Price $ 5.00

GARDNER-DENVER®

13-10-601
2nd Edition

ELECTRA-SAVER® STATIONARY BASE MOUNTED COMPRESSOR

MODELS

100 HP

ESMF, EAQPM, EAQQM, EAQSM

125 HP

ESNF, EAQPN, EAQQN, EAQSN

150 HP

ESOF, EAQPO, EAQQO, EAQSO

Operating and Service Manual

COOPER INDUSTRIES

INDUSTRIAL MACHINERY

GARDNER-DENVER®

WARRANTY
ROTARY SCREW COMPRESSORS
EC ELECTRA-SAVER II®
EA ELECTRA-SAVER®
EB, ET ELECTRA-SCREW®
SE, ST PACKAGES

A warranty registration card is provided with each machine. The card must be completed by the purchaser and mailed (card is preaddressed and postage paid) within ten days after machine start up in order to validate this warranty.

Gardner-Denver/Industrial Machinery Division (the "Company") warrants to each original retail purchaser ("Purchaser") of its products from the Company or its authorized distributors that such products will be free from defects in material and workmanship caused by Company and shall be warranted as follows:

BASIC COMPRESSOR AIR ENDS

Basic compressor air ends, consisting of all parts within and including the compressor cylinder and gear housing, are warranted for 24 months from date of initial use or 27 months from date of shipment to the first purchaser, whichever occurs first.

The Company will furnish, at its option, air end repairs, a remanufactured replacement air end, or a new replacement air end, FOB factory for any air end which in its judgment proved not to be as warranted within the applicable period.

Purchaser must return, transportation charges prepaid, any air end claimed to be not as warranted to a Gardner-Denver factory. Any disassembly or partial disassembly of the air end, or failure to return the "unopened" air end per Company instructions, will be cause for denial of warranty.

ELECTRIC MOTORS

Electric motors, when specified and furnished by the Company, are warranted for 12 months from date of initial use or 15 months from date of shipment to the first purchaser, whichever occurs first.

The motor manufacturer or authorized service shop will provide at its option, motor repairs or replacement motor FOB manufacturer's location for any motor which in the manufacturer's judgment proves not to be as warranted within the applicable period.

ENGINES

Engines are warranted to the extent of the original manufacturer's warranty to the Company.

OTHER COMPONENTS

All other components are warranted for 12 months from date of initial use or 15 months from date of shipment to first purchaser, whichever occurs first.

The Company will furnish at its option FOB Company location repairs or replacement parts for any component which in the Company's judgment proved not to be as warranted within the applicable period.

GENERAL PROVISIONS AND LIMITATIONS

No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Company's judement, as to affect the product adversely.

2. Any product which has, in the Company's judgment been subject to negligence, accident, improper storage, or improper installation or application.

3. Any product which has not been operated or maintained in accordance with normal practice and with the recommendations of the Company.

4. Components or accessories manufactured, warranted and serviced by others, except as separately rated.

5. Any reconditioned or prior owned product.

Claims for items descibed in (4) above should be submitted directly to the manufacturer.

The Company's obligation under this warranty is limited to repair or replacement, at its option during normal business hours at an authorized service facility of the Company, of any part which in its judgment proved not to be as warranted within the applicable Warranty Period. The Company may require the return of any part claimed not to be as warranted to one of its facilities as designated by Company, transportation prepaid by Purchaser, to establish a claim under this warranty.

The Company will provide labor for repair or replacement of any product or part thereof which in the Company's judgment is proved not to be as warranted, by Company representative up to the amount specified in the Company's labor rate schedules, or up to the amount the Company determines is reasonable. Labor costs in excess of the Company rate schedule amounts or labor provided by unauthorized service personnel is not provided for by this warranty.

Replacement parts provided under the terms of the warranty are warranted for the remainder of the Warranty Period of the product upon which installed to the same extent as if such parts were original components thereof.

DISCLAIMER

THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY.

THE REMEDY PROVIDED UNDER THIS WARRANTY SHALL BE THE SOLE, EXCLUSIVE AND ONLY REMEDY AVAILABLE TO PURCHASER AND IN NO CASE SHALL THE COMPANY BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES. UNDER NO CIRCUMSTANCES SHALL THE COMPANY BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOSSES OR DELAYS HOWSOEVER CAUSED.

No statement, representation, agreement, or understanding, oral or written, made by any agent, distributor, representative, or employee of the Company which is not contained in this Warranty will be binding upon the Company unless made in writing and executed by an officer of the Company.

This warranty shall not be effective as to any claim which is not presented within 30 days after the date upon which product is claimed not to have been as warranted. Any action for breach of this warranty must be commenced within one year after the date upon which the cause of action occurred.

Any adjustment made pursuant to this warranty shall not be construed as an admission by the Company that any product was not as warranted.

FOREWORD

GARDNER-DENVER® ELECTRA-SAVER® COMPRESSORS ARE THE RESULT OF ADVANCED ENGINEERING AND SKILLED MANUFACTURING. TO BE ASSURED OF RECEIVING MAXIMUM SERVICE FROM THIS MACHINE, THE OWNER MUST EXERCISE CARE IN ITS OPERATION AND MAINTENANCE. THIS BOOK IS WRITTEN TO GIVE THE OPERATOR AND THE MAINTENANCE DEPARTMENT ESSENTIAL INFORMATION FOR DAY-TO-DAY OPERATION, MAINTENANCE AND ADJUSTMENT. CAREFUL ADHERENCE TO THESE INSTRUCTIONS WILL RESULT IN ECONOMICAL OPERATION AND MINIMUM DOWNTIME.

DANGER

FAILURE TO OBSERVE A DANGER NOTICE COULD RESULT IN INJURY TO, OR DEATH OF PERSONNEL.

WARNING

FAILURE TO OBSERVE A WARNING NOTICE COULD RESULT IN DAMAGE TO EQUIPMENT.

CAUTION

CAUTION NOTICES SET FORTH GENERAL REMINDERS OF GOOD SAFETY PRACTICE, OR DIRECT ATTENTION TO UNSAFE PRACTICES.

NOTE – INFORMATION FURNISHED IN A NOTE WILL INCLUDE GENERAL INFORMATION OR THE HIGHLIGHTS OF A PROCEDURE.

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SECTION 1

GENERAL INFORMATION

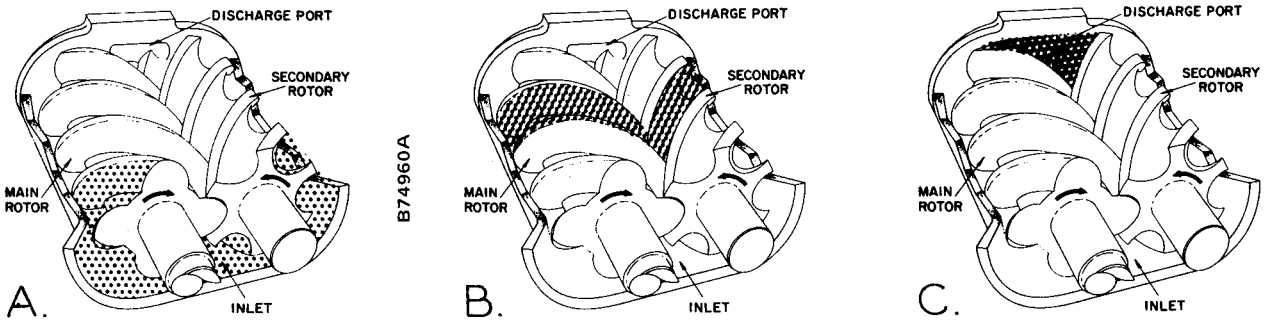

FIGURE 1-1. — COMPRESSION CYCLE

COMPRESSOR — The *Gardner-Denver® Electra-Saver®* compressor is a single-stage, positive displacement rotary machine using meshing helical rotors to effect compression. The input drive shaft and helical drive gear are supported in the gear case by high capacity tapered roller bearings. The drive gear meshes with a driven gear mounted on the main rotor shaft to drive the rotors. Both rotors are supported between large capacity antifriction bearings located outside the compression chamber. Single-width cylindrical roller bearings are used at the inlet end of the rotors. Early models used two (2) heavy-duty single-row angular contact ball bearings at the discharge end locate each rotor axially and carry all thrust loads; later models use tapered roller bearings in this location.

COMPRESSION PRINCIPLE (Figure 1-1) — Compression is accomplished by the main and secondary rotors synchronously meshing in a one-piece cylinder. The main rotor has four (4) helical lobes 90° apart. The secondary rotor has six (6) matching helical grooves 60° apart to allow meshing with main rotor lobes.

The air inlet port is located on top of the compressor near the center. The discharge port is near the bottom at the opposite end of the compressor cylinder. *Figure 1-1 is an inverted view to show inlet and discharge ports.* **The compression cycle** begins as rotors unmesh at the inlet port and air is drawn into the cavity between the main rotor lobes and secondary rotor grooves (A). When the rotors pass the inlet port cutoff, air is trapped in the interlobe cavity and flows axially with the meshing rotors (B). As the meshing continues, more of the main rotor lobe enters the secondary rotor groove, normal volume is reduced and pressure increases. Oil is injected into the cylinder to remove the heat of compression and seal internal clearances. Volume reduction and pressure increase continues until the air/oil mixture trapped in the interlobe cavity by the rotors passes the discharge port and is released to the oil reservoir (C). Each rotor cavity follows the same "fill-compress-discharge" cycle in rapid succession to produce a discharge air flow that is continuous, smooth and shock-free.

AIR FLOW (Figures 2-1 & 3-1) — Air enters the air filter and passes through inlet unloader valve to compressor. After compression, the air/oil mixture passes into oil reservoir where most of the entrained oil is removed by velocity change and impingement and drops back into reservoir. The air and remaining oil then passes through the oil separator; the separated oil is returned to the system through tubing connecting the separator and compressor. The air passes through the reservoir discharge manifold, discharge check valve, minimum pressure valve and the customer furnished unit shutoff globe valve to the plant air lines.

LUBRICATION, COOLING AND SEALING — Oil is forced by air pressure from the oil reservoir through the oil cooler, thermal control (thermostatic mixing) valve and oil filter and discharges into the compressor main oil gallery. A portion of the oil is directed through internal passages to the bearings, gears and shaft oil seal. The balance of the oil is injected directly into the compression chamber to remove heat of compression, seal internal clearances and lubricate the rotors.

TURN VALVE — The turn valve is a rotary helical valve located on the discharge side of the cylinder toward the inlet end. The valve opens and closes ports in the cylinder which communicate with the inlet passage. This varies the compressor rotor volume to match the demand for air, thus reducing the part-load power requirement.

COMPRESSOR OVERHAUL — For compressor overhaul procedures and rebuilding data including dimensions, running clearances and fits, see Service Manual 13-9-623.

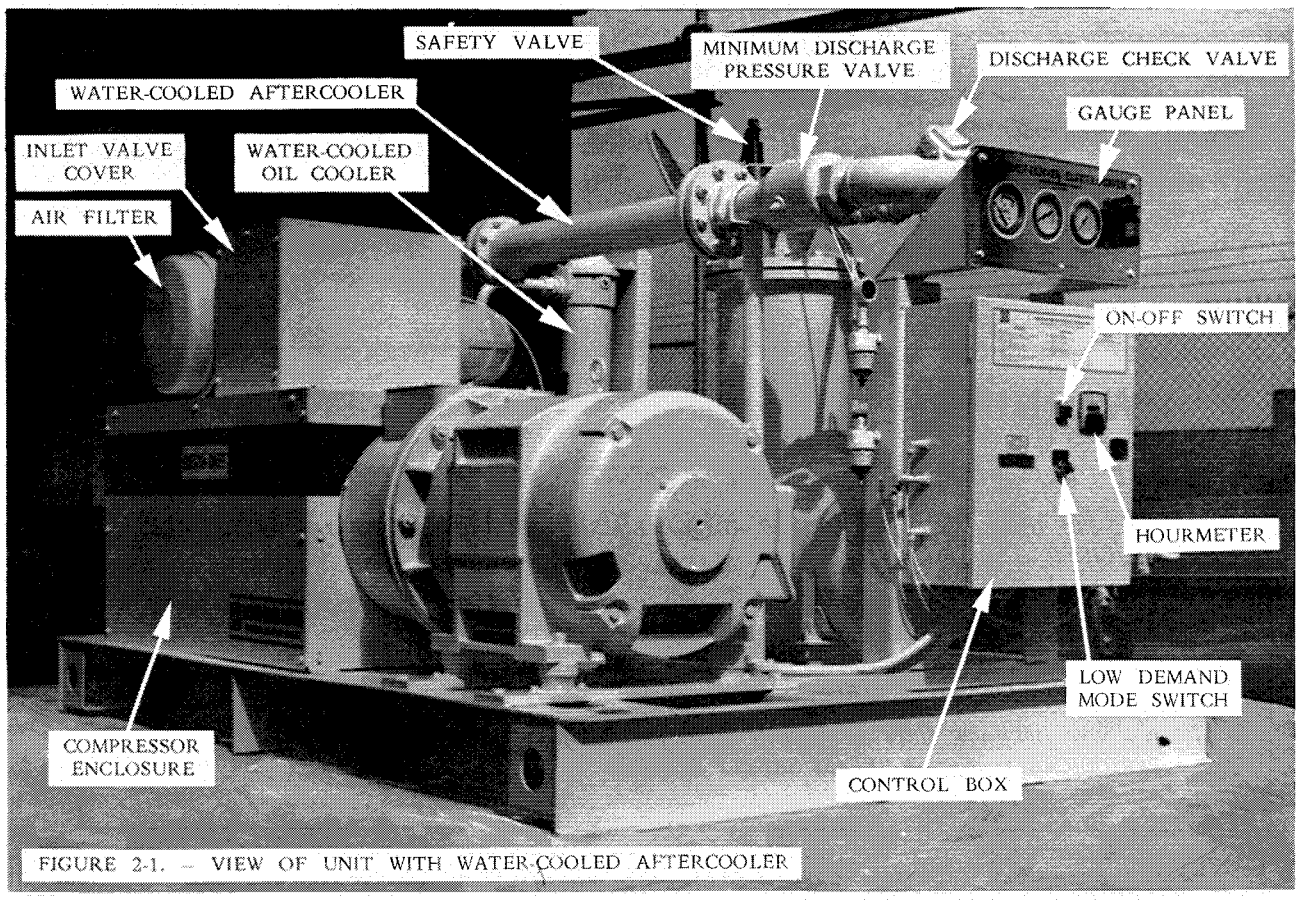

FIGURE 2-1. – VIEW OF UNIT WITH WATER-COOLED AFTERCOOLER

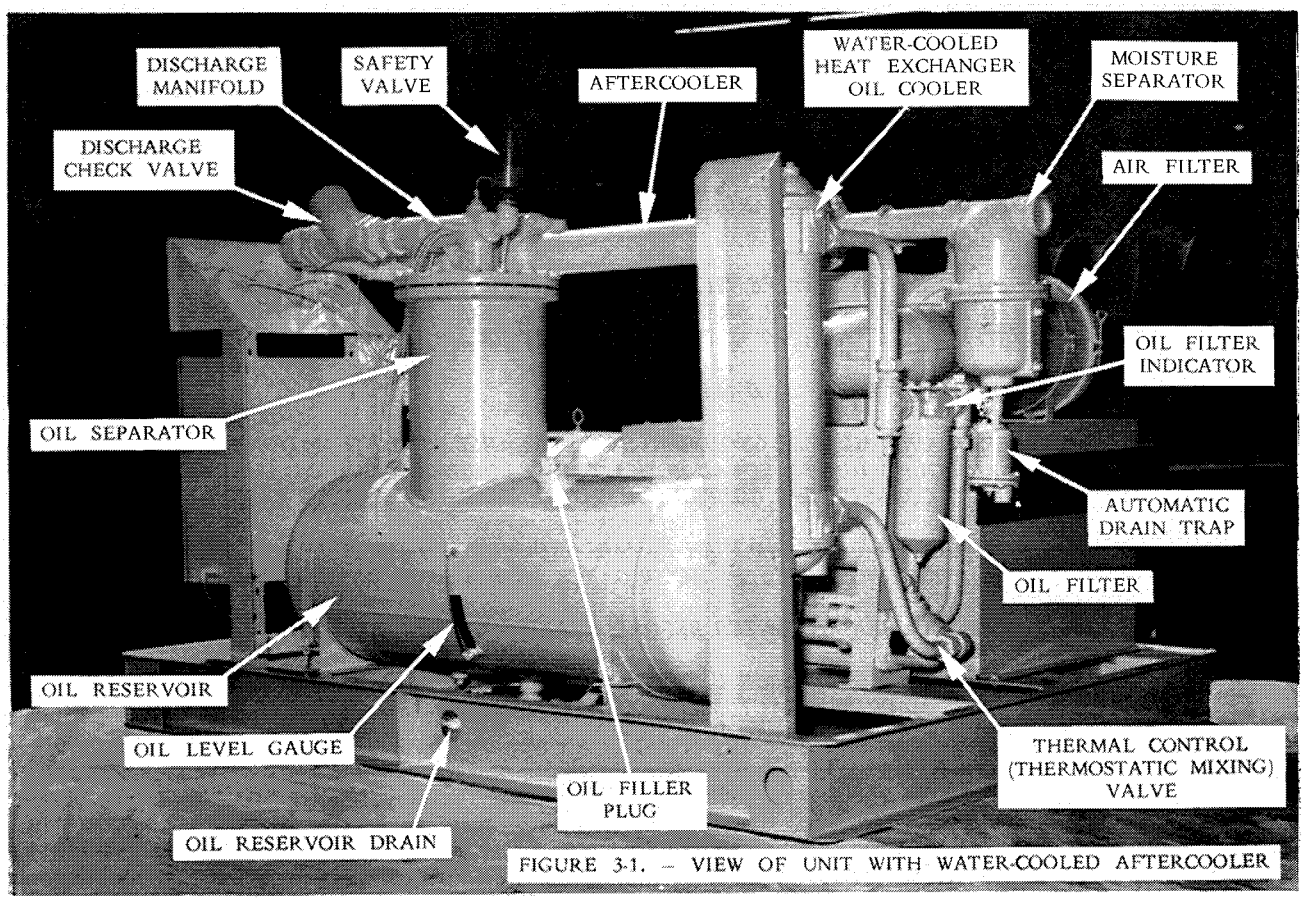

FIGURE 3-1. – VIEW OF UNIT WITH WATER-COOLED AFTERCOOLER

SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious.

Some general safety precautions are given below:

⚠ WARNING

FAILURE TO OBSERVE THESE NOTICES COULD RESULT IN DAMAGE TO EQUIPMENT.

- *STOP THE UNIT IF ANY REPAIRS OR ADJUSTMENTS ON OR AROUND THE COMPRESSOR ARE REQUIRED.*
- *ALL COMPRESSED AIR SUPPLY HOSES EXCEEDING 1/2 INCH INSIDE DIAMETER SHOULD HAVE AN EXCESS FLOW VALVE. (OSHA REGULATION, SECTION 1518.302)*
- *DO NOT EXCEED THE RATED MAXIMUM PRESSURE VALUES SHOWN ON THE NAMEPLATE.*
- *DO NOT OPERATE UNIT IF SAFETY DEVICES ARE NOT OPERATING PROPERLY. CHECK PERIODICALLY. NEVER BYPASS SAFETY DEVICES.*

⚠ DANGER

FAILURE TO OBSERVE THESE NOTICES COULD RESULT IN INJURY TO OR DEATH OF PERSONNEL.

- *KEEP FINGERS AND CLOTHING AWAY FROM REVOLVING FAN, DRIVE COUPLING, ETC.*
- *DO NOT USE THE AIR DISCHARGE FROM THIS UNIT FOR BREATHING – NOT SUITABLE FOR HUMAN CONSUMPTION.*
- *DO NOT LOOSEN OR REMOVE THE OIL FILLER PLUG, DRAIN PLUGS, COVERS, THE THERMOSTATIC MIXING VALVE OR, BREAK ANY CONNECTIONS, ETC. IN THE COMPRESSOR AIR OR OIL SYSTEM UNTIL THE UNIT IS SHUT DOWN AND THE AIR PRESSURE HAS BEEN RELIEVED.*
- *ELECTRICAL SHOCK CAN AND MAY BE FATAL.*
- *COMPRESSOR UNIT MUST BE GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. A GROUND JUMPER EQUAL IN SIZE TO THE EQUIPMENT GROUND CONDUCTOR MUST BE USED TO CONNECT THE COMPRESSOR MOTOR BASE TO THE UNIT BASE.*
- *FAN MOTORS HAVE BEEN AND MUST REMAIN GROUNDED TO THE MAIN BASE THROUGH THE STARTER MOUNTING PANEL IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.*
- *OPEN MAIN DISCONNECT SWITCH BEFORE WORKING ON THE CONTROL.*
- *DISCONNECT THE COMPRESSOR UNIT FROM ITS POWER SOURCE BEFORE WORKING ON THE UNIT – THIS MACHINE IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME.*

SECTION 2

INSTALLATION

GENERAL — On receipt of the unit, check for any damage that may have been incurred during transit. Report any damage or missing parts as soon as possible.

CAUTION

DO NOT ELECTRIC WELD ON THE COMPRESSOR OR BASE; BEARINGS CAN BE DAMAGED BY PASSAGE OF CURRENT.

LIFTING UNIT — Proper lifting and/or transporting methods must be used to prevent damage.

CAUTION

LIFT COMPRESSOR UNIT BY BASE ONLY. DO NOT USE OTHER PLACES SUCH AS ENCLOSURE, MOTOR, COMPRESSOR OIL DISCHARGE MANIFOLD AND PIPING AS LIFTING POINTS.

DANGER

THE EYEBOLTS OR LUGS PROVIDED ON THE MOTOR ARE FOR LIFTING THE MOTOR ONLY AND SHOULD NOT BE USED TO LIFT ANY ADDITIONAL WEIGHT. ALL EYEBOLTS MUST BE SECURELY TIGHTENED. WHEN LIFTING THE MOTOR THE LIFTING ANGLE MUST NOT EXCEED 15 DEGREES. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN DAMAGE OR PERSONAL INJURY.

Physical size and weight of unit may allow use of tow motors. Unit may also be moved into location by rolling on bars.

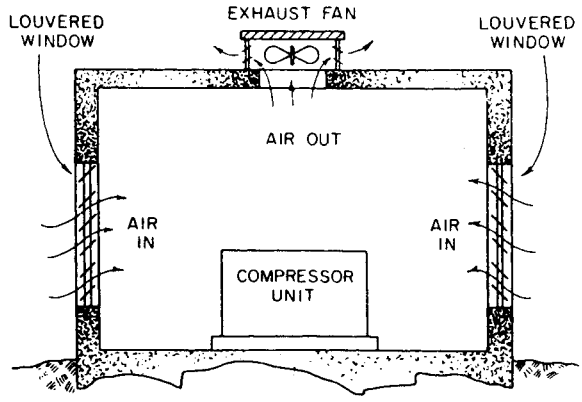

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FIGURE 1-2. — TYPICAL COMPRESSOR ROOM

LOCATION — The compressor should be installed in a clean, well-lighted, well-ventilated area with ample space all around for maintenance. Select a location that provides a cool, clean, dry source of air. In some cases it may be necessary to install the air filter at some distance from the compressor to obtain a proper air supply.

The compressor unit requires electric motor cooling air as well as air to the compressor inlet. Proper ventilation MUST be provided (Figure 2-2); hot air must be exhausted from the compressor operating area. A typical inlet-outlet air flow arrangement is shown in Figure 1-2.

If the air-cooled oil cooler module is to be installed at a location remote from the compressor unit, be sure that adequate ventilation is provided, Figure 2-2. Hot air must be exhausted from the oil cooler area.

Size	Open Compressor Unit	Oil Cooler Module	Open Unit With Oil Cooler Module
100 HP	3600	17500	21100
125 HP	4400	19300	23700
150 HP	5200	19300	24500

* 80° F. Inlet Air

FIGURE 2-2. — MINIMUM AIR* FLOW FOR COMPRESSION AND COOLING (Cubic Feet/Minute)

VENTILATION — The unit, whether air or water cooled, requires sufficient air flow, Figure 2-2, for electric motor cooling. Air is drawn into the back and front of motor and is discharged out the sides. Do not block air flow to and from the unit.

