |   |   |   |   |   |   |   |
| 8               | 37 | 36                     | 35 | 34        | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |   |   |   |   |   |   |   |   |   |   |
| 7               | 36 | 35                     | 34 | 33        | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |   |   |   |   |   |   |   |   |   |   |
| 6               | 35 | 34                     | 33 | 32        | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |    |   |   |   |   |   |   |   |   |   |   |
| 5               | 34 | 33                     | 32 | 31        | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |    |    |   |   |   |   |   |   |   |   |   |   |
| 4               | 33 | 32                     | 31 | 30        | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| 3               | 32 | 31                     | 30 | 29        | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| 2               | 31 | 30                     | 29 | 28        | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| 1               | 30 | 29                     | 28 | 27        | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| 0               | 29 | 28                     | 27 | 26        | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |    |    |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| SUCTION PSIG    | 54 | 53                     | 52 | 51        | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 |    |    |    |   |   |   |   |   |   |   |   |   |   |

MARK SUCTION PSIG & EVAP. TEMP AT 1 MINUTE INTERVALS. AVOID SHADED AREA.

NOTES:

| RECOMMENDED SUPERHEAT |         |        |
|-----------------------|---------|--------|
| 118/218               |         |        |
| MINIMUM               | MAXIMUM | TARGET |
| 8°                    | 12°     | 10°    |
| 8°                    | 12°     | 10°    |
| 8°                    | 12°     | 10°    |
| Crit. Ice             | 9°      | 11°    |

## FREEZER PRESSURE SWITCHES

The freezing time period for the production of cylinder ice is controlled by the freezer pressure switch located inside the control panel.

The switch was set at the factory to produce ice of recommended thickness. Look at the "Certificate of Test" which was provided with the machine for a sample set of pressure readings with corresponding time periods and water temperatures. Do not make any adjustments until several discharging cycles have been made and pressure gage accuracy is checked.

If it becomes necessary to install a new freezer pressure switch, the following procedure is recommended for its adjustment.

### ALLEN BRADLEY SWITCH

The following procedure is recommended for initially setting an Allen Bradley pressure switch which has not been previously adjusted:

1. Turn the bottom screw (differential) approximately  $\frac{1}{2}$  turn to the left (counter clockwise). The pointer arrow, which is at the top middle of the switch, will be at the "F" setting.
2. Turn the top screw (range adjustment) approximately  $4 \frac{1}{2}$  turns to the left (counter clockwise). The pointer on the range setting will be between 40 psi and 50 psi.
3. After the machine is running, the range adjustment (top screw) will have to be fine tuned to get the proper ice thickness. (Clockwise = Thinner Ice), (Counter Clockwise = Thicker Ice)

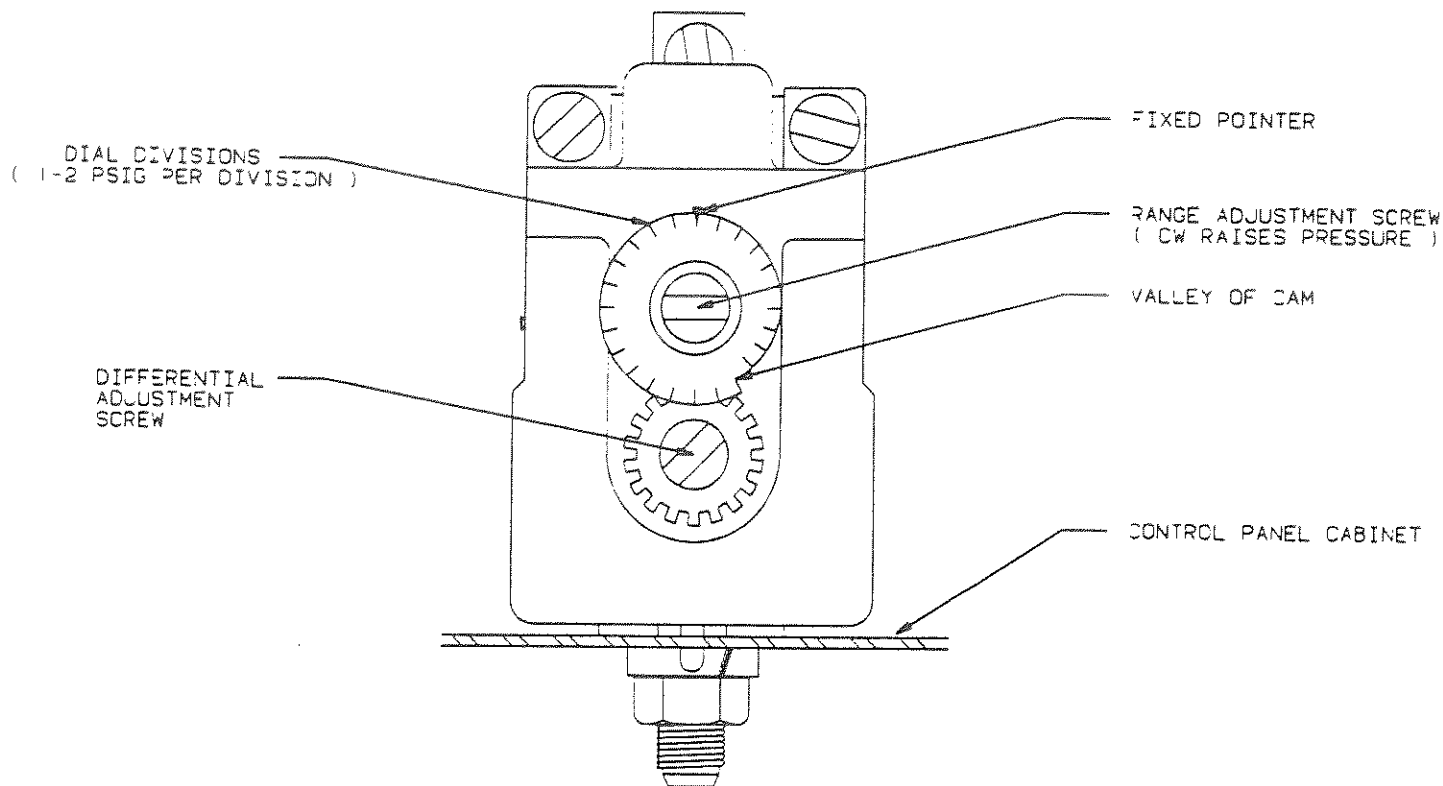
See Drawing B-56992 on Page 42.

The freezing time can be such that a small percentage of the ice is frozen solid. If so, some ice from the top and bottom of the freezer should have a small hole in the center to insure that the freezing time has not been extended to where a loss in capacity would result.

It is preferable that the freezing cycle be such that a small hole remain in the center of the ice cylinder ( $\frac{1}{16}$ " hole for  $\frac{7}{8}$ " ice, and  $\frac{1}{4}$ " hole for  $1 \frac{3}{8}$ " ice). This insures that the freezing cycle is not extended unnecessarily and eliminates a possible opaque core in the center of the ice.

When crushed ice is produced, the freezer pressure switch can be set to produce ice having a wall thickness of anywhere from  $\frac{1}{4}$ " to  $\frac{1}{8}$ ", depending on the needs of the owner.  $\frac{3}{16}$ " thick ice provides crushed ice of good appearance that does not melt excessively fast.

|                                |             |
|--------------------------------|-------------|
| PART NO.                       |             |
| DMN. BY                        | PECKENPAUGH |
| CHK. BY                        |             |
| RLSD. BY                       |             |
| DATE                           | 11 APR 91   |
| SCALE                          | NONE        |
| HENRY W. HAINLINE (1)          |             |
| LOUISVILLE, KY                 |             |
| FREEZER PRESSURE SWITCH DETAIL |             |
| FOR                            |             |
| MID-SIZE TUBE-ICE              |             |
| TNE                            |             |
| ORG. NO. B-565                 |             |



### HIGH-LOW PRESSURE SWITCH

The high-low pressure switch is a two pole dual function switch. Located in the machine, next to the compressor, it protects the machine from possible damage due to abnormal pressure during operation.

**CAUTION:** WHEN THIS SWITCH CAUSES THE MACHINE TO STOP, THE CAUSE SHOULD BE IDENTIFIED AND CORRECTED BEFORE RESUMING NORMAL OPERATION.

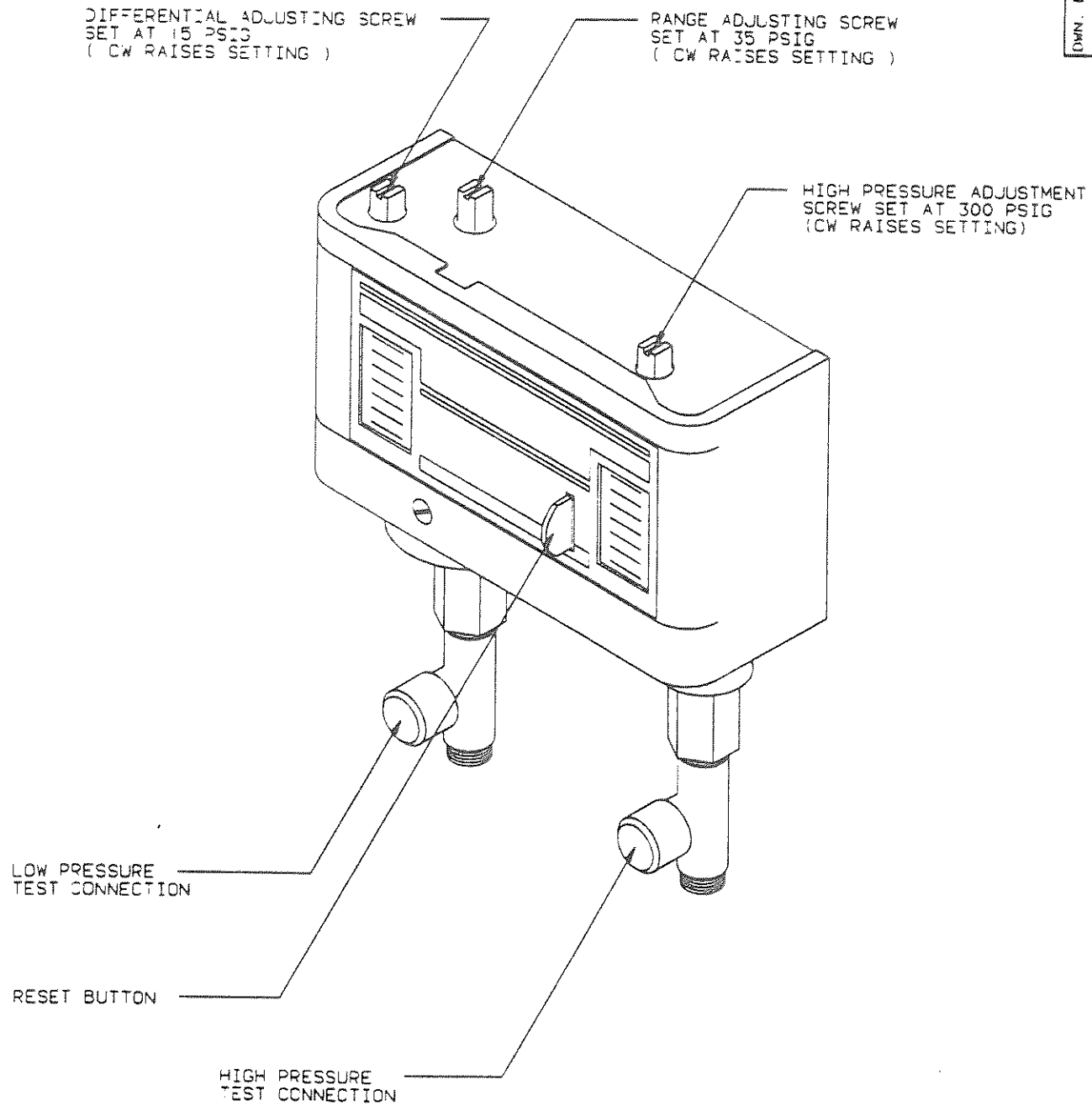
The low pressure cut-in should be set at 35 PSIG and the cut-out set at 15 PSIG. after tripping at the cutout setting, the switch will reset automatically when the pressure rises to the cut-in setting.

The high pressure cut-out should be set at 300 PSIG. After tripping, reset the switch manually.

If it becomes necessary to install a high-low pressure switch, the following procedure is recommended for its adjustment.

Turn the adjusting screws clockwise to raise the pressure setting. Turn counter-clockwise to lower the setting. Adjust the switch to the indicated pressure settings and test with an accurate gage to be sure the switch functions properly.

See Drawing B-56993 on Page 44.





### HEAD PRESSURE

The head pressure should be maintained at 190-210 PSIG during the freeze cycle. The accuracy of the pressure gages on the machine can be checked at the test connection in the high pressure line, near the high-low pressure switch.

See Drawing B-56993 on Page 44.

### AIR-COOLED UNITS

The condenser fan switch is used to regulate the head pressure. This is an adjustable pressure switch located on the right-hand front of machine above the thawing gas pressure switch. It controls the operation of the condenser fan motor(s) through a contactor (FC) located in the control panel. The switch is set to cycle the fan motor(s) "ON" at 210 PSIG and "OFF" at 190 PSIG.

See Drawing B-56994 on Page 46.

### WATER COOLED UNITS WATER REGULATING VALVE

A water regulating valve located in the condenser water inlet line is used to control the water flow through the condenser. This valve should be adjusted to maintain a head pressure of 190-200 PSIG. Increasing the water flow lowers the head pressure and decreasing the water flow raises the head pressure. This valve is adjusted during the factory test.

Running at higher head pressure may reduce water usage but will reduce ice capacity and increase energy consumption. Likewise, running at lower head pressures increases water use. Running at 200 PSIG is a good compromise for typical installation.

See Drawing B-56994 on Page 46.

| NO. | DATE | REVISIO | BY | CHK |
|-----|------|---------|----|-----|
|     |      |         |    |     |

ADJUSTING STEM

CUT IN ADJUSTING SCREW  
SET AT 210 PSIG  
( CW LOWERS SETTING )

CUT OUT ADJUSTING SCREW  
SET AT 190 PSIG  
( CW RAISES SETTING )

WATER REGULATING VALVE

TO COMPRESSOR  
DISCHARGE

TO COMPRESSOR  
DISCHARGE

CONDENSER FAN SWITCH

|  |   |
|--|---|
| PART NO.   |   |
| DIM. BY REGISTRATION<br>CHKD. BY<br>RLSD. BY<br>DATE 11 APR 91<br>SCALE NONE | HENRY VOGEL MACHINE CO<br>LOUISVILLE, KY<br>WATER REGULATING VALVE AND<br>CONDENSER FAN SWITCH DETAILS<br>FOR<br>MID-SIZE TUBE-IT<br>HUNE<br>DHC, NO. B-569 |

### COMPRESSOR CRANKCASE HEATER

When electrical power is supplied to terminals L1, L2, & L3 the crankcase heater is energized when the compressor is not operating.

When installing a new insertion type crankcase heater, be sure to use the special thermal to insure optimum heat conductance and a retainer cup to hold the heater in place.

### WATER DISTRIBUTORS

To clean distributors, stop the unit and remove the distributing head (8) on top of the freezer. The water distributors may then be removed for cleaning by soaking in a solution of ice machine cleaner or 10% muratic acid and water.

**WARNING:** ACID CAN CAUSE SERIOUS BURNS OR BLINDNESS. ALWAYS ADD ACID TO WATER FOR DILUTION. WEAR EYE AND BODY PROTECTION.

### THAWING GAS VALVE PRESSURE SWITCH

The thawing gas valve (18) is closed and opened during the harvest cycle by an adjustable pressure switch located in the machine, outside the control panel. The pressure CUT-IN (contacts close) are to be set at 62 PSIG and CUT-OUT (contacts open) set at 68 PSIG.

If it becomes necessary to install a new thawing gas valve pressure switch, the following procedure is recommended for its adjustment:

Set the cut-out pressure at 68 PSIG (CW raises setting). Set the cut-in pressure at 62 PSIG (CCW lowers setting).

Attach a refrigerant gage to the test connection in the low pressure line near the high/low pressure switch. Adjust the CUT-OUT and CUT-IN during a harvest cycle, using the refrigerant gage for reference.

