OPERATOR’S MANUAL

JOY®

TWISTAIR® III

ROTARY SCREW COMPRESSOR

TA MODELS 150 thru 290

FORM NO. MCT-121
WARRANTY
INDUSTRIAL SCREW COMPRESSOR

The JOY Manufacturing Company warrants that this compressor conforms to applicable drawings and specifications approved in writing by JOY and that the rotary screw compressor, stator and rotor assembly will be free from defects in material and workmanship for a period of 24 months from the date of initial start-up or 30 months from the date of shipment from the factory, whichever period first expires, and in the case of all other components of JOY’s manufacture will be free from defects in material or workmanship for a period of 12 months from the date of initial start-up or 18 months from the date of shipment from the factory, whichever period first expires. In cases where a unit is in Distributor stock and start-up is beyond 6 months from shipment from the factory, it will be necessary for the Distributor to obtain approval of satisfactory condition from an authorized JOY Representative to initiate warranty from the date of start-up. Any work or parts necessary to restore the unit to satisfactory condition prior to start-up will be for the Distributor’s account. If within such periods, JOY receives from the Buyer written notice of any alleged defect in or non-conformance of the compressor, and if in JOY’s judgment the compressor does not conform or is found to be defective in material or workmanship, JOY will at its option either: (a) furnish a Service Representative to correct defective workmanship, or (b) upon return of the component F.O.B. JOY’s designated plant in order to receive warranty consideration, defective material must be shipped within 30 days of receipt of authorized return instructions, repair, or replace the component or issue credit for the replacement part ordered by Buyer, or (c) refund the full purchase price for the compressor without interest. Deterioration or wear occasioned by chemical and/or abrasive action or excessive heat shall not constitute defects.

Joy’s sole responsibility and buyer’s exclusive remedy hereunder is limited to such repair, replacement, or repayment of the purchase price. Component parts or assemblies not of Joy’s manufacture are warranted only to the extent that they are warranted by the original manufacturer. Joy shall have no responsibility for any cost or expense incurred by Buyer from Joy’s inability to repair under said warranty when such inability is beyond the control of Joy or caused solely by Buyer.

THERE ARE NO OTHER WARRANTIES, EXPRESS, STATUTORY OR IMPLIED, INCLUDING THOSE OF MERCHANTABILITY AND OF FITNESS FOR PURPOSE; NOR ANY AFFIRMATION OF FACT OR REPRESENTATION WHICH EXTENDS BEYOND THE DESCRIPTION ON THE FACE HEREOF.

This warranty shall be void and Joy shall have no responsibility to repair, replace, or repay the purchase price of defective or damaged parts or components resulting directly or indirectly from the use of repair or replacement parts not of Joy’s manufacture or approved by Joy or from Buyer’s failure to store, install, maintain, and operate the compressor according to the recommendations contained in the Operating and Maintenance Manual and good engineering practice.

NOTICE: UNAUTHORIZED DISASSEMBLY OR REPAIR OF AIR ENDS IN THE FIELD WILL VOID THE WARRANTY AND ADVERSELY AFFECT THE TRADE-IN VALUE.

SCREW COMPRESSOR AIR END EXCHANGE PROGRAM:
A factory re-manufactured screw compressor air end can be purchased on an exchange basis. This is not just a factory-rebuilt air end, but one which is re-manufactured to high quality as new. All bearings, seals, gaskets, and the inlet valve are always replaced. All other parts not meeting our quality standards are also replaced. The air end is then thoroughly factory tested prior to shipment. When you purchase a re-manufactured air end there is a warranty which is twelve (12) months from date of shipment in accordance with the terms set forth in the above warranty.
OPERATOR'S MANUAL

JOY®
TWISTAIR® III
Rotary Screw Compressor

WARNING

THIS MANUAL CONTAINS VITAL INFORMATION FOR THE SAFE USE AND EFFICIENT OPERATION OF THIS UNIT. CAREFULLY READ THE OPERATOR'S MANUAL BEFORE STARTING THE UNIT. FAILURE TO ADHERE TO THE INSTRUCTIONS COULD RESULT IN SERIOUS BODILY INJURY.

TA Models 150 thru 290

JOY MANUFACTURING COMPANY
INDUSTRIAL COMPRESSOR GROUP
MICHIGAN CITY, INDIANA 46360

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FORM NO. MCT-121
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FPSI-11/85
DISCHARGE AIR USED FOR BREATHING. WILL CAUSE SEVERE INJURY OR DEATH.