FOUNDATION — The *Electra-Saver®* compressor requires no special foundation but should be mounted on a smooth, solid surface of sufficient strength to support the weight of the unit. Whenever possible install the unit near level. Temporary installation may be made at a maximum of 10° angle lengthwise or 30° sidewise.

Mounting bolts are not normally required. However, installation conditions such as piping rigidity, angle of tilt, or danger of shifting from outside vibrations or moving vehicles may require the use of mounting bolts to the foundation.

OIL RESERVOIR DRAIN (Figure 3-1) — The oil reservoir drain valve is located near the center of the oil reservoir just below the separator tower. The drain valve is approximately 4-1/2 inches from the floor level. If this height is not sufficient to conveniently drain the oil, some other methods of providing oil drain are:

1. Elevate the compressor unit on the foundation to obtain the desired drain height.
2. Construct an oil sump or trough below the floor level and pump or bail the drained oil.
3. Pump oil from the reservoir filler opening or reservoir drain to a container.

ACOUSTIC ENCLOSURE — The *Electra-Saver®* unit is furnished with an acoustic enclosure over the compressor

only, as standard equipment. The enclosure reduces the normal operating sound of the unit to 90 DBA or below in free field conditions.

AIR-COOLED OIL COOLER MODULE — The air-cooled oil cooler is a separate module and may be mounted remote to the compressor unit.

Ventilation — The oil cooler requires adequate cooling air flow. Proper ventilation MUST be provided, with hot air exhausted away from the cooler; take care that hot air is not recirculated from the exhaust to the inlet side of the cooler. Cooling air flow direction is from the motor side through the grille side of the oil cooler. Do not obstruct the air flow to or from the cooler. Allow two (2) feet clearance on all sides of the cooler module. See Figure 2-2 for cooling air flow requirements.

Low Oil Pressure Protection — The standard factory-installed low oil pressure shutdown switch in the control box will prevent start-up or shut the unit down if oil pressure is not established or maintained due to malfunction in the oil cooler system.

Oil Cooler — The oil cooler module can be mounted in any of several remote locations: close coupled but not joined to the compressor unit; horizontal remote, located on the same level as the compressor unit, but some distance away; or overhead remote, located above level of the compressor unit, as on a roof.

⚠ WARNING

THE LOW DEMAND MODE SWITCH CANNOT BE USED WITH REMOTE OVERHEAD OIL COOLER. THESE UNITS REQUIRE SPECIAL WIRING DIAGRAM – CHECK WITH FACTORY. USE OF LOW DEMAND SWITCH WITH AN OVERHEAD COOLER COULD RESULT IN DAMAGE TO COMPRESSOR.

All piping and wiring between the compressor unit and the remote oil cooler is to be supplied by the user. THE DESIGN OF THE REMOTE OIL COOLER MODULE SYSTEM MUST BE APPROVED BY THE FACTORY BEFORE INSTALLATION. The design information to be submitted for approval includes:

1. Location of oil cooler module — inside or outdoors.
2. Range of operating ambient temperatures at the oil cooler location.
3. Elevation of the oil cooler above the compressor unit.
4. Pipe type and size(s) to be used to connect oil cooler and compressor unit. Minimum pipe size is 2" IPS.
5. Horizontal and vertical lengths of the pipe run. If more than one pipe size is used, list length of each size and total length.
6. Number and size of elbows, tees, unions, reducers and valves to be used in the pipe run.
7. A dimensioned sketch of the proposed piping system showing location of the compressor unit, oil cooler and pipe fittings of 3 through 6 above.

All remote piping should be of adequate size to insure the minimum pressure loss. Design point 4 above lists the pipe size at the compressor unit oil inlet and outlet connections and is the minimum pipe size to be used. Long runs of pipe and the use of valves and fittings require larger than the minimum pipe sizes in the system to keep the pressure loss low. All pipe and fittings used in a remote oil cooler system should be galvanized or treated internally to prevent rust, and all valves are to be of a nonferrous construction to prevent corrosion and fouling.

The remote cooler should be placed so that the fan air flow through the cooler (air flow is from motor side through core) and the prevailing winds are in the same direction. A baffle should be provided on the exhaust side of the cooler for protection against occasional wind shifts.

When the oil cooler is mounted above the compressor unit, a check valve is to be mounted on the compressor unit, in the line to the oil cooler; see Figure 2-5. A pneumatic pilot-operated normally-closed valve is to be mounted at the oil filter inlet on the compressor unit line from the oil cooler; see Figure 2-5. The check valve permits oil flow to the oil cooler during operation, but prevents return oil flow from the cooler when the unit is shut down. The pilot valve is held open by air pressure from the unit oil reservoir during operation and closes under spring load when the unit is shut down to prevent return oil flow from the oil cooler.

An oil filler stand pipe and plug must be located in the piping on the oil cooler module for ease of filling of a remote oil cooler; see Figure 2-5.

INSTALLATION FOR COLD WEATHER OPERATION — It is recommended that whenever possible the unit be installed inside a shelter that will be heated to temperatures above freezing (32° F., 0° C.). This will eliminate many of the problems associated with operating the units outside in cold climates where freezing rain, drifting snow, freezing condensate and bitter cold temperatures are encountered.

When an outside installation must be made, the precautions required will depend on how severe the environment will get. The following are general guidelines for outside installations:

Cold Weather (Down To −10° F.)

1. Be sure all control lines, drains and traps are heated to avoid freezing of condensate. Heat tape with thermostat control is generally satisfactory for this purpose. This is not a factory option, but can be obtained at various local plumbing or hardware outlets.
2. If an air-cooled aftercooler is to be used, provisions to bypass the aftercooler should be made. Since cold air contains very little moisture, successful operation can be achieved without the aftercooler. Successful operation down to +15° F. can be accomplished by reversing fan flow, but cooler bypass should still be provided should it be required.
3. Provide at least some simple shelter (Plywood windbreak, etc.) to protect against drifting snow.
4. Use only *Gardner-Denver*® "GD800 Lubricating Coolant".
5. Monitor unit carefully during start-up and operation to be sure it is functioning normally.
6. When the coolers are mounted horizontally use weather protected enclosure for the unit.

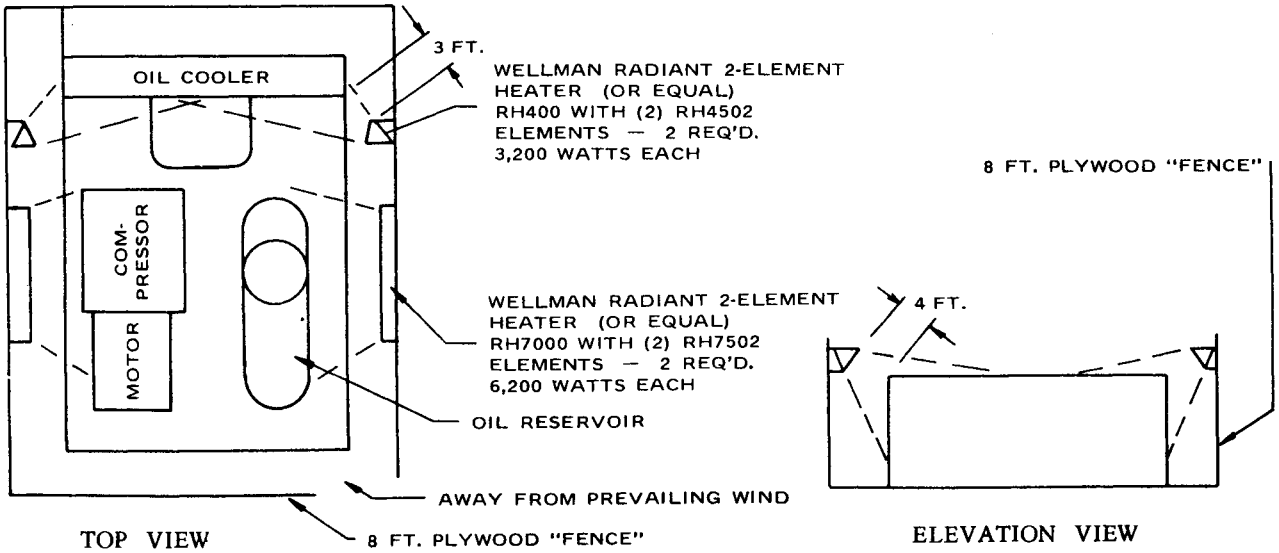


FIGURE 3-2.

7. Use NEMA 4 enclosure for electrical devices.

Extreme Cold Weather Operation (Down To −40° F.)

In addition to recommendations for −10° F. installations, the following should be provided:

1. A temperature switch to control the fan should be provided for better starting and quicker warm-up. This switch can be provided from the factory and will delay fan start-up until discharge temperature reaches approximately 150-160° F.

2. It will probably be necessary to provide shutters or to block off part of the cooler in some manner since the cooler is greatly oversized for operation in these low temperatures. Shutters are not a factory option.

3. Coolers should be located as close to unit as possible. Long lines to and from the cooler only further complicates the circulation of oil flow on cold starts. Lo-Demand or Duomatic operation cannot be used in extreme environments. Heat tape and insulation may be required on oil lines.

4. Some means of providing heat to the oil reservoir and cooler during shutdown should be provided. There are various methods to accomplish this, but since openings are not provided for sump heaters, the use of radiant heaters is recommended. The heaters should be sized to provide at least a −10° F. environment for the coolers, motor and sump. Figure 4-2 shows how these might be located in a typical installation and sizes required.

Remember unsheltered (outside) installations should be avoided where possible. Installation next to a heated building where enough heat can be used to keep the compressor room above freezing, will save many complications in the operation and installation of the unit.

AUXILIARY AIR RECEIVER — The unit requires an auxiliary air receiver unless the piping system is large and provides sufficient storage capacity to prevent rapid cycling. When used, an air receiver should be of adequate size, provided with a relief valve of proper setting, a pressure gauge and a means of draining condensate.

AFTERCOOLER (Figures 2-1, 3-1 & 4-2) — An aftercooler will provide control of moisture entering the shop air lines while reducing the normal low discharge temperature of about 179° F. at 100 PSIG discharge pressure to near inlet air temperature.

Air-Cooled Machines — When an aftercooler is furnished on an air-cooled machine, the aftercooler is installed on the oil cooler module between the fan and the oil cooler. Later models of steel air-cooled aftercoolers are coated internally to resist corrosion. Coated aftercoolers have a tag attached to one header with identification and date. The moisture separator is furnished by Gardner-Denver Compressors but must be mounted by the customer between the aftercooler and the auxiliary air receiver with a condensate drain provided at the bottom. All air piping from the compressor discharge to aftercooler to auxiliary air receiver is to be furnished and mounted by customer. *The design of the aftercooler piping must be approved by the factory before installation.* The design information to be submitted for approval includes:

1. Location of aftercooler module — inside or outdoors.

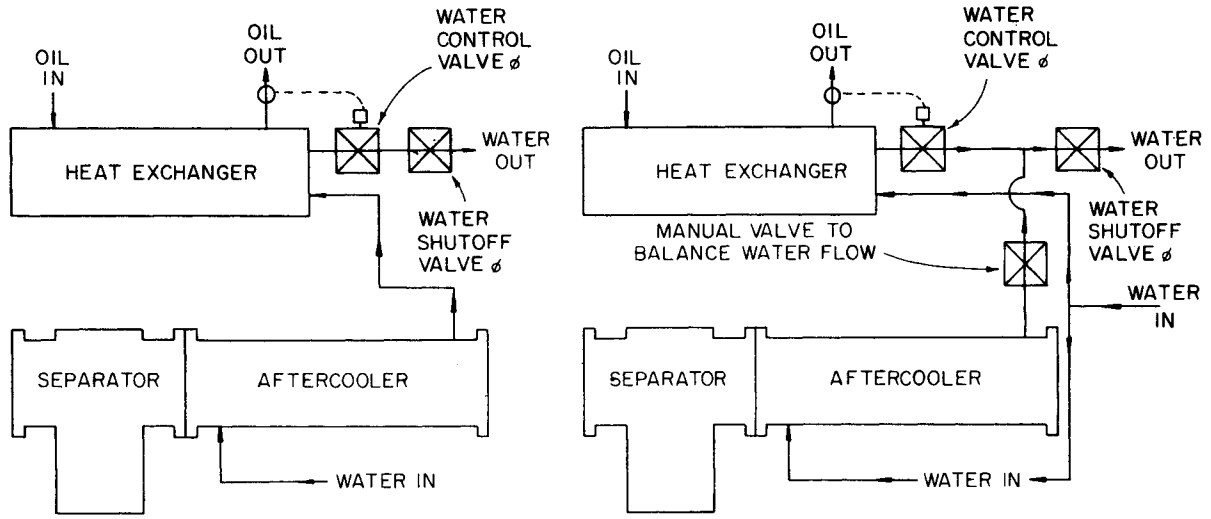
2. Range of operating ambient temperatures at the aftercooler location.

3. Pipe type and size(s) to be used to connect the aftercooler, separator and compressor unit — minimum pipe size is 2" IPS.

4. Lengths of the pipe run. If more than one pipe size is used, list length of each size and total length.

5. Number and size of elbows, tees, unions, reducers and valves to be used in the pipe run.

6. A dimensional sketch of the proposed piping system showing location of the compressor unit, aftercooler, separator and auxiliary air receiver, pipe and fittings



SERIES PIPING - WATER FLOW MUST BE THROUGH AFTERCOOLER FIRST FOR EFFECTIVE COOLING OF DISCHARGE AIR.

PARALLEL PIPING WATER CONTROL VALVE REQUIRED FOR TEMPERATURE CONTROL OF OIL

ø MUST BE ORDERED SEPARATELY.

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FIGURE 4-2. — PIPING DIAGRAM FOR AFTERCOOLER AND HEAT EXCHANGER

Size	Rated Pressure PSIG	Water Temperature To Heat Exchanger				Maximum Water Flow	Approximate Water Pressure Drop @ Maximum Flow (PSI)
		60° F.	70° F.	80° F.	90° F.		
100 HP	ALL	11.0	13.5	17.5	26.0	40	18
125 HP	ALL	12.0	15.5	20.5	32.0	60	20
150 HP	ALL	15.5	19.0	25.5	37.5	60	20

The Maximum Water Flow Shown Is That Allowable Through The Heat Exchanger.

FIGURE 5-2. — HEAT EXCHANGER (OIL COOLER) APPROXIMATE WATER FLOW (U.S. Gallons/Minute)

Size	Rated Pressure PSIG	Water Temperature To Aftercooler				Maximum Water Flow	Approximate Water Pressure Drop @ Maximum Flow (PSI)
		60° F.	70° F.	80° F.	90° F.		
100 HP	ALL	2.4	3.0	4.0	6.0	30.0	2.5
125 HP	ALL	2.8	3.5	4.7	7.0	30.0	2.5
150 HP	ALL	4.0	5.0	6.7	10.0	30.0	2.5

Water flow rates (gpm) are based on 110° F. water temperature out of cooler. Maximum water flow shown is the maximum allowable flow through aftercooler.

FIGURE 6-2. — AFTERCOOLER APPROXIMATE WATER FLOW (U.S. Gallons/Minute)

of 3 through 5 above.

Water-Cooled Machines (Figure 4-2) — On water-cooled machines with aftercooler, the moisture separator and condensate drain are shipped loose and must be installed by customer. Customer must furnish and install all water piping required.

CONTROL PIPING — Control piping is not necessary since the *Electra-Saver®* unit is factory-wired and piped for the control system specified.

INLET LINE — Where an inlet line is used between an outside air filter and the compressor, or to connect the unit mounted air filter to an outside source of air, it must be thoroughly cleaned on the inside to prevent dirt or scale from entering the compressor. **If welded construction is used, the line must be shot blasted and cleaned to remove welding scale.** In either case, the inlet line must be coated internally by galvanizing or painting with a moisture and oil-proof sealing lacquer. The inlet line should be the full size of the inlet opening on the compressor. If an extra-long line is necessary, the pipe size should be increased accordingly:

Length Of Inlet Line	Diameter Of Pipe Size
0 to 10 Ft	Same As Compressor Inlet Opening
10 to 17 Ft	One Size Larger Than Inlet Opening
17 to 38 Ft	Two Sizes Larger Than Inlet Opening

Accessability for inlet air filter servicing must be considered when relocating the filters from the unit to a remote location.

DISCHARGE SERVICE LINE — The discharge service line connection on water-cooled units with aftercooler is made at the moisture separator. On air-cooled units and water-cooled without aftercooler, the connection is made at the minimum pressure valve located behind the instrument panel. When manifolding two or more *Electra-Saver®* units on the same line, each unit is isolated by the check valve in the unit discharge line. If an *Electra-Saver®* unit is manifolded to another compressor, be sure the other compressor has a check valve in the line between the machine and the manifold. If an *Electra-Saver®* and a reciprocating compressor are manifolded together, an air receiver must be located between the two units.

DANGER

DO NOT USE THE AIR DISCHARGED FROM THIS UNIT FOR BREATHING — IT IS NOT SUITABLE FOR HUMAN CONSUMPTION.

BLOWDOWN VALVE PIPING — The blowdown valve is fitted with a muffler, for operation indoors. If the installation requires, the muffler may be removed and the blowdown valve piped to the outside with pipe the same size as the blowdown valve outlet connection.

WATER PIPING (Water-Cooled Heat Exchanger Models Only) — On machines equipped with a water-cooled heat exchanger, pipe water to the inlet or water flow control valve mounted in the water inlet piping to the heat exchanger. Pipe outlet water from the outlet or magnetic water shutoff valve to a sump or drain. The thermal bulb is inserted in the heat exchanger oil outlet line; refer to the unit outline drawing for location.

The water source should be capable of supplying up to the maximum flow shown in Figure 5-2 at a minimum pressure of 40 PSIG; maximum allowable water pressure is 150 PSIG. The water flow rates shown in Figure 5-2 are approximate and a guide to sizing piping, cooling tower and other water system equipment.

The heat exchanger is designed to operate with water inlet temperatures from 60° F. to 90° F., and a water outlet temperature not to exceed 110° F. If water cooler than 60° F. is used, high water outlet temperatures (over 110° F.) will be experienced along with shortened heat exchanger life caused by tube fouling and corrosion. If water warmer than 90° F. is used, higher compressor oil temperatures and high water usage will result.

Most water systems will require control of impurities: filtration, softening or other treatment. See "Compressor Oil Cooler — Water-Cooled Heat Exchanger" for more information on the water system.

Aftercooler — Heat Exchanger Water Piping (Figure 4-2) — If an aftercooler is used and piped in series with the heat exchanger, install the water flow control valve and magnetic water shutoff valve, if used, downstream of the exchanger. Pipe the aftercooler water outlet to the heat exchanger water inlet on the compressor unit.

If the aftercooler is piped in parallel with the heat exchanger, provide a manual valve between the aftercooler outlet and the heat exchanger outlet after the water control valve to adjust aftercooler water flow for discharge temperature required and most economical water use; separate water inlet lines are piped to the aftercooler and heat exchanger.

CAUTION

WHEN AN AFTERCOOLER IS PIPED IN SERIES WITH THE OIL COOLER, THE MAXIMUM ALLOWABLE WATER FLOW RATE THROUGH THE OIL/AFTERCOOLER SYSTEM IS THE MAXIMUM ALLOWED BY THE AFTERCOOLER. IF THE OIL COOLER REQUIRES MORE WATER FLOW THAN THE MAXIMUM ALLOWED BY THE AFTERCOOLER, A PARALLEL WATER PIPING SYSTEM MUST BE USED.

If the standard factory built-in aftercooler is used, the maximum allowable water flow through the aftercooler is 30 gallons per minute and the maximum water inlet pressure is 150 PSIG. If another aftercooler is used, consult the manufacturer for operating limits.

The water control valve MUST be used to maintain discharge temperatures approximately 10 F° over the dew point for expected ambient (Figure 8-5). See Section 5 for adjustment instructions and maximum allowable oil temperature.

ELECTRICAL WIRING — The *Electra-Saver®* unit is furnished with the compressor motor enclosure as specified by the user. If the unit has an air-cooled oil cooler, this fan motor is a totally enclosed "air-over" or fan-cooled type and is complete with starter and enclosure as specified by the user. Allow 42" deep by 30" wide clear space to nearest obstruction over control enclosure in accordance with Article 110-16 (a) National Electrical Code.

It is necessary to connect the compressor unit (and oil cooler, if used) to a main starter of the correct size, power characteristics and enclosure for the application. See

Section 4 for typical wiring diagrams; however, use only the wiring diagrams supplied with the unit for final connections.

Starter — The main starter is to be mounted at a location selected by the user at the time of installation. The first three (3) feet of line from the motor conduit box to the starter must be of flexible conduit to maintain effective vibration isolation. Electrical connections to other parts of the unit (instrument panel, fan motor, etc.) from the starter do not require flexible conduit since the compressor and motor are already isolated from these parts. See Table 110-16 (a) National Electrical Code for correct working clearance.

Grounding — Equipment must be grounded in accordance with Table 250-95 of the National Electrical Code.

⚠ WARNING

AN EQUIPMENT GROUND JUMPER, EQUAL IN SIZE TO THE EQUIPMENT GROUND CONDUCTOR, MUST BE USED TO CONNECT THE COMPRESSOR-MOTOR SUBBASE TO THE MAIN BASE, SINCE THE BASES ARE ISOLATED FROM EACH OTHER BY VIBRATION MOUNTS. THE OIL COOLER FAN AND ENCLOSURE VENT FAN MOTOR FRAME WILL BE GROUNDED TO THE MAIN BASE WITH A GROUNDING CONDUCTOR COMPATIBLE WITH THE FAN SHORT CIRCUIT PROTECTION AT THE FACTORY. FAILURE TO PROPERLY GROUND EQUIPMENT COULD RESULT IN ELECTRICAL SHOCK.

MOTOR LUBRICATION — Long time satisfactory operation of an electric motor depends in large measure on the bearings and timely lubrication. The following charts show recommended grease qualities and regreasing intervals for motor supplied with ball bearings. For additional information refer to the motor manufacturer's instructions.

The following procedure should be used in regreasing:

1. Stop the unit.
2. Disconnect the unit from the power supply.
3. Remove the relief plug and free the hole of hardened grease.
4. Wipe the lubrication fitting clean and add grease with a hand-operated grease gun.
5. Leave the relief plug temporarily off. Reconnect the unit and run for about 20 minutes to expell the excess grease.
6. Stop the unit. Replace the relief plug.
7. Restart the unit.

GREASE RECOMMENDATIONS

	Standard Service	High Temperature
Worked Penetration	265-296	220-240
Oil Viscosity, SSU At 100° F.	400-550	475-525
Soap Type	Lithium	Lithium
N-H Bomb, Minimum Hours For 20 PSI Drop At 210° F.	750	1000
Bleeding, Maximum Weight % In 500 Hours 212° F.	10	3
Rust Inhibiting	Yes	Yes

REGREASING INTERVAL

Type Of Service	Typical Examples	Rating	Relubrication Interval
Standard	One- Or Two-Shift Operation	150 HP and Below	18 Months
		Over 150 HP	12 Months
Severe	Continuous Operation	150 HP and Below	9 Months
		Over 150 HP	6 Months
Very Severe	Dirty Locations, High Ambient Temperature	150 HP and Below	4 Months
		Over 150 HP	2 Months

SECTION 3

STARTING & OPERATING PROCEDURES

A new unit as received from the factory has been prepared for shipping only. Do not attempt to operate the unit until checked and serviced as follows:

1. **Compressor Oil** — Check the oil level in the oil reservoir. Add oil only if the oil level gauge reads in the red ADD OIL range. Do not mix different types of oils. The unit is shipped filled with *Gardner-Denver*® GD800 Lubricating Coolant which is suitable for the first 2000 hours under normal operating conditions. REPLACE OIL FILTER ELEMENT EVERY 1000 HOURS.

   Initial fill, or filling after a complete draining of the system, may show the oil level beyond the red EXCESS oil range. After start-up, oil will fall into the operating range as system components are filled. If necessary, add oil to bring level into the center of the RUN range when unit is operating on load; see Figure 4-5 for quantity of oil required.