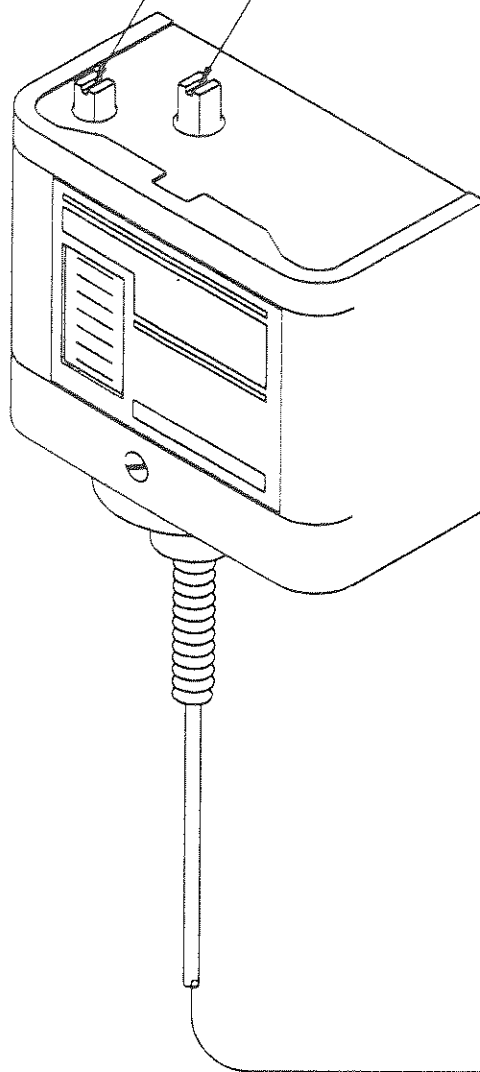
See Drawing B-56995 on Page 48.

|     |      |         |      |
|-----|------|---------|------|
| NO. | DATE | REVISOR | FROM |
|     |      |         |      |

|   |            |
|---|------------|
| PART NO.  |            |
| OWN. BY   | PELLEGRINI |
| LD. BY  |            |
| RLSD. BY  |            |
| DATE  | 11 APR 91  |
| SCALE   | NONE       |
| HENRY MACHINE CO.<br>LOUISVILLE, KY   |            |
| THAWING GAS PRESSURE SWITCH DETAIL<br>FOR<br>MID-SIZE TUBE ICE<br>MACHINE<br>DRG. NO. B-569 |            |

CUT IN ADJUSTING SCREW  
SET AT 62 PSIG  
( CW LOWERS SETTING )

CUT OUT ADJUSTING SCREW  
SET AT 68 PSIG  
( CW RAISES SETTING )



TO FREEZER PRESSURE CONNECTION

CLEANING PROCEDURE  
VOGT TUBE-ICE MACHINES  
P118F and P218F

1. Set toggle switch to "OFF" position. (If the machine is running, it will shut down on completion of the last ice harvest period.)
2. Remove ice from storage area or securely cover opening into it.
3. Shut off water supply and drain water tank (7). Remove any loose sediment from tank.
4. Close drain valve and fill water tank with water. On units equipped with petcock on the water pump, close the petcock during the cleaning period.
5. Add three bottles (approximately 36 oz.) of Calgon Ice Machine Cleaner (a food grade liquid phosphoric acid) to water tank during the refill period.
6. Remove grid in ice discharge of water tank and place inside tank during the cleaning operation.
7. To run pump only, set the toggle switch to the "CLEAN" position. If necessary to purge air from pump, return switch to "ICE" position for a few seconds, then back to "CLEAN" position.
8. Circulate cleaning solution for 30 minutes or until deposits are dissolved.
9. Set switch to "ICE" position to stop pump, then drain and flush water tank with fresh water. Open water supply to machine.
10. Replace grid in ice discharge chute and start pump again by setting switch to "CLEAN". Operate for 15 minutes, then stop pump by returning switch to "ICE".
11. Drain and flush tank and then refill with fresh water.
12. Clean inside of ice storage area and remove any solution that entered during the cleaning process. Remove cover if one was installed over opening into storage area.
13. Place toggle switch to the "ON" position.
14. Start ice making cycle by depressing "START" push button.
15. Adjust setting of pump petcock per instructions under "Adjustable Blowdown".

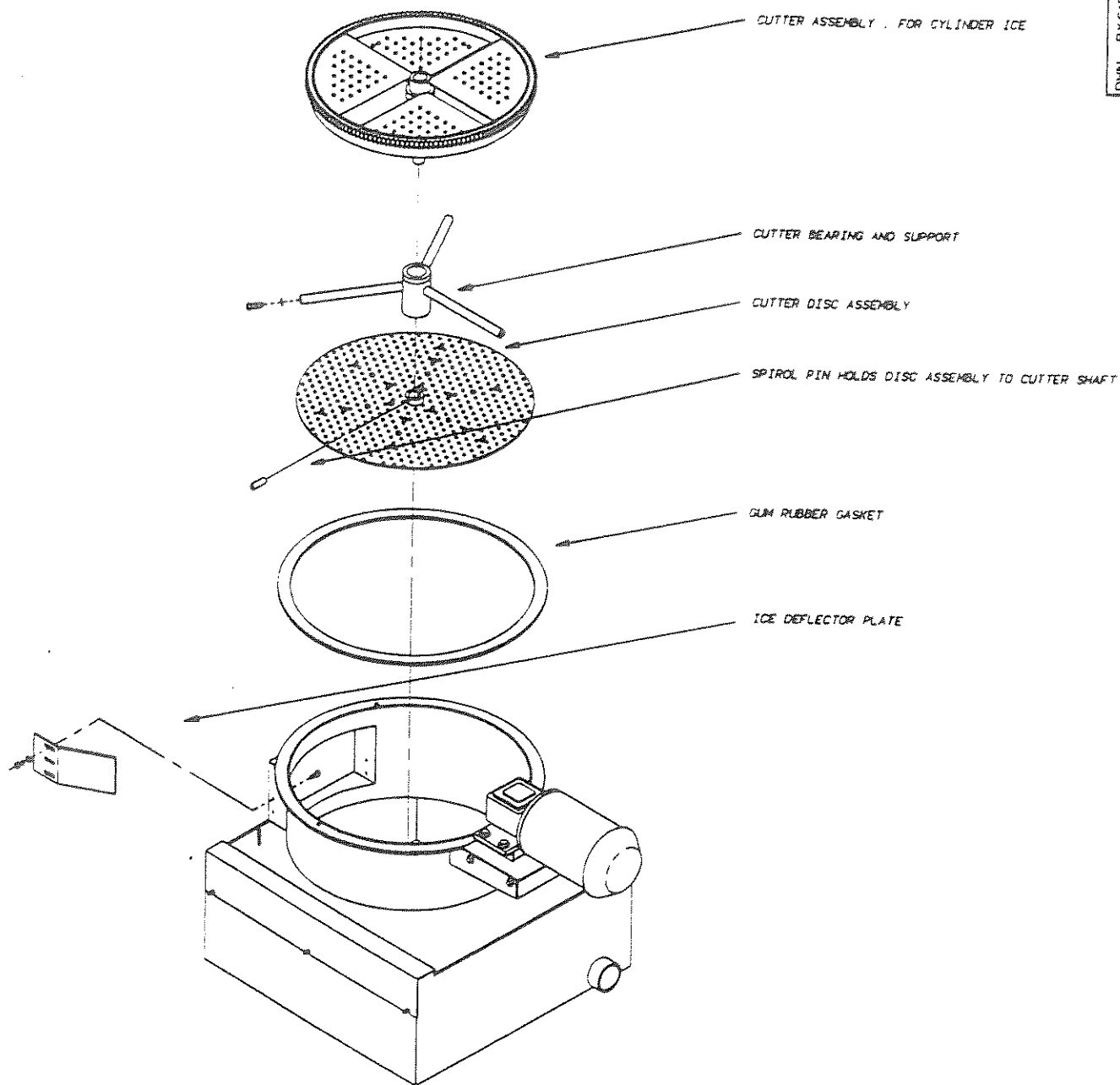
## CRUSHED ICE CONVERSION

### REMOVING OLD CUTTER (See Page 51)

1. Turn power off.
2. Shut off water supply.
3. Drain water tank.
4. Disconnect make-up water line at float valve, and also tubing from drain and pump connections.
5. Remove four bolts from flange of the gear reducer holding the motor to the gear reducer, and pull the motor away from the reducer, removing it completely from the reducer.
6. Remove ice discharge chute.
7. Remove the three bolts or nuts from around the freezer flange progressively, allowing the water tank to drop down inside the frame. (If available, two 3/8" thk x 2" wide x \_\_\_\_ long bars can be used to lay across lower frame members for tank to rest on when lowered).
8. Remove the water tank from the frame.
9. Remove spiral pin that holds cutter disc to cutter shaft.
10. Pull cutter assembly out of water tank.
11. Remove the three screws that bolt cutter bearing support to tank and remove support.
12. Unbolt screws and remove ice deflector plate.

| REVISION |          |          |    |
|----------|----------|----------|----|
| NO.      | DATE     | FROM     | TO |
| 1        | 12/28/91 | REVISION | 1  |

| SERVICE MANUAL         |         |         |                |
|------------------------|---------|---------|----------------|
| OWN. BY                | GARY RO | BY      | LOUISVILLE, KY |
| CRUSHED ICE CONVERSION | DATE    | 4-10-91 | SCALE          |
| REMOVING OLD CUTTER    | DATE    | 4-10-91 | SCALE          |
| DRG. NO. B-56998       |         |         |                |



## CRUSHED ICE CONVERSION

### INSTALLING CRUSHED ICE CUTTER (See Page 53)


1. Drill four holes in tank and tap for 10/24 screws.
2. Install slush screen assembly and secure to water tank with 10/24 screws.
3. Set cutter disc assembly down in bottom of water tank.
4. Install cutter bearing support and bolt in place.
5. Install crushed ice cutter assembly (12-6413A).
6. Slip cutter disc assembly over shaft and drive in spiral pin.
7. Install ice deflector plate to opposite side of ice discharge opening.
8. When making crushed ice the cutter must turn the opposite direction. To change the rotation of the cutter, the following wiring change is required:

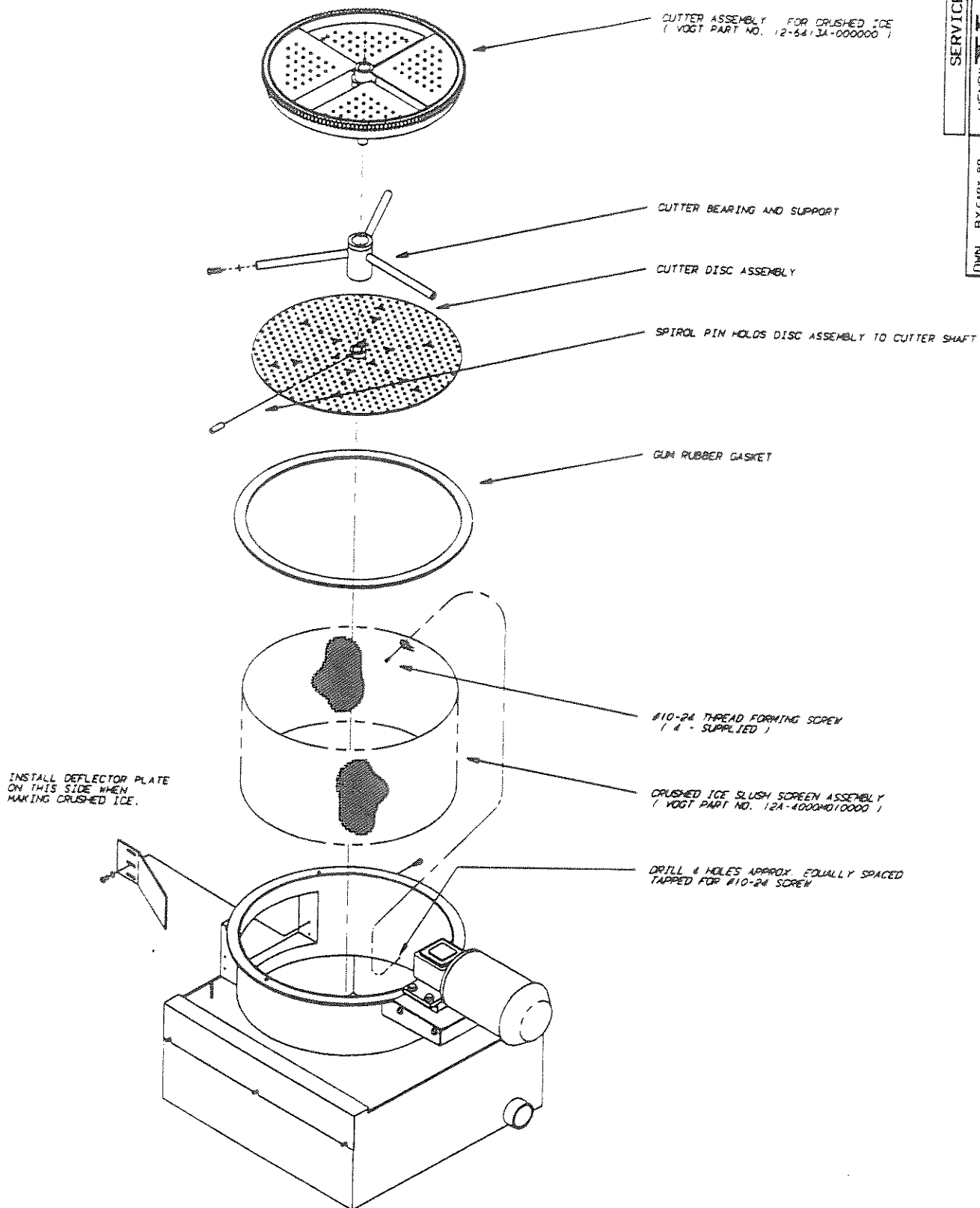
On old style P118F with 1 1/2" tubes, the cutter has a single phase motor. To change the direction, change the wiring in the motor by hooking the blue and black wire to L1, tie the red, orange, and white wire together and leave the yellow wire on L2.

All other P118 and P218 models have 3 phase cutter motors. To change the direction, switch two of the three wires (52-53-54) at the terminal block inside the control panel.
9. Reinstall water tank with gum rubber gasket in place and bolt up snug to bottom of freezer.
10. Connect water line and tubing, making sure hose clamps are tight, especially on the pump suction.
11. Install cutter motor onto the gear reducer, sliding keyed shaft into reducer. Lubricate shaft before installation.
12. After completing reassembly of all parts, turn the power and water on, and check operation.
13. Adjust freezer pressure switch to approximately 40 PSI (see page 41) or until ice wall thickness is approximately 3/16" thick.