CONSULT FILTRATION SPECIALIST FOR ADDITIONAL FILTRATION AND TREATMENT EQUIPMENT TO MEET HEALTH AND SAFETY STANDARDS.
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INTRODUCTION

The JOY® Rotary Screw Compressor is an electric motor-driven, single-stage, screw-type, heavy-duty air compressor. It is sold as a complete package unit mounted on a steel base. See Figure 1. The package includes the compressor, motor, air intake system, electrical starting unit, control system, cooling system, air/oil separator, and instrument panel. Installation requires only the connection of electric power, a service line; and when applicable, a water line and drain.

There are several models of Rotary Screw Compressors covered in this manual. Refer to "Specifications" for the air delivery capability, horsepower, and operating pressure of each unit. All models are available either air or water cooled. They are intended for indoor installation. Although the unit is generally totally enclosed, it can be ordered without enclosure.
DESCRIPTION
The complete operating unit consists of the following major components.
1. Compressor and motor
2. Oil sump/separator
3. Oil cooling system
4. Air cooling system
5. Electrical control
6. Instrument panel

COMPRESSOR
COMPRESSOR AND MOTOR
The compressor assembly is a positive displacement, oil flood lubricated, screw type unit employing one stage of compression to achieve the desired pressure. Components include a housing (stator), two screws (rotors), bearings and bearing supports. See Figure 2. The male rotor has four lobes and the female has six.

In operation, two helically grooved rotors (Figure 2) mesh to compress air. Inlet air entering the casing is compressed as the male lobes roll down the female grooves, pushing trapped atmospheric air along and compressing it in one stage of compression. This process delivers smooth-flowing air at full pressure to the receiver.

To illustrate the compression sequence, consider the action of the male lobe as similar to a ball. In Figure 3, one compression cycle has been isolated for simplification. As a helix rotates, the ball (male lobe) meshes with the groove to start a compression cycle with trapped atmospheric air (A). As the ball moves down the groove, air is compressed (B). The compressed air is discharged as the ball reaches the end of the groove (C). Atmospheric air fills in behind the ball preparing the groove for another compression cycle as rotation continues and the male lobe again meshes with the groove.
During the compression cycle, oil is injected into the compressor for the purpose of lubricating, cooling, and sealing. Compressed air laden with oil leaves the compressor unit through a discharge port which is designed to give optimum performance within the desired discharge pressure range.

Related components to the compressor assembly include the air filter, the inlet valve, and a full flow oil filter. The air filter is a two-stage, dry type with a pleated paper replaceable element. The inlet valve (Figure 2) is pneumatically operated. It functions in response to the control system which regulates the amount of valve opening and closing in proportion to the air demand.

**Pressure Differential System**

Sump pressure and air end suction pressure create conditions necessary for oil to flow. This system reduces the package horsepower by eliminating the oil pump.

**Compressor Lubrication System**

The oil that is directed to the compressor from the oil sump serves three purposes:

1. Lubricates the rotating parts and bearings.
2. Serves as a cooling agent for the compressed air to maintain the discharge air temperature within 100 Deg. F. of ambient temperature.
3. Helps assure high efficiency and maximum air delivery by sealing the running clearances.
FIGURE 5
Major Compressor Components (Water Cooled Model Without Enclosure Shown)

2. Oil Cooler 6. Oil Sump 10. Lifting

As oil passes through the compressor, it mixes with the air being compressed and is
discharged with the compressed air into the oil sump. Here the oil accumulates, then moves on
to be filtered, and finally returns through the oil cooler for recirculation through the com-
pressor—completing the cycle.

The flow schematic, Figure 4, illustrates air/oil separation and the circulation of oil in an air
or water cooled system.

MINIMUM PRESSURE VALVE

The function of the minimum pressure valve (See Figures 4 and 5) is to insure maximum oil
flow upon start-up, also it maintains proper velocity for high efficiency of air/oil separator. It
also acts as a check valve; in the event the compressor is manifolled with other compressors,
it will not be pressurized during shutdown.

AIR/OIL SEPARATOR AND SUMP

Compressed, oil-laden air enters the oil sump directly from the compressor discharge
through a large unrestricted pipe to a point well above the oil level of the sump. As the oil-laden
air enters the sump, much of the oil is separated from the air by centrifugal action. The oil then
runs downward and accumulates at the bottom of the sump for recirculation.

An air/oil separator is located in the upper portion of the oil sump. When air is demanded at
the service line, it first passes through the separator element which is the final stage of oil
separation. Any oil that does pass through the element will collect at the bottom of the
separator and be removed by the oil return line (Figure 4).
OIL RETURN LINE

The oil return line is provided to remove any oil accumulation from the bottom of the separator and return it to the compressor. A semi-clear tubing is provided in this line to observe the oil flow daily. Under loaded conditions, oil bubbles will continuously trickle through the tubing. If the tubing shows full of oil or no oil flow at all, it is a sign that oil is not being drained.