DANGER

ALWAYS STOP THE UNIT AND RELEASE AIR PRESSURE BEFORE REMOVING OIL FILLER PLUG TO ADD OIL.

   During unloaded operation and after shutdown, the system will partially drain back into the oil reservoir and oil level will read higher than when operating on load. DO NOT DRAIN OIL TO CORRECT; on the next loaded cycle or start, oil will again fill the system and the gauge will indicate the operating level.

2. **Air Filter** — Inspect the air filter to be sure it is clean and tightly assembled. Refer to Section 6 "Air Filter" for complete servicing instructions. Be sure inlet line, if used, is tight and clean.

3. **Piping** — Refer to Section 2 "Installation" and make sure the piping meets all requirements.

4. **Moisture Separator Trap** — The trap is constructed of cast iron with side inlet and outlet connections and inverted bucket design. A stainless steel internal strainer is used in trap; it should be checked periodically for clogging and replaced if necessary. Repair parts are available for trap cap, retainer gasket and strainer. See package outlines for mounting dimensions of moisture separator trap.

   The moisture trap must be primed by filling with clean water prior to initial start-up of unit.

5. **Electrical** — Check the unit and user-installed wiring with the wiring diagrams furnished to be sure it is properly wired. See Section 4 "Controls and Instruments" for general wiring diagrams and Section 2 for installation instructions.

6. **Rotation** — Check the motor rotation by momentarily starting the motor. Compressor drive shaft rotation is counterclockwise standing at the motor end.

7. **Operating Light Test** — Observe the operating lights on the ON-OFF switch when jogging the motor in Step 6. Be sure all lamps are operative.

8. **System Pressure** — Set the turn-valve pilot, inlet pilot and operating air pressure switch to the desired unload pressure and differential. DO NOT EXCEED MAXIMUM OPERATING PRESSURE ON THE COMPRESSOR NAME PLATE EXCEPT AS SPECIFIED UNDER "CONTROL ADJUSTMENTS" SECTION 4.

9. **Operating Mode** — Refer to Section 4 for detailed information on the control system.

STARTING THE UNIT — The Constant Speed with Low Demand Mode Unit requires only pressing of the OFF/RESET and then the ON push button.

The Automatic Start/Timed Stop with Low Demand Mode Units require selecting the desired mode of operation (see Section 4) and then pressing first the RESET and then the ON push button.

OBSERVE UNIT COLD OR UNIT HOT STARTING PROCEDURES.

Unit Cold — Close the air service valve (furnished by customer) between the main air system and the unit check valve. If the unit is a water-cooled heat exchanger model, open any manual water inlet wide open. Start the unit and run for one minute. Open the air service valve. Since the unit is equipped with a minimum (65 PSIG) pressure discharge valve, no special procedure to maintain unit reservoir pressure is required.

CAUTION

ON AUTOMATIC START-TIMED STOP MODE, IT IS IMPORTANT TO OPEN THE SERVICE VALVE AFTER STARTING AND BEFORE THE SET DISCHARGE PRESSURE IS REACHED TO PREVENT THE ALMOST IMMEDIATE SHUTDOWN OF THE UNIT FOLLOWED BY A RESTART WHICH MAY CAUSE MOTOR OVERLOAD HEATERS TO OVERHEAT AND BLOW.

Unit Hot — No warm-up period is required. Close the air service valve (furnished by customer). If the unit is a water-cooled heat exchanger model, open any manual water inlet valves wide open. Start the unit. Open the air service valve.

DAILY CHECK — Refer to Section 8 "Maintenance Schedule".

STOPPING THE UNIT — Close the air service valve (furnished by customer), allow the unit to build up to full unloaded pressure and press the OFF push button. Stopping the unit at a pressure below full receiver may cause oil carry-over. The oil reservoir will automatically blow down as the motor stops. If the unit is a water-cooled heat exchanger type, close any manual water inlet valves. Open the air service valve.

SECTION 4

CONTROLS & INSTRUMENTS

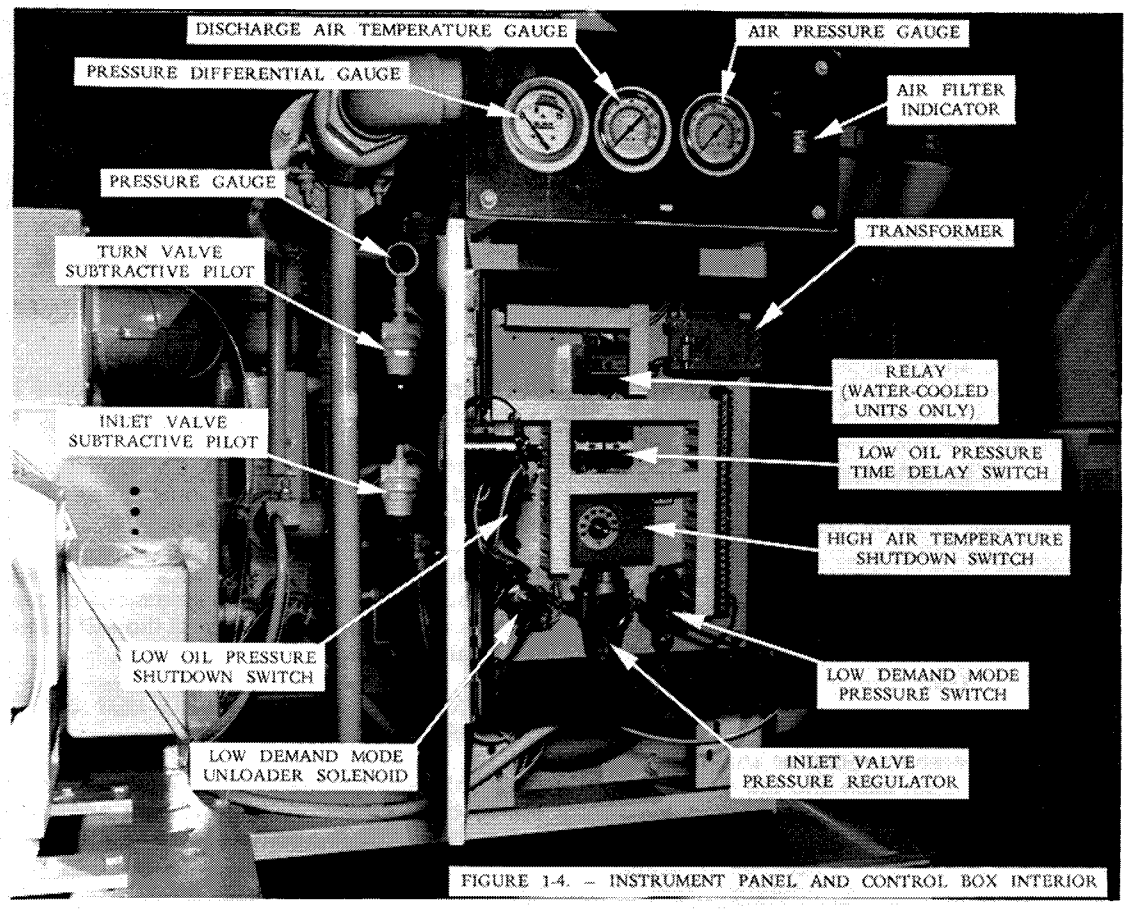


FIGURE 1-4. – INSTRUMENT PANEL AND CONTROL BOX INTERIOR

GENERAL — The *Gardner-Denver® Electra-Saver®* compressor units are available with two (2) different control systems:

Constant Speed With Low Demand Mode

Automatic Start/Timed Stop With Low Demand Mode

The standard *Electra-Saver®* unit consists of the compressor, oil reservoir and cooler, air and oil filters, the control system specified, an open drip-proof motor, and a dust resistant control enclosure/instrument panel all mounted on a steel base. The compressor is isolated in an acoustic enclosure. The unit is factory wired for the voltage specified; electrical connection to a main starter, connection to the shop air line, shop water line or oil lines to air-cooled oil cooler are to be made by the user.

CONTROL VOLTAGE — The control voltage for the start-stop push button, hourmeter, pressure switch, high discharge temperature shutdown switch, and other electrical control devices is 115 volts regardless of power supply voltage. On standard units, the transformer in the control enclosure is connected to change the specified user's power supply voltage to 115 volt control voltage.

RESET — The Reset Button must be pushed whenever power is interrupted or turned off. For circuit interruption, see paragraph below relating to the specific safety device.

DANGER

DO NOT CONTINUE TO RESET THE CIRCUIT IF THE SAME MALFUNCTION OCCURS WITHIN A SHORT PERIOD OF TIME. FIND AND CORRECT THE TROUBLE BEFORE RESUMING OPERATION. FAILURE TO CORRECT THE PROBLEM MAY RESULT IN DAMAGE TO EQUIPMENT OR PERSONAL INJURY.

Start-Stop/Reset Switch — Later model Constant Speed units with Low Demand switch that use the two-probe high discharge temperature switch have a two-button Start-Stop/Reset switch in the control box door. The indicating pilot light is separately mounted adjacent to the switch.

On-Off-Reset Switch — Later model Automatic Start/Timed Stop units with Low Demand switch that use the two-probe high discharge temperature switch have a three-button On-Off-Reset switch in the control box door. The indicating pilot light is separately mounted adjacent to the switch.

Pilot Light — Later model units with either Constant Speed or Automatic Start/Timed Stop control system and the

two-probe high discharge temperature switch have an indicating pilot light mounted in the control box door. The amber lighted ON indicates compressor running under Constant Speed Control. Under Automatic Start/Timed Stop, the compressor may be stopped with the amber light ON indicating power on. The blue lighted LOAD indicates compressor is loaded.

To replace the bulbs in the pilot light (replacement bulb number is Sylvania 120 PSB or equal):

1. Turn power off at main breaker panel.
2. Open control panel.
3. Turn slotted locking screw on upper side of pilot light body counterclockwise 1/4 turn and remove the body from the lens holder.
4. Remove old bulb located in the body and insert new bulb.
5. Reassemble body to lens holder and secure by turning locking screw 1/4 turn clockwise.

ON-OFF SWITCH (Figure 2-1) — Early model Constant Speed units with Low Demand Mode switch and the units with Automatic Start/Timed Stop with Low Demand Mode have an ON-OFF push button with an amber lighted section to indicate ON (compressor running) and a green lighted section to indicate LOAD (compressor loaded). The red bar on the bottom of the ON-OFF switch is the OFF and RESET on the Constant Speed unit with Low Demand Mode. The black bar on the bottom of the Automatic Start/Timed Stop ON-OFF switch is the RESET.

To replace the bulb (Sylvania 120 PSB or equal) in any of the switches:

1. Turn the power off at the main breaker panel.
2. Open the control panel.
3. Turn the slotted locking screw on the upper side of the switch body counterclockwise 1/4 turn and remove the switch body from the switch operator.
4. Remove the old bulb located in the stem of the switch body and insert the new bulb.
5. Reassemble the switch body to the operator and lock in place by turning the locking screw 1/4 turn clockwise.

LOW DEMAND MODE SWITCH (Figure 2-1) — The low demand mode switch, when turned to the ON position, will blow the reservoir down when the compressor unloads. When switch is turned to OFF, unit will retain pressure in reservoir when unloaded.

WARNING

THE LOW DEMAND MODE SWITCH CANNOT BE USED WITH REMOTE ELEVATED OIL COOLERS. THESE UNITS REQUIRE SPECIAL WIRING DIAGRAMS – CHECK WITH FACTORY. IMPROPER INSTALLATION OR USE OF LOW DEMAND MODE MAY RESULT IN DAMAGE TO EQUIPMENT.

SAFETY DEVICES — Both control systems incorporate these safety devices:

Motor Protection Devices — Overload heaters are furnished for the air-cooled oil cooler fan motor starter in the voltage range specified. There are three (3) overloads of proper size for the starter and its enclosure. When replacing or changing overloads, be sure to select them from a 3-overload heater table, since the use of a third overload derates each overload for a given enclosure due to the extra heat. An overload from a 2-overload heater table would be undersize.

The overload heaters are in a common overload block in the starter and have a single common percentage adjustment knob with a 90 to 110% range. The knob is set at the factory on the 100% mark.

Main unit starter should be adequately fused and provided with overload heaters suitable for the application to provide protection for the unit drive motor.

High Discharge Temperature Switch — Later Models — Later models of the compressor unit are protected from high discharge temperature by a two-probe adjustable switch. One probe is located in the discharge pipe between the compressor and the oil reservoir to sense compressor discharge air/oil mixture temperature. The second probe is located in the final discharge manifold and senses the temperature of the air at the oil separators. The switch is located inside the control box (Figure 2-1); the shutdown temperature is set on the adjustable dial. If the temperature of the air at either of the probes exceeds the temperature set on the dial, the switch will stop the unit. Press reset button of the Start/Stop (On-Off) switch, then the Start (On) button to restart the unit.

DANGER

THIS ADJUSTABLE SWITCH DIAL MUST NOT BE SET HIGHER THAN 225° F.

DO NOT CONTINUE TO RESET CIRCUIT IF THE SAME MALFUNCTION OCCURS WITHIN A SHORT PERIOD OF TIME. FIND AND CORRECT THE TROUBLE BEFORE RESUMING OPERATION. FAILURE TO CORRECT THE PROBLEM MAY RESULT IN DAMAGE TO EQUIPMENT OR PERSONAL INJURY.

In addition to protecting the unit from damage or failure resulting from high air temperature, the switch also incorporates four (4) indicator lights which show the point of high temperature and/or the condition of the temperature probes. This information is shown on the decal inside the control box and in Figure 2-4.

The High Air Temperature Switch may be checked periodically to assure proper operation. To check with the unit running, turn the dial on the switch to the temperature indicated by the discharge temperature gauge. Unit should shutdown. If it does not, check the temperature gauge accuracy and indicator lights — refer to the condition decal on the control box door for the malfunction. After operational check, always reset switch dial to the proper setting (225° F.).

High Air Temperature Shutdown — Early Models — Early Models of the compressor were protected from high discharge temperature by a temperature switch, with a single probe located in the discharge pipe between the compressor discharge and the oil reservoir. This switch is wired into the motor control circuit and will shut the unit down if the discharge temperature exceeds 225° F. The reset button must be pressed any time unit is shut down due to high air discharge temperature.

DANGER

THIS ADJUSTABLE SWITCH DIAL MUST NOT BE SET HIGHER THAN 225° F.

DO NOT CONTINUE TO RESET CIRCUIT IF THE SAME MALFUNCTION OCCURS WITHIN A SHORT PERIOD OF TIME. FIND AND CORRECT THE TROUBLE BEFORE RESUMING OPERATION. FAILURE TO CORRECT THE PROBLEM MAY RESULT IN DAMAGE TO EQUIPMENT OR PERSONAL INJURY.

This switch should be checked periodically to assure proper operation. To check with unit running, reset switch to the discharge temperature indicated by the discharge temperature gauge. Unit should shut down — if not, switch is inoperative and should be replaced. Always reset switch to proper setting after check (225° F.).

Automatic Blowdown Valve — A pilot-operated valve piped into the oil reservoir final discharge manifold ahead of the check valve and connected to the unloader solenoid valve which is wired into the motor control circuit, will release pressure from the oil reservoir each time the unit is unloaded with low demand mode switch ON or when unit is shut down. The blowdown line is equipped with a muffler to reduce air discharge noise.

Safety Valve (Figures 2-1 & 3-1) — A pressure relief valve is installed in the final discharge manifold and set at the factory to approximately 120% of the specified operating pressure for protection against overpressure. Periodic checks should be made to insure its proper operation. Never operate the unit without a proper safety valve setting.

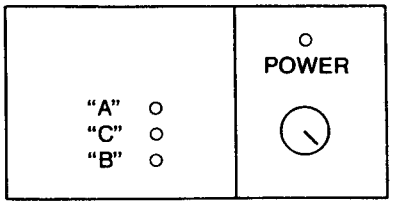
Low Demand Mode Pressure Switch (Figure 1-4) — The low demand mode switch when turned ON will cause the low demand mode pressure switch to de-energize the low demand mode solenoid valve when discharge pressure reaches the set point. This switch should be set approximately 5 PSI above full load pressure with a 8-12 PSI differential.

Low Demand Mode Unloader Solenoid (Figure 1-4) — The low demand mode solenoid valve when energized supplies an air signal to close the blowdown valve. When de-energized, it supplies an air signal to close compressor inlet valve and exhausts air to open the blowdown valve.

Pressure Regulator (Figure 1-4) — The pressure regulator

HIGH DISCHARGE TEMPERATURE SWITCH CONDITION CHART

"A" indicates Temperature Condition at Compressor Discharge.
"B" indicates Temperature Condition at Oil Separator.
"C" indicates Probe Condition.



CONDITION	POWER ON	"A"	"B"	"C"
POWER OFF	OFF	OFF	OFF	OFF
NORMAL TEMPERATURE	RED	RED	RED	OFF
COMPRESSOR HIGH TEMPERATURE	RED	OFF	RED	OFF
SEPARATOR HIGH TEMPERATURE	RED	RED	OFF	OFF
COMPRESSOR PROBE OPEN	RED	OFF	RED	GREEN
SEPARATOR PROBE OPEN	RED	RED	OFF	GREEN
COMPRESSOR PROBE SHORTED	RED	OFF	RED	RED
SEPARATOR PROBE SHORTED	RED	RED	OFF	RED
COMPRESSOR PROBE SHORTED/ SEPARATOR PROBE OPEN	RED	OFF	OFF	ORANGE
COMPRESSOR PROBE OPEN/ SEPARATOR PROBE SHORTED	RED	OFF	OFF	ORANGE

FIGURE 2-4.

must be set 15-20 PSIG to prevent inlet valve "slam".

Reservoir Pressure Switch (Figure 1-4) — A pressure switch is connected to the discharge manifold and wired to the motor control circuit to prevent attempted starting of the unit when there is more than 5 psig pressure in the oil reservoir. This protects the unit from starting against load when the oil reservoir has not had enough time to blow down. Blowdown time is usually about 45 seconds.

WARNING

DO NOT SET THE SWITCH HIGHER THAN 5 PSIG OR RENDER THE SWITCH INOPERATIVE; SEVERE DAMAGE TO THE MOTOR CAN OCCUR IF STARTED WITH PRESSURE IN THE OIL RESERVOIR.

Low Oil Pressure Shutdown (Figure 1-4) — Units are provided with a pressure switch piped to the compressor oil sump and wired into the motor control circuit to protect the unit against operation at too low an oil pressure and against complete lubrication failure due to an oil line restriction or sudden loss of oil pressure. The pressure switch is set 10-15 PSIG and will stop the unit if the oil pressure falls below this pressure any time during operation, and will prevent the unit being started if the oil pressure does not rise to 10-15 PSIG within 10 seconds of starting.

The pressure switch is set at 10-15 PSIG at the factory. If resetting is necessary:

1. Adjust the upper limit pressure to 15 PSIG by turning the slotted screw (pressure) near the top of the switch. Clockwise movement of the screw raises the pressure; counterclockwise lowers the pressure. Note approximate pressure setting is indicated on the range scale on left face of switch.

2. Adjust the lower limit pressure to 10 PSIG by turning the slotted screw (differential) near the bottom of the switch until the cam-shaped calibrated dial under the pressure setting screw indicates about 1/4 of full scale reading from lowest setting. Clockwise movement of the screw reduces the differential; counterclockwise increases differential. Note differential range (1-18 PSI) is indicated by marks on the cam-shaped dial.

   If a unit with Constant Speed with Low Demand Mode Switch shuts down from low oil pressure, pressing the ON button will restart the unit.

Since the Automatic Start/Timed Stop control is an automatic starting type, a reset relay is used as a positive means to interrupt the circuit on either a low oil pressure shutdown or high discharge air temperature shutdown; to restart these units, press the black bar marked RESET and then press the ON button.

DANGER

DO NOT CONTINUE TO RESTART THE UNIT IF THE SAME MALFUNCTION OCCURS WITHIN A SHORT PERIOD OF TIME. FIND AND CORRECT TROUBLE BEFORE RESUMING OPERATION. FAILURE TO CORRECT PROBLEM MAY RESULT IN DAMAGE TO EQUIPMENT OR PERSONAL INJURY.

This switch should be checked periodically to assure proper operation. To check, disconnect the timed-opening instantaneous-closing time delay relay from the system at point 10 (see wiring diagram). Try to start unit — unit should not run — if it does, switch is inoperative and should be replaced. Be sure to reconnect the time delay relay after checking.

Low Oil Pressure Time Delay Switch (Figures 1-4 & 3-4) located in the control panel enclosure, is wired into the control circuit to provide the 10-second delay required for the compressor oil pressure to rise to 10-15 PSIG and energize the low oil pressure switch circuit.

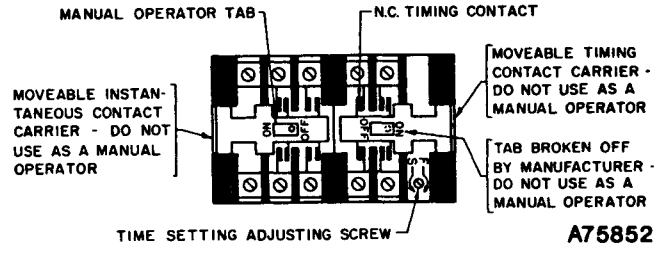


FIGURE 3-4. — LOW OIL PRESSURE TIME DELAY SWITCH

To check the time delay switch setting:

1. Pull main breaker switch.

2. Move black timer tab located on the left half of relay block to the ON position and hold. Timer will begin to run for set time.

3. Observe the action of the right hand set of contacts on the right half of the relay block; the contacts will open when the preset time runs out.

4. Adjustment of time delay setting is made by turning screw on lower right face of relay block to a faster (F) or slower (S) setting. Recheck setting of relay as in No. 2 and 3 above each time screw is turned.

WARNING

TIMER IS FACTORY SET AT 10 SECONDS. NEVER ATTEMPT TO ADJUST TIMING RELAY FOR MORE THAN 15 SECONDS DELAY – SERIOUS COMPRESSOR DAMAGE MAY RESULT FROM OPERATION WITHOUT LUBRICATION FOR EVEN A SHORT PERIOD.

CAUTION

NEVER DISCONNECT SAFETY DEVICES THAT PROTECT THE UNIT.

INSTRUMENTS & GAUGES (Figures 3-1 & 1-4) — Both control system instrument panels incorporate the following:

Hourmeter — A continuous reading (nonreset) type hourmeter displays the accumulated operating time of the unit and provides a convenient means for scheduling changes of oil supply and servicing of filters, separators and other devices.

Air Pressure Gauge — A direct reading air pressure gauge indicates the final discharge air pressure at the discharge manifold.

Discharge Air Temperature Gauge — A direct reading

temperature gauge indicates the compressor discharge air temperature.

Pressure Differential Gauge — This gauge reads the pressure differential across the oil separators providing a continuous monitoring of their condition and indicates when changing of the elements is required.

Air Filter Indicator — An air filter indicator is located on the instrument panel and indicates when the air filter requires servicing.

Oil Filter Indicator — An oil filter indicator is located on the head of the oil filter and indicates when oil filter needs servicing.

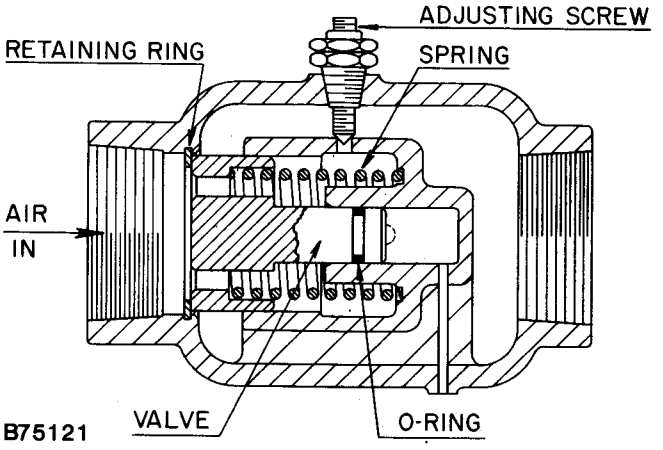


FIGURE 4-4. — MINIMUM DISCHARGE PRESSURE VALVE

MINIMUM DISCHARGE PRESSURE VALVE (Figures 2-1 & 4-4) — An internal spring-loaded minimum pressure valve is used in the final discharge line to provide a positive pressure on the oil system of the compressor even when the air service valve is fully open.