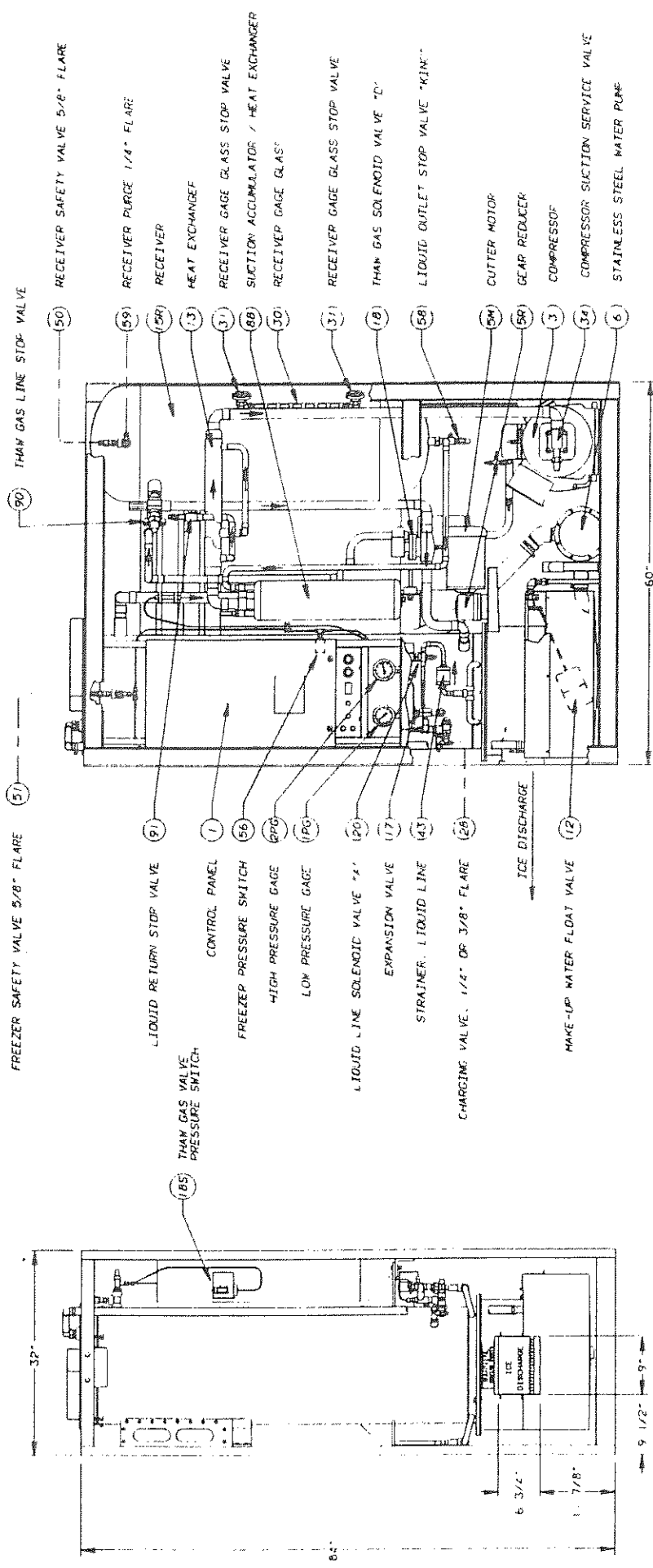


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| 1       | 10/1/91 | BY | IN |

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| SERVICE MANUAL |           |  |  |
| OWN. BY        | GARY BO   | <br>HENRY MACHINE CO.<br>LOUISVILLE, KY<br><br>CRUSHED ICE CONVERSION<br><br>MODELS P118F AND P218F<br><br>DRG. NO. B-56999 |  |
| UNK. BY        |           |  |  |
| RLSD. BY       | GMB 41593 |  |  |
| DATE           | 4 10 91   |  |  |
| SLAT           | NINE      |  |  |



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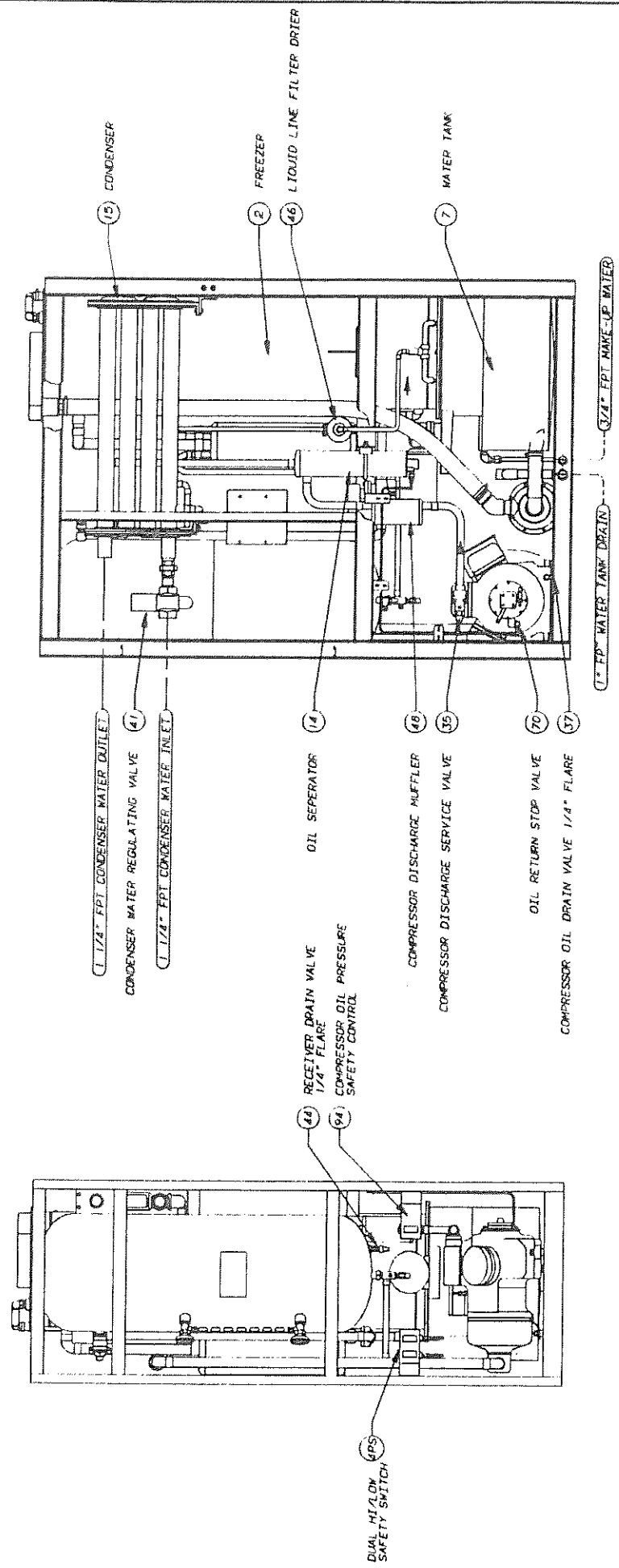


FRONT VIEW

LEFT SIDE VIEW

| SERVICE MANUAL   |          |
|--|----------|
| DWN. BY  | LOGSDON  |
| CKD. BY  |          |
| RLSD. BY   |          |
| DATE   | 04/06/93 |
| HENRY VOLT MACHINE CO<br>LOUISVILLE, KY                        |          |
| P1187 ASSEMBLY<br>WATER COILED 60HZ<br>FRONT AND 77 SIDE VIEWS |          |

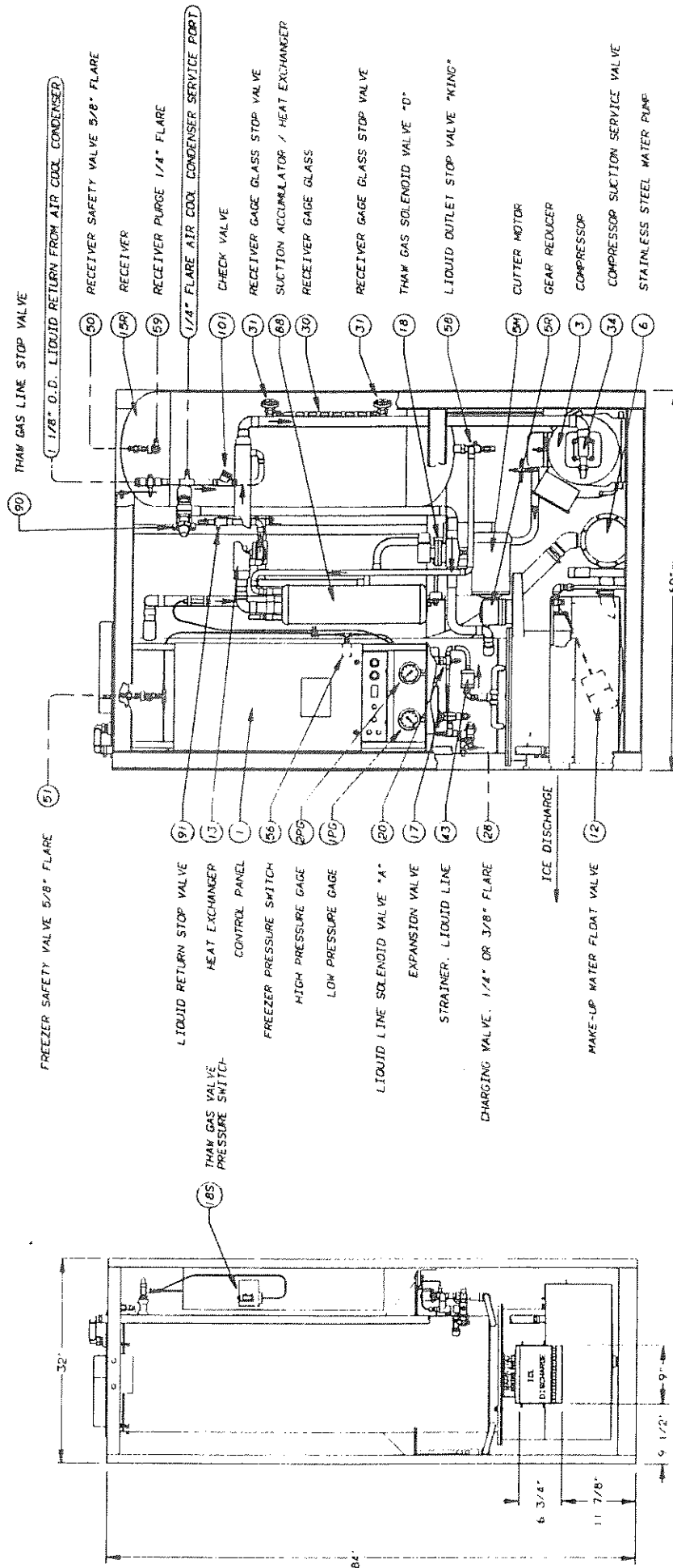
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| TO     | BY     |
| 1      | 1/1/93 |



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| SERVICE MANUAL   |  |
| HENRY MACHINE CO<br>LOUISVILLE, KY.                              |  |
| P118F ASSEMBLY<br>WATER COOLED 60HZ<br>REAR AND RIGHT SIDE VIEWS |  |

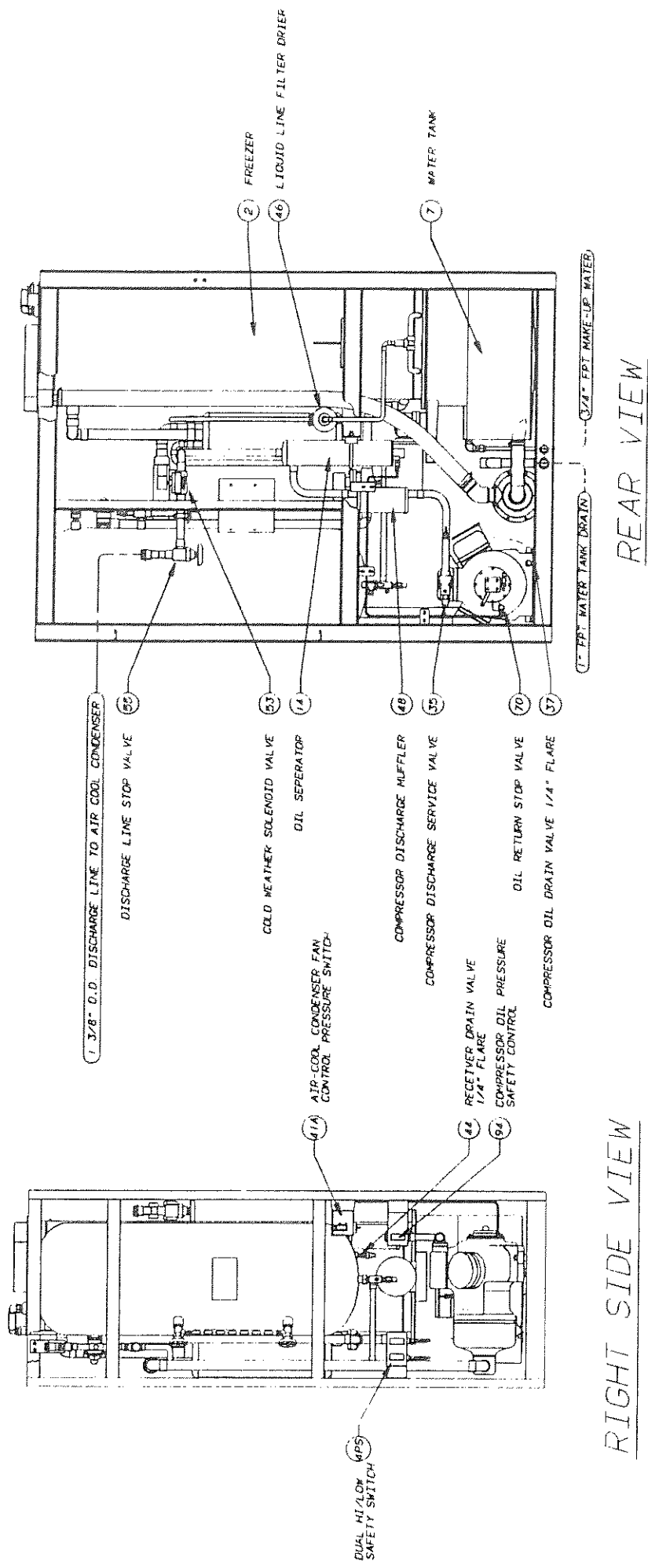
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| DWN. BY  | LOGSDON  |
| CKD. BY  |          |
| PLSD. BY |          |
| DATE     | 04/06/93 |

| RECORD |         | REVISION |         |
|--------|---------|----------|---------|
| NO.    | DATE    | BY       | CHK     |
| 1      | 10/1/83 | REVISION | 10/1/83 |



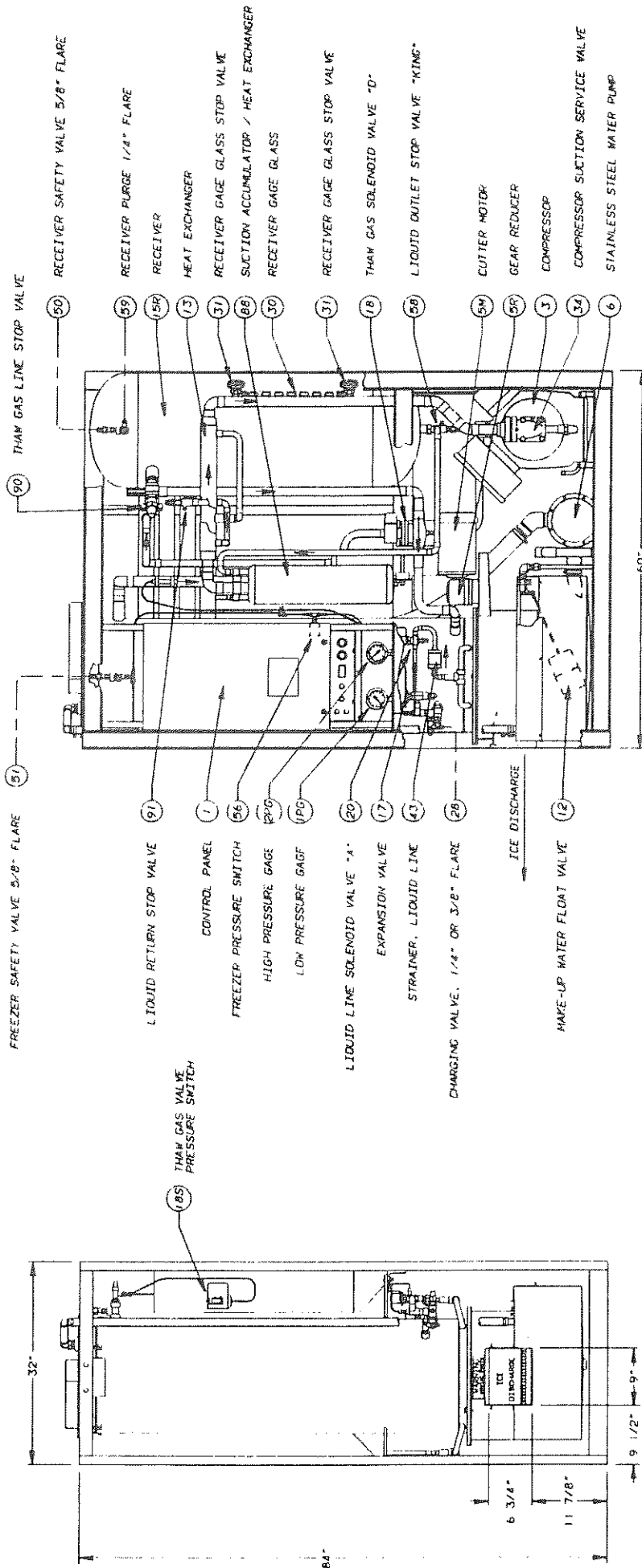
| SERVICE MANUAL   |                        |
|------------------|------------------------|
| DWN. BY LOGSOON  | HENRY                  |
| CKD. BY          | LOUISVILLE, KY.        |
| PLSD. BY         | P118F ASSEMBLY         |
| DATE 04/07/93    | AIR ED 60HZ            |
| SCALE 1/2"=1'-0" | FRONT AND T SIDE VIEWS |

| RECORD            |         | BY CK   |         |
|-------------------|---------|---------|---------|
| NO                | DATE    | TO      | DATE    |
| 1                 | 10/1/93 | 10/1/93 | 10/1/93 |
| REPAIR WORK ORDER |         |         |         |



| SERVICE MANUAL  |          |
|---|----------|
| DWN. BY   | LOESDON  |
| CKD BY  |          |
| RLSD BY   |          |
| DATE  | 04/08/93 |
| HENRY <b>Vogel</b> MACHINE CO<br>LOUISVILLE, KY                 |          |
| P1118F ASSEMBLY<br>AIP COOLED 60HZ<br>REAR AND RIGHT SIDE VIEWS |          |