OIL FILTER

The oil filter is the replaceable element type. It is equipped with a built in maintenance indicator which signals when a clogging element requires changing. If the oil filter plugs very rapidly, an internal bypass will continue to allow oil to flow to the compressor.

OIL COOLING SYSTEM

The prime components of the oil cooling system include a thermal valve and oil cooler. The thermal valve is located in the oil cooler piping and is designed to be fully open until the oil temperature reaches approximately 135 Deg. F., thus allowing the oil to bypass the cooler and maintain a desirable oil temperature for operation in cool or humid ambient conditions. This decreases the probability of water build up in the sump. Above 135 Deg. F., the thermal valve gradually strokes to allow cooled oil from the cooler to mix with the hotter oil from the sump to maintain the discharge air temperature approximately 100 Deg. F. over ambient. The discharge air temperature is also dependent on the ambient air temperature, the quantity of oil for injection; and if water cooled, the temperature and quantity of cooling water supplied.

The oil cooler may be either air or water cooled. If air cooled, a finned heat exchanger is used and a fan provides cooling air circulation through the exchanger. When water cooled, a shell and tube bundle cooler is used and a cooling water supply is required. See Figures 5 and 6.
AIR COOLING SYSTEM

This system contains an aftercooler and a moisture separator with automatic condensate trap. The aftercooler is used to reduce the temperature of the compressed air and remove moisture before it reaches the service lines. Depending on the configuration, the cooling medium used for aftercooling may be air or water and will be connected in series with the oil cooler. If air cooled, a finned, radiator type aftercooler is used. Water cooled units are provided with a shell and tube bundle aftercooler. See Figure 4.

In reducing the air temperature at the aftercooler, moisture is condensed out of the air and then separated by action of the moisture separator. Water and other impurities removed accumulate at the moisture trap and are automatically eliminated. Condensate should be piped to an "open" drain avoiding freezing conditions. Keep the line the same size as the connection provided. The line should be pitched slightly downward away from the installation being careful not to create a trap in the piping. See Section 5 for suggested installation. To accommodate varying applications, the separator trap must be piped exterior to the machine during installation.

COOLING WATER

On water cooled units, an adequate supply of clean water must be available to maintain proper operation of the compressor (See SPECIFICATIONS for water flow rate). The use of dirty or scale forming water will clog the tubes of the heat exchanger and reduce its efficiency. This will lead to high temperature shutdowns of the compressor.

The flow rate can be as important as the quality of the water. Too low of a flow rate will promote scale promotion. If the water flow is too high tube erosion will occur causing a failure of the heat exchanger.

Care should also be taken in using moderate flow rates of extremely cold water. Oil near the tubes will cool too quickly and form a heat transfer boundary. This boundary will reduce the heat exchanger efficiency and cause high discharge temperature problems.
INSTRUMENT PANEL

The instrument panel (Figure 7) contains all the necessary gauges and instruments for operation. Following is an explanation of their use.

Start Button
The "Start" button (8, Figure 7) will start the compressor providing the main disconnect is connected and the safety circuit is cleared.

Stop Button
The Stop button (9, Figure 7) will stop the compressor at any time. When the stop button is pushed, the "Run" light will go out and the stop light will become lighted.

The reset feature of this button is connected to the compressor's safety circuit. Whenever the compressor shuts down due to a malfunction detected by the safety circuit, it will be necessary that the trouble be corrected and that the stop-reset button be pushed before another start is tried.

Load/Unload Button
The LOAD/UNLOAD (Figure 7) button permits the operator to unload the compressor anytime during operation. It is recommended that under normal conditions the machine be unloaded prior to stopping.

Hourmeter
The HOURMETER (Figure 7) records the accumulated total hours of compressor operation. It serves to determine when periodic inspections and maintenance should be performed.

Reset Operator
The reset operator is provided to reset the motor overloads. Whenever the compressor shuts down due to the tripping of the motor overloads, it will be necessary that the trouble be corrected and that the reset button be pushed before another start is tried.

STANDARD
Service Separator
The service separator gauge (1, Figure 7) warns that the maximum recommended pressure differential of the separator element has been reached and the element should be serviced.

Discharge Air Temperature
This gauge (5, Figure 7) indicates the temperature of the air/oil mixture immediately after final compression. Normal temperature in operation is approximately 100 Deg. F. above ambient.