The valve incorporates an orifice which, when air is flowing through it, maintains approximately 65 PSIG in the oil reservoir. A spring-loaded piston valve senses air pressure on the downstream (shop air line side) of the valve. When the system pressure rises above 65 PSIG, the spring is overridden and the valve opens to full porting.

The valve does not require maintenance or adjustment. If the valve fails to function, check the valve stem O-rings for sealing, valve orifices for restriction, or valve and valve seat for burrs and dirt.

The valve is adjustable within a small range. It is adjusted by a set screw secured by a locknut on the side of the valve body. The minimum pressure can be adjusted as follows:

1. Start the compressor.
2. Reduce pressure downstream of minimum pressure valve to below desired minimum pressure. DO NOT REDUCE DOWNSTREAM PRESSURE OR ADJUST VALVE BELOW 65 PSIG.
3. Loosen locknut on adjusting screw.
4. Turn set screw in to increase, or out to decrease minimum pressure to be held.
5. Hold set screw at desired point and tighten locknut.

CHECK VALVE (Oil Reservoir) (Figure 2-1) — A renewable seat swing type check valve in the final discharge manifold prevents backflow of air from the shop air line when the unit stops, unloads or is shut down.

COMPRESSOR CAPACITY CONTROL — The capacity of the compressor is controlled by the action of the Turn Valve and the Compressor Inlet Valve.

The turn valve reduces compressor capacity down to approximately 40% and the inlet valve then throttles the compressor from 40% to approximately 20% compressor capacity.

Example with normal setting of 100 PSIG:

Compressor	Inlet Valve	Turn Valve	Discharge Manifold Pressure
Full Capacity	Open	Closed	100
70% Capacity	Open	50% Open	100
40% Capacity	Open	Full Open	100
30% Capacity	Closing	Full Open	103
20% Capacity	Closing	Full Open	105
0% Capacity	Closed	Full Open	110

On Constant Speed Control with low demand mode switch in the ON position, the reservoir will blow down at below 20% compressor capacity. On Automatic Start/Timed Stop Control with low demand mode switch in the ON position, at below 20% capacity, the reservoir will blow down and

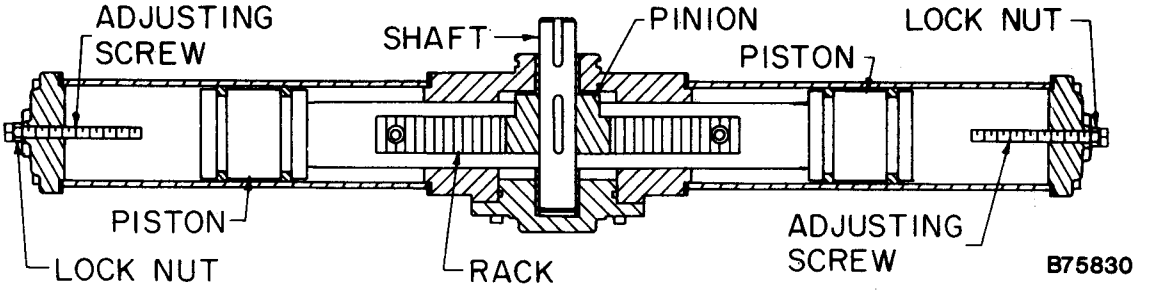


FIGURE 5-4. — TURN VALVE ACTUATOR

the timer will start timing. The unit will stop if air demand does not increase before timer runs out.

On Constant Speed Control and Automatic Start/Timed Stop Control systems with the low demand mode switch in the OFF position, at 20% compressor capacity, the unit will partially unload and continue to run.

The capacity control system pilots and actuator control valve are protected from moisture and dirt by manually drained line filters located just downstream from the turn valve pilot and the inlet valve pilot. The filter should be drained periodically to prevent moisture buildup and carry-over into the control lines.

TURN VALVE — The turn valve is located below and between the two compressor rotors and is an integral part of the compressor. The valve is mounted on two large tapered roller bearings. Rotation of the turn valve opens or closes ports cast in the cylinder. Excess air in rotor pockets returns to the suction, thus reducing amount of air to be compressed. The rotation of this valve is controlled by the turn valve actuator. The tubing connecting the turn valve system is shown in Figure 11-4.

TURN VALVE ACTUATOR (Figure 5-4) — The turn valve actuator is a double-acting hydraulic-operated rack and pinion type rotary actuator with approximately 270° rotation.

There are timing marks on the rack and pinion which must be lined up before actuator is assembled. When mounting actuator to compressor, the turn valve coupling keyways must be 180° apart.

Adjustment is required only when compressor is disassembled. The adjusting screw on the left end (as you look at the discharge end of the compressor) adjusts the open position of the turn valve; the right end adjusting screw adjusts the full closed position of the valve.

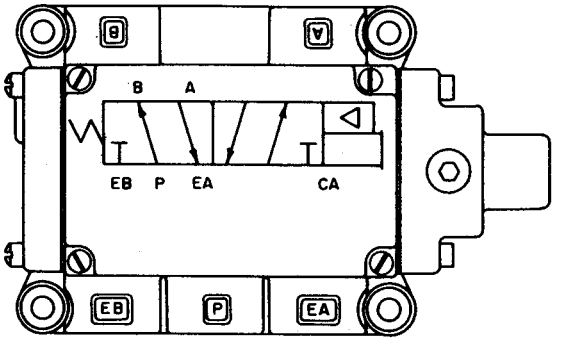


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FIGURE 6-4. — TURN VALVE ACTUATOR CONTROL VALVE

TURN VALVE ACTUATOR CONTROL VALVE (Figure 6-4) — This valve is a pneumatic pilot-actuated 4-way spring-loaded valve with all ports blocked in the centered position. When discharge pressure is below set point, spring pressure returns or holds valve in position to allow oil to flow to the turn valve actuator which rotates turn valve to maximum compressor capacity. When discharge pressure is over set point, the control valve shifts to centered position blocking oil flow and the turn valve actuator is held in that position. When discharge pressure is over the set point, the control valve shifts further to allow oil to flow in the opposite direction to the actuator which rotates the turn valve to a reduced capacity position.

TURN VALVE SUBTRACTIVE PILOT (Figure 1-4) — The turn valve subtractive pilot is a spring-loaded diaphragm-actuated valve that regulates air pressure from the discharge manifold to the pilot port on the turn valve actuator control valve. As the discharge manifold pressure increases, the pilot pressure also increases on the spool valve, moving it toward the center position. At the full load unload pressure, the spool is in the center position. As the discharge manifold pressure raises slightly, the spool will shift rotating the turn valve to open, which unloads the compressor. When the discharge pressure falls, the valve will shift to rotate the turn valve closed. The pilot can be adjusted from 65 to 150 PSIG. This pilot will have a pressure gauge located on the top port.

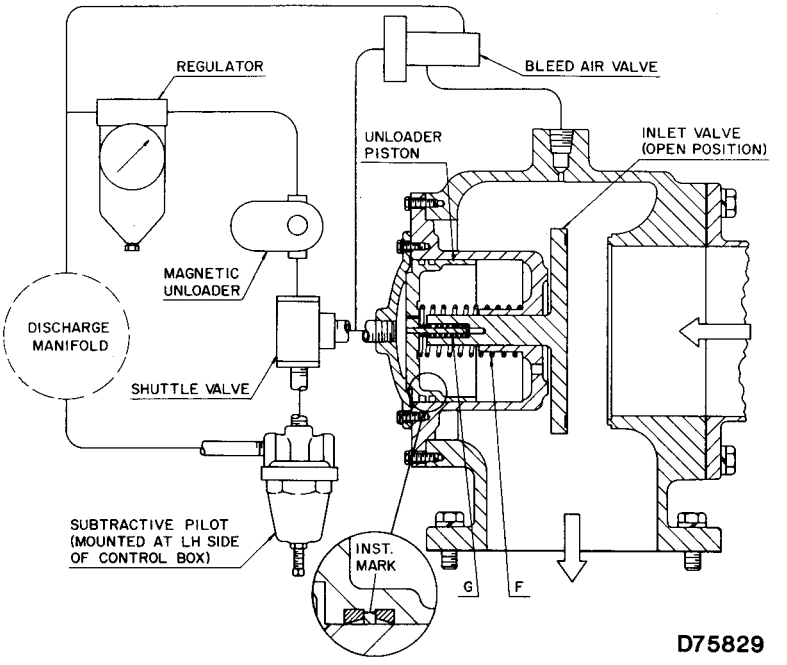

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FIGURE 7-4. — INLET VALVE

INLET VALVE (Figure 7-4) — The inlet valve is a piston-actuated device which controls the compressor inlet and operates on air pressure from the inlet valve subtractive pilot. The valve is closed when full pressure is on the system and changes degree of opening in direct response to system pressure changes.

The inlet valve contains piston spring "F" which returns the unloader piston and allows the inlet valve to open as pressure decreases, and valve spring "C" which returns the inlet valve to a closed position on shutdown of the compressor and prevents oil back-flow from the compressor to the air filter.

The inlet valve piston is lubricated by a separate line which introduces oil from the compressor oil system.

BLEED AIR VALVE — A pilot-operated air valve is provided in the inlet valve system to admit air to the compressor to scavange oil during the unloaded cycle. The inlet valve subtractive pilot admits air to the bleed air valve piston at the

same time as air is being admitted to the inlet valve piston at the beginning of the unloaded cycle. The bleed air valve piston shifts, allowing air to pass from the oil reservoir to the inlet valve behind the closed inlet valve, providing scavenging air as long as the compressor remains unloaded with low demand mode switch OFF.

INLET VALVE SUBTRACTIVE PILOT (Figure 1-4) is the same type that is used on the turn valve actuator control valve. The pilot admits air to the inlet valve piston when a discharge manifold pressure equal to the pilot low setting is reached. The air begins to pass through the pilot to the piston, and the inlet valve begins to close. As the discharge manifold pressure increases the pilot pressure also increases on the inlet valve piston, closing the inlet valve. At full manifold pressure (pilot unload setting) the pilot is exerting full differential pressure on the inlet valve piston and the inlet valve is fully closed. As the discharge manifold pressure falls, the pilot exerts proportionally less pressure on the inlet piston allowing the inlet piston spring to return the piston and the inlet valve to open. The pilot can be adjusted from 65 to 150 PSIG. The differential range of approximately 15 PSI cannot be changed. In order to obtain full capacity at maximum operating pressure, the pilot should be set to unload *with the inlet valve fully closed* at approximately 10 PSIG above the maximum operating pressure.

COMPRESSOR CAPACITY AND PRESSURE ADJUSTMENTS — Any adjustment made affecting the compressor capacity and pressure must be made with care. This is a finely balanced control and must be handled as such if optimum performance is to be obtained from the unit.

Turn Valve Adjustment — Adjustment should be required only when the compressor has been disassembled for repairs. The turn valve should be adjusted so that it blocks all of the cylinder ports (windows) when it is in the closed position, and the ports should be open when it is in the open position. During assembly, the turn valve can be tested by connecting an air source to the actuator (15 to 20 PSI MAXIMUM) to rotate the turn valve.

Refer to "Compressor Overhaul Procedures" 13-9-623 for setting of turn valve to full closed position.

CAUTION

USE CARE WHEN ROTATING THE TURN VALVE WITH AIR PRESSURE. TOO MUCH AIR PRESSURE CAN CAUSE THE ACTUATOR TO SLAM, RESULTING IN GEAR AND SHAFT DAMAGE.

Operating Air Pressure Adjustment — Turn low demand mode switch OFF. Start the unit. Close the air service line valve (furnished by customer), allow the unit to build to full pressure and unload, and proceed as follows:

A. INLET VALVE SETTING — Should be 10 PSI above compressor rating.

Pressure Too High:

1. Loosen the inlet valve subtractive pilot locknut. Back the adjusting screw out about one turn.
2. Open the air service valve and bleed air from the unit so that compressor loads again. Close the valve and allow the compressor to unload.
3. Repeat Steps 1 and 2 until the proper pressure is obtained. Tighten the locknut.

Pressure Too Low:

1. Loosen the inlet valve subtractive pilot locknut.
2. Turn the adjusting screw in until the proper pressure is obtained.
3. Tighten the locknut.

B. TURN VALVE SETTING — With low demand mode switch in the OFF position, compressor running and unloaded (the turn valve pilot gauge should read aproximately 20 PSIG), SLOWLY open the air service line valve and allow pressure to drop until pressure stabilizes — this point is the turn valve pressure setting.

Pressure Too High:

1. Loosen the turn valve subtractive pilot locknut. Back the adjusting screw out until correct pressure is reached.
2. Tighten the locknut.

Pressure Too Low:

1. Loosen the turn valve subtractive pilot locknut.
2. Turn the adjusting screw in until the proper pressure is obtained.
3. Tighten the locknut.

C. SET RESERVOIR BLOWDOWN AND COMPRESSOR UNLOAD.

1. Turn the upper adjusting screw on the low demand mode pressure switch until the pointer on the left edge indicates the desired pressure.
2. Adjust service valve until unit is operating at full load set point.
3. Turn low demand mode switch ON.
4. Close service valve. Note the air pressure when unit blows down. If it is not the pressure desired, repeat Steps 1, 2, and 3 until proper unload pressure is obtained.

D. SET COMPRESSOR LOAD POINT.

1. With unit running, air receiver at full pressure and shop air line valve closed, and low demand mode switch in the ON position, set the lower (differential) adjusting screw on the low demand mode pressure switch near the desired pressure. Full receiver pressure minus the differential is the compressor load point. The differential range is approximately 2-18 PSIG on the circular scale above the adjusting screw. It should be set approximately 10 PSIG.
2. Bleed air from the air receiver and note the pressure at which the compressor loads.
3. Repeat Steps 1 and 2 until desired low receiver

pressure point is obtained.

CAUTION

DO NOT ADJUST THE FULL UNLOADED AIR PRESSURE TO MORE THAN 10 PSIG HIGHER THAN THE MAXIMUM STAMPED ON THE UNIT NAMEPLATE.

MINIMUM OPERATING PRESSURE IS 65 PSIG.

LOW DEMAND MODE CONTROL SYSTEM — The low demand mode control system is suitable for use only on water-cooled or air-cooled units which have the oil cooler module close coupled but not joined or having horizontal remote (located on same level with compressor but at some distance away) mounting from the compressor unit main base.

WARNING

LOW DEMAND MODE CONTROL SYSTEM CANNOT BE USED WITH A REMOTE OVERHEAD MOUNTED OIL COOLER. FAILURE TO HEED THIS WARNING MAY RESULT IN SEVERE DAMAGE TO COMPRESSOR.

CONSTANT SPEED CONTROL SYSTEM WITH LOW DEMAND MODE — This control system is used where there is a demand for air with no long periods of non-usage.

With compressor running with the low demand mode switch in the ON position, the compressor will build to the set pressure and unload, and the air in the oil reservoir will blow down.

During the time the compressor is unloaded with the motor running, the unit draws only about 20% of the power required on load at 100 PSIG.

With the low demand mode switch in the OFF position, the compressor oil reservoir will not blow down when the compressor unloads.

Electrical Wiring — Figures 12-4, 13-4, 14-4 and 15-4 are the wiring diagrams for the units with Constant Speed Control System.

AUTOMATIC START/TIMED STOP CONTROL SYSTEM WITH LOW DEMAND MODE — This control system is used where the air requirements vary widely, change in frequency of demand and where it is desirable to have some degree of control over the length of time the motor will run after the compressor unloads.

The Automatic Start/Timed Stop Control System offers three modes of operation controlled by turning the low demand mode switch and/or the timer. Constant Speed, and Automatic Start/Timed Stop both with or without low demand mode.

Constant Speed Operation: When the low demand mode switch is in the OFF position, the compressor will build to full pressure and unload and continue to run unloaded.

Automatic Start/Timed Stop Operation: When the low demand mode switch is in the ON position and when the timer is set between 0 and 30, the unit will start and the inlet valve open when the pressure in the receiver falls to the pressure switch low setting.

When the pressure rises to the pressure switch high setting, the unit will unload (LOAD light off), the inlet valve will close, the motor will continue to run and the oil reservoir will blow down. If the system pressure does not fall to the pressure switch low setting within the time set on the timer, the unit will stop.

The ON indicator light will remain on as long as the On-Off switch ON pushbutton is depressed. When air is again required, the unit will start, the timer will reset and the loaded-unloaded-stop cycle will repeat.

The timer must never be set at a time less than that indicated by the minimum run time caution plate on the instrument panel.

Use of less time of run interval will allow excessive motor starts and cause shortened motor life or failure.

When the low demand mode switch is in the ON position and timer is positioned so the letter "N" in MINUTE" is opposite the green arrow mark on the escutcheon, the compressor will build to full pressure, unload and blow down. At this setting the motor will not time out and stop.

MINIMUM RUN TIME SETTING FOR AUTOMATIC START/TIMED STOP CONTROL	
Size	Time (Minutes)
All	6

Electrical Wiring — Figures 16-4 and 17-4 are the wiring diagrams for the units with Automatic Start/Timed Stop Control System.

VIBRATION SWITCH (Optional Equipment) — The optional vibration shutdown switch, mounted on the compressor coupling cover, detects an increase in vibration that could be an indication of impending damage to the unit. The switch actuates when the selected level of vibration is exceeded.

The switch MUST BE ADJUSTED when the unit is first installed. Refer to switch manufacturer's instruction manual for complete details.

AUXILIARY AIR RECEIVER — An auxiliary air receiver with adequate volume must be used with both control systems to prevent rapid cycling of the unit. Occasionally shop air lines are of such a length as to provide adequate volume, but this should be carefully checked before using the unit without an auxiliary air receiver.

LOW STARTING TORQUE (Unloaded Start) CONTROL (Optional Equipment) — When a reduced voltage closed transition starter is used, problems may arise as the torque required by the compressor may exceed that available from the compressor drive motor during and just after the starting cycle. This is especially true when a unit uses full motor horsepower at some pressure lower than 100 PSIG. The Low Starting Torque Control holds the compressor inlet valve closed for a short period while the motor is starting and reduces internal air loads and the compressor torque.

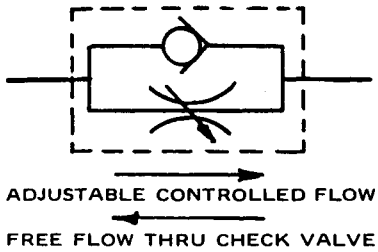


FIGURE 8-4. — FLOW CONTROL/CHECK VALVE

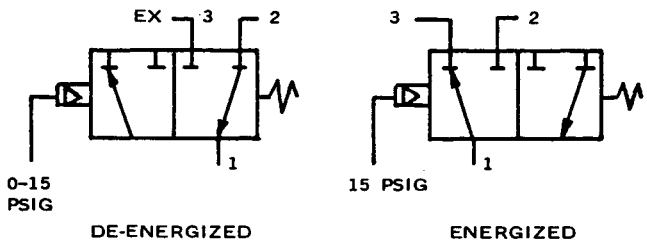


FIGURE 9-4. — THREE-WAY VALVE

CAUTION

THIS CONTROL WILL FUNCTION PROPERLY ONLY WHEN THE LOW DEMAND SWITCH IF OFF. IF THE LOW DEMAND SWITCH IS ON, THE LOW TORQUE CONTROL WILL REACT TO ALL DEMANDS FOR AIR AS INITIAL START-UP AND DELAY BUILDUP IN AIR PRESSURE FOR THE TIME DELAY BUILT INTO THE SYSTEM.

The control allows the compressor to build up a pressure of approximately 15 PSIG in the oil reservoir which is directed to the pilot on the inlet valve to close the valve and unload the compressor while the motor reaches full load speed. A pneumatic timing circuit then bleeds the pressure off the inlet valve pilot after approximately 10-15 seconds, allowing the compressor to load up and operate normally.

The control consists of a flow control-check valve, a small surge chamber, a normally open three-way air valve, and a shuttle valve.

The **Flow Control-Check Valve** consists of a check valve and an adjustable orifice in one body; see Figure 8-4.

The **Three-Way Valve** (Figure 9-4) requires 15 PSIG control pressure to shift the valve.

In operation (Figure 10-4), the adjustable orifice in the flow control check valve controls the rate at which presure will build in the surge chamber; the unloaded starting time is proportional to the pressure buildup time. When the pressure in the surge chamber reaches 15 PSIG, the three-way valve will shift, bleed control pressure from the inlet valve

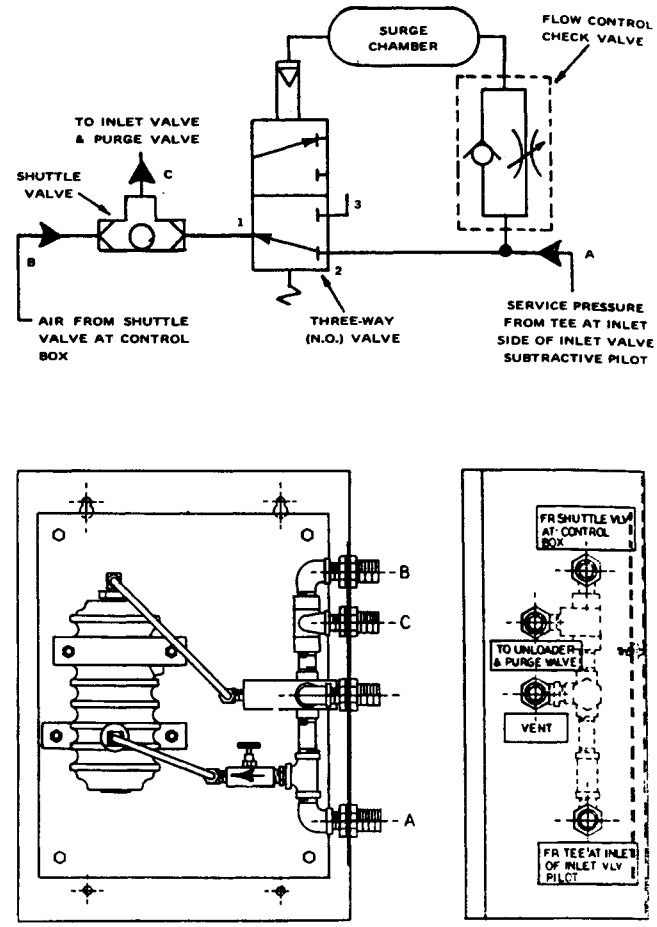


FIGURE 10-4. — SCHEMATIC AND OUTLINE — LOW STARTING TORQUE CONTROL

and purge valve, and allow the compressor to load.

See Figure 10-4 for the complete Low Starting Torque Control assembly. Figure 11-4 is the unit tubing diagram with control in place.

RESERVOIR PRESSURE SWITCH — The reservoir pressure switch will prevent motor damage if an attempt to start motor is made before the reservoir is completely blown down. The pressure switch will not allow the motor to be restarted after the unit has stopped, until the pressure in the reservoir is below 5 PSIG. The switch pressure is sensed at the separator tower section of the oil reservoir. The switch is factory set at 5 PSIG, with an adjustable range of 3-30 PSIG.

WARNING

DO NOT SET SWITCH TO PRESSURE ABOVE 5 PSIG OR DAMAGE TO MOTOR MAY RESULT.