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|-----|------|----|--------|----|----|
| 1   |      |    |        |    |    |

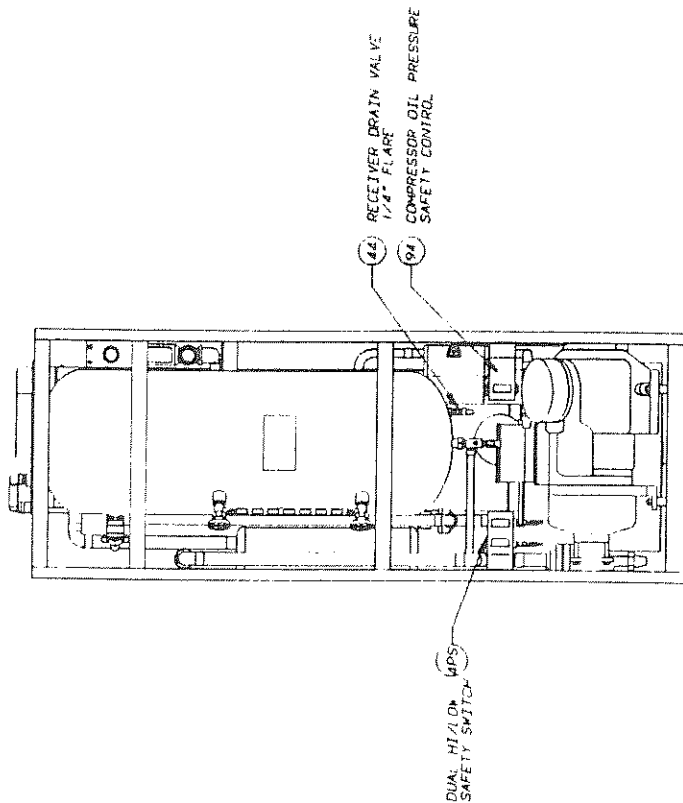


FRONT VIEW

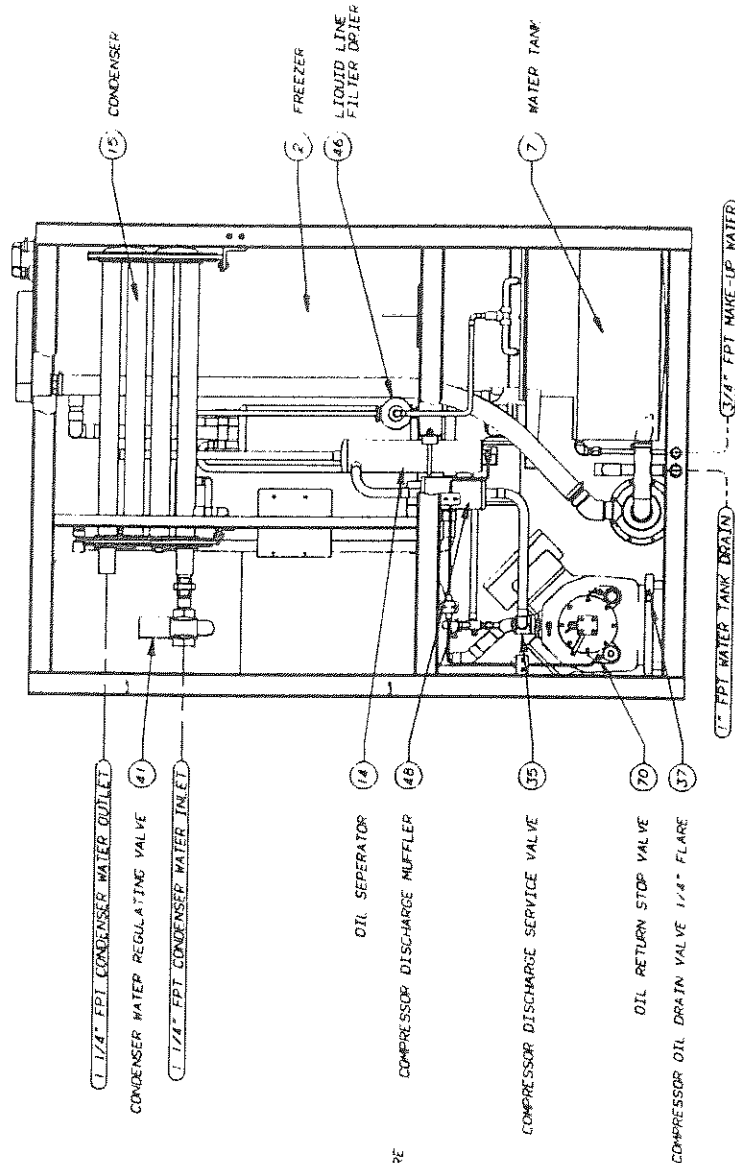
LEFT SIDE VIEW

| SERVICE MANUAL   |          |
|--|----------|
| DWN. BY  | LOOSDON  |
| CKD. BY  |          |
| PLSD. BY   |          |
| DATE   | 04/06/93 |
| SCALE  | 1"=1'-0" |
| HENRY <b>VOGT</b> MACHINE CO.<br>LOUISVILLE, KY              |          |
| P118F ASSEMBLY<br>WATER HELED 50HZ<br>FRONT AND 7 SIDE VIEWS |          |

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| 1      |      | REPAIR | REPAIR |



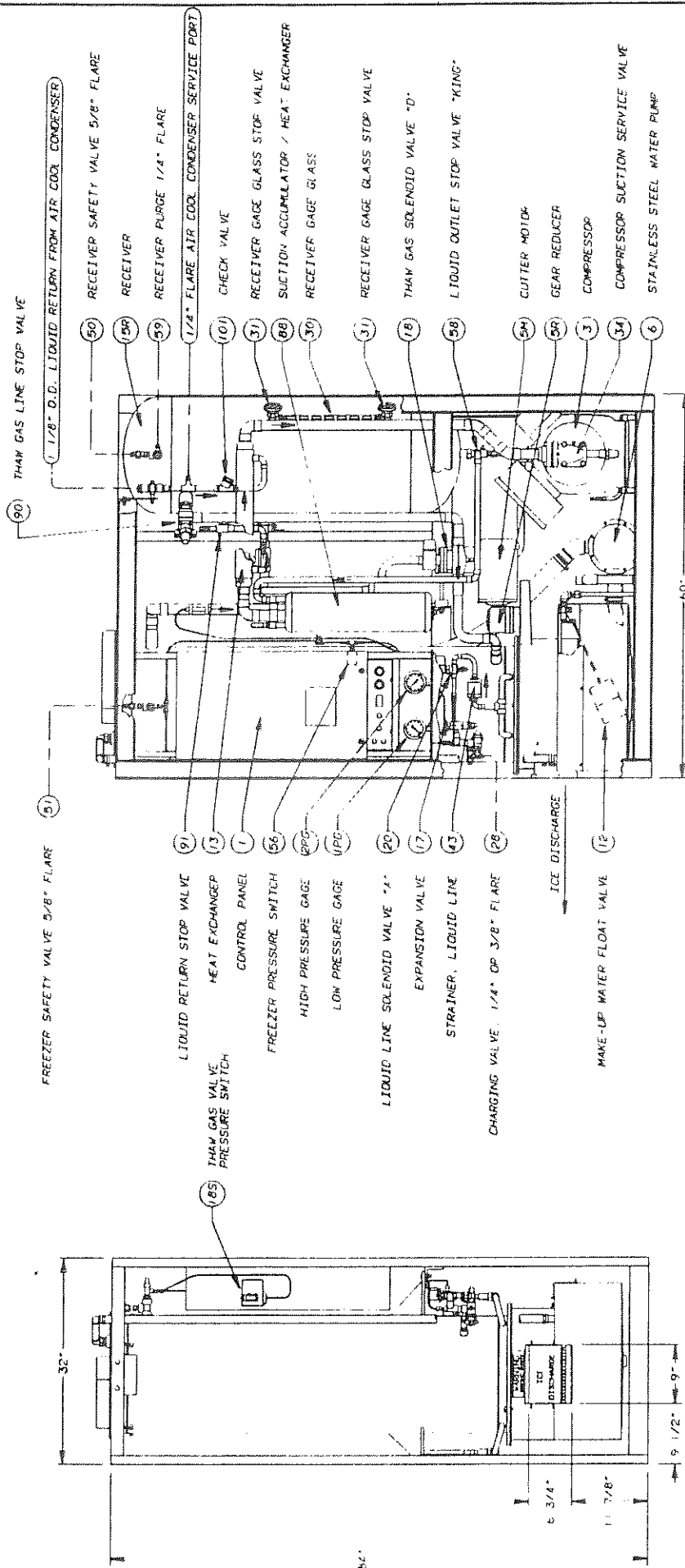
RIGHT SIDE VIEW



REAR VIEW

| SERVICE MANUAL |          |       |                           |
|----------------|----------|-------|---------------------------|
| DWN. BY        | LOOSDON  | HENRY | VOGT MACHINE CO.          |
| CKD. BY        |          |       | LOUISVILLE, KY            |
| RLSD. BY       |          |       | P118F ASSEMBLY            |
| DATE           | 04/07/93 |       | WATER COOLED 50HZ         |
|                |          |       | REAR AND RIGHT SIDE VIEWS |

| RECORD |         | RE   |    |
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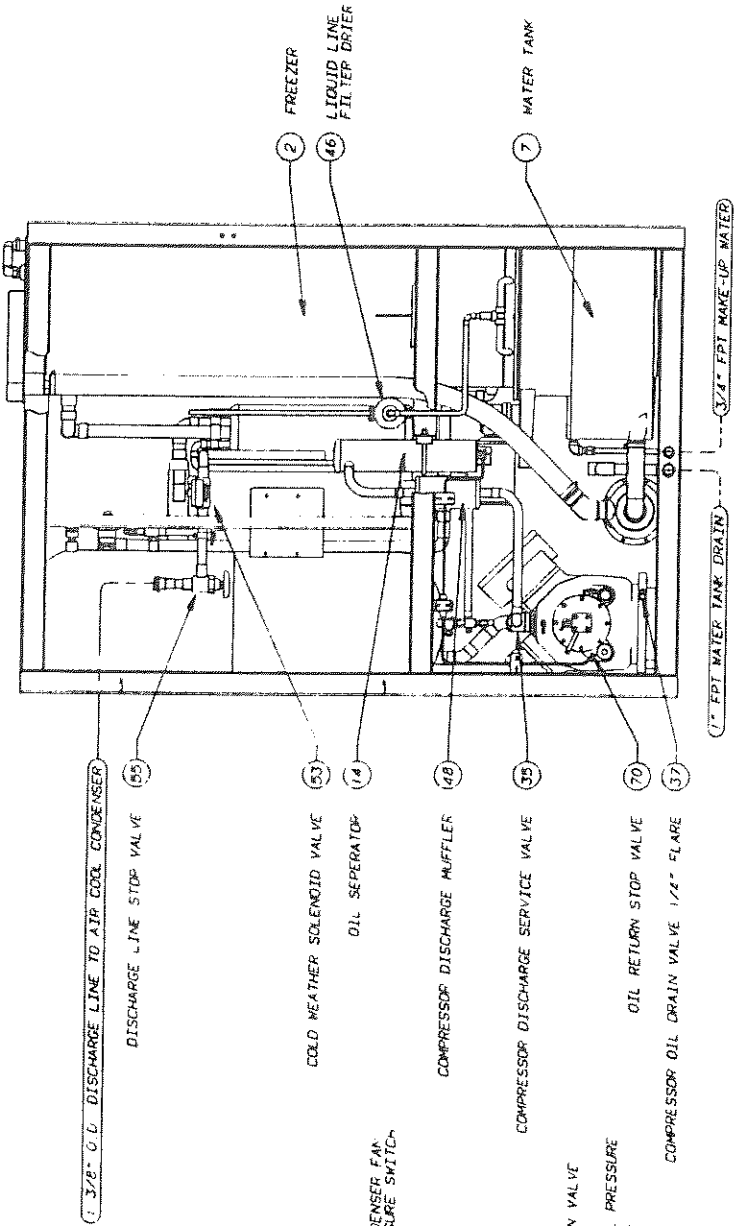
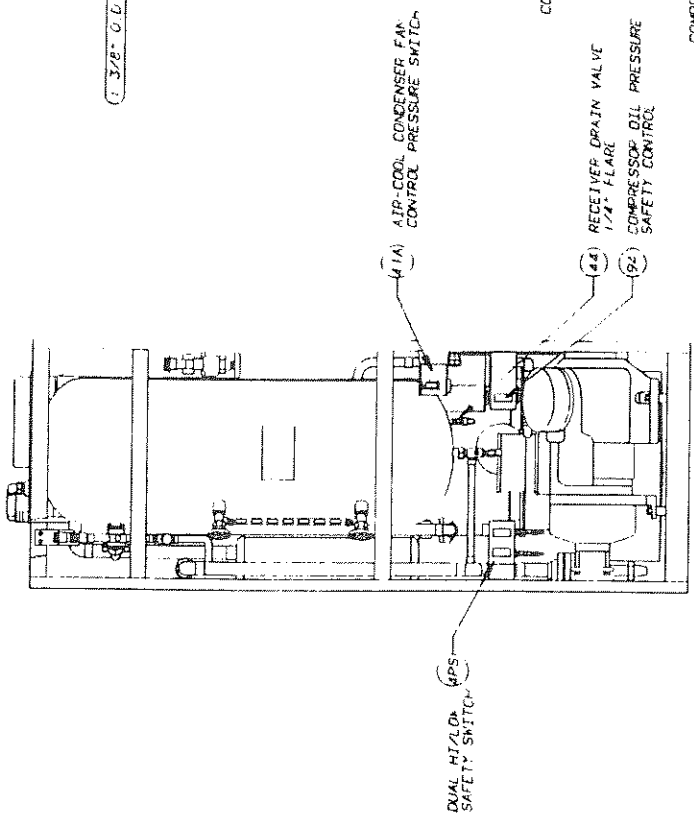
FRONT VIEW

LEFT SIDE VIEW

| SERVICE MANUAL  |          |
|---|----------|
| DWN. BY   | LOOSDOON |
| CKD BY  |          |
| RLSC BY   |          |
| DATE  | 04/08/93 |
| HENRY <b>Root</b> MACHINE CO<br>LOUISVILLE, KY.         |          |
| P118F ASSEMBLY<br>AIP ED 50HZ<br>FRONT ANL T SIDE VIEWS |          |



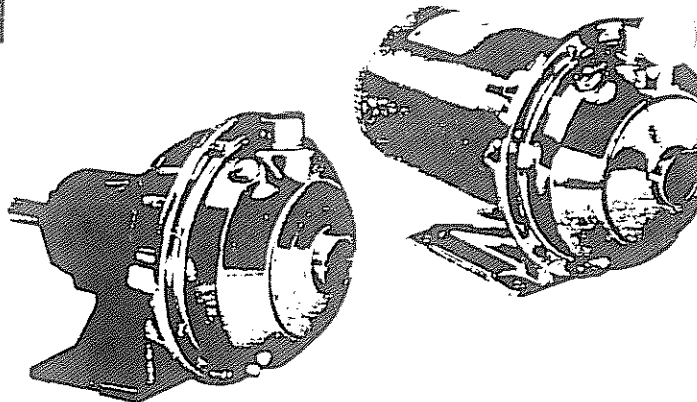
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| RECORD |      |
| NO.    | DATE |
| BY     | TO   |
| BY CK  |      |



|  |               |
|--|---------------|
| SERVICE MANUAL   |               |
| HENRY Voigt MACHINE CO<br>LOUISVILLE, KY.                      |               |
| P118F ASSEMBLY<br>AIR COOLED 50HZ<br>REAR AND RIGHT SIDE VIEWS |               |
| DWN. BY LOGSDON  | CKD. BY       |
| RLSD. BY   | DATE 04/08/93 |

# Installation, Operation and Maintenance Instructions

## Model NPE/ NPE-F



### DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 304 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

#### 1. Important:

- 1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.
- 1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.