Discharge Air Pressure
The discharge air pressure gauge (6, Figure 7) measures the pressure being delivered into your system. A comparison of this reading with discharge pressure indicates Aftercooler performance. An increase in the difference will indicate a blockage on the air side requiring maintenance.

OPTIONAL
Delivery Air Temperature
The delivery air temperature gauge (2, Figure 7) measures the temperature of air being delivered into your system. A comparison of this reading to the discharged temperature reading gives you a performance measure on the aftercooler. A drop off in this performance would indicate maintenance requirement on coolant side.

Delivery Air Pressure
The delivery air pressure gauge (7, Figure 7) measures the pressure being delivered in your system. A comparison of this reading with discharge pressure indicates aftercooler performance. An increase in the difference will indicate a blockage on the air side requiring maintenance.

Rotor Coolant Injection Temperature
This gauge (4, Figure 7) shows the temperature of the oil just prior to injection into the compression chamber. Normal temperature in operation is approximately 40-60 Deg. F. below the air discharge temperature.
MAINTENANCE INDICATORS

Air Filter

A pop-up indicator is located at the outlet of the AIR FILTER. A red element appears indicating the need to change the filter element. This is at a pressure drop of twenty five inches of water.

Oil Filter

An indicator is located on the OIL FILTER head. When a machine has two filters, both filters should be changed when either indicator shows a change required. These indicators show a need to change the elements at a fifteen PSI differential.
PNEUMATIC CONTROL SYSTEM

The compressor control system (Figure 10) is designed to match output capacity to the air demand by operating the inlet valve. As the air demand varies within the control range the inlet valve will modulate the intake air flow to the necessary capacity. See Figure 8.

The primary components that govern the operation of the inlet valve are the control valve, air pressure switch, and unloader valve (Figure 10). In operation, let us assume that the compressor is to operate at 110 psig maximum pressure. On start-up, the inlet valve will be fully open. As compression commences, pressure rises. At 100 psi, the control valve will begin to send a secondary pressure to the inlet valve which will start to close the inlet valve. Thus, as discharge pressure increases, capacity diminishes. See a to b Figure 8. If discharge pressure should drop, control valve pressure will decrease, allowing the inlet valve to move open and capacity to increase. Between 100 psi and 110 psi, output capacity will modulate between 40 percent and 100 percent.

At 110 psig, the unloader valve is de-energized by the air pressure switch and sends discharge pressure to close the inlet valve — reducing capacity to 0%. (See c to d). At 100 psig, the air pressure switch energizes the unloader valve, allowing the inlet valve to open and capacity to go to 100%. (See d to a).

At shut-down, the inlet valve is closed and the blow-down valve is de-energized. This relieves unit pressure.

CONTROL CENTER

The Control Center (Figure 9) is designed as a NEMA 12 standard. It houses the electrical components which support starting and automatic operation. Items included will depend upon the compressor model and options.

**WARNING**

A LOCKABLE DOOR IS PROVIDED FOR SAFETY PURPOSES. THE DOOR SHOULD ONLY BE OPENED BY A QUALIFIED ELECTRICIAN. BE CAREFUL OF ELECTRICAL SHOCK WHEN DOOR IS OPEN AND POWER IS ON. FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

Electrical Control Wiring

ALL electrical control wiring (main motor, fan motor, and high air temperature probes) is wired with 16 gauge wire, in liquid-tite flexible metal conduit to keep oil and dust out of electrical system.

**WARNING**

DO NOT PERFORM MAINTENANCE ON MACHINE WHEN THE "RUN LIGHT" IS ON, AS THE MACHINE COULD START WITHOUT WARNING. FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

Air Pressure Switch

The AIR PRESSURE SWITCH functions in response to discharge pressure to close or open the electrical circuit to the unloader valve. This action causes the unloader valve to pneumatically close the inlet valve and "unload" the compressor; or, to vent the unloading air line to atmosphere and allow the compressor to "load."

When control pressure rises to the top setting of the pressure switch, the electrical circuit to the unloader valve is opened and the compressor "unloads." When control pressure drops to the lower setting, the circuit is closed and the compressor "loads."

Unloader Valve

The unloader valve is a 3-way, normally open, solenoid valve that functions in response to the air pressure switch to pneumatically operate the inlet valve and the blowdown valve.

High Air Discharge Temperature Switch

The high air discharge temperate switch functions in the compressor safety circuit to effect shutdown should operating temperature become excessive (235 Deg. F.). A red warning light on the panel will light simultaneously with shutdown.
The function of the control relay is the primary control of the compressor and all its circuitry. The start-stop push button latches the compressor "on" through a control relay contact in parallel with the start push button. Any one of three failure modes may shut down the compressor. They are high air temperatures, main motor and fan motor overload, and loss of compressor control or main power. All of these, as well as the stop push button, de-energize the control relay, stopping the compressor. To restart, the start push button must be manually actuated. After high air temperature shutdown, the stop-reset push button and then the start push button must be manually actuated. After motor overload, the appropriate reset button and then the start push button must be manually actuated.