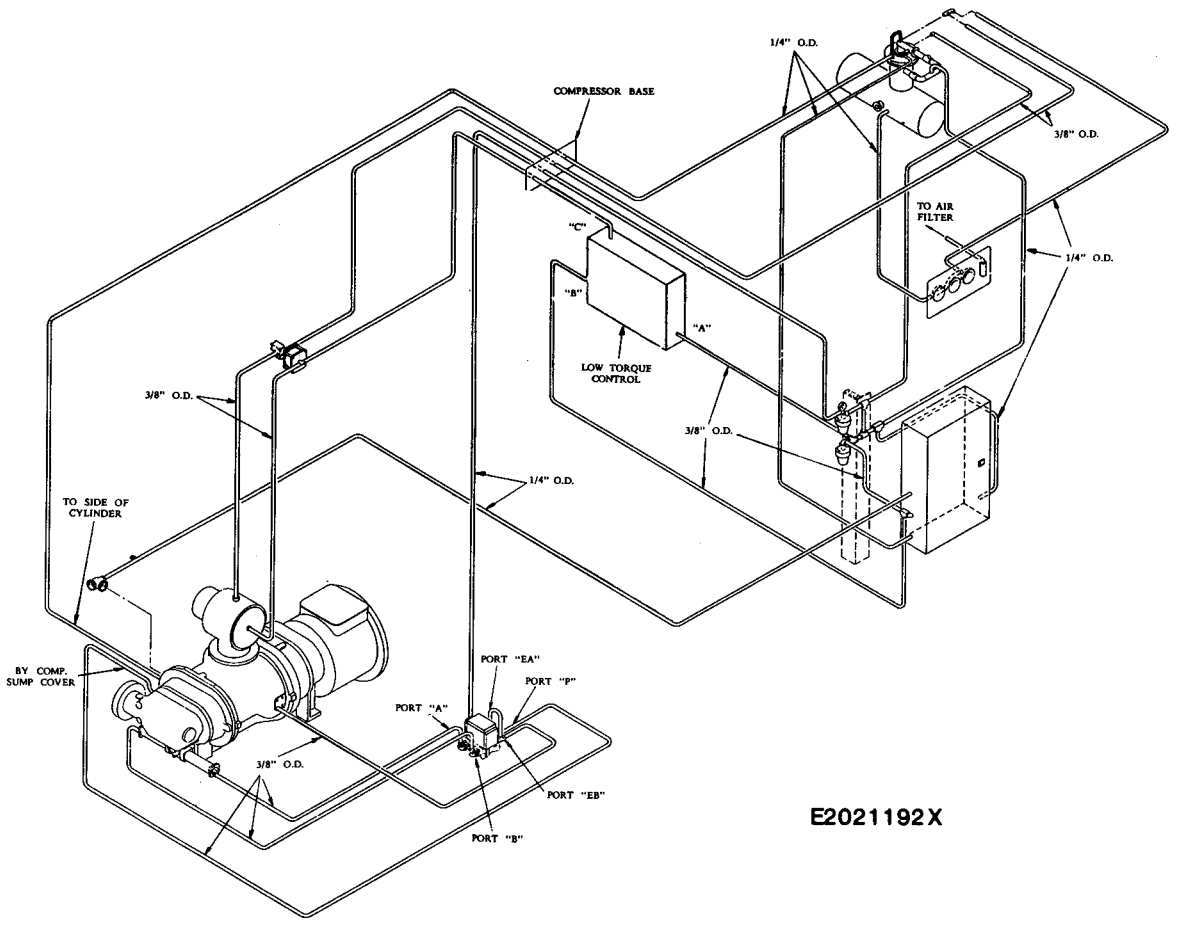


FIGURE 11-4. — CONTROL TUBING WITH LOW STARTING TORQUE CONTROL

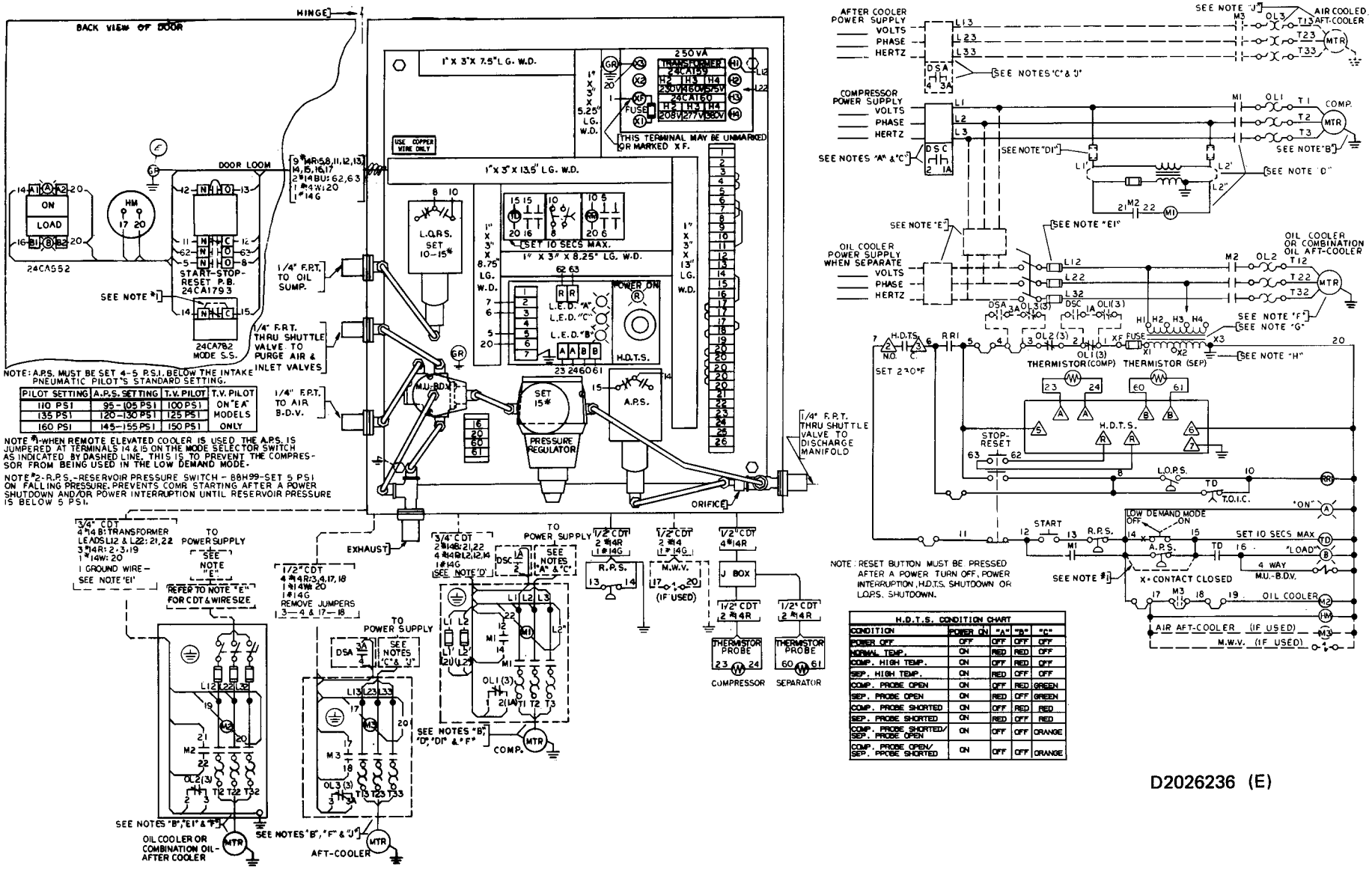
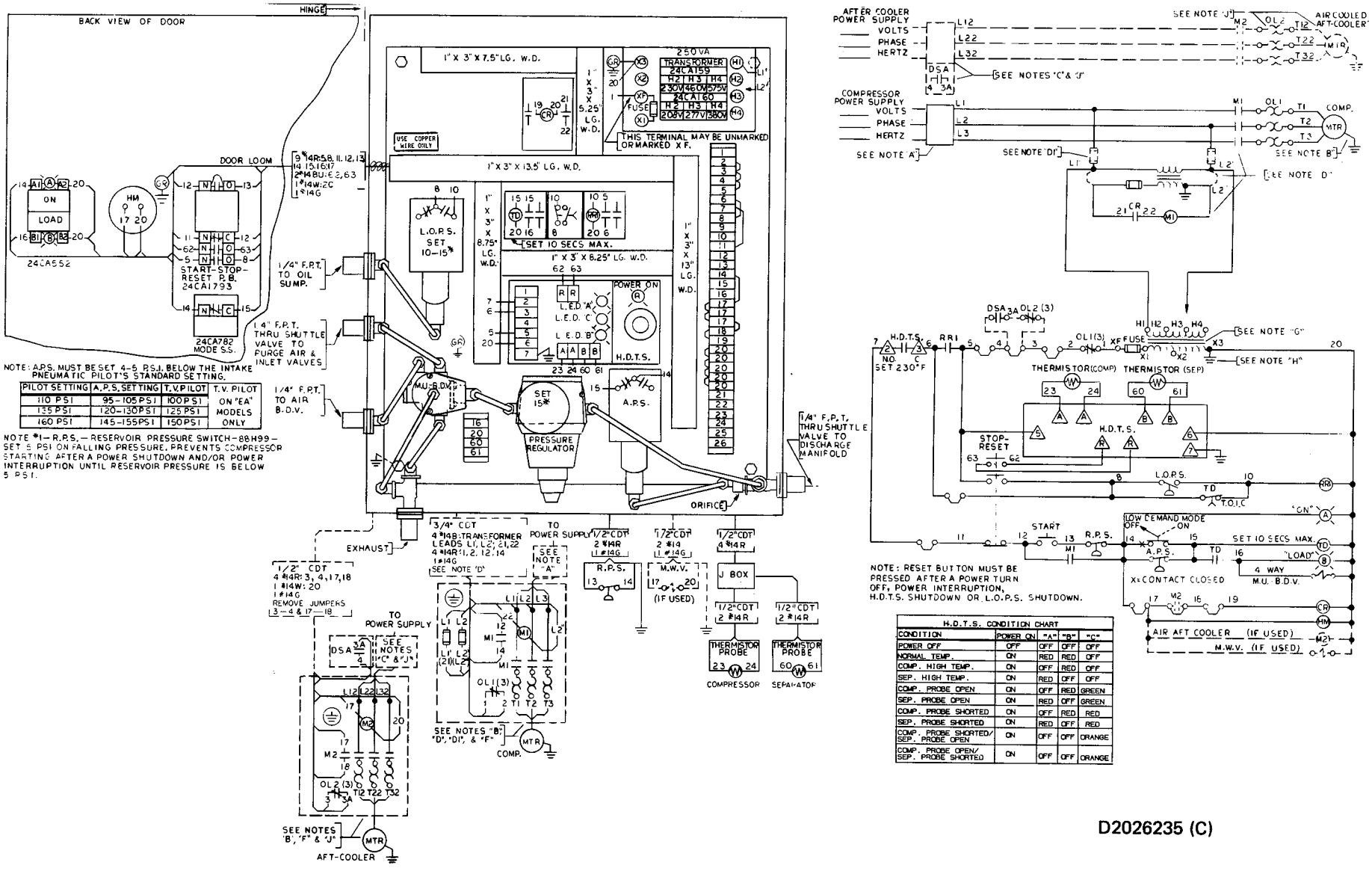


FIGURE 12-4. — WIRING DIAGRAM — AIR-COOLED UNITS — CONSTANT SPEED WITH LOW DEMAND MODE SWITCH

(FOR NOTES, SEE SECTION 4, PAGE 17)



NOTE: A.P.S. MUST BE SET 4-5 P.S.I. BELOW THE INTAKE PNEUMATIC PILOT'S STANDARD SETTING.

PILOT SETTING	A.P.S. SETTING	T.V. PILOT	T.V. PILOT
110 PSI	95-105 PSI	100 PSI	ON "EA" MODELS ONLY
135 PSI	120-130 PSI	125 PSI	
160 PSI	145-155 PSI	150 PSI	

NOTE *1 — R.P.S. — RESERVOIR PRESSURE SWITCH — 88H99 — SET 5 PSI ON FALLING PRESSURE, PREVENTS COMPRESSOR STARTING AFTER A POWER SHUTDOWN AND/OR POWER INTERRUPTION UNTIL RESERVOIR PRESSURE IS BELOW 5 PSI.

NOTE: RESET BUTTON MUST BE PRESSED AFTER A POWER TURN OFF, POWER INTERRUPTION, H.D.T.S. SHUTDOWN OR L.O.P.S. SHUTDOWN.

H.D.T.S. CONDITION CHART

CONDITION	POWER ON	"A"	"B"	"C"
POWER OFF	OFF	OFF	OFF	OFF
NORMAL TEMP.	ON	RED	RED	OFF
COMP. HIGH TEMP.	ON	OFF	RED	OFF
SEP. HIGH TEMP.	ON	RED	OFF	OFF
COMP. PROBE OPEN	ON	OFF	RED	GREEN
SEP. PROBE OPEN	ON	RED	OFF	GREEN
COMP. PROBE SHORTED	ON	OFF	RED	RED
SEP. PROBE SHORTED	ON	RED	OFF	RED
COMP. PROBE SHORTED/ SEP. PROBE OPEN	ON	OFF	OFF	ORANGE
COMP. PROBE OPEN/ SEP. PROBE SHORTED	ON	OFF	OFF	ORANGE

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FIGURE 13-4. — WIRING DIAGRAM — WATER-COOLED UNITS — CONSTANT SPEED WITH LOW DEMAND MODE SWITCH

(FOR NOTES, SEE SECTION 4, PAGE 17)

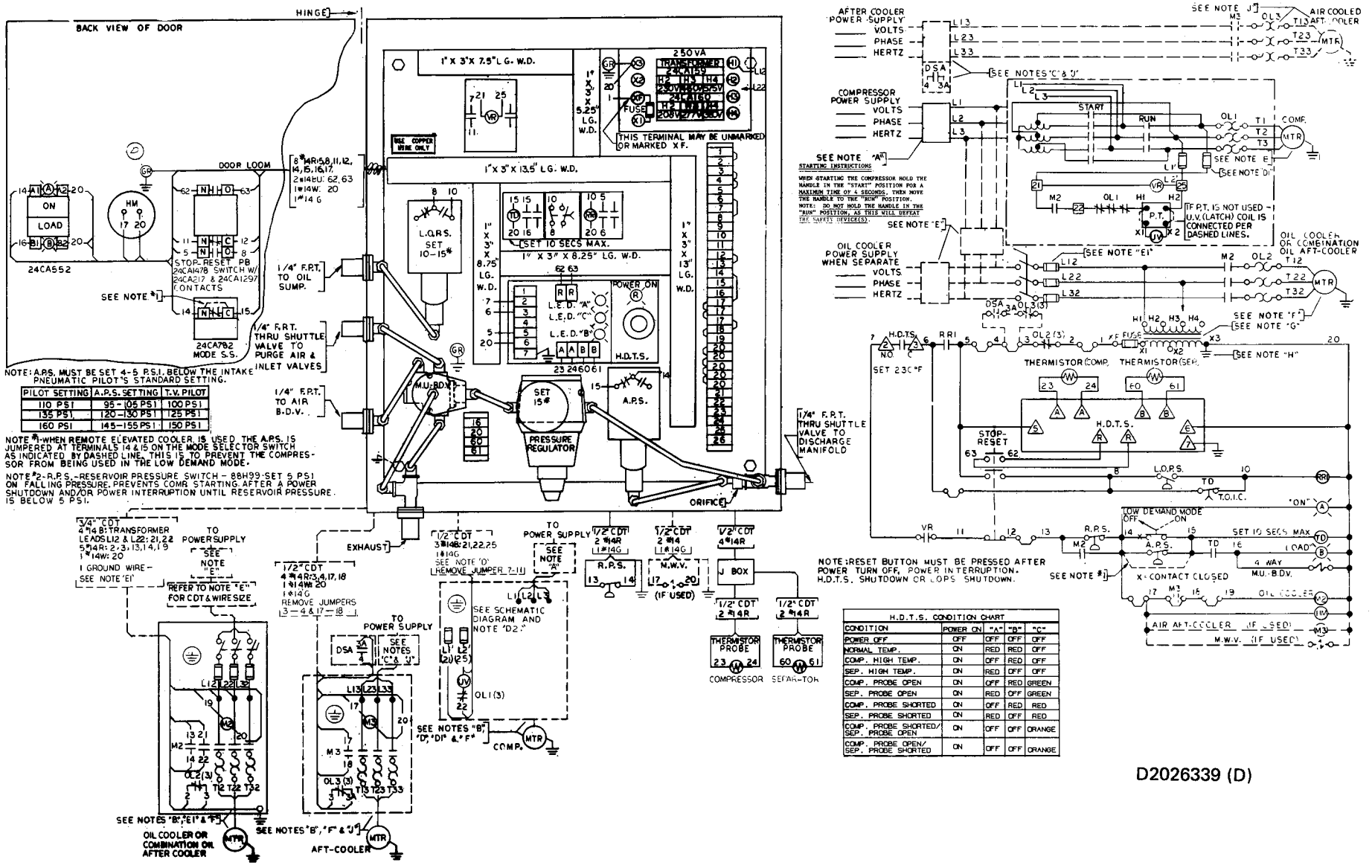


FIGURE 14-4. — WIRING DIAGRAM — AIR-COOLED UNITS — CONSTANT SPEED WITH LOW DEMAND MODE SWITCH WITH MANUAL REDUCED VOLTAGE STARTER

(FOR NOTES, SEE SECTION 4, PAGE 17)

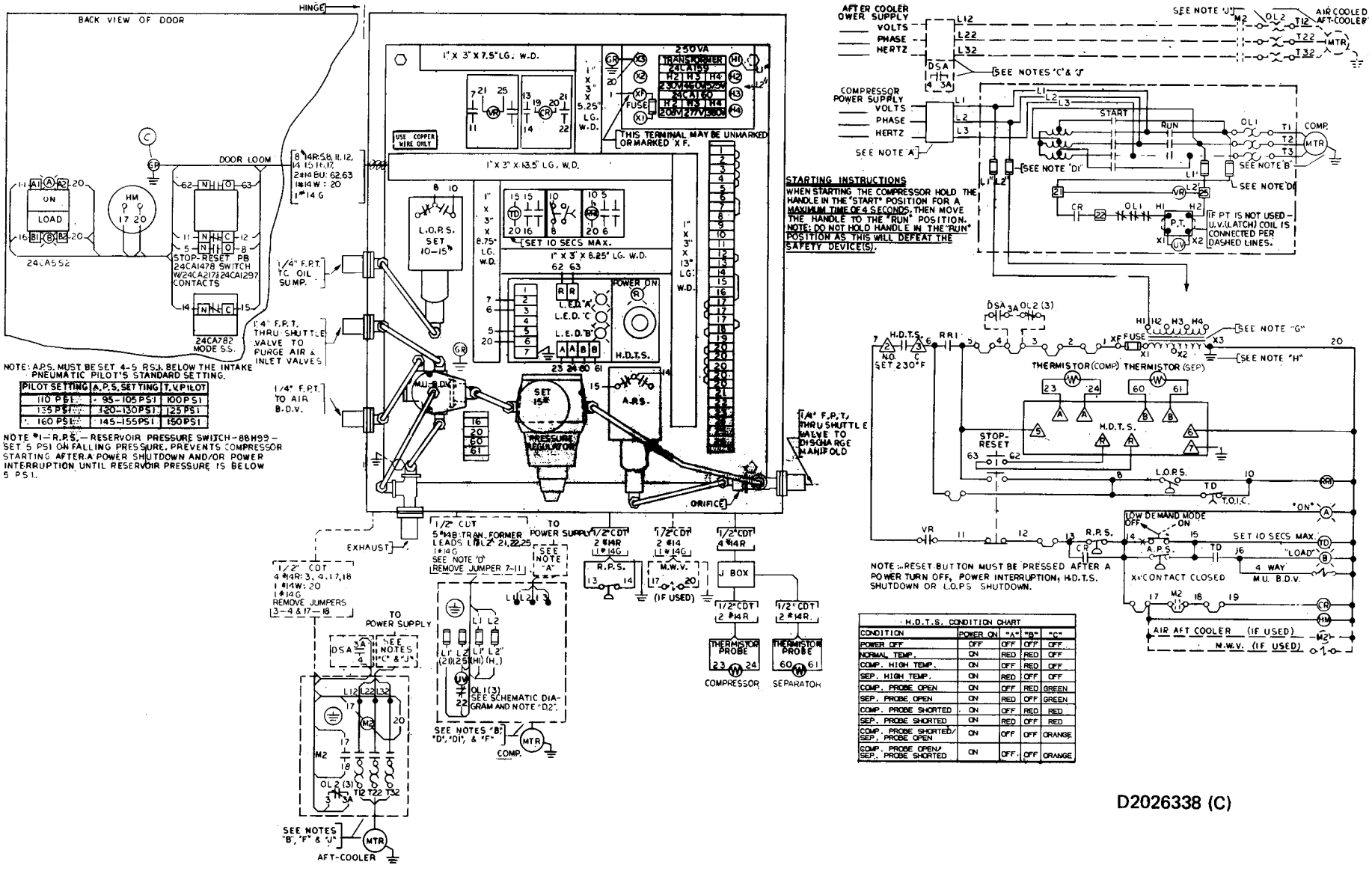


FIGURE 15-4. — WIRING DIAGRAM — WATER-COOLED UNITS — CONSTANT SPEED WITH LOW DEMAND MODE SWITCH WITH MANUAL REDUCED VOLTAGE STARTER

(FOR NOTES, SEE SECTION 4, PAGE 17)

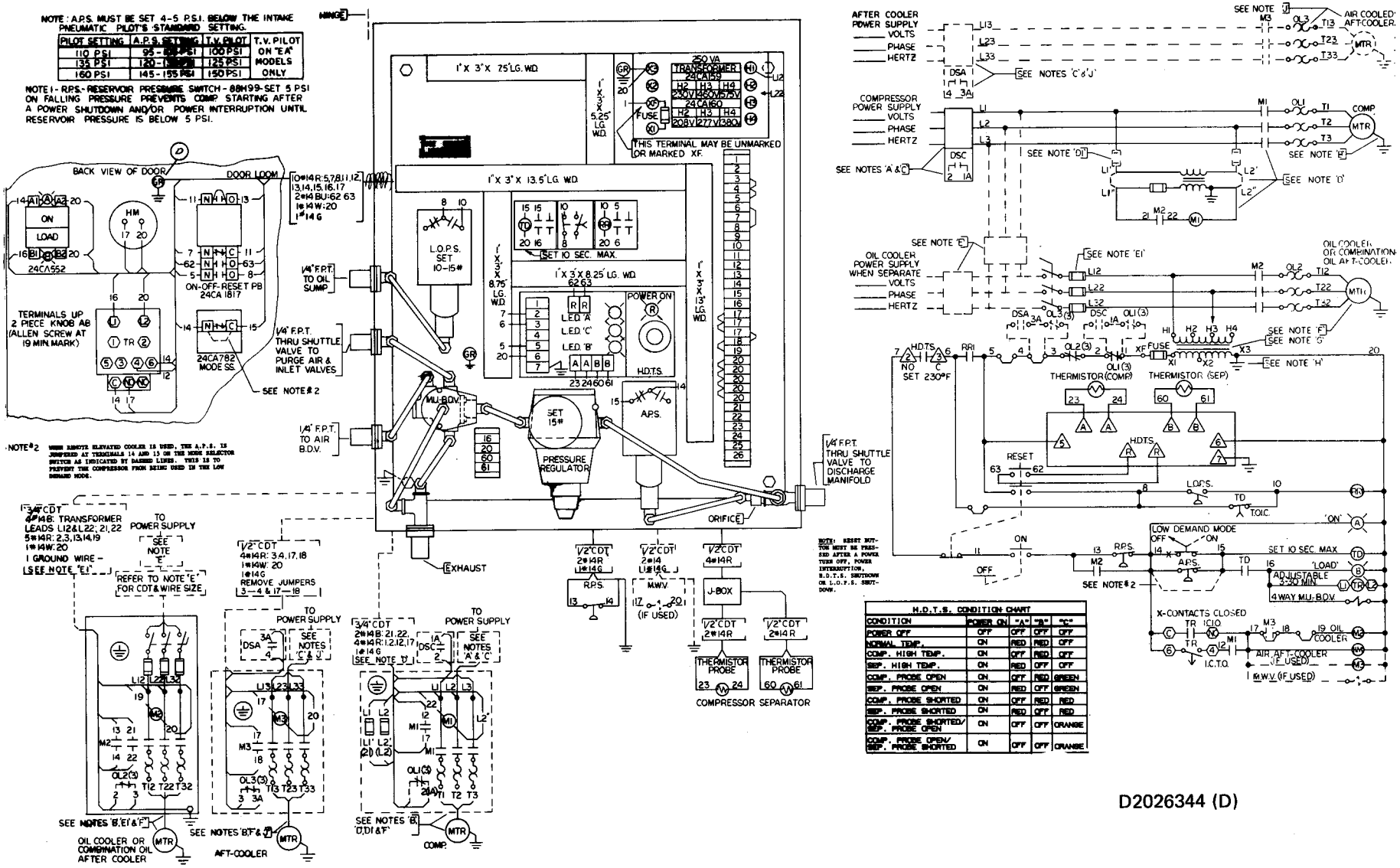


FIGURE 16-4. — WIRING DIAGRAM — AIR-COOLED UNITS — AUTOMATIC START/TIMED STOP WITH LOW DEMAND MODE SWITCH

(FOR NOTES, SEE SECTION 4, PAGE 17)