#### CAUTION

Always disconnect electrical power when handling pump or controls.

- 1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.
- 1.4. Always use horsepower-rated switches, contactor and starters.
- 1.5. Motor Protection

1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

#### 1.6. Maximum Operating Limits:

Liquid Temperature: 212 F (100 C) with standard seal.  
250 F (120 C) with optional high temp seal.  
Pressure: 75 PSI.  
Starts Per Hour: 20, evenly distributed.

1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

### 2. Installation:

#### 2.1. General

- 2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).
- 2.1.2. Protect from freezing or flooding.
- 2.1.3. Allow adequate space for servicing and ventilation.
- 2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

#### CAUTION

Never draw piping into place by forcing the pump suction or discharge connections.

- 2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

#### 2.2. Close-Coupled Units:

- 2.2.1. Units may be installed horizontally, inclined or vertically.

#### CAUTION

Do not install with motor below pump. Any leakage or condensation will affect the motor.

- 2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

- 2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

#### 2.3. Frame-Mounted Units:

- 2.3.1. Bedplate must be grouted to a foundation with solid footing. Refer to Fig. 1.

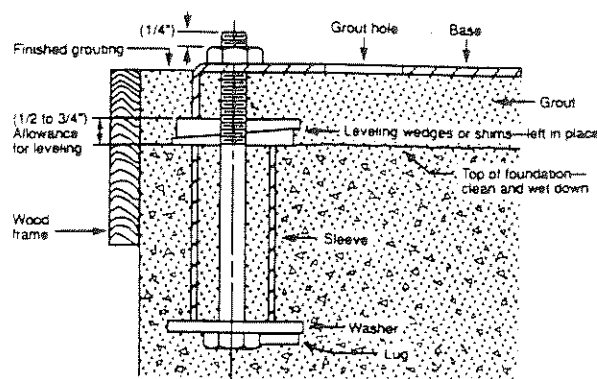
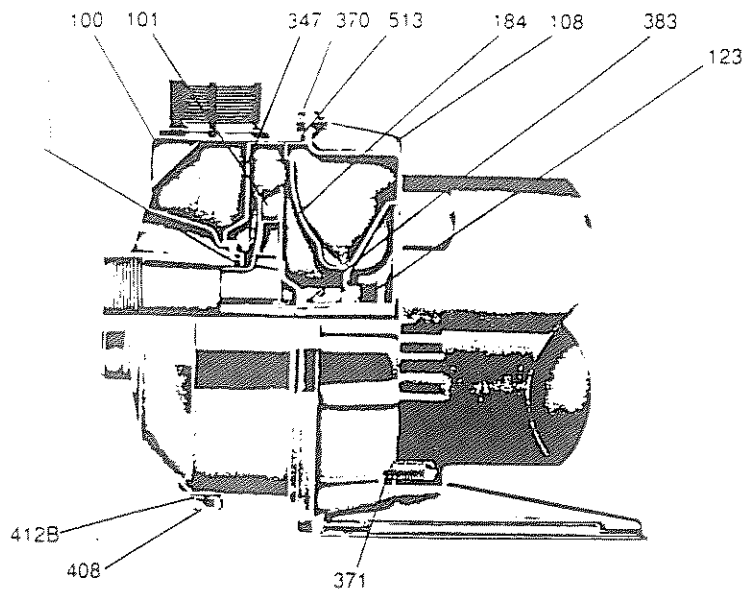
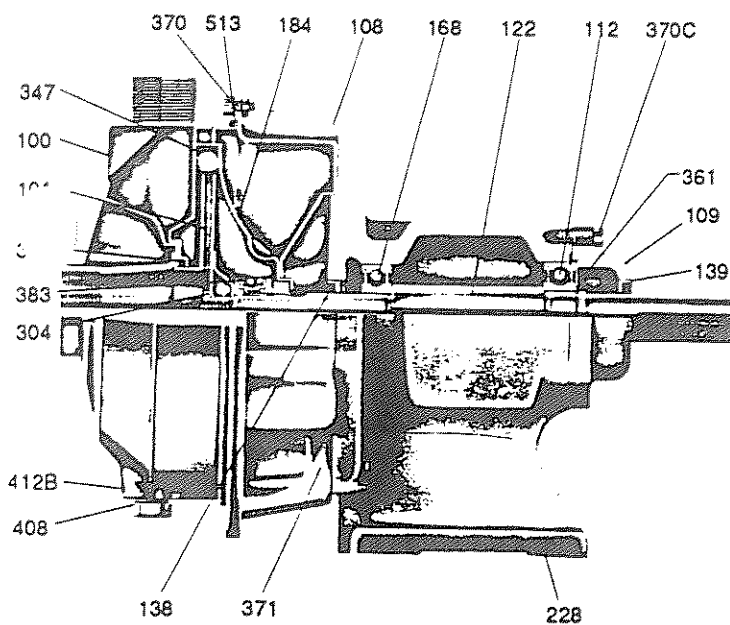


Figure 1



NPE



NPE-F

| Liquid End Components |                               |                          |
|-----------------------|-------------------------------|--------------------------|
| Item No.              | Description                   | Materials                |
| 100                   | Casing                        | AISI 304 Stainless Steel |
| 101                   | Impeller                      |                          |
| 184                   | Seal Housing                  |                          |
| 304                   | Impeller Locknut              |                          |
| 347                   | Guidevane                     |                          |
| 349                   | O-Ring, Guidevane             | Buna-N                   |
| 370                   | Socket Hd. Screws, Casing     | AISI 304 S.S.            |
| 383                   | Mechanical Seal               | ** see chart             |
| 408                   | Drain & Vent Plug, Casing     | AISI 304 S.S.            |
| 412B                  | O-Ring, Drain & Vent Plug     | Buna-N                   |
| 513                   | O-Ring, Casing                | Buna-N                   |
| Power End Components  |                               |                          |
| 108                   | Adapter                       | AISI 304 S.S.            |
| 109                   | Bearing Cover                 | Cast Iron                |
| 112                   | Ball Bearing (Outboard)       | Steel                    |
| 122                   | Shaft                         | AISI 303 S.S.            |
| 138                   | Lip Seal (Inboard)            | Buna/Steel               |
| 139                   | Lip Seal (Outboard)           | Buna/Steel               |
| 168                   | Ball Bearing (Inboard)        | Steel                    |
| 228                   | Bearing Frame                 | Cast Iron                |
| 361                   | Snap Ring                     | Steel                    |
| 370C                  | Hex. Hd. Cap Screw, Brg. Cvr. | Plated Steel             |
| 371                   | Hex. Hd. Cap Screw, Adapter   | Plated Steel             |

| **Mechanical Seals—Item 383 |                       |                |            |           |             |            |
|-----------------------------|-----------------------|----------------|------------|-----------|-------------|------------|
| Part No.                    | Service               | Rotary         | Stationary | Elastomer | Metal Parts | Crane Type |
| 10K46                       | Standard              | Carbon         | Ceramic    | Buna      | 18-8 S.S.   | 21         |
| 10K18                       | Option-High Temp.     |                | Ni-Resist  | EPR       |             |            |
| 10K24                       | Option-Chemeical Duty |                | Ceramic    | Viton     |             |            |
| 10K55                       | Option-High Temp.     |                | Tungsten   |           |             |            |
| 10K29                       | Option-Severe Duty    | Silicon Carbon |            | Buna      |             |            |

### LIMITED WARRANTY

This warranty applies to all pumps and related accessories manufactured and/or supplied by Goulds Pumps, Inc. - Water Systems Division.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the buyer or any subsequent owner during the warranty period. The warranty period shall exist for twelve (12) months from date of installation, or eighteen (18) months from date of manufacture, whichever expires first.

A consumer who believes that a warranty claim exists must contact the authorized dealer from whom the equipment was originally purchased and furnish complete details regarding the claim. The dealer is authorized to adjust any warranty claim utilizing Goulds Customer Relations Department and its distributor organization.

This warranty excludes: (a) Labor, transportation and related costs incurred by the consumer to make the allegedly defective equipment available to the dealer for inspection.

(b) Re-installation costs of repaired equipment. (c) Re-installation costs of replacement equipment. (d) Consequential damages of any kind. (e) Reimbursement for loss caused by interruption of service.

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

### 3. Suction Piping:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply:

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

#### CAUTION

Do not use suction isolation valve to throttle pump.

3.5. Installation with pump above source of supply:

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figs. 2-5

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

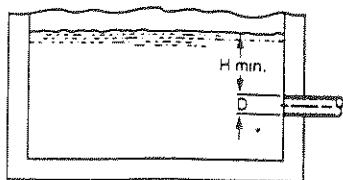


Figure 2

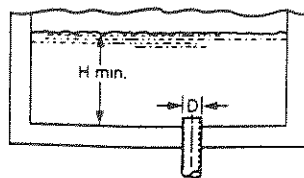


Figure 3

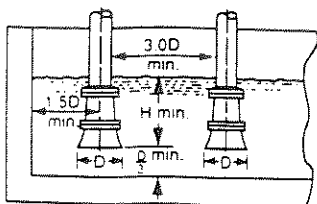


Figure 4

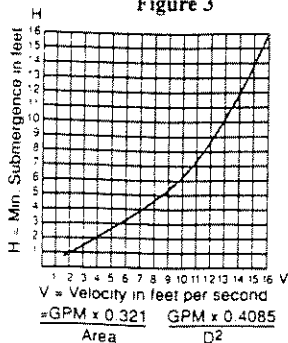


Figure 5

### 4. Discharge Piping:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

### 5. Motor-To-Pump Shaft Alignment:

5.1. Close-Coupled Units:

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units:

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Fig. 6.

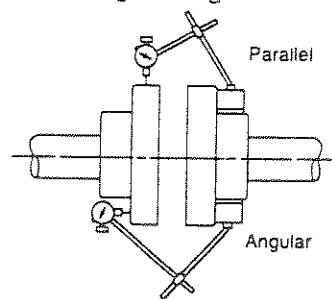


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

#### CAUTION

Always recheck both alignments after making any adjustment.

### 6. Rotation:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

### 7. Operation:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

#### CAUTION

Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

## 8. Maintenance:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units:

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

## 9. Disassembly:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End:

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

### CAUTION

Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

### CAUTION

Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame:

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 & 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 & 168).

## 10. Reassembly:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.4. Observe the following when reassembling the bearing frame:

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end:

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

### CAUTION

Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

## 11. Trouble Shooting Chart:

### MOTOR NOT RUNNING

(See causes 1 thru 6)

### LITTLE OR NO LIQUID DELIVERED:

(See causes 7 thru 17)

### POWER CONSUMPTION TOO HIGH:

(See causes 4, 17, 18, 19, 22)

### EXCESSIVE NOISE AND VIBRATION:

(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

### PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged.
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:  
Suction lift too high or suction losses excessive. Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

*Browning*®

**RAIDER**™

**WORM GEAR SPEED REDUCERS**

**MAINTENANCE INSTRUCTIONS**

**SERIES 133, 154, 175, 206, 237, 262, 300, 325, 375, 450, 516 AND 600**



**BROWNING MANUFACTURING**  
EMERSON POWER TRANSMISSION CORP  
P O BOX 687 MAYSVILLE KY 41056  
PHONE 606 564 2011 FAX 606 564-2022/23

## INTRODUCTION

The following instructions apply to Browning Raider Worm Gear Speed Reducers. When ordering parts or requesting information specify all information stamped on the reducer nameplate.

## EQUIPMENT REQUIRED

In addition to standard mechanic's tools, the following equipment is required: arbor press, wheel puller, torque wrench, dial indicator, seal driver, bluing, adhesive sealant, snapping pliers for internal and external rings.

## GENERAL INSTRUCTIONS

**Housings** - Clean external surfaces of reducer before removing seal cages and end covers to prevent dirt from falling into the unit. Record mounting dimensions of accessories for reference when reassembling. If it is necessary to remove the reducer from its operating area, disconnect all connected equipment and lift reducer from its foundation.

**Seals** - Replacement of all seals is recommended when a unit is disassembled. However, if seals are not to be replaced, protect seal life by wrapping shaft with thin, strong paper coated with oil or grease before removing or replacing seal case assembly. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

## CAUTION

If the reducer is painted, extreme care should be taken to mask the shaft extensions and rubber surface of the seals. Paint on the shaft adjacent to the seal or on the seal lip will cause oil leakage.

## TO CHANGE OUTPUT SHAFT DIRECTION

To change the hand of a unit from left hand to right hand, or vice versa, the following instructions apply:

1. Remove drain plug and drain oil from unit.
2. Remove end cover and seal cage capscrews; then while supporting output shaft remove end cover and shims from the unit.
3. Remove output shaft and seal cage together from extension side.  
NOTE: Keep shims with their respective seal cage and end cover.
4. Reassemble unit per instructions on Page 5, Item 3.

## CAPSCREW TIGHTENING TORQUE

Table 1

| Capscrew Diameter     | 1/4-20 UNC | 5/16-18 UNC | 3/8-16 UNC | 1/2-13 UNC |
|-----------------------|------------|-------------|------------|------------|
| Torque (in. lbs.) Dry | 96         | 204         | 360        | 900        |

## UNIT DISASSEMBLY

1. Remove drain plug and drain oil from unit.
2. Low speed shaft (gear shaft) removal:
  - A. Remove end cover and seal cage capscrews.
  - B. With a firm hold on the output extension remove end cover and shims.
  - C. Carefully slide output shaft assembly and seal cage out extension side.
  - D. Slide seal cage off low speed shaft using caution to prevent damage to seal lips.
  - E. Wire or tie the shims to their mating end cover and seal cages. They will be available for reference when assembling the unit.
3. High speed shaft (worm shaft) removal:
  - For Q style units 133 through 325:
    - Use a small chisel to make a groove in the stamped steel cover opposite the motor flange. Pry cover off. Remove internal snap ring from housing bore. Remove motor flange. Using a plastic hammer, gently tap on the motor end of the shaft to feed worm shaft assembly through housing and out.

- For Q style units 375 through 600:
  - Remove motor flange. Remove seal cage opposite motor face. Keep shims with seal cage for reassembly. Remove bearing nut and washers from end opposite motor. Using a plastic hammer, gently tap the shaft on the motor end. Push shaft assembly through housing until rear bearing outer race is free. Slide bearing inner-races off of shaft and remove worm through front of housing. If a press is available, pressing the shaft out is preferable.
- For U style units 133 through 325:
  - Use a small chisel to make a groove in the stamped steel cover opposite the extension. Pry cover off. Remove internal snap ring from housing bore. Using a plastic hammer, gently tap on the extension end of shaft to feed assembly through housing and out. On units 133, 154, 262 and 300, front bearing will remain in housing bore. Use soft tool and plastic hammer to tap bearing out extension end of housing from rear. Be sure to tap on outer-race of bearing. If a press is available, pressing this bearing out is preferable.
- For U style units 375 through 600:
  - Remove front and rear seal cages. Keep shims with seal cages for reassembly. Remove bearing nut and washers from end opposite extension. Using a plastic hammer, gently tap the shaft on extension end. Push shaft assembly through housing until rear bearing outer-race is free. Slide rear bearing inner-race off of shaft. Reverse direction and push shaft through extension end of housing and out. If a press is available, pressing the shaft out is preferable.

## PARTS SERVICE

1. **Housing** – Clean inside of housing with kerosene or solvent and then dry.
2. **Seal cages and end cover** – Remove dirt from joint faces, wipe clean and dry.
3. **Air vent** – Wash in kerosene, blow clean and dry.
4. **Seals** – To replace seals without dismantling reducer refer to steps C through F below. To replace seals when the entire reducer is dismantled and coupling hubs, sprockets, pulleys, pinions, keys, etc. have been removed the following instructions apply:

**NOTE:** Replacement of all seals is recommended when a unit is disassembled.

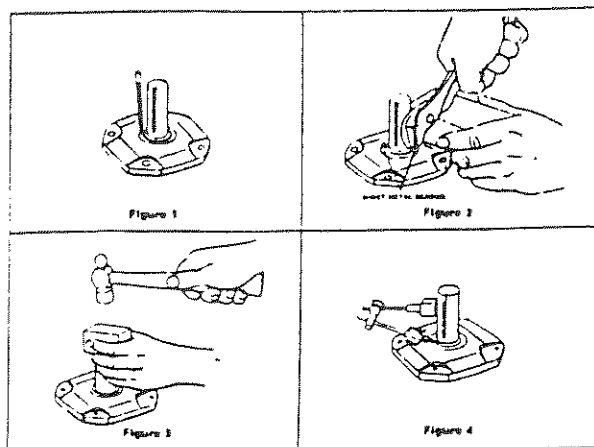
### Caution

New seals will leak if the seal lips or if seal's rubbing surface on the shaft has been altered. Protect seal lips at all times. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

- A. Block up seal cages and press or drive out seal.
- B. Remove old sealing compound from seal seat in cage if it is present. If a seal with rubber coating on the outside diameter is used, no sealant is necessary. If no rubber coating is on seal outside diameter, coat seal cage bore with adhesive sealant immediately before assembly.