**Dual Control (Time Delay Relay Shutdown)**

A time delay relay (7, Figure 9) will automatically shut down the compressor after a predetermined interval of unloaded operation. This interval is factory set for 20 minutes which is the minimum setting recommended. Automatic re-start will occur at the low limit of the air pressure switch control range.

The 20 minute minimum delay interval is based on the motor manufacturers' recommendation of three starts per hour.

Any reloading during the timing interval will reset the timer to zero. The green "Run" light on the control center will be lit when the machine is in a shutdown interval.

**LOCATION**

The compressor is designed for indoor operation in ambient temperatures ranging from 35 Deg. F. to 110 Deg. F. In selecting the location for the compressor, it is important that there is an ample supply of cool, clean, well-circulated air. Do not set the unit with an air-cooled oil cooler closer than 48 inches from a wall or other obstruction which would restrict the free flow of air through the cooler. A good circulation of air through the cooler is important. For additional information refer to Figures 13 and 13A.

If contaminated air containing acid, paint, corrosive matter, toxic fumes, etc. is present, then a clean outside source of air must be provided for the compressor air intake.
With Fork Lift

FIGURE 11
Compressor Handling

**WARNING**

DO NOT PERFORM MAINTENANCE ON MACHINE WHEN THE "RUN LIGHT" IS ON, AS THE MACHINE COULD START WITHOUT WARNING. FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

**CAUTION**

INCORRECT COUPLING SPACE CAN CAUSE PREMATURE COUPLING, BEARING AND/OR SHAFT SEAL FAILURE. MAKE SURE THE COUPLING HUBS ARE SPACED PER JOY SPECIFICATION.

**Coupling (Compressor to Motor)**

The coupling assembly used to drive the compressor unit is of the flexible type. It is provided to compensate for minor misalignment and to accept torsional stress as necessary in operation. Also, it is prealigned and not subject to readjustment.

**Caution**

INCORRECT COUPLING SPACE CAN CAUSE PREMATURE COUPLING, BEARING AND/OR SHAFT SEAL FAILURE. MAKE SURE THE COUPLING HUBS ARE SPACED PER JOY SPECIFICATION.

**Coupling Spacing**

While coupling alignment is insured by the registered C-flanging to the motor, care still must be taken in reassembling the coupling. If the hubs are too close together detrimental preloading of bearings and shaft seals will result. Conversely, if the hubs are too far apart, the elastomeric cushions will become overloaded, promoting early coupling failure.

The correct spacing from motor face to back of coupling hub is 0.250 inches. On the air side, the spacing from face to the back of the hub is 0.3125 inches. The set screws should be tightened to torque value after assembly of the compressor-motor assembly.

**INSTALLATION**

**WARNING**

MACHINE DAMAGE CAN OCCUR DUE TO IMPROPER LIFTING. DO NOT LIFT MACHINE WITH THE MOTOR EYEBOLT

**RECEIVING**
(Refer to Figure 13 and 13A)

For shipment, the compressor is encased in a protective crate. Upon receiving, remove the crating and inspect the unit for signs of damage in shipment. If there is shipment damage, the carrier should be notified immediately.

Refer to "Specifications" for compressor weight and dimensions.

**HANDLING**

**With Fork Lift Truck**

The unit can be moved with a fork lift truck. Be sure that the forks extend completely through the width of the unit*, and be sure to apply pad material to the enclosure to prevent any damage.

**With Shop Crane**

To move the unit with a shop crane, steel wire ropes can be used but spreader bars must also be used to prevent the wire rope from exerting a force against the top of the enclosure, and be sure to apply pad material to the enclosure to prevent any damage.
FOUNDATION
No special foundation is required. It is only necessary that the unit’s frame be located on a level floor that provides the necessary contact and support. It is recommended that the unit be bolted to the floor.

ELECTRICAL CONNECTIONS
Have electrical connections to the power source made by a competent electrician in accordance with local codes.

The electrical source must have the same characteristics and voltage as indicated on the motor nameplate and as is called for on the compressor nameplate.