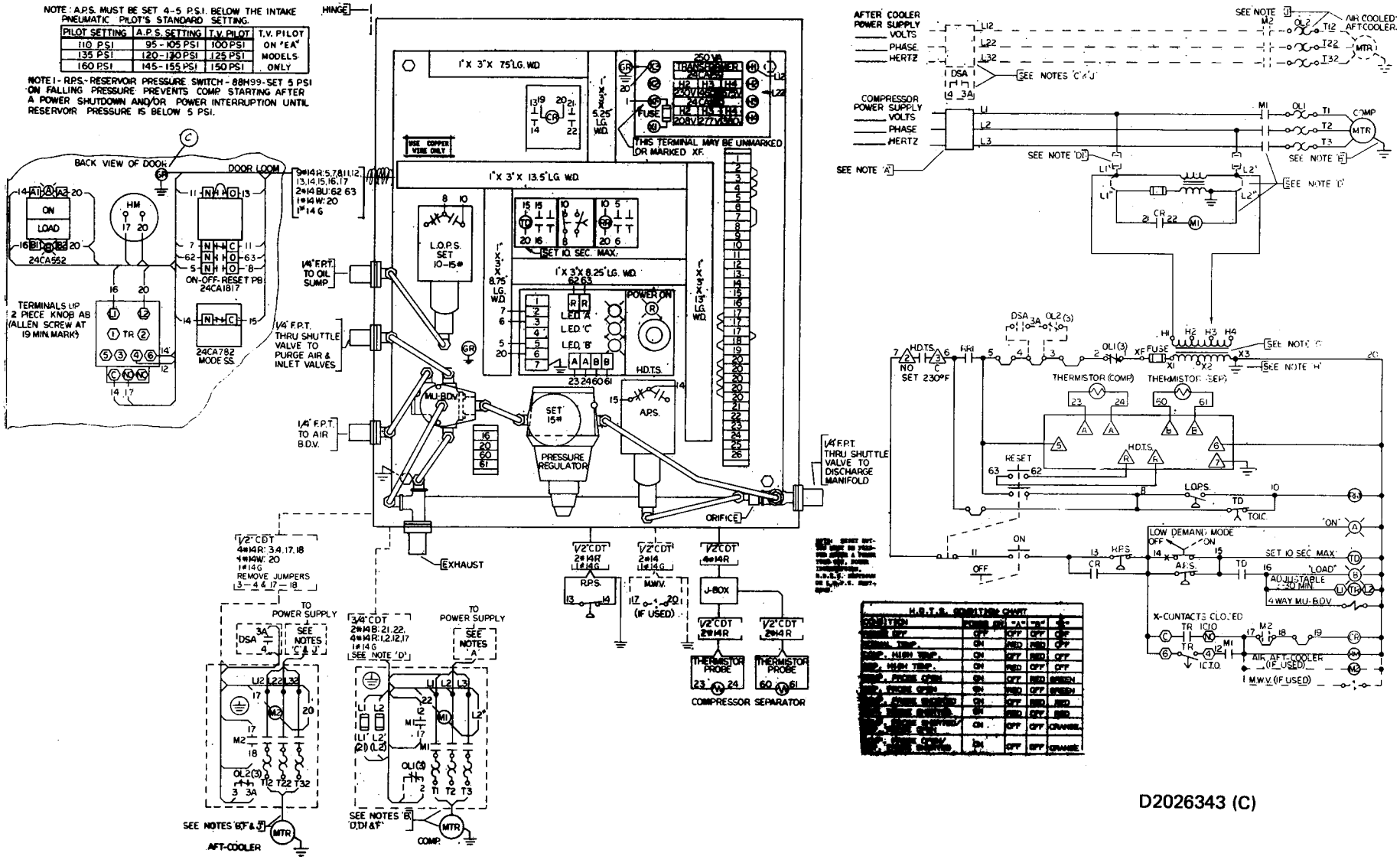


FIGURE 17-4. — WIRING DIAGRAM — WATER-COOLED UNITS — AUTOMATIC START/TIMED STOP WITH LOW DEMAND MODE SWITCH

(FOR NOTES, SEE SECTION 4, PAGE 17)

NOTES FOR WIRING DIAGRAMS

(Figures 13-4 thru 17-4)

ALL NOTES ARE NOT APPLICABLE TO ALL WIRING DIAGRAMS — READ CAREFULLY AND COMPLETELY FOR WIRING INSTRUCTIONS.

All equipment must be connected and phased exactly as shown. All piping, wiring and other equipment not specified on order is to be supplied by other than Gardner-Denver/Industrial Machinery.

"A" — Compressor power supply disconnecting means — Fused Switch or Circuit Breaker (not furnished as a standard item — if ordered, it must be remote mounted and wired by customer).

"B" — Equipment must be grounded in accordance with Table 250-95 of the National Electrical Code.

DANGER

AN EQUIPMENT GROUND JUMPER EQUAL IN SIZE TO THE EQUIPMENT GROUND CONDUCTOR MUST BE USED TO CONNECT THE COMPRESSOR MOTOR BASE TO THE MAIN BASE BECAUSE THE BASES ARE ISOLATED FROM EACH OTHER BY VIBRATION MOUNTS. FAILURE TO OBSERVE THIS NOTICE COULD RESULT IN INJURY TO OR DEATH OF PERSONNEL.

The oil cooler motor (when used) is grounded to the starter as shown. The ground conductor for this motor is compatible to the motor short circuit protection.

"C" — When the control circuit voltage is from a separate power (voltage) source and is not controlled by the motor power supply disconnecting means, a disconnect switch (DS) interlock (not furnished) shall be mounted immediately adjacent to the motor power supply disconnecting means and wired by the customer as shown in the Schematic Wiring Diagram and per the data shown for that starter and its disconnecting means.

This interlocking device (DS) may be an Auxiliary (Aux.) or Electrical Interlock (E.I.) contact operated by the handle of the motor power supply disconnecting means.

When this disconnect switch (DS) interlock is a separate device, it shall be used to turn the control circuit "OFF" before operating the motor power supply disconnecting means. See Article 430-74 of the National Electrical Code.

"D" — The compressor motor starter is remote mounted and wired by the customer.

All reduced voltage (current inrush) starters, manual and magnetic, are also remote mounted and wired by the customer. See reduced voltage starter note on page 20.

The compressor motor starter coil voltage shall be the same as the motor voltage, i.e., 200, 230, 460 volts, etc., unless the starter is ordered with its own fused control transformer. The contact (relay or fan-oil cooler starter interlock) from the compressor control panel to the remote mounted starter control circuit is rated 600 volts.

Remote mounted magnetic compressor starter control circuits are to be connected for TWO (2) WIRE control.

The remote compressor starter control wiring shall be interlocked with the rest of the control wiring as shown in the Schematic Wiring Diagram and per the wiring data shown for the remote starter. The internal wiring shown is typical only. For exact wiring, see diagram on inside of starter or diagram supplied with starter.

"D1" — Motor control circuits must be fused in accordance with article 430-72 of the National Electrical Code. Control circuits shall have short circuit protection (fuses, etc.) in all instances because the control circuit wiring leaves the starter enclosure to go to the external devices.

An ESG66459 Electrical Group with Buss Limitron KTK15 (600V-15A) Fuses will be furnished in addition to starter control fuses for water-cooled compressors with remote mounted manual reduced voltage starters.

Customer is to mount and wire fuses using the following mounting data: Fuse Block Mounting Data — Approximate area 2-1/2" L x 3" H — Mounting centers 2.1" No. 29 Drill (.1360) two holes for No. 8 self-tapping screws furnished with fuse block and fuses.

"D2" — A G.E. CR234 air break manual starter is shown. The undervoltage (latch) coil circuit for the G.E. oil break and other manufacturers' manual starters is to be similarly reconnected and interlocked as shown with the compressor control wiring.

"E" — Oil Cooler power supply disconnecting means — Fused Switch or Circuit Breaker. NOT FURNISHED — and is remote mounted and wired by customer.

Wire and conduit in the following table is sized for S.F. T.E.A.O. motors when used. This table may also be used for T.E.F.C. motors or refer to N.E.C. for T.E.F.C. motors.

"E1" — Fused combination starter mounted on separate oil cooler module in NEMA 1 enclosure unless specified NEMA 4 for outdoor usage. The oil cooler module is remote from the compressor and the interconnecting wiring is not furnished. This interconnecting wiring (by customer) is to be interlocked with the rest of the control wiring as shown in the Schematic Wiring Diagram and per the wiring data shown for oil cooler starter. The remote oil cooler equipment ground wire must be

H.P.	Voltage	Wire Size	Conduit
3	200 V	No. 12 TW	1/2"
3	230-575 V	No. 14 TW	1/2"
5	200 V	No. 10 TW	1/2"
5	230 V	No. 12 TW	1/2"
5	460-575 V	No. 14 TW	1/2"
7-1/2	200 V	No. 8 TW	3/4"
7-1/2	230 V	No. 10 TW	1/2"
7-1/2	460-575 V	No. 14 TW	1/2"
10	200 V	No. 6 TW	1"
10	230 V	No. 8 TW	3/4"
10	460-575 V	No. 12 TW	1/2"

Interconnecting Equipment Ground		
H.P.	Voltage	Ground Wire
3	200 V	No. 12
3	230-575 V	No. 14
5	200-230 V	No. 12
5	460-575 V	No. 14
7-1/2	200-230 V	No. 10
7-1/2	460 V	No. 12
7-1/2	575 V	No. 14
10	200-230 V	No. 10
10	460 V	No. 12
10	575 V	No. 14

connected to the main control panel as shown. Use the Interconnecting Equipment Ground Table to determine ground wire size. Fuses are sized for HP and voltage.

"F" — Since most AC motors are wound for dual voltage, be certain leads are connected per the motor nameplate for the correct voltage.

"G" — Control transformers are sized for the components shown in the Schematic Wiring Diagram on 115 volts and not for any remote mounted compressor starter controls.

Transformer part number is shown on the wiring diagrams.

"H" — Control circuit ground. A green ground wire is connected from the terminal shown on the wiring diagram to the control panel.

"J" — Air-cooled aftercooler with its starter and its power supply disconnecting means (Fused Switch or Circuit Breaker) with disconnect switch (DS) interlock — see Note "C" — (Not furnished as standard item — if ordered, it is remote mounted and wired by customer.)

The aftercooler (when sized for an individual compressor) starter coil is 120 volts and is wired and interlocked with the rest of the control wiring as shown in the Schematic Wiring diagram and per the wiring data shown for the aftercooler starter with its disconnecting means.

When the aftercooler is sized for more than one compressor, see instructions for aftercooler starter coil on the special wiring diagram or sketch.

THE FOLLOWING COMPONENTS ARE NOT USED ON ALL UNITS

(See Wiring Diagram For Usage)

A.P.S. — Air Pressure Switch — 2009006 — Set and/or Reset per table on wiring diagram.

The "Low Demand Switch" is furnished to provide low unloaded horsepower when the requirement for air is low. Turning the switch to "ON" switches the A.P.S. into the control circuit.

It is necessary to make sure the unload-load cycle time is greater than 45 seconds or else oil mist will be carried into the air lines. The unload-load cycle time can be increased in the same manner described for excessive starts.

Excessive starting of the motor can and will cause premature motor failure. Too frequent starting causes excessive heat which deteriorates the motor insultation. Excessive starting may be reduced by lowering the A.P.S. cut-in point (increasing differential) or by adding additional receivers to increase the system air storage capacity or both. The elimination of air leaks will also reduce the number of motor starts.

B.D.V. — 1" — 2-Way Normally Open — 2W.N.O. Air Operated Valve — 90AR114.

B.D.V.'s are sized to blow down oil reservoir in approximately 45 seconds. If the compressor is started or loads up (low unloaded HP only) before the reservoir is blown down, the compressor may be starting under load which may cause motor failure, and/or oil mist will be carried over into the lines.

BOOT — 24CA281 — Transparent for PB's when NEMA 4.

C.R. — Control Relay — 24CA771 — 110/120 V — 50/60 Hz Coil — 2S.P.N.O. Convertible 600 Volt Contacts.

D.S.A. — Disconnect Switch Interlock — Aftercooler.

D.S.C. — Disconnect Switch Interlock — Compressor.

FUSE — 2-1/4 AMP — 250 Volt — Time Delay Type. Tan Terminal Board — 24CA158 (Buss FRN 2-1/2 or Equal). Blue Terminal Board — 24CA1026 (Buss MDL 2-1/2 or Equal).

H.D.T.S. — High Discharge Temperature Switch — Set 230° F.

Single Probe Controller — 24CA779. Thermister Probe 24CA780.

Dual Probe Controller — 21D80. Thermistor Probe — 21D81 (2 Required).

△ — Terminals on Temperature Switch.

H.M. — Hourmeter — 2009369 — 120 V — 60 Hz (Alternate 2009370 — 110 V — 50 Hz).

I.C.I.O. — Instant Closing — Instant Opening.

I.C.T.O. — Instant Closing — Timed Opening.

I.O.I.C. — Instant Opening — Instant Closing.

I.O.T.C. — Instant Opening — Timed Closing.

L.O.P.S. — Low Oil Pressure Switch — 88A301. Set 10-15 PSI.

NOTE:
When starting unit for first time at final installation loosen tube fitting on bottom of pressure switch. After compressor is started and oil appears at the fitting, tighten fitting. If compressor shuts down on low oil pressure on the first start, wait until all the air has been bled off thru the blowdown valve before pressing reset button and restarting the compressor.

M. — Motor Starter Coil, Contacts, etc. The oil cooler starter furnished as standard equipment has 110/120 V — 50/60 Hz coils. (See Note "D" for Compressor Starter.)

M.U.-B.D.V. — Magnetic Unloader — Blowdown Solenoid Valve — 110/120 V — 50/60 Hz — Four Way — 91B34.

The LOW DEMAND MODE switch should be in the "OFF" position when starting the unit to keep the compressor from cycling rapidly if service valve is closed.

M.W.V. — Magnetic Water Valve — 110/120 V — 50/60 Hz — Two-Way Normally Closed — 2W.N.C.

WATER-COOLED OIL COOLER †	
NEMA 1	NEMA 4
91B3 — 1-1/2"	91B24 — 1-1/2"

M.W.V.'s are also shown on the Wiring Diagrams for Water-Cooled Aftercoolers (when used) and are to be sized for the aftercooler (if used).

O.L. — Overload — Heater  Contacts  .

R.P.S. — Reservoir Pressure Switch (not standard on early models) — 88H99. Set 5 PSI falling pressure. Prevents compressor starting after a power shutdown and/or power interruption until reservoir is below 5 PSI.

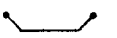
R.R. — Reset Relay — 24CA541 — 110/120 V — 50/60 Hz Coil — 2S.P.N.O. Convertible 300 Volt Contacts. Used with all automatic start controls which have low oil pressure shutdown. This relay gives LOW VOLTAGE PROTECTION which means a manual reset is required after every power turnoff or interruption. See the appropriate control wiring diagram for additional control switch components and resetting instructions.

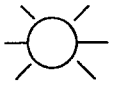
T.C.I.O. — Timed Closing — Instant Opening.

T.D. — Time Delay Relay — 24CA285 — 110/120 V — 50/60 Hz Coil — is set for a maximum of 10 seconds to establish oil pressure after each start-up. If the TD timing coil fails the compressor will not load when started and will unload if running when control is constant speed. If the TD timing relay fails on an auto-start timed-stop control the compressor will not start; if running, unit will unload and continue running unloaded for the time setting of TR.

T.O.I.C. — Timed Opening — Instant Closing.

V.R. — Voltage Relay
200 Volts — 60 Hz — 24CA772
230 Volts — 60 Hz — 24CA773
380/460 Volts — 50/60 Hz — 24CA774
575 Volts — 60 Hz — 24CA775

 — Jumpers On Terminal Blocks (T.B.)

 — Indicating Light — 24CA40 (Sylvania 120 PSB or Equal).

ADDITIONAL COMPONENTS
WHEN COMPRESSOR CONTROL IS OTHER THAN CONSTANT SPEED
(See Wiring Diagram Title For Type Of Compressor Control)

T.R. — Timing Relay (Auto-Start/Timed Stop Only) — 24A482 (Thru Door Mounting) — 110/120 V — 50/60 Hz Coil — 24A515 (Inside Panel Mounting) — 110/120 V — 50/60 Hz Coil.

DO NOT SET TIMER DIAL BETWEEN THE 0 AND 6 MINUTES.

See remarks following A.P.S. If compressor remains unloaded for time set on timer dial head (adjustable to 30 minutes), compressor will stop and then start up when needed.

To make compressor run Constant Speed, set timer dial head so the letter "N" in "Minute" is opposite the green arrow mark on the escutcheon. When timer dial is set for Constant Speed operation and compressor is not running, compressor will not start until air is required (A.P.S. closes).

⬡ — Terminals On T.R. Timing Relay.

Special Notes, Components, Parts Numbers and Description, will be shown on Wiring Diagrams requiring the special notes and/or components.

REDUCED VOLTAGE STARTER NOTE

1. Two extra Normally Open Auxiliary contacts are required on most magnetic autotransformer reduced voltage starters. These contacts are required to interlock the compressor starter back to the 115 volt compressor control.

   To determine whether or not these N.O. Aux. contacts are required, look at the typical wiring diagram shown in most starter manufacturers' control handbook, digest, catalog, etc. If the typical wiring diagram shows two or more contacts paralleling the start pushbutton, then these Aux. contacts are required.

   If the typical wiring diagram shows a control (timing) relay, with or without control transformer, then the additional contacts are not required.

   Generally, these Aux. contacts are to be ordered for the start and run contactors. If these Aux. contacts are not ordered with the starter, then the starter manufacturers' field installation kits for Aux. contacts will have to be ordered and used.

   These two N.O. Aux. contacts, when required, will be supplied if Quincy orders the starters.

2. STARTING (All Types Reduced Voltage Starters)

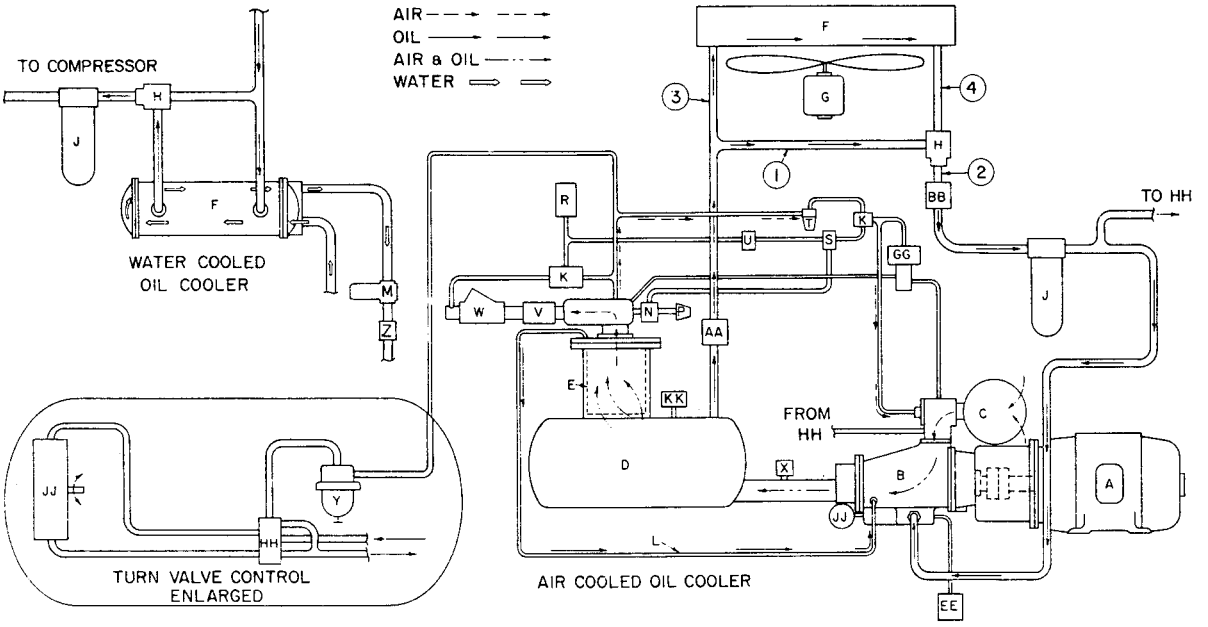
   The first point acceleration time should not be longer than 4-5 seconds. This is in order that the pressure buildup in the compressor will not bog down nor stall the motor when the starter goes from the start to the run mode.

   NOTE:
   First point acceleration time may be limited to 2-3 seconds on some part winding motors.

   On magnetic reduced voltage starters, set the starter timer for 4-5 seconds. If the starter is of the manual type, then do not hold the handle in the start position longer than 4-5 seconds.

   NOTE:
   LOW TORQUE CONTROL IS PREFERABLE FOR ALL TYPES OF REDUCED VOLTAGE STARTING.

SECTION 5
LUBRICATION
OIL COOLER, OIL FILTER & SEPARATOR



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A — MOTOR
B — COMPRESSOR
C — AIR FILTER
D — OIL RESERVOIR
E — OIL SEPARATOR
F — OIL COOLER
G — FAN AND MOTOR
H — THERMAL CONTROL (THERMOSTATIC MIXING VALVE
J — OIL FILTER
K — SHUTTLE VALVE
L — SEPARATOR TO CYLINDER OIL RETURN LINE
M — WATER FLOW CONTROL VALVE
N — PNEUMATIC BLOWDOWN VALVE
P — BLOWDOWN MUFFLER
R — OPERATING AIR PRESSURE SWITCH
S — MAGNETIC UNLOADER
T — SUBTRACTIVE PILOT (INLET VALVE)
U — PRESSURE REGULATOR
V — MINIMUM DISCHARGE PRESSURE VALVE
W — DISCHARGE CHECK VALVE
X — HIGH DISCHARGE TEMPERATURE SHUTDOWN SWITCH
Y — SUBTRACTIVE PILOT (TURN VALVE)
Z — MAGNETIC WATER SHUTOFF VALVE
AA — OIL LINE CHECK VALVE (REMOTE OVERHEAD OIL COOLER ONLY)
BB — OIL STOP VALVE (REMOTE OVERHEAD OIL COOLER ONLY)
EE — LOW OIL PRESSURE SWITCH
GG — BLEED AIR VALVE
HH — TURN VALVE DIRECTIONAL VALVE
JJ — TURN VALVE ACTUATOR
KK — RESERVOIR PRESSURE SWITCH

FIGURE 1-5. — FLOW DIAGRAM — AIR-OIL SYSTEMS

COMPRESSOR OIL SYSTEM (Figures 1-5 and 2-5) cools the compressor, lubricates moving parts and seals internal clearances in the compression chamber.

The oil suction line is connected at the bottom of the oil reservoir. Air pressure in the oil reservoir forces oil through the oil cooler, thermostatic mixing valve, oil filter, and into the compressor main oil gallery.

The oil passes through internal passages for lubrication, cooling and sealing during the compression cycle. After compression the air-oil mixture is discharged to the oil reservoir where most of the entrained oil is removed by impingement and velocity change. The air and remaining oil then passes through the final oil separator. The separated oil is returned to the compressor oil system and the air passes to the final discharge line.

OIL SPECIFICATIONS — The recommended compressor lubricant is *Gardner-Denver*® "GD800 Lubricating Coolant" which can be used for year-round operation except as noted in the High Temperature Operation paragraph below. GD800 Lubricating Coolant is a superior petroleum base lubricant formulated and containing additives for use in *Electra-Saver*® compressors.