To prevent possible damage to seal lips, do not reassemble seals until high speed and low speed shafts have been reassembled to the housing. Then see steps E and F below.

- C. See Figures 1 through 4 – To replace seals without dismantling reducer, proceed as follows:





#### Caution

Do not damage shaft; new seals will leak if seal contacting surface is marred. Use punch and place two or more holes in steel casing of seal, Figure 1. (The steel casing may be rubber coated.) Insert three metal screws, leaving the heads sufficiently exposed so they can be pried up or grasped with pliers, Figure 2. Do not drill holes because chips may get into the unit.

- D. Work seal loose. Be careful to keep all metal or dirt particles from entering unit. Remove old sealing compound from seal seat if it is present. Also remove burrs and sharp edges from shaft. Clean with rag moistened with solvent. Do not use abrasive material on shaft seal contacting surface.

#### Caution

- E. Protect seal lips when handling; seal leakage will result if these are damaged. If a seal with rubber coating on the outside diameter (O.D.) is used, no sealant is necessary. If no rubber coating is on seal O.D., coat seal cage bore with adhesive sealant. Coat seal lips with oil and carefully work seal into position. Before sliding seal into position, protect seal lips from shaft keyway edges by wrapping shaft with thin, strong paper coated with oil. Position garter spring toward the inside of the unit. Place a square face pipe or tube against the seal O.D. and drive or press seal until fully seated as shown in Figure 3. Do not strike seal directly.
- F. For best performance, seat the seal square with shaft within .005" at 180°. Check with dial indicator as shown in Figure 4, Page 3, or with a straight edge and feelers, or square and feelers. To straighten a cocked seal, place tubing over the seal and tap the tube lightly at a point diametrically opposite the low point on the seal. DO NOT strike seal directly.

#### 5. Bearings -

- A. Wash all bearings in clean kerosene and then dry.
- B. Inspect bearings carefully and replace those that are worn or questionable.  
**NOTE: Replacement of all bearings is recommended.**
- C. Use a wheel puller or press to remove worm shaft bearings. Apply force to inner race only - not to cage or outer race.
- D. Use a wheel puller or press to remove tapered bearing inner races.
- E. To replace tapered bearing inner races and all ball bearings, heat bearings in an oil bath or oven to maximum of 290° F (143° C). Slide high speed shaft bearings onto the oiled shaft until seated against the shoulder or snap ring of the shaft. Slide low speed shaft bearing onto the oiled shaft against the gear spacer.
- F. Thoroughly coat all bearings with lubrication oil.

#### 6. Worm, gear and shaft -

- A. Worm and high speed shaft - since all worms are integral with the high speed shaft, any wear or damage to the worm will necessitate replacing both.
- B. Press shaft out of bronze worm gear. To reassemble gear and low speed shaft, freeze shaft or heat gear. Do not exceed 200° F (93° C). Insert key into the shaft keyway and press shaft into oiled gear bore.  
**NOTE: It is advisable to replace both the worm and worm gear should either of the assemblies require replacement.**

### UNIT REASSEMBLY

#### 1. Preliminary

- A. Check to see that all worn parts have been replaced, gear and bearings coated with oil and all parts cleaned. Remove all foreign matter from unit feet. The feet must be flat and square with each other.
- B. Before starting to reassemble reducer, add old shims or replace with new shims of equal thickness

#### 2. High Speed Shaft (Worm Shaft) Assembly

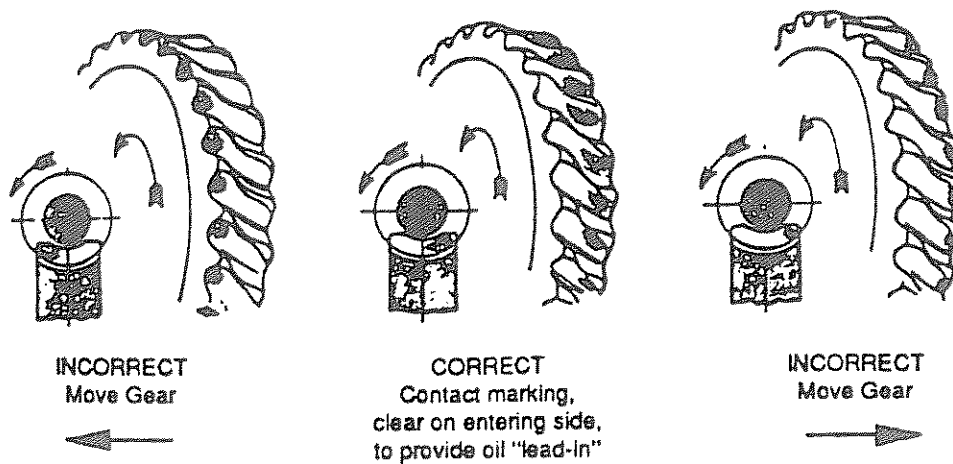
##### • For Q style units 133 through 325:

- Lubricate bearing bores of housing. Press bearing onto end of worm shaft flush to shoulder (or snap ring). Lock bearing onto shaft with external snap ring. Insert shaft assembly from opposite motor end into housing until seated against shoulder in bore. Lock shaft assembly into housing bore with internal snap ring. Coat outside diameter of stamped steel end cover with adhesive sealant and press into input bore opposite motor flange until flush with housing. If endcover is rubber coated, do not use sealant.

##### • For Q style units 375 through 600:

- Apply adhesive sealant to both housing input faces. Subassemble the two bearing inner-races onto rear of worm shaft and secure with locknut and washers. Insert shaft assembly into rear bore of housing along with the first bearing outer-race. With plastic hammer gently tap end of shaft until bearing outer-race is seated against shoulder in housing bore. If a press is available, pressing the assemble in is preferable. Press the final bearing outer-race in and install the rear seal cage. Adjust endplay per instructions on Page 5, Item 3. Install motor flange.

Figure 6 Gear Contact Pattern



4. **Seals** - To reassemble seals to unit, see Parts Service Steps 4E and 4F, Page 4.

5. **Motorized Coupling Adapter**

Certain mounting dimensions should be adhered to when removing motor and coupling assembly for service. When ordering replacement coupling halves (metal gear), specify correct bore diameter. See Table 2 for mounting dimensions.

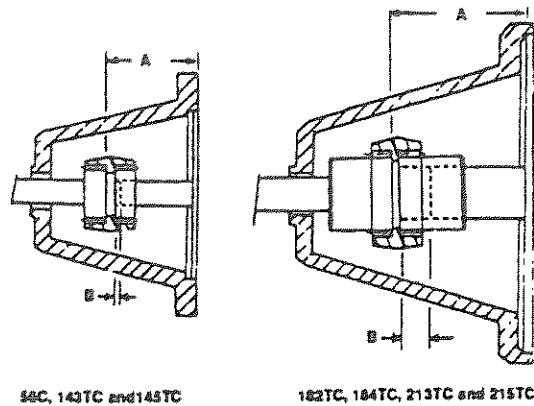


Figure 7 Motorized Coupling Adapter  
Units 133 through 516

COUPLING ADAPTOR DATA

Table 2

| Center Distance | 56C  |     | 140TC |     | 180TC |     | 210TC |     |
|-----------------|------|-----|-------|-----|-------|-----|-------|-----|
|                 | A    | B   | A     | B   | A     | B   | A     | B   |
| 133             | 2.25 | .06 | 2.31  | .12 | -     | -   | -     | -   |
| 154             | 2.31 | .12 | 2.38  | .19 | -     | -   | -     | -   |
| 175             | 2.25 | .06 | 2.31  | .12 | -     | -   | -     | -   |
| 206             | 2.25 | .06 | 2.31  | .12 | -     | -   | -     | -   |
| 237             | 2.25 | .06 | 2.31  | .12 | -     | -   | -     | -   |
| 262             | 2.25 | .06 | 2.31  | .12 | 3.12  | .12 | -     | -   |
| 300             | 2.25 | .06 | 2.31  | .12 | 3.12  | .12 | -     | -   |
| 325             | 2.25 | .06 | 2.31  | .12 | 3.12  | .12 | -     | -   |
| 375             | -    | -   | 2.69  | .42 | 3.66  | .66 | 3.91  | .41 |
| 450             | -    | -   | 2.41  | .15 | 3.40  | .40 | 3.65  | .15 |
| 516             | -    | -   | -     | -   | 3.25  | .25 | 3.50  | 0   |

## 6. Final Inspection

- A. Turn gear train over by hand as a final check.
- B. Re-install reducer and accessories.

### Caution

Discard motor key. Use only special key provided with reducer. Failure to use special key will make assembly impossible.

- C. Fill reducer with the recommended oil to proper level. See Figure 8 for standard oil levels.
- D. Spin test for three minutes and check for noise, leakage and rapid temperature rise.

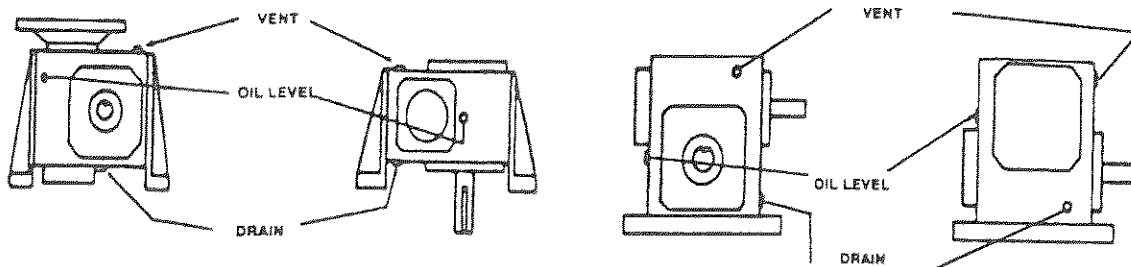


Figure 8 Standard Oil Levels

## PREVENTATIVE MAINTENANCE

1. After first week, check all external capscrews and plugs for tightness.
2. Periodically, check oil level when gears are at rest. Add oil if needed. Do not fill above mark indicated by level because leakage and overheating may occur.

## STORED AND INACTIVE UNITS

1. All units are shipped with oil that will protect parts against rust for a period of four (4) months in an outdoor shelter or twelve (12) months in a dry building after shipment from the factory. Indoor dry storage is recommended.
2. If a unit is to be stored or is to be inactive after installation beyond the above periods, fill the unit completely with oil.

### Caution

Before starting a stored unit or re-starting an inactive unit, the oil level should be returned to the proper value as indicated by the oil level.

## LUBRICATION

Normal operating temperature of a worm gear reducer is less than 200° F but during initial break-in the temperature may exceed 200° F. After break-in is completed the temperature will fall below 200° F. If temperature exceeds 200° F for greater than 100 hours consult Browning Engineering.

1. Change initial oil fill after 500 hours service or 5 weeks.
2. Change oil every 2500 hours service or 6 months. If severe operating conditions exist, change the oil every 1 to 3 months.
3. **90 WEIGHT OIL AND EP OIL ARE NOT RECOMMENDED.**
4. For ambient temperatures -40° F to 15° F use Mobil SHC634.
5. Units running at slow speeds (less than 100 RPM input) should carry high oil level and in ambient temperatures of 15° to 125° F use an AGMA #8C lubricant.
6. See Table 3 for list of recommended lubrication manufacturers.

### Lubrication Manufactures

The companies and oil shown are typical. Any other make of oil meeting American Gear Manufacturers Association (AGMA) standards #7C and #8C will be satisfactory.

**Table 3**

| Ambient Temperature             | 15 to 60° F         | 50 to 125° F              |
|---------------------------------|---------------------|---------------------------|
| Viscosity Range<br>MM/S at 40°C | 414 - 506           | 612 - 748                 |
| ISO Grade                       | 460                 | 680                       |
| SAE Gear Lubricant (approx.)    | #140                | #250                      |
| Oil Company Name                | AGMA #7C            | AGMA #8C                  |
| Amoco Oil Co.                   | Amoco Worm Gear Oil | Amoco Cyl. Oil 680        |
| Atlantic Richfield (ARCO)       | "                   | Modoc 175                 |
| Chevron Oil Co.                 | Cylinder Oil 460X   | Cylinder Oil 680X         |
| Conoco Oil Co.                  | Inca Oil            |                           |
| Exxon Oil Co.                   | Cylasstic TK460     | Cylasstic TK680           |
| Fiske Brothers                  | SPO 277             | SPO288                    |
| Gulf Oil Co.                    | Senate 460          | Senate 680                |
| Gulf-Canada                     | Senate 460          | Senate 680                |
| Keystone-Penwalt                | Keygear K-600       |                           |
| Mobile Oil Corp.                | Mobil 600W Cyl. Oil | Mobil 600W Super Cyl. Oil |
| Pennzoil                        | Cyl. Oil #8         | Cyl. Oil No. 6            |
| Phillips Petroleum Co.          | Hector 460S         | Hector 630S               |
| Shell Oil Co.                   | Valvata Oil J460    | Valvata Oil J680          |
| Sohio                           | Energol DC-600C     | Energol DC-600C           |
| Texaco Inc.                     | Vanguard 460        | Honor 680                 |
| Union Oil Co. of CA             | Steaval B110        | Steaval B165              |

**Table 4**

**Oil Capacity (oz.)**

| C.D | Worm<br>Top | Worm<br>Bottom | Worm<br>Vertical | Output<br>Vertical |
|-----|-------------|----------------|------------------|--------------------|
| 133 | 4           | 8              | 8                | 4                  |
| 154 | 6           | 18             | 18               | 14                 |
| 175 | 8           | 20             | 20               | 12                 |
| 206 | 12          | 22             | 28               | 18                 |
| 237 | 16          | 30             | 36               | 26                 |
| 262 | 26          | 46             | 60               | 40                 |
| 300 | 46          | 78             | 82               | 72                 |
| 325 | 56          | 65             | 101              | 66                 |
| 375 | 78          | 115            | 140              | 100                |
| 450 | 120         | 180            | 182              | 157                |
| 516 | 174         | 216            | 240              | 198                |
| 600 | 274         | 366            | 400              | 274                |

- For U style units 175, 206, 237 and 325:

- Lubricate bearing bores of housing. Subassemble bearings onto worm shaft. Lock rear bearing onto shaft with external snap ring. Insert shaft assembly from opposite extension end into housing until bearing is seated against shoulder in bore. Lock shaft assembly in housing bore with internal snap ring. Coat outside diameter of stamped steel endcover with adhesive sealant and press into input bore opposite extension until flush with housing. If endcover is rubber coated, **DO NOT** use sealant.

- For U style units 133, 154, 262 and 300:

- Follow above procedure with the following exception:

Subassemble only the rear bearing onto worm shaft. After subassembly is installed into housing, press front bearing into extension side of housing until seated against shoulder or snap ring on worm.

- For U style units 375 through 600:

- Apply adhesive sealant to both housing input faces. Press extension side bearing inner-race onto worm. Insert worm shaft into extension side bore of housing. Hold worm shaft in place and slip rear bearing inner-race onto shaft until seated against shoulder. Press rear bearing outer-race into housing bore opposite extension until seal cage can be installed. Install rear seal cage. Press extension side bearing outer-race into housing until extension side seal cage can be installed. Install seal cage. Adjust endplay per instructions on Page 5, Item 3.

### 3. Low Speed Shaft (Gear Shaft) Assembly

A. Determine output shaft direction.

B. Assemble low speed shaft assembly, seal cage, and end cover with shims on both seal cage and end cover. Torque capscrews to torques listed in Table 1. Rotate the input shaft to seat output bearings.

C. Moving the shaft back and forth by hand, check axial float with dial indicator as shown in Figure 5. Axial float must be .0005-.003" with .0005 being the absolute minimum. Do not preload bearings. If the axial float is not as specified, add or subtract required shims under end cover.