**WARNING**
IT IS EXTREMELY IMPORTANT THAT THE WIRING IS INSTALLED PROPERLY TO ASSURE CORRECT ROTATION OF THE COMPRESSOR AS INDICATED BY THE DIRECTION OF THE ROTATION ARROW ON THE COUPLING HOUSING (4, FIGURE 11). ANY FAN POWERED BY THE UNIT MUST ALSO BE OBSERVED FOR PROPER ROTATION (FIGURE 6). FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

UNIT MUST BE GROUNDED
Ground from ground connection behind control center on main frame to a metal, cold water pipe or other good ground. Use #4 or larger (Figure 5).

Complete connection details for the electrical wiring are provided in Figure 15.

AIR INTAKE PIPING
A clean air supply is desirable for the satisfactory operation of your Joy compressor. Where alternate sources of intake air are available, select the source supplying the cleanest air. The standard air filter with which the compressor is equipped is of sufficient size and design to meet all normal operating conditions.
When an outside air intake source is used, a flexible sleeve should be provided to connect the filter inlet to the inlet piping. The machine should be located as close as possible to the intake source because a restriction at the inlet will result in a capacity loss for the machine. It is not intended that the filter be removed except for maintenance. In making up this installation, consideration should be given to the following:

1. Keep the piping as short and direct as possible.
2. Piping size must be at least as large as the inlet opening.
3. MAKE ABSOLUTELY SURE THAT INLET PIPING IS CLEANED AFTER FABRICATION.
4. Consider using corrosion resistant piping such as plastic, aluminum, etc.
5. Support piping properly so that its weight is carried by supports and not by compressor.
6. See that there are no leaks in the intake piping which would permit the entrance of dirt.

DISCHARGE PIPING TO SERVICE LINES

As previously stated, the compressor should be located as closely as possible to the point of compressed air usage. However, whatever piping is used in the distribution system should be constructed to offer a minimum amount of resistance to air flow between the compressor and point of use. Long radius elbows and pipe of sufficient size should be used. In no case should the piping be of smaller size than the discharge opening.

In cases where the compressor is in the same line as a reciprocating compressor, a surge volume chamber must be installed in the line between the two compressors to dampen pulsations.

If the compressor is discharging into a plant system that has other compressors in the system, it is recommended that a gate valve be placed in the discharge line from the compressor. This is to isolate the unit for service. The valve should be of the same size as the discharge pipe. The use of a check valve is not recommended.

WARNING

AN OVER PRESSURIZED MACHINE CAN CAUSE INJURY, DEATH, AND WILL CAUSE SEALS TO BLOW. INSTALL A SAFETY VALVE BETWEEN THE COMPRESSOR AND RELIEF GATE VALVE.

HEATED MOISTURE SEPARATOR WITH TRAP

Units provided with an aftercooler will include a standard separator with trap. See “Air Cooling Group” — Section 1. A heated moisture separator can be supplied for those applications where the separator may be subjected to freezing conditions.
PRECAUTIONS

AIR COMPRESSOR OPERATING AND SAFETY PRECAUTIONS

Because an air compressor is a high-speed, rotating piece of machinery, the same common sense safety precautions should be observed as with any piece of machinery of this type where carelessness in operation or maintenance is hazardous to personnel.

In addition to the many obvious safety rules that should be followed with this type of machinery, we are suggesting additional safety precautions as listed below:

1. Pull main disconnect switch and disconnect any separate control lines, if used, before attempting to work or perform maintenance on the unit.
2. Do not attempt to remove any compressor parts without first relieving the entire system of pressure.
3. Do not attempt to service any part while machine is operating.
4. Do not operate the compressor at pressures in excess of its rating as indicated on the compressor nameplate.
5. Do not operate the compressor at speeds in excess of its rating as indicated on the compressor nameplate.
6. Do not remove any guards, shields, or screens while the compressor is operating.
7. Observe terminal pressure gauge daily to be sure automatic control system is governing compressor operation within proper limits.
8. Periodically check all safety devices for proper operation.
9. Do not play with compressed air. Pressurized air can cause serious injury to personnel.
10. Be sure no tools, rags, or loose parts are left on the compressor or drive parts.
11. Do not use flammable solvents for cleaning parts.
12. Exercise cleanliness during maintenance and when making repairs. Keep dirt away from parts by covering parts and exposed openings with clean cloth or kraft paper.
13. Do not operate the compressor without guards, shields, and screens in place.
14. Do not install a shut-off valve in the discharge line without installing a safety relief valve in the line between the shut-off valve and the compressor discharge.
15. Do not operate compressor in areas where there is a possibility of ingesting flammable or toxic fumes.
16. Never disconnect (or jumper) high air temperature switch and operate the machine.
17. Know what mode a machine is in before working around it. The Power can be on and a machine may not be running, as the machine may be in AUTO RESTART MODE.