CAUTION

MIXING OF DIFFERENT TYPES OR THE USE OF INFERIOR LUBRICANTS WILL RESULT IN THE FORMATION OF HEAVY VARNISH AND SLUDGE THROUGHOUT THE SYSTEM.

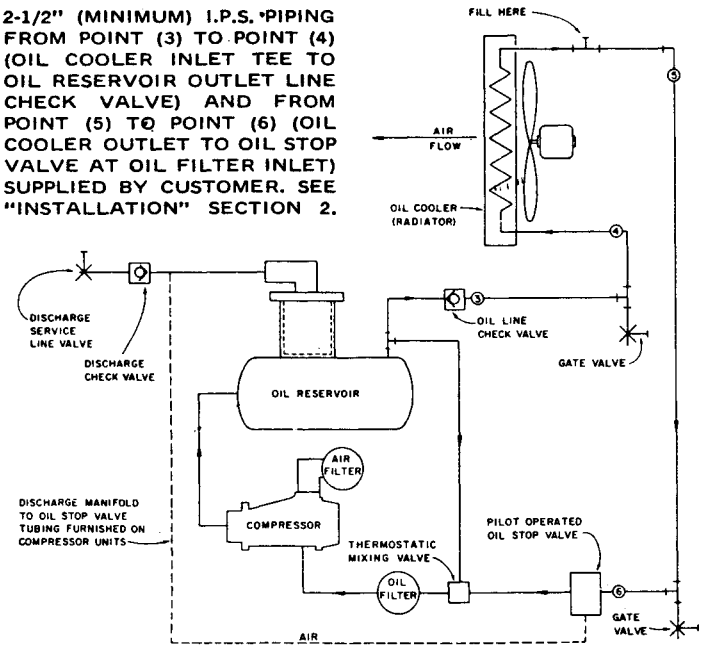

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FIGURE 2-5. — OIL FLOW DIAGRAM — REMOTE OVERHEAD MOUNTED OIL COOLER

Recommended Oil	Temperature Range
Gardner-Denver® GD800 Lubricating Coolant	Year-round operation at discharge temperatures to 200° F.
Gardner-Denver® GD8000 Lubricating Coolant	Over four (4) hours sustained discharge temperature between 200-210° F.

FIGURE 3-5. — COMPRESSOR LUBRICANT

SYNTHETIC LUBRICANTS — Certain synthetic lubricants such as synthetic hydrocarbons, diester or polyesters offer an extended drain interval when used in screw compressors. A superior diester lubricant is available in *Gardner-Denver*® "GD8000 Lubricating Coolant" which can extend lubricant change interval from 2 to 4 times that of GD800. A good lubricant analysis program for periodic check of lubricant quality and remaining life can maximize the change interval. See the instructions on use of GD8000 in systems previously filled with other lubricants under "High Temperature Operation" below.

WARNING

DO NOT MIX GD800 AND GD8000 LUBRICATING COOLANTS OR OTHER PETROLEUM OR SYNTHETIC LUBRICANTS. MIXING MAY RESULT IN FORMATION OF VARNISH OR SLUDGE.

CAUTION

REGARDLESS OF SYNTHETIC LUBRICANT CHANGE INTERVAL USED, OIL FILTER AND OIL SEPARATOR CHANGE INTERVALS REMAIN THE SAME AS FOR GD800 – SEE MAINTENANCE SCHEDULE, SECTION 8.

HIGH TEMPERATURE OPERATION — If the discharge temperature is sustained between 200-210° F. for a period of more than four (4) hours due to continuing high ambient air or water temperatures, use *Gardner-Denver*® "GD8000 Lubricating Coolant" which is a superior viscosity grade diester synthetic lubricant. Short periods of up to four (4) hours of sustained discharge temperatures up to 210° F. do not require a change from the recommended year-round lubricant GD800.

When installing GD8000, the original lubricant should be drained completely and the system flushed before filling with GD8000. Complete draining will involve removal of all plugs in the compressor, oil reservoir and oil lines. In some cases, piping may require removal to insure complete draining. To insure complete removal of the original lubricant, good practice indicates draining of the original lubricant, refill with GD8000, operation for 100 hours, then draining and final refill.

WARNING

DO NOT MIX GD800 AND GD8000 LUBRICATING COOLANTS OR OTHER PETROLEUM OR SYNTHETIC LUBRICANTS. MIXING OF LUBRICANTS MAY RESULT IN FORMATION OF VARNISH OR SLUDGE.

WARNING

DO NOT SET THE HIGH DISCHARGE AIR TEMPERATURE SWITCH ABOVE 225° F TO COMPENSATE FOR HIGH TEMPERATURE OPERATION. DAMAGE TO EQUIPMENT OR PERSONAL INJURY MAY RESULT.

Use caution when selecting GD8000 lubricant, as some down-stream air system components such as air line lubricator bowls, gaskets and valve trim may not be compatible. Check with the component supplier for suitability of the part with diester synthetic lubricant. All materials used in *Electra-Saver*® compressor units are compatible with GD8000.

COLD AMBIENT OPERATION — *Gardner-Denver*® "GD800 Lubricating Coolant" must be used when the ambient temperature drops to +40° F. in the space enclosing the compressor unit/oil cooler module. See "Installation for Cold Weather Operation" in Section 2.

If a synthetic lubricant is used, a lighter viscosity lubricant than *Gardner-Denver*® GD8000 is necessary in the temperature range of +10° F. to –40° F. The lighter viscosity lubricant must have foam depressant, oxidation and corrosion inhibiting characteristics equal to those of GD800 and meet these minimum specifications:

Viscosity at 100° F. ..... 140 SUS
Viscosity at 210° F. ..... 44 SUS
Pour Point ..... –60° F.

ADDITION OF OIL BETWEEN CHANGES must be made when level of oil in the gauge is below the RUN range while the unit is operating.

DANGER

STOP UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. FAILURE TO RELEASE PRESSURE MAY RESULT IN PERSONAL INJURY OR DEATH.

Wipe away all dirt around the oil filler plug (Figure 3-1). Remove the oil filler plug and add oil as required to return the oil level to the center of the RUN range when the unit is operating. The quantity required to raise the oil level from the top of the ADD range to the centerline of the RUN range is shown in Figure 4-5. Repeated addition of oil between oil changes may indicate excessive oil carry-over and should be investigated.

OIL LEVEL GAUGE (Figure 3-1) indicates the amount of oil in the oil reservoir. When the unit is stopped the oil level will be higher in the RUN range than when operating on load. When the unit is operating the oil level should be near the center of the RUN range. In normal operation the oil level will fluctuate slightly as the compressor loads and unloads. Add oil only when the oil level gauge indicates in the ADD OIL range when the compressor is loaded. Drain oil only when the oil level gauge indicates EXCESS OIL when the compressor is loaded.

MOISTURE IN THE OIL SYSTEM — In normal humidity and with normal operating temperatures and pressures, the thermal mixing valve controls the oil temperature and prevents moisture contamination of the oil. Unusual cooling of the oil reservoir, short loaded cycle in high humidity, malfunctions of the thermal valve or cooling water system may result in moisture in the oil system which would be detrimental to compressor lubrication. If moisture is observed in the oil reservoir, drain the moisture and correct the condition causing the accumulation. See "Compressor Oil System Check" and "Thermal Control (Thermostatic Mixing) Valve" in this section.

OIL CHANGE INTERVAL is determined by air filter maintenance, operating conditions and quality of oil. Good practice is to change oil often enough that the drained oil is relatively clean. Under good operating conditions *Gardner-Denver*® GD800 may be used up to 2000 hours of operation. When operating conditions are severe (very dusty, high humidity or high temperature) it will be necessary to change the oil more frequently. Operating conditions and appearance of drained oil must be surveyed and the oil change intervals planned accordingly by the user. A good lubricant analysis program is helpful in planning change interval.

CAUTION

CHANGE THE OIL FILTER EVERY 1000 HOURS.

DRAINING AND CLEANING OIL SYSTEM —

DANGER

STOP UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. REMOVAL OF OIL FILLER PLUG WHILE RESERVOIR IS PRESSURIZED MAY RESULT IN PERSONAL INJURY OR DEATH.

Always drain the complete system. Draining when the oil is hot will help to prevent varnish deposits and to carry away impurities. To drain the system, use one of the following methods:

If the unit is not elevated high enough to use the oil reservoir drain valve to drain oil, a small hand-, electric- or air-operated pump should be used to drain reservoir through the oil filler opening or from the drain valve. Remove oil cooler drain.

If the unit is elevated so that the oil reservoir drain valve can be used, empty the oil reservoir, then remove the oil cooler drain plug.

If the drained oil and/or the oil filter element are contaminated with dirt, flush the entire system: reservoir, oil cooler, mixing valve and lines. Inspect the oil separator elements for dirt accumulation; replace if necessary. If a varnish deposit exists, contact factory for recommendations for removal of the deposit and prevention of recurrence.

Size	Approximate System Capacity (Initial Fill)	Oil Reservoir Capacity** (Refill)	Quantity Top Of ADD To Centerline Of RUN
100 HP	Air Cooled* - 34 Water Cooled - 32	30	8
125 HP	Air Cooled* - 34 Water Cooled - 32	30	8
150 HP	Air Cooled* - 34 Water Cooled - 32	30	8

* System capacity shown is for the initial fill of the compressor unit and oil cooler module ONLY — remotely mounted oil coolers will require additional oil to fill the piping between the compressor unit and the oil cooler.

** The oil reservoir refill quantity shown is measured at the centerline of the oil level gauge RUN range or approximately 3.5 inches below the centerline of the oil reservoir.

FIGURE 4-5. — OIL SYSTEM CAPACITIES (APPROXIMATE) — U.S. GALLONS

FILLING OIL RESERVOIR —

DANGER

STOP UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. FAILURE TO RELEASE PRESSURE MAY RESULT IN PERSONAL INJURY OR DEATH.

Wipe away all dirt before removing the oil filler plug (Figure 3-1). Refer to "Oil System Capacities" Figure 4-5 for the oil quantity required to fill the compressor oil system. This amount may bring the oil level into the EXCESS OIL range on the gauge. After a short time of operation, the oil level will drop into the RUN range as oil fills other parts of the system. Maintain the oil level in the RUN range. On unloaded operation and after shutdown some oil will drain back into the oil reservoir and the oil level gauge may read in EXCESS OIL range. DO NOT DRAIN OIL TO CORRECT. On the next start, oil will again fill the system and the gauge will indicate the operating oil level. DO NOT OVERFILL as oil carryover will result. Use only CLEAN containers and funnels so no dirt enters the reservoir. Provide for clean storage of oils. Changing oil will be of little benefit if done in a slipshod manner.

COMPRESSOR OIL FILTER (Figure 5-5) — This replaceable element filter is a vital part in maintaining a trouble-

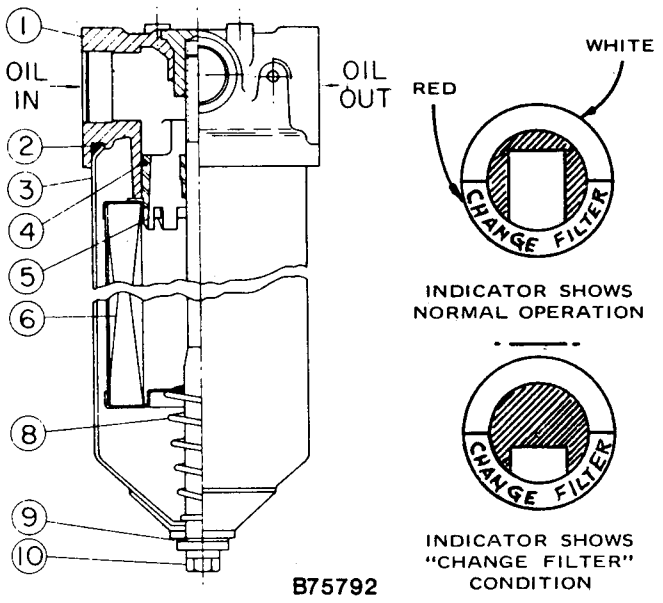

FIGURE 5-5. — COMPRESSOR OIL FILTER

free compressor, since it removes dirt and abrasives from the circulated oil. The filter is equipped with a relief valve that opens in the event the element becomes dirty enough to block the flow of oil.

CAUTION

ELEMENT MUST BE REPLACED EVERY 1000 HOURS OR SOONER, OR WHEN TOP OF THE INDICATOR ON THE FILTER IS IN RED "CHANGE FILTER" HALF OF WINDOW. THE UNIT MUST BE RUNNING AND WARMED UP FOR INDICATOR TO READ ACCURATELY. CHECK WITH LIGHT TO BE CERTAIN OF INDICATOR POSITION – SOME LUBRICANTS WILL OBSCURE THE INDICATOR.

Use only the replacement element shown on the filter tag or refer to the parts list for the part number. Use the following procedure to replace the filter element. Do not disturb the piping.

1. **DANGER**

STOP UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. FAILURE TO RELEASE PRESSURE MAY RESULT IN PERSONAL INJURY OR DEATH.

To remove cannister (3) rotate tie bolt (10) counterclockwise until cannister is free of head assembly (1).

2. Remove the element (6) from cannister. Remove indicator assembly (5) from the element by inserting screwdriver between indicator assembly and element and carefully prying downward. Inspect O-ring (4) for cuts or excessive wear and discard the element. Rinse out cannister with clean fluid to remove any contamination.

3. Remove O-ring (2) from head assembly and inspect for cuts or excessive wear. Wipe O-ring area of head (1) with clean cloth and after covering O-ring with oil, reinstall in head assembly. Check the indicator assembly (5) machined bore in the head for burrs or deep scratches and carefully smooth out if required.

4. Install indicator assembly (5) into new element. Place the element into cannister making sure spring (8), washer gasket (9) and tie bolt (10) are in the proper position.

NOTE:
LARGE DIAMETER END OF SPRING SHOULD CONTACT THE NEW ELEMENT.

5. Place cannister as previously assembled into head assembly and rotate bolt clockwise until torqued to 20 foot-pounds.

6. If leakage appears at bottom of cannister, replace washer gasket (9). If leakage appears at top of cannister replace O-ring (2). If this does not stop the leakage, the cannister may be nicked or distorted by overtorquing and should be replaced.

COMPRESSOR OIL COOLER (RADIATOR TYPE) MODULE — The air-cooled oil cooler module is remote mounted.

The oil cooler requires pipe and electrical connection to the main compressor unit. Connecting piping and wiring are furnished by the user. See "Installation" Section 2.

Do not obstruct the air flow to and from the oil cooler. Allow two (2) feet clearance on all sides of the oil cooler.

See Figure 2-2 for cooling air flow requirements. Keep both faces of the oil cooler core clean for efficient cooling of the compressor oil. Oil cooler malfunctions may be traced by checking oil pressure drop through the oil cooler; check by installing pressure gauges at fittings in the inlet and outlet oil piping near the end of the cooler. At normal operating air service pressures (65 to 150 PSIG) with the unit warm, a pressure drop of 2 to 25 PSIG can be expected between the inlet and outlet side of the cooler. The instrument panel thermometer indicates compressor discharge air temperature which would also be the approximate oil temperature into the mixing valve.

An oil filler stand pipe and plug must be located in the piping on the oil cooler module for ease of filling the oil cooler when it is mounted at a distance from the compressor unit.

When filling a remotely mounted oil cooler, be sure all lines to and from the compressor unit are also filled to prevent excessive drawdown of the oil supply in the oil reservoir. A vent line should be installed between the oil cooler and compressor oil reservoir as an aid in filling and to prevent siphoning.

THERMAL CONTROL (THERMOSTATIC MIXING) VALVE (Figure 6-5) on current units is installed in system as shown in Figure 1-5 (on early units this valve is in line between reservoir and cooler). This valve is used to control temperature of the oil in both radiator and tube type oil cooler systems. The element is so designed that a portion of the oil can flow through the oil cooler at all times. On start-up with unit cold, element is open to bypass, allowing oil to pass directly from the reservoir to compressor during warm-up. As oil warms, element gradually closes to the bypass allowing more of the oil from the cooler to mix with oil from the bypass. After unit is warmed up, mixing valve maintains oil injected into compressor at a minimum of

160° F. (on early units compressor discharge temperature is maintained at a minimum of 70° F. above ambient temperature). This system provides proper compressor warm-up and prevents moisture contamination of the oil.

To check element, heat in oil — it should be fully extended at 160° F. (180° F. for early units). If unit shuts down due to high air discharge temperature, the cause may be that the element is stuck open to the bypass, in which case lines 1 and 2 (Figure 1-5) will be hot to the touch and lines 3 and 4 much cooler. When flushing the oil system, remove mixing valve and clean all parts thoroughly.

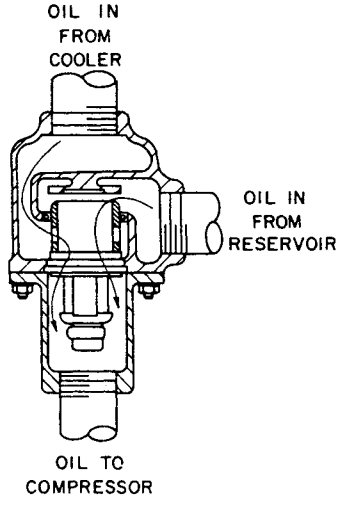

FIGURE 6-5. — THERMAL CONTROL (THERMOSTATIC MIXING) VALVE

COMPRESSOR OIL COOLER — WATER-COOLED HEAT EXCHANGER (Figure 3-1) — The heat exchanger oil cooler is a multiple pass type, with water in the tubes and oil in the shell. The oil temperature is controlled by the thermal control (thermostatic mixing) valve. The optional water control valve may be used to conserve water.

Oil cooler malfunction may be traced by checking pressure at oil inlet and outlet. Fitting in the oil cooler at these locations are equipped with a pipe tap for a gauge. At normal operating air service pressure (65 to 150 PSIG) with unit warm, a pressure drop of 2 to 25 PSI can be expected between the oil inlet and the oil outlet.

Water pressure drop from water inlet to outlet will vary with the inlet pressure and amount of water flowing. A normal pressure drop may range from 5 to 10 PSI. Any change in the pressure drop from that normally held may indicate tube leakage or fouling and should be investigated.

In many instances, the cooling water supply for the heat exchanger will contain impurities dissolved in solution and/or in suspension. These substances can cause scale formations, corrosion and fouling (plugging) of any water-cooled heat exchanger equipment. Disregarding the possibility that one or more of these conditions exists may result in increased maintenance and operation expense, reduced equipment life and emergency shutdown. It is strongly recommended that a reputable, local water treatment concern be engaged to establish the corrosion, scale-forming and fouling tendency of the cooling water and take steps necessary to remedy the situation if a problem does exist. The need for water treatment may only involve filtration (screening) to remove debris, sand and/or silt in the cooling water supply. However, chemical treatment methods may be necessary in certain instances to inhibit corrosion and/or remove scale deposits, or prevent growth of microorganisms. The normal maintenance program for the unit should include periodic cleaning on the tube side (water side) of the heat exchanger to remove deposits which enchance fouling and corrosion.

Hex head zinc anodes are used in the return bonnet (opposite end to the water pipe connections) of heat exchangers to provide internal water system corrosion protection. These anodes should be inspected periodically and replaced when the zinc has been reduced to about 1/2" in length.

WATER FLOW CONTROL VALVE FOR HEAT EXCHANGER (Optional Equipment — Recommended To Conserve Water Where Appropriate) (Figures 1-5, 7-5 and 8-5) — The water flow control valve is adjustable to compensate for varying water inlet temperatures and pressures. Use the compressor discharge air temperature gauge on the instrument panel in setting the flow control valve. The compressor discharge temperature must be maintained a minimum of 10° F. above the dew point temperature at the maximum anticipated ambient; refer to Figure 8-5 for the

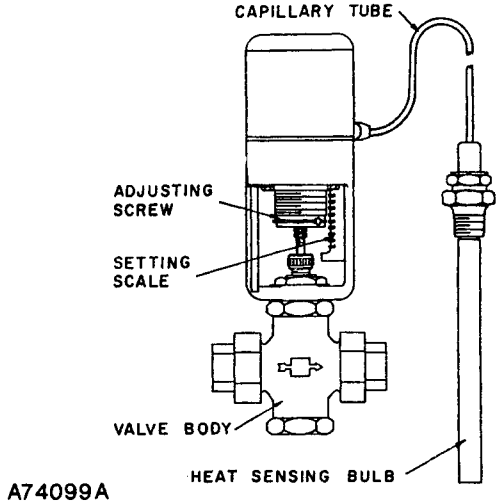

FIGURE 7-5. — WATER CONTROL VALVE

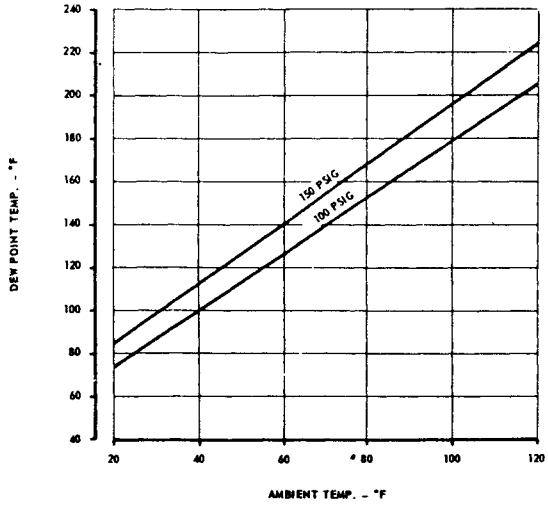

FIGURE 8-5. — DEW POINT TEMPERATURE VS. AMBIENT TEMPERATURE (100% RELATIVE HUMIDITY)

dew point temperature at your operating pressure and ambient temperatures.

To decrease water flow (increase compressor discharge air temperature) turn the adjusting screw from left to right, increasing spring tension. **To increase water flow** (decrease compressor discharge air temperature) turn the adjusting screw in the opposite direction. The groove at the lower edge of the adjusting screw is an index line for use with the index scale 0 to 8 in obtaining a desired setting.

These valves must be handled with care and proper tools and techniques must be used when working on the valve.

Care must be used when handling the capillary tube; a kink or break in the tubing or connections will make the valve inoperative. Never attempt to change capillary length. Excess capillary tube should be carefully coiled and placed so that damage will not occur in normal maintenance or traffic past unit.

If a leak develops through the packing, tighten the packing gland nut firmly with a wrench to reseat the packing around the valve stem, then back off the nut until loose, and finally retighten the nut finger tight. Tightening the packing nut too tight may cause erratic operation. An occasional drop of oil on the valve stem at the packing nut will prolong packing life.

If the valve malfunctions, check for bent or binding (paint or corrosion, etc.) valve stem, foreign material in the valve, erosion, or thermal system (capillary) failure. If foreign material or scale is likely, the use of a strainer in the inlet water line is recommended.

WATER SHUTOFF VALVE — WATER-COOLED HEAT EXCHANGER (Optional Equipment But Recommended) (Figure 1-5) — A magnetic solenoid-operated water shutoff valve rated at 150 PSIG water pressure should be mounted in the water outlet line after the oil cooler. The valve should be wired into the compressor control circuit in such a manner that valve opens to allow water to flow any time the ON-OFF push button is ON and the compressor is running. When compressor stops under automatic control, or is shut off manually, the valve should close, stopping water flow through the system.

OIL RESERVOIR — The oil reservoir-separator combines two functions into one vessel. The horizontal section is the oil reservoir, providing oil storage capacity for the system and a primary oil separation means. The vertical section contains the final oil separator and has the discharge line mounted on the upper flange. The reservoir also provides limited air storage for control and gauge actuation.

COMPRESSOR OIL SEPARATOR (Figure 9-5) located in the vertical section of the oil reservoir consists of two renewable cartridge type separator elements and provides the final removal of oil from the air stream. Oil from inside the separator elements is returned through tubing to the compressor cylinder. Oil impinging on the outside of the first stage of the dual-element separator drains directly back into the oil reservoir by gravity.