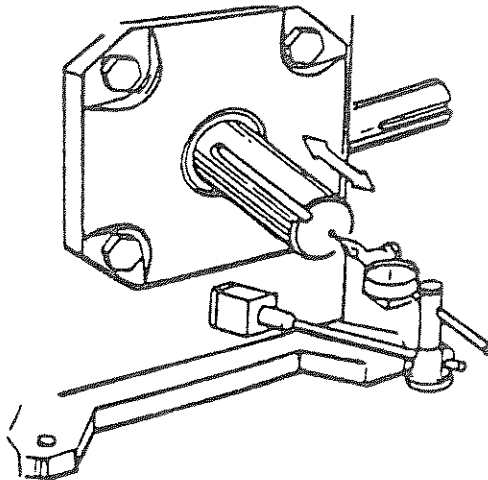


Figure 5 Checking Axial Float

D. Remove output shaft with seal cage and apply bluing to several teeth on the gear. Worm thread and gear teeth must be clean or oil. Reassemble output shaft and seal cage with output key facing up.

E. Use a rag to apply hand pressure to the output shaft and rotate the high speed shaft both direction until the gear teeth with bluing have gone through gear mesh several times. Return output shaft to original position. Remove output shaft and seal cage to inspect contact. Compare with Figure 6. If contact is not correct, move assembly in the direction shown in Figure 6 by adding shims to the side to which the arrow points after removing them from the opposite side. Repeat Steps D and E until contact pattern is correct.

F. Recheck axial float with dial indicator.

G. When contact pattern is correct, tighten seal cage and end cover capscrews to torques listed in Table 1.

**JOHNSON  
CONTROLS**Johnson Controls, Inc.  
Controls Group507 E. Michigan Street  
P. O. Box 423  
Milwaukee, WI 53201**Series P70, P72  
Refrigeration Pressure Controls  
Single Pole and Two Pole Construction.****Application**

The P70 single pole and P72 two pole controls incorporate a load-carrying contact structure which provides direct control of A.C. motors within the control rating. (See cover label for the electrical rating.) The P72 heavy duty controls provide direct control of motors having integral line-interrupting overload protectors up to 3 H.P., 240 V. single phase. No starter is needed.

The controls with "all-range" construction can be used with R-12, R-22, R-500 and R-502 refrigerants.

**WARNING:** On ammonia installations the ammonia pressure control should be mounted separately from the electrical cabinet.

**Operation**

The P70 and P72 controls are available with either CLOSE high-OPEN low or OPEN high-CLOSE low contact action. The snap-acting contacts operate from the pressure actuated bellows.

The controls have a single "sight-set" calibrated scale which shows both the cut-in and cutout settings. Adjustments can be made without removing the control cover.

**Installation****Mounting**

The control can be mounted in any position to a flat surface or panel board by inserting screws or bolts through the two holes in the back of the control's case. It is suggested however, that the pressure connection on the bellows be above the refrigerant

liquid level of the equipment on which the control is used. This prevents possible accumulation of foreign matter inside the bellows by providing drainage from the sensing elements.

**CAUTION:** Do not mount the control in a position where dirt, sediment, or oil will affect the operation of the control.

Universal mounting bracket No. 271-51 is available, if required. (NOTE: Use only mounting screws supplied with the control to prevent damage to internal components.)

Do not install this control where the ambient temperature falls below  $-30^{\circ}\text{F}$  ( $-34^{\circ}\text{C}$ ) or exceeds  $140^{\circ}\text{F}$  ( $60^{\circ}\text{C}$ ).

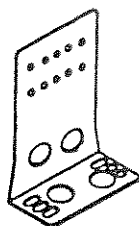


Fig. 2 — Part No. 271-51 standard mounting bracket.

**General Instructions**

1. Avoid sharp bends or kinks in capillary tubing.
2. Be sure pressure controls installed on ammonia systems are built for ammonia service.
3. Purge all tubing and lines before connecting pressure controls.
4. Make sure control is not installed on equipment to handle a load in excess of electrical rating.

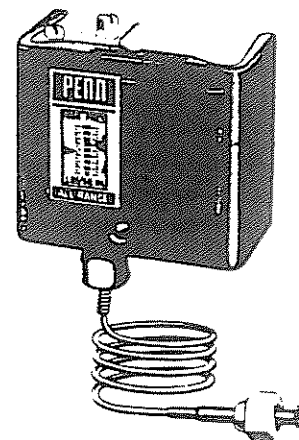


Fig. 1 — Single function high pressure control.

5. Coil and secure excess capillary length to avoid vibration. Allow some slack in capillary to avoid "violin string" vibration which can cause tubing to break. Do not allow tubing to rub against metal surfaces where friction can damage capillary.

**Wiring**

**CAUTION:** Disconnect power supply before wiring connections are made to avoid possible electrical shock or damage to equipment.

All wiring should conform to the National Electrical Code and local regulations. Use copper conductors only. For maximum electrical rating of control, see cover label on inside of control cover.

**CAUTION:** Use terminal screws furnished in the contact block (8-32 x 1/4"). Longer terminal screws can interfere with switch mechanism and damage the switch.

pressure connector labeled "LOW." (See Fig. 1.)

- Coil and secure excess capillary to avoid vibration. Allow some slack in capillary to avoid "violin string" vibration which can cause tubing to break. Do not allow tubing to rub against metal surfaces where friction can damage the capillary.

**CAUTION:** With a 1/4" male SAE flare fitting and 1/4" tubing a pulsation dampener must be used where there is a possibility of pulsation.

## Wiring

**CAUTION:** Disconnect the power supply before the wiring connections are made to avoid possible electrical shock or damage to the equipment. On multiple circuit units, more than one circuit may have to be disconnected.

Make all wiring connections using copper conductors only, and in accordance with the National Electrical Code and local regulations. For maximum electrical rating of the control, see the label inside the control cover.

**NOTE:** Use the terminal screws furnished in the Pennswitch (8-32 x 1/4" binder head). Substitution of other screws may cause problems in making proper connections.

See the label inside the control cover or in the manufacturer's specifications for typical wiring diagram.

For external wiring diagrams, see Figs. 4 through 11.

For applications using a 208 volt control circuit, it is suggested that one leg of the 208 volt circuit and a neutral or ground wire be used as a 120 volt source to power the time delay heater.

When a P28 control is installed on a 440 or 550 VAC system, use an external step-down transformer to provide either 120 or 240 volts to the pilot and time delay relay circuits. The transformer must be of sufficient volt-ampere capacity to operate the

motor starter and the P28's time delay relay.

## Electrical Power Required for Time Delay Relay

| Timing<br>In Seconds     | Voltage         |        |
|--------------------------|-----------------|--------|
|                          | 12, 24 or 120 V | 240 V* |
| 10                       | 30 VA           | 60 VA  |
| 30, 45, 60,<br>90 or 120 | 15 VA           | 30 VA  |

\*Includes dropping resistor wattage.

## Adjustment

Factory setting may be changed in the field. Standard stock setting is:

Cutout 9 PSI (62 kPa) pressure difference. ("Heater off" pressure is about 5 PSI [34 kPa] higher than cutout.)

**NOTE:** When the controls are shipped as an accessory to the compressor unit, time delay and pressure are set to manufacturer's specifications. Replacement controls should duplicate the manufacturer's specifications for time delay and pressure settings.

When manufacturer's settings are not known, call the nearest distributor or proceed as follows:

- With the compressor running, read
  - Oil pressure.
  - Crankcase pressure.
- Subtract the crankcase pressure from the oil pressure gage reading. This is net oil pressure to the bearings.
- Set the cutout pointer 6 to 8 PSI (41 to 55 kPa) below the established running net oil pressure.

**CAUTION:** Obtain the compressor manufacturer's net oil bearing pressure specifications as soon as possible, and reset the cutout pointer if it is not in accordance with the manufacturer's specifications.

To raise the cutout setting, turn adjusting disk "C" (Fig. 3) to the left as viewed from the front of the control. Turn the disk to the right to lower the cutout setting.

**EXAMPLE:** Suppose the minimum lube oil pressure required to the bearings is 9 PSI (62 kPa) (oil pump pressure minus crankcase pressure). The control scale setting should be 9 PSI (62 kPa). Upon an initial start of the compressor, or if the oil pressure drops during the running cycle, the time delay heater is energized. If the lube oil pressure does not build up to the scale setting, plus 5 PSI (34 kPa) for switch differential or total of 14 PSI (97 kPa), during the timing period, the control breaks the circuit to the compressor. If this pressure of 14 PSI (97 kPa) is reached during the timing period, the time delay heater is de-energized and the compressor is permitted to continue normal operation.

## Pressure Specifications

| Time Delay<br>Shutdown Range<br>(Pressure<br>Difference)* | Maximum<br>Allowable<br>Overrun<br>Pressure |
|---|---|
| 8 to 70 PSI<br>(55 to 480 kPa)                            | 325 PSIG<br>(2240 kPa)                      |

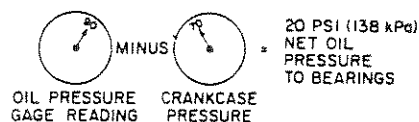
\*The time delay heater is de-energized at 5 PSI (34 kPa) pressure difference above scale setting.

## Test For Shutdown

Immediately after installing, and at regular intervals thereafter, the time delay relay should be tested to be sure that all circuits are operating correctly. Proceed as follows:

Pull the disconnect switch and remove the cover from the P28 control. Connect a jumper between terminals 1 and 2. (See Fig. 3 for terminal location.) Close the line switch to start the compressor running. The time delay relay will stop the compressor after the time delay interval.

**NOTE:** If the control is mounted on a condensing unit where air from auxiliary equipment, such as



**LUBRICATING PRESSURE TO THE BEARINGS IS NOT THE OIL PRESSURE GAGE READING — it is: OIL PRESSURE GAGE READING MINUS THE CRANKCASE PRESSURE. THIS IS CALLED NET OIL PRESSURE.**

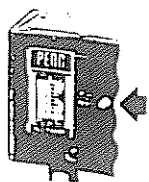


Fig. 3

Manual reset lever (Fig. 3, left) on independent high or independent low pressure cutout controls. Lever must be pushed in and released to restart after lockout occurs.

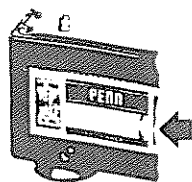


Fig. 4

If lockout is supplied on safety cutout mechanism of "dual" controls (Fig. 4, left), lever provides for manual reset after operation of high pressure cutout.

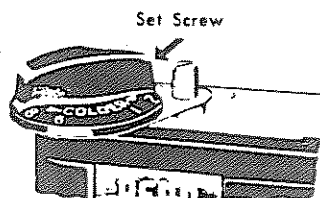


Fig. 5

Where it is desirable for the user to increase or decrease the DIFFERENTIAL ONLY, external adjusting knob is supplied on differential screw as shown in Fig. 5. Knob is provided with stops and factory assembled to permit change only within specified limits.

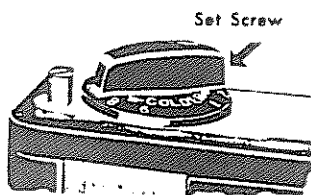


Fig. 6

External adjusting knob may be placed on range screw, as shown in Fig. 6, where it is necessary for the user to raise or lower both CUT-IN and CUTOUT points (differential remains constant). Knob is provided with stops and factory assembled to permit adjustments within specified limits.

NOTE: Knob is usually factory assembled in either position as shown in Figs. 5 or 6 above, depending upon specifications of original buyer. However, knob may be changed in the field from the differential to the range screw or vice versa by loosening set screw, removing knob and indicator plate and reversing their positions. Assuming that knob is factory assembled on range screw (Fig. 6) and set to limit adjustment to 20 psig (140 kPa), this adjustment will become approximately 10 psig (69 kPa) if knob is placed on differential screw (Fig. 5).

## Adjustments

High Pressure Cutout Models . . . contacts open high; close low.

On high pressure cutout models, the range adjusting screw "A" (see Fig. 7) raises or lowers both the cutout point and the cut-in

point by the same amount. Set the cutout point first by using adjusting screw "A". The cut-in (differential) adjusting screw "B" changes the cut-in point only. If the control is equipped with lockout, the contacts must be reset manually after opening.

## Checkout Procedure

The operating point of the control should be confirmed by an accurate pressure gauge.

Before leaving the installation, at least three complete operating cycles should be observed to see that all components are functioning properly.

## Repairs and Replacement

Field repairs must not be made except for replacement of the cover or knob. For a replacement control, cover or knob, contact the nearest Johnson Controls wholesaler.

### Contacts Close High; Open Low

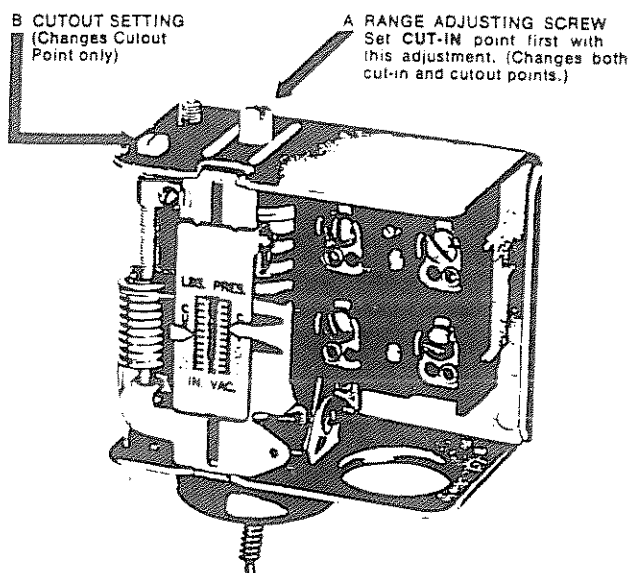


Fig. 7 — Interior view of a heavy duty single function low pressure control.

### Two Pole Dual Function

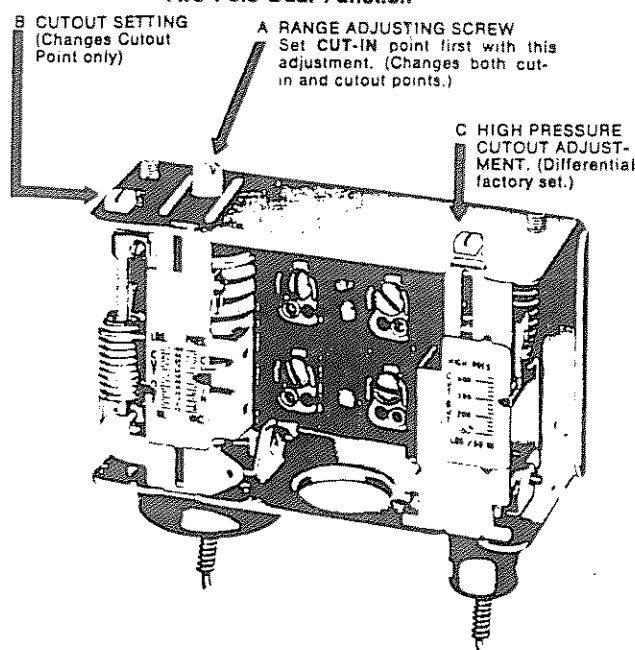


Fig. 8 — Interior view of a heavy duty two pole dual control.



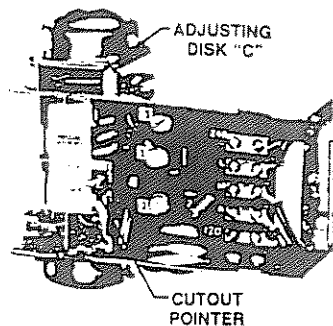


Fig. 3 — Interior view showing adjusting disk. Optional runlight and alarm terminals are shown.

blowers or fans, may strike the control, the cover should be replaced before the test. After testing the time delay relay, again pull the disconnect switch and remove the jumper between terminals 1 and 2. Place the cover on the control and close the disconnect switch. Manually reset the time delay relay.

### Checkout Procedure

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

### Repairs and Replacement

The time delay relay assembly (timer and terminal board) may be replaced or interchanged in the field. Field repairs must not be made except for replacement of the time delay relay assembly. For a replacement control or time delay relay assembly, contact the nearest Johnson Controls wholesaler.

### Replacement Time Delay Relay Assemblies

| Part Number | Voltage     | Type of Reset | Timing in Seconds | Alarm Circuit |
|-------------|-------------|---------------|-------------------|---------------|
| RLY13A-600R | 120/240 VAC | Manual        | 60                | No            |
| RLY13A-602R | 120/240 VAC | Manual        | 90                | No            |
| RLY13A-603R | 120/240 VAC | Manual        | 90                | Yes           |
| RLY13A-608R | 120/240 VAC | Automatic     | 90                | No            |
| RLY13A-609R | 24 VAC/VDC  | Manual        | 120               | No            |
| RLY13A-610R | 120/240 VAC | Manual        | 30                | No            |
| RLY13A-616R | 120/240 VAC | Manual        | 120               | No            |
| RLY13A-617R | 120/240 VAC | Manual        | 45                | No            |

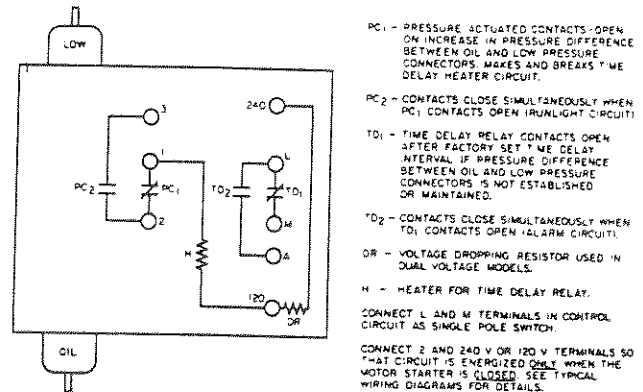


Fig. 4 — Internal wiring circuit for 120/240 VAC P28 control showing shutdown alarm circuit A and runlight terminal no. 3.

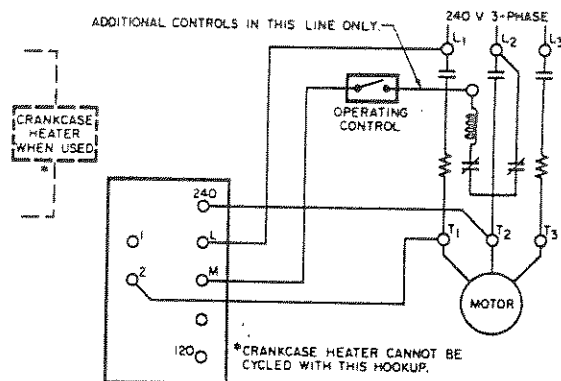
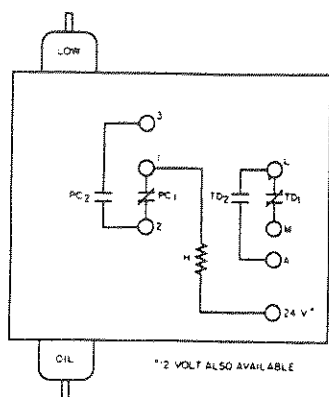
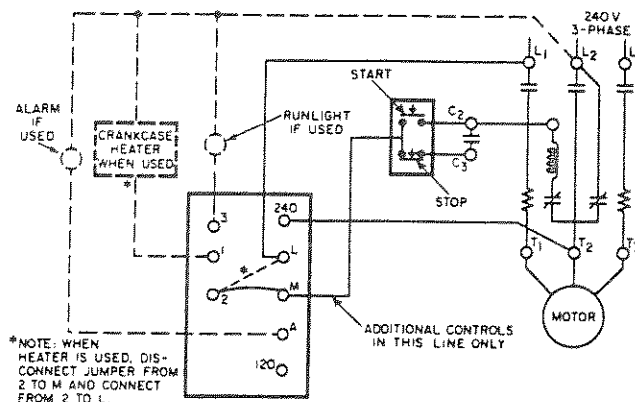
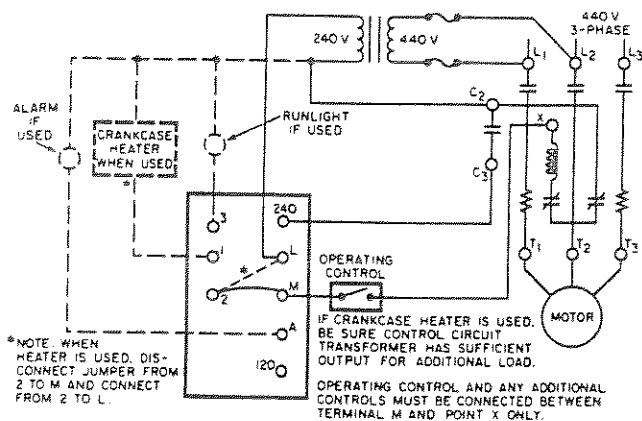
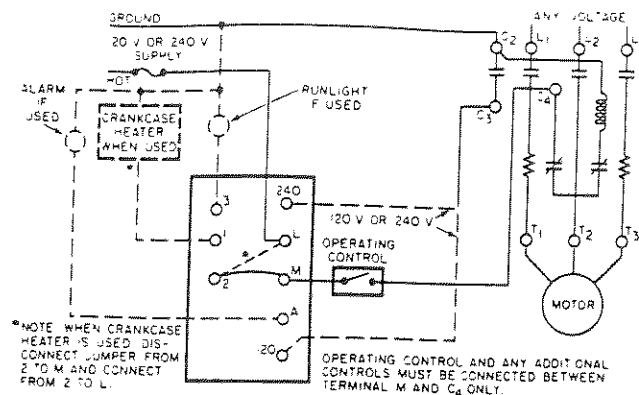
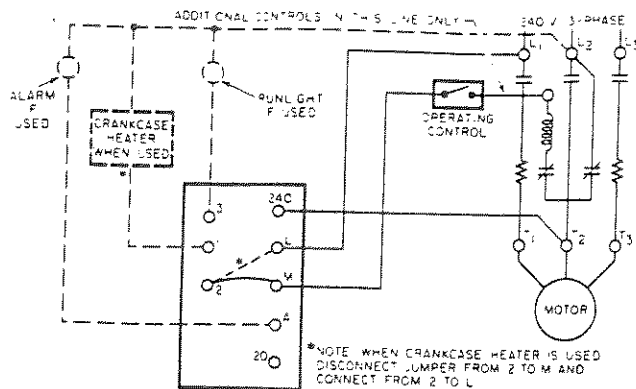


Fig. 5 — Typical wiring diagram for a P28 when used on 240 volt system with 240 volt magnetic starter coil. \*Crankcase heater cannot be cycled with this hookup, see Fig. 6.



PC<sub>1</sub> - PRESSURE ACTUATED CONTACTS - OPEN ON INCREASE IN PRESSURE DIFFERENCE BETWEEN OIL AND LOW PRESSURE CONNECTORS. MAKES AND BREAKS TIME DELAY HEATER CIRCUIT.

PC<sub>2</sub> - CONTACTS CLOSE SIMULTANEOUSLY WHEN PC<sub>1</sub> CONTACTS OPEN (RUNLIGHT CIRCUIT).

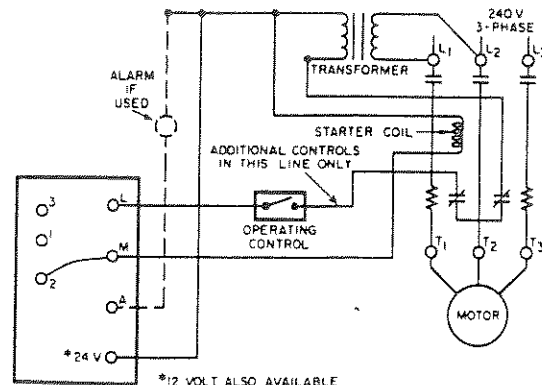
TD<sub>1</sub> - TIME DELAY RELAY CONTACTS OPEN AFTER FACTORY SET TIME DELAY INTERVAL IF PRESSURE DIFFERENCE BETWEEN OIL AND LOW PRESSURE CONNECTORS IS NOT ESTABLISHED OR MAINTAINED.

TD<sub>2</sub> - CONTACTS CLOSE SIMULTANEOUSLY WHEN TD<sub>1</sub> CONTACTS OPEN (ALARM CIRCUIT).

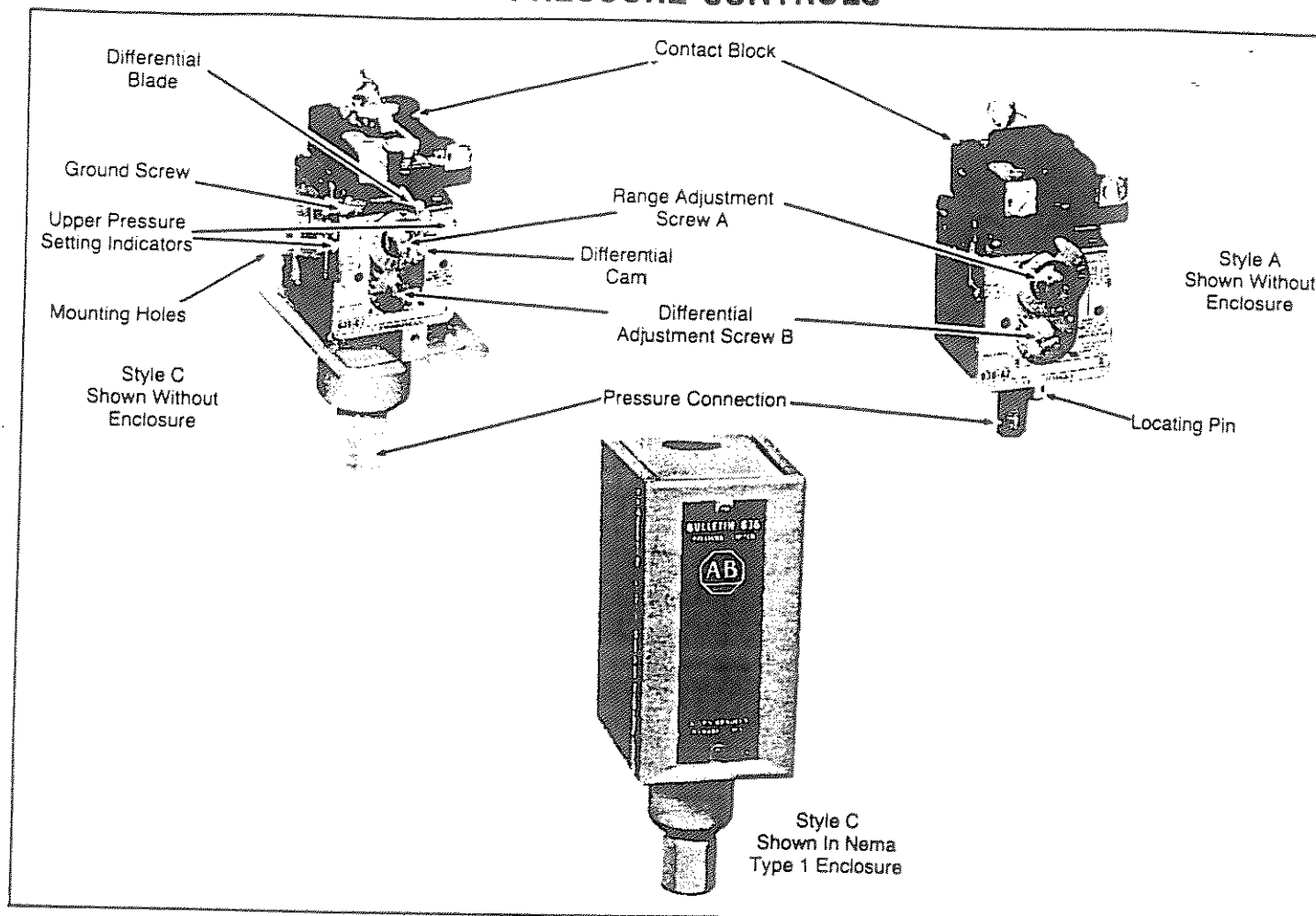
H - HEATER FOR TIME DELAY RELAY.

CONNECT L AND M TERMINALS IN CONTROL CIRCUIT AS SINGLE POLE SWITCH.

CONNECT TERMINAL L SO THAT CIRCUIT IS ENERGIZED ONLY WHEN THE OPERATING CONTROL AND OVERLOAD TERMINALS ARE CLOSED. SEE TYPICAL WIRING DIAGRAM FOR DETAILS.



## PRESSURE CONTROLS



**DESCRIPTION** — Bulletin 836 Pressure Controls are designed for use with air, water, oil and other non-corrosive liquids, vapors, and gases. (Type 316 stainless steel bellows are available for more corrosive liquids or gasses.)

Bulletin 836 Controls are available in NEMA Types 1, 4, 4X, 7, 9, and 13 enclosures in addition to open type.

The operating range pressure and differential are adjustable. Fixed differential versions are also available.

Pressure ranges available from 30 in. Hg. vacuum to 900 psi.

The contact block is single pole, double throw and can be wired to open or close on increasing or decreasing pressure.

## CONTACT RATINGS

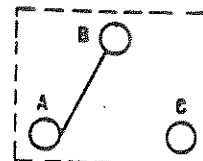
| Non-Inductive Ratings | Control Circuit Ratings        |
|-----------------------|--------------------------------|
| 5 Amperes, 250 Volts  | AC-125 VA<br>24 To 600 Volts   |
| 3 Amperes, 600 Volts  | DC-57.5 VA<br>115 to 230 Volts |

Manual reset, horsepower rated and other contact block modifications are also available.

**OPERATION** — A low friction, straight in-line mechanism operates a snap switch at a predetermined pressure setting. An increase in pressure causes the normally closed circuit A-B to open and normally open circuit B-C to close. This is known as the trip pressure. When the pressure returns to a lower predetermined setting, the circuit A-B will close and circuit B-C will open. This is known as the reset pressure. The difference between the trip and reset pressure is the differential.

For controls which operate in a vacuum, the following sequence occurs: 1) an increase in vacuum (lower pressure toward 30 in. Hg), causes circuit A-B to close and B-C to open. This is the trip setting. 2) when the pressure returns to a predetermined lower vacuum (higher pressure toward 0 psi.), circuit A-B will open and circuit B-C will close. This is the reset point. The difference between the trip and reset setting is the differential.

**EXAMPLE:** Vacuum control set to close contacts at 15 in. Hg vacuum, open at 5 in. Hg vacuum. Circuit A-B would be used.



40060-217-01(B)  
Printed in U.S.A.

**ALLEN-BRADLEY**  
Milwaukee, Wisconsin 53204

**ADJUSTMENT** — Generally, unless otherwise specified, controls shipped from the factory are set at the maximum operating range pressure and minimum differential. The following procedure should be used to set the control to a particular requirement:

**OPERATING RANGE ADJUSTMENT:** Turn range adjustment Screw "A" clockwise to raise upper and lower pressure settings. To decrease the upper and lower settings, turn Screw "A" counterclockwise. The approximate upper pressure setting is shown by indicators on the outer edges of the nameplate.

**DIFFERENTIAL ADJUSTMENT:** When differential blade is at the low point of the differential cam the control will function at minimum differential. To increase the differential, turn adjustment Screw "B" counterclockwise. This will decrease the lower pressure setting only. To decrease the differential, turn differential adjustment Screw "B" clockwise. This will raise the lower setting only.

Condensed instructions are supplied with open style controls and are on the inside of the cover on enclosed devices.

**NOTE:** The use of a pressure gauge is desirable when setting the control.

**CAUTION:** The range adjustment Screw "A" should not be adjusted beyond the pressure indicated on the calibrated scale as this may cause the control to malfunction.

It is recommended that a periodic inspection of gauge pressure be made and the pressure control adjusted to compensate for any variables.

**BELLOWS LIFE** — The pressure applied to a bellows in a normal cycle of operation should not exceed the maximum rated range. The maximum pressure in the cycle plus the change in pressure in the cycle should never exceed the rated maximum allowable pressure. For even longer bellows life, it is recommended that the control be operated at about its mid-range pressure.

**MOUNTING** — The pressure control should be mounted securely to a firm base using two mounting screws. The mounting holes are provided either in the base of the enclosure or in a convenient mounting bracket which is provided as part of the open type Style C control. Although mounting brackets are available for the open type Style A control, they are normally panel mounted with the pressure connection outside the panel.

**CAUTION:** The control should not be supported by the electrical and pressure connections only. A support wrench should be used when tightening the electrical hub and pressure connections.

**CAUTION:** If a liquid thread sealant is used on the pressure connection, care must be taken to avoid excess sealant from getting into bellows orifice.

**REPAIRS** — Due to the integral construction of the Bulletin 836 Pressure Control, it must be returned to the factory for repairs. The control will be adjusted for optimum performance and tested to specifications.

**CONTACT BLOCK REPLACEMENT** — To order the Bulletin 836 Contact Block Replacement Kit, specify Catalog No. 836-N2.