Pressure vessels (receivers, aftercoolers, intercoolers) may require ASME Code stamping to meet local codes. Investigate code requirements before operation to make sure all requirements have been met.

The owner, lessor, or operator of the compressor is hereby notified and forewarned that any failure to observe these safety precautions may result in damage or injury.

Joy Manufacturing Company expressly disclaims responsibility or liability for any injury or damage caused by failure to observe these specified precautions or by failure to exercise that ordinary caution and due care required in operating or handling the compressor even though not expressly specified above.

CAUTION

IT IS IMPORTANT THAT THE COMPRESSOR OIL BE OF A RECOMMENDED TYPE AND THAT THIS OIL, AS WELL AS THE AIR FILTER, OIL FILTER AND AIR/OIL SEPARATOR ELEMENTS BE INSPECTED AND REPLACED AS STATED IN THIS MANUAL. FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

DANGER

DISCHARGE AIR USED FOR BREATHING. WILL CAUSE SEVERE INJURY OR DEATH.

CONSULT FILTRATION SPECIALIST FOR ADDITIONAL FILTRATION AND TREATMENT EQUIPMENT TO MEET HEALTH AND SAFETY STANDARDS.
The following decals are designed to warn the user of potential hazards and to protect against personal injury and property damage. Locate each safety decal on the machine and adhere to instructions. Also, review additional safety information that is located throughout this book.

**SAFETY DECALS**

- **DANGER**
  - Hot oil under pressure.
  - Will cause severe personal injury or death.
  - Shutdown compressor and relieve system of all pressure before removing valves, caps, and plugs.
  
  See Section 3
  Pages 2 and 6

- **DANGER**
  - Discharge air used for breathing.
  - Will cause severe injury or death.
  - Consult filtration specialist for additional filtration and treatment equipment to meet health and safety standards.

  See Section 3
  Pages 8 and 9

- **WARNING**
  - Read the operator's manual before starting this unit.
  - Failure to adhere to instructions can result in severe personal injury.
  - Replacement manuals can be purchased from Joy Manufacturing Company 900 S. Woodland Avenue Michigan City, IN 46360

  See Section 1
  Pages 11

- **WARNING**
  - High voltage/electrical shock.
  - Can cause severe injury or death.
  - Ground unit and disconnect all power supplies to unit before opening enclosure.

  See Section 1
  Pages 8 and 9

- **CAUTION**
  - Machine damage.
  - Can occur due to improper lifting.
  - Do not lift machine with the motor eyebolt.

  See Section 1
  Page 11

- **CAUTION**
  - Reverse rotation of compressor and fan.
  - Will cause machine damage.
  - Check for correct rotation of compressor and fan.
  - See operator's manual.

  See Section 1
  Page 12

- **NOTICE**
  - Assemble connecting plugs to aftercooler before starting unit.
  - Failure to do so will result in loss of water from unplugged openings.

  See Section 1
  Page 12

- **WARNING**
  - Unit can automatically restart.
  - Will cause personal injury.
  - Know mode of operation before working on or near the machine.
FIGURE 24
TA SYSTEMS SCHEMATIC)
SECTION 2

OPERATION

INTRODUCTION

Every JOY® compressor is operated and thoroughly tested at the factory before shipment. The test assures that the compressor will deliver its rated capacity and is in good working order. However, regardless of the care taken at the factory, there is a possibility that damage may occur in shipment. For this reason, it is recommended that the unit be carefully inspected for evidence of possible damage or malfunction during the first few hours of operation.

**WARNING**

EXCEEDING MAXIMUM PRESSURE WILL CAUSE COMPONENT AND SYSTEM DAMAGE. DO NOT EXCEED MAXIMUM PRESSURE INDICATED ON COMPRESSOR NAMEPLATE.

PREPARATION FOR INITIAL START-UP

1. Pull main disconnect switch to assure that no power is connected to the unit.
2. Review installation as covered in Section 1 to see that applicable instructions have been complied with.

**WARNING**

DO NOT ATTEMPT TO OPERATE COMPRESSOR ON VOLTAGE OTHER THAN THAT SPECIFIED ON THE COMPRESSOR NAMEPLATE. FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

3. Inspect unit for any visible signs of damage that could have occurred in shipment or during installation.
4. Make sure that protective covering (paper) has been removed from air intake filter, enclosure openings and any other components or area that could require protection from painting or shipping.
5. Fill sump to proper level with oil as specified in Section 3, “Lubrication.” Do not over-fill. If sump is over-filled, drain to proper level. Tighten oil fill fitting securely. Remember this is a pressurized vessel.
6. On water cooled units, make sure that water supply is connected and open to give proper flow.
7. Reconnect main disconnect switch.
8. Refer to Section 1, Instrument Panel, in regard to the functions of the panel components.
9. “Jog” motor (press start and then stop button quickly) and check for proper direction of rotation as indicated by direction arrow on coupling housing. Coupling may be observed at bottom of the housing or viewing directly the motor armature. If rotation direction is wrong, reverse input connections L1 and L2 (ref. Figure 15). Also, check to see that fan is blowing OUTWARD.

After unit has run for several minutes, shut it down and check oil level. It may be necessary to add oil to compensate for the amount of oil needed to fill the entire system.

**CAUTION**

REVERSE ROTATION OF THE COMPRESSOR WILL CAUSE AIR END DAMAGE. AFTER ANY CHANGE OR RECONNECTION OF WIRING, CHECK FOR CORRECT ROTATION OF COMPRESSOR AND FAN. DO NOT ALLOW COMPRESSOR TO RUN IN REVERSE ROTATION.

NORMAL STARTING

1. Press START button; let machine build up to operating pressure; at this stage, the automatic controls will take over.
It is especially important to let the machine warm up to operating temperature in cold ambients prior to giving the unit an air demand. If this is not done, it is possible to collapse the air/oil separator element on start up because of the oil saturating the element.

ON WATER COOLED UNITS, SEE THAT WATER IS TURNED ON.

NORMAL STOPPING
1. Press STOP RESET button to stop compressor.
2. Stop flow of cooling water if unit is water cooled.

**WARNING**

DO NOT PERFORM MAINTENANCE ON MACHINE WHEN THE "RUN LIGHT" IS ON, AS THE MACHINE COULD START WITHOUT WARNING. FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

EMERGENCY SHUT DOWN
To shut down the compressor in case of an emergency, press STOP RESET button.

RESTART AFTER POWER FAILURE
1. Check fuses and re-set starters.
2. Check to see that main disconnect is connected.
3. Follow Normal Starting Procedure.

RESTART AFTER SAFETY CIRCUIT SHUTDOWN
(Pull main disconnect switch prior to correcting problem).
1. After the cause of shutdown is corrected, press stop-reset button.
2. Follow Normal Starting Procedure.

PREPARATION FOR STORAGE AND START-UP AFTER PROLONGED STORAGE

Prolonged shutdown or storage requires special consideration as there are many conditions which could affect the compressor. Storage, indoors, outdoors in freezing temperatures, salt air, dampness, etc., only to mention a few. Unless otherwise stated in the sales agreement (sales order), the standard preparation for compressor shipment provides for up to eight weeks of indoor storage, starting from the time the machine leaves the factory.

Should prolonged storage or shutdown become necessary, the following action should be taken to offset a possible malfunction upon start-up:

**STORAGE**

IN PREPARATION FOR STORAGE:
1. Cover and seal all machine openings to prevent the entrance of dirt and water.
2. Cover all openings on open-drip-proof type motors to prevent the entrance of rodents.
3. If the machine is to be stored for any length of time at all in freezing conditions, it is necessary to drain all the water that may have accumulated in water-cooled coolers, air-cooled aftercoolers, traps, and attendant air piping prior to sealing all machine openings.
4. If the machine is to be stored outside, it must be protected from the weather to prevent the entrance of all dirt and water from any machine components especially the electrical controls.
5. It is suggested that any machine be completely covered with a waterproof tarpaulin that can be easily removed for in-storage maintenance.

IN-STORAGE MAINTENANCE
It is extremely important that the air end shaft be rotated several revolutions every two to three months to protect the bearings from receiving flat spots.

PREPARATION FOR START-UP:
Prior to start-up, after long term storage, the steps for preparation for initial start-up on Page 1, Section 2 should be followed.
IF MACHINE HAS BEEN IN STORAGE FOR MORE THAN A YEAR, IT IS SUGGESTED THAT A FRESH CHARGE OF OIL BE ADDED PRIOR TO START-UP.

If prolonged storage in extreme conditions not considered above becomes necessary, your Joy representative should be contacted immediately so that he may recommend additional precautions which may be taken to offset a possible malfunction upon start-up. It is our desire to maintain customer satisfaction by advising you in anticipation of a trouble-free start-up.
LUBRICANT

Your machine has been tested and filled with Syn Flo 80 lubricant. This fluid is a compound-ed olefin specifically formulated to optimize the performance of Rotary Screw compressors. In most installations, this lubricant will last significantly longer than standard petroleum oils.

No matter how good a lubricant, it cannot replace proper maintenance attention. We suggest you adhere to regular filter