Oil carry-over through the service lines may be caused by a faulty separator, faulty minimum pressure valve, overfilling of the oil reservoir, oil that foams, or oil return line malfunction. If oil carry-over occurs, inspect the separators only after it is determined that the oil level is not too high,

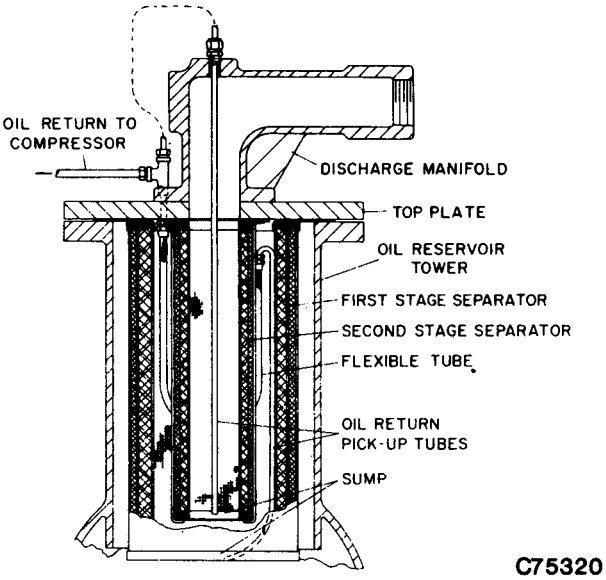

FIGURE 9-5. — OIL SEPARATOR

the oil is not foaming excessively, the oil return line from the discharge manifold to the compressor cylinder is not clogged or pinched off, and the return tubes inside the separators are not loose or broken.

Oil carry-over malfunctions of the oil separator are usually due to using the elements too long, heavy dirt or varnish deposit caused by inadequate air filter service, use of improper oil or using oil too long for existing conditions. Ruptured or collapsed separator elements are usually due to heavy dirt or varnish buildup in the filtering material.

Excessive tilt angle of the unit will also hamper separation and cause oil carry-over.

Oil separator element life cannot be predicted; it will vary greatly depending on the conditions of operation, the quality of oil used and the maintenance of the oil and air filters. The condition of the oil separator can be determined by pressure differential gauging or by inspection.

The smaller second-stage (inner) element may not need replacement as often as the first-stage element. Careful inspection or pressure differential gauging, plus operating experience, will determine the change interval.

The oil separator pressure differential gauge reads differential across both separator elements. The first-stage element, and depending on condition, the second-stage element should be changed when the oil separator gauge indicates 8 PSI differential with the unit on load at rated pressure. Usually the first stage will contribute most of the pressure differential. It may be possible to reuse the second stage several times before an appreciable contribution to total pressure differential is noticed and the second stage changed.

Removal Of Oil Separators For Inspection Or Replacement:

1. Disconnect oil return to compressor tubing at tee near discharge manifold flange on top plate.

2. Disconnect tubing from tee to top of the discharge manifold at tee. Loosen nut on fitting at top of the manifold and completely withdraw tubing through the fitting.

3. Disconnect discharge manifold pipe union.

4. Remove screws holding the top plate to the oil reservoir tower. Lift the plate just enough to disconnect the flexible oil return tube for the first-stage separator from the top plate fitting. Lift top plate and second-stage separator from the oil reservoir.

5. Remove tube fitting holding second-stage separator to the top plate. *DO NOT REST THE ASSEMBLY ON THE SEPARATOR.*

6. Lift first-stage separator from the oil reservoir tower.

7. Inspect and/or replace the first- and second-stage separators as necessary. Note that the second stage may not need replacement as frequently as the first stage. Before installing (or reinstalling) any separator, be sure gaskets bonded to the separator flanges are not damaged. Remove any old gasket material adhering to top plate or reservoir tower flange from old separators.

8. Connect the flexible oil return tubing to the metal pick-up tube in the first-stage separator. Make sure fitting is tight. Lower first-stage separator into oil reservoir tower.

9. Secure the second-stage separator to the top plate by passing the tube fitting through the clearance hole in the second-stage separator flange. Be sure connection is tight.

10. Lower top plate and second-stage separator assembly into first-stage separator in the oil reservoir tower.

    Be sure the metal pick-up tube and fitting in the first-stage separator has been rotated at an angle to clear the second stage.

    As the assembly is lowered, connect the flexible tubing to the fitting on the top plate and tighten securely. Seat the top plate to the oil reservoir flange; install and tighten all cap screws.

11. Reconnect the discharge manifold pipe union and all tubing.

12. Reconnect oil return tubing from compressor to tee near discharge manifold flange.

13. Install original second-stage oil return by slipping tube through fitting at the top of the discharge manifold until ferrule bottoms in fitting. If a new fitting and return tube is used, slip the tube through fitting until it touches the bottom of the second-stage separator, then raise the tube about 1/4" off the bottom and tighten the fitting nut securely. Connect the other end of the tube to the compressor oil return tee; trim any excess from new tube to fit into tee — do not bend tube to fit or raise tube any further from bottom of separator.

PRESSURE DIFFERENTIAL GAUGE (Figure 1-4) — A gauge mounted on the instrument panel continuously monitors the pressure differential across the oil separators and indicates the condition of the separators.

The oil separators should be changed when the gauge indicates a pressure differential of 8 PSI with the unit on full load at rated service pressure. See "Compressor Oil Separator" above.

NOTE:
PRESSURE DIFFERENTIAL ON NEW ELEMENTS IS APPROXIMATELY 1-2 PSI. AS SEPARATORS RETAIN DIRT, DIFFERENTIAL WILL RISE. A SUDDEN DROP TO ZERO DIFFERENTIAL OR A SUDDEN HEAVY OIL CARRY-OVER MAY INDICATE A RUPTURED SEPARATOR.

AUTOMATIC BLOWDOWN VALVE (Figure 1-5) — A pilot-actuated valve receives an air signal from a solenoid-operated magnetic valve wired into the control circuit, and is used to relieve pressure in the oil reservoir section each time the unit unloads (low demand mode only) or is shut down. A muffler terminates the blowdown line to reduce air discharge noise.

COMPRESSOR OIL SYSTEM CHECK — Compressor should be at operating temperature at the time of checks. One-half hour of loaded operation is usually sufficient to reach level-out operating temperatures. The data shown below is for an oil system in good condition.

If the unit will operate at discharge temperatures over 200° F. for more than 4 consecutive hours, refer to the "High Temperature Operation" paragraph and use recommended lubricant.

⚠ WARNING

REGARDLESS OF LEVEL OF SUSTAINED DISCHARGE TEMPERATURE, THE HIGH DISCHARGE AIR TEMPERATURE SWITCH MUST NEVER BE SET HIGHER THAN 225° F. SHUTDOWN TEMPERATURE.

Air and Oil Discharge Temperature — 170° F. to 180° F. — Check with a thermometer in the tapped opening on top of the compressor discharge pipe to the oil reservoir.

Ambient Temp. (° F.)		80	90	100
ESM, EAQ_M	Discharge Temperature ° F.	176	186	196
ESN, EAQ_N		180	190	200*
ESO EAQ_O		184	194	204*

* For Temperatures above 200° F. see "High Temperature Operation".

FIGURE 10-5.

For **air cooled oil systems**, Figure 10-5 shows the normal upper limit of discharge temperatures for varying ambient temperatures beginning at the system design point of 80° F. At ambient temperatures below 80° F., the mixing valve will hold the discharge temperature at the 80° F. ambient temperature point. Above 80° F., the oil cooler is fully used and the discharge temperature varies degree for degree with the ambient temperature.

For **water cooled oil systems**, the water flows at various temperatures outlined in Section 2 will hold the discharge temperature below the 80° F. ambient temperature level of Figure 10-5. Small variations in specific water flows or temperatures will not be noted in the discharge temperature since the water control valve will tend to hold a constant oil temperature. A significant change in the discharge temperature is cause to check for a change in water flow or temperature.

Oil Inlet Pressure — Check at the fitting in the line near the compressor oil inlet. With air receiver pressure at 100 PSI, oil inlet pressure should match values shown in the following table.

Size	Pressure
100 HP	50-60
125 & 150 HP	70-80

Oil Cooler Pressure Differential (Air-Cooled Radiator) — 2 to 25 PSI (65 to 150 PSIG Receiver Pressure) — Check at the fitting in the inlet and outlet lines of the oil cooler.

Oil Cooler Oil Pressure Differential (Water-Cooled Heat Exchanger) — 2 to 25 PSI (65 to 150 PSIG Receiver Pressure) — Check at the heat exchanger oil inlet and outlet fittings.

Oil Cooler Temperature Differential (Air-Cooled Radiator) — The oil temperature differential depends on the temperature of the air at the oil cooler fan and cleanliness of the core faces. As ambient temperatures and core restrictions increase, the oil cooler outlet temperature will increase. The inlet oil temperature may be checked at the fittings in the oil inlet line on the oil cooler module.

The outlet oil temperatures may be checked at the fittings in the oil inlet line on the oil cooler module. The outlet oil temperatures may be checked at the fitting in the oil outlet line.

Oil Cooler Temperature Differential (Water-cooled Heat Exchanger) — The oil temperature differential depends on the inlet water temperature and the water flow rate permitted by the water flow control valve setting. The oil inlet temperature is approximately the same as the air discharge temperature — see gauge on instrument panel. The oil outlet temperature may be checked at the compressor oil inlet line fitting.

Oil Cooler Water Pressure Differential (Water-Cooled Heat Exchanger) — The water pressure differential through the heat exchanger will depend on supply pressure, flow rate, cooler tube cleanliness and outlet pressure. The inlet and outlet water pressures may be checked at pipe fittings supplied by the customer.

SECTION 6

AIR FILTERS

AIR FILTER (Figure 1-6) furnished as standard equipment is a washable element two-stage dry-type filter. The air filter must receive proper maintenance if maximum service is to be obtained from the unit. Establishing adequate and timely filter service is MOST IMPORTANT. To service the air filter, proceed as follows:

Dust Cup — Service every 4 to 120 hours depending on dust conditions. To service, loosen the retaining band clamp and remove the dust cup. Do not wash the dust cup — wipe clean with a clean dry cloth. Do not bend the edge of cup by striking on a hard surface. When installing the dust cup, make sure the clamp is securely tightened to prevent leakage.

Filter Element — The element should be serviced when the pressure drop through the filter reaches 20 inches of water (indicator shows service required) or when inspection indicates a heavy accumulation of dirt on the outside of the element. Clean every 50 to 250 operating hours depending on dust conditions and to be sure that indicator is not malfunctioning. Inspect every few days until experience determines the proper time for servicing. Higher than normal current use by the motor or loss of compressor capacity may indicate a need for servicing the filter element.

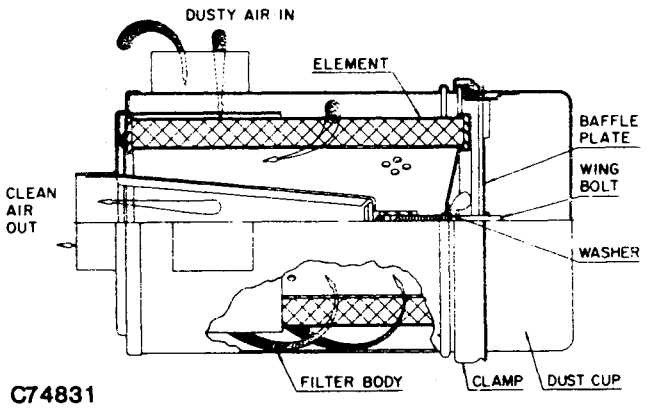

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FIGURE 1-6. — AIR FILTER

To service:

(a) Loosen the retaining band clamp and remove the dust cup from the body of the filter.

(b) Visually inspect the element in place. If cleaning is not necessary, reinstall the dust cup on the filter. If the element requires cleaning, unscrew the wing bolt and withdraw the element from the body.

(c) Wash the element by soaking in warm water with a mild detergent for about 15 minutes. Rinse the element thoroughly with clean water; a hose may be used if the water pressure does not exceed 40 PSIG.

(d) Inspect the element for ruptures or cracks in the pleated media; replace with new element if any are found. Inspect the gasket on the bottom (outlet end) of the element; use new element if gasket is damaged.

(e) Allow the element to air dry COMPLETELY. Do not expose the element to heat over 150° F. Install the element in the filter body and fasten securely with the wing bolt. Reinstall the dust cup and retaining band clamp. Make sure the clamp is tightened securely to prevent leakage.

CAUTION

DO NOT OIL THIS ELEMENT. DO NOT WASH IN OTHER CLEANING FLUIDS. NEVER OPERATE THE UNIT WITHOUT THE ELEMENT. NEVER USE ELEMENTS THAT ARE DAMAGED, RUPTURED OR WET. NEVER USE GASKETS THAT WON'T SEAL. KEEP SPARE ELEMENTS AND GASKETS ON HAND TO REDUCE DOWNTIME. STORE ELEMENTS IN A PROTECTED AREA FREE FROM DAMAGE, DIRT AND MOISTURE. HANDLE ALL PARTS WITH CARE.

Filter Element Life — The element should be replaced after six (6) cleanings or if:

(a) Visual inspection indicates a rupture, crack or pin hole in the pleated media. Inspection should be done by placing a bright light inside the element.

(b) Pressure drop through a filter with a freshly cleaned element is below 3 inches of water with compressor running at full load — this would indicate a rupture or crack.

Inlet Screen and Tube — Inspect the inlet screen and tube for dirt accumulation each time the filter element is serviced. Clean the tube when required by ramming a clean dry cloth through the tube. Wipe the inside of the filter body to remove any dirt falling from the inlet tube before reinstalling the filter element.

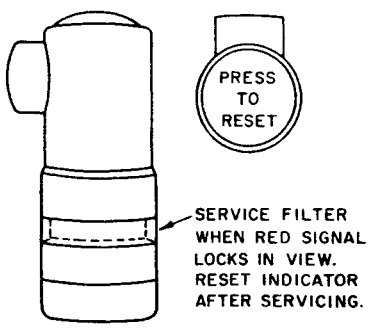

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FIGURE 2-6. — AIR FILTER SERVICE INDICATOR

AIR FILTER SERVICE INDICATOR (Figures 1-4 and 2-6) signals time to change or service the air filter. The

flag in the window gradually rises as the filter element loads with dirt. When the pressure drop across the filter reaches the preset restriction (equivalent of 20 inches of water), the flag reaches the top and locks in position, indicating the need for filter servicing.

After servicing, reset the indicator by pushing the reset button all the way in, then release.

CAUTION

THE AIR FILTER SERVICE INDICATOR IS AN EFFECTIVE DEVICE ONLY AS LONG AS THE INLET SYSTEM VACUUM IS MAINTAINED. IF THE VACUUM IS BROKEN BECAUSE OF A DEFECTIVE FILTER GASKET OR RUPTURED ELEMENT, THE INDICATOR WILL NOT FUNCTION. IT IS WISE, THEREFORE, TO PERIODICALLY INSPECT THE AIR FILTER FOR EXCESSIVE DUST BUILDUP.

SECTION 7
COUPLING

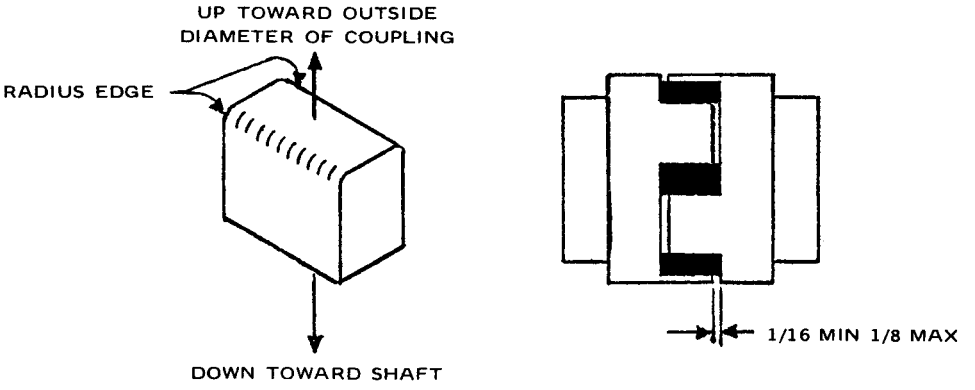

FIGURE 1-7. — INSTALLATION OF COUPLING CUSHIONS

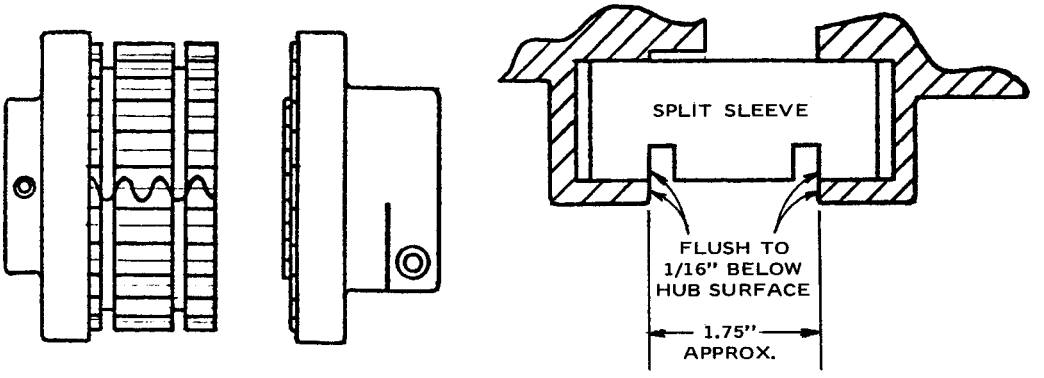

FIGURE 2-7. — INSTALLATION OF SPLIT SLEEVE

COUPLING — The motor and compressor are direct connected by a resilient type flexible coupling. Depending on type, coupling will have either several individual cushions, Figure 1-7, or a split toothed sleeve, Figure 2-7. Neither coupling type requires lubrication.

If maintenance on mating parts is required, reassemble coupling as follows:

Individual Cushion Design (Figure 1-7):

1. Slide coupling halves over shaft extensions. Be sure collar is installed on shaft behind one coupling body.
2. Assemble motor to compressor.
3. Working through cover plate opening, center coupling over gap between shafts, maintaining gap as shown in Figure 1-7 between the ends of the jaws on one coupling body and the flange on the opposite coupling body. Tighten set screws in each coupling body.
4. Insert individual cushions as shown in Figure 1-7 and slide collar over cushions and secure with cap screws. Reinstall the cover plate.

Split Sleeve Design (Figure 2-7):

1. Slide coupling halves over shaft extensions.
2. Assemble motor to compressor.
3. Working through cover plate opening, center coupling halves over gap in shafts. See Figure 2-7 for hub spacing.
4. Fix position of short hub on shaft by securely tightening set screws over shaft key and 90° to key.
5. Assemble halves of split sleeve over shaft and into teeth of short hub.
6. Slide long hub over split sleeve. Split sleeve should be uniformly flush to 1/16" below surfaces of each hub (Figure 2-7).
7. Lock long hub in position by tightening socket head capscrew to clamp hub to shaft and tightening set screw over shaft key securely. Reinstall cover plate.

Alignment — The coupling is permanently aligned by the flanges on the compressor and motor.

SECTION 8

MAINTENANCE SCHEDULE

SERVICE CHECK LIST

Air Filter — Operating conditions determine frequency of service; refer to "Air Filters" Section 6 and plan maintenance accordingly.

Oil Separator — Change the oil separator element when pressure differential gauge indicates an 8 PSI differential.

Refer to "Compressor Oil Separator" in Section 5 for further details.

Motor Lubrication — See Section 2.

Every 8 Hours Operation

1. Check the reservoir oil level — add oil if the oil level is in the ADD range with the compressor on load.

   If oil consumption is high, refer to "Compressor Oil Separator" in Section 5 and "Excessive Oil Consumption" in Section 9.

2. Observe if the unit loads and unloads properly.

3. Drain the moisture traps on turn valve and inlet valve pilots and on separate air receiver and moisture separator, if used.

4. If moisture is noted in the oil level gauge, drain accumulated moisture and see Section 5 "Moisture in the Oil System".

Every 125 Hours Operation

1. Check for dirt accumulation on radiator-type oil cooler core faces and on the fan and fan motor. Blow off dirt if accumulation is excessive.

Every 1000 Hours Operation

1. Change the oil filter element every 1000 hours or sooner, or when the indicator on filter is in "Change Filter" area with unit running and warmed up.

Every 2000 Hours Operation

1. If using GD800 Lubricating Coolant, change the compressor oil. UNDER ADVERSE CONDITIONS CHANGE MORE FREQUENTLY (refer to "Oil Change Interval" in Section 5). Flush the system if required.

2. The use of *Gardner-Denver*® GD8000 Lubricating Coolant or other synthetic lubricant may extend the required change interval. See "Synthetic Lubricants" in Section 5.

SECTION 9

TROUBLE SHOOTING

IF UNIT FAILS TO START, check:

1. Wiring system for wrong lead connections.
2. Temperature and/or pressure shutdown reset on control panel and/or reset relay in control box.
3. Fuses in control enclosure or starter enclosure.
4. Compressor motor starter overload heaters and adjusting knob.
5. Oil cooler fan motor overload heaters and adjusting knob.
6. Low oil pressure or faulty low oil pressure switch.
7. Contacts of timing relay for low oil pressure shutdown stuck open.
8. Faulty timing relay.
9. Reduced voltage starter only — starting phase time set too long.
10. Reservoir pressure switch setting.

UNIT STARTS BUT STOPS AFTER A SHORT RUN, check:

1. High air discharge temperature caused by:
   (a) Low compressor oil level.
   (b) Clogged oil cooler or oil filters.
   (c) Thermal control (thermostatic mixing) valve inoperative.
   (d) Dirt on oil cooler core faces.
   (e) Poor ventilation of unit and/or oil cooler.
   (f) Water control valve inoperative.
   (g) Water inlet temperature too high.
   (h) Water shutoff valve inoperative.
   (i) On remote oil cooler unit, pilot-operated valve or check valve in piping to oil cooler inoperative.
   (j) Reservoir pressure switch setting.
2. Fuses in control panel enclosure or starter enclosure.
3. Compressor motor starter overloads and adjusting knob.
4. Oil cooler fan motor overload heaters and adjusting knob.
5. Low oil pressure or faulty low oil pressure shutdown switch.
6. Time delay on timing relay for low oil pressure shutdown set too short a time. MAXIMUM DELAY SETTING IS 15 SECONDS.
7. Timing relay setting screw not engaged.
8. (a) Faulty or intermittent HDTS or probe.
   (b) Incorrect HDTS setting (225° F. is maximum).
9. Faulty timing relay.

COMPRESSOR DOES NOT UNLOAD, check:

1. Magnetic unloader or pressure switch for malfunction.
2. Control lines for restriction.
3. Air leaks in control system.
4. Inlet valve stuck open due to corrosion.
5. Inlet valve disc not sealing.
6. Broken inlet valve stem spring.
7. Pilot(s) or pressure switch adjustment.
8. Pilot(s) or pressure switch for dirt or leaking diaphragm.

PNEUMATIC BLOWDOWN VALVE CONTINUES TO PASS AIR, check for:

1. Loose or broken air line to blowdown valve pilot.
2. Loose wiring to the blowdown valve actuator solenoid.
3. Coil failure on the blowdown valve actuator solenoid.
4. Pressure regulator not set to correct pressure.

EXCESSIVE OIL CONSUMPTION, check for:

1. Oil carry-over through discharge line caused by:
   (a) Overfilling the reservoir.
   (b) Clogged, broken or loose oil return lines.
   (c) Ruptured oil separator elements.
   (d) Loose assembly.
   (e) Incorrect oil causing foam.
   (f) Inoperative minimum pressure valve.
2. Oil leaks at all fittings and gaskets.
3. Oil leaking into water system of oil cooler.

COMPRESSOR LOW ON DELIVERY AND PRESSURE, check for:

1. Clogged air filter.
2. Restricted inlet valve.
3. Corrosion in inlet valve causing sticking.
4. Broken inlet valve stem spring.
5. Binding inlet valve piston.
6. Incorrect motor speed.
7. Turn valve and/or inlet valve pilot adjustment and/or malfunction.
8. 4-way valve malfunction.
9. Pressure gauge faulty.

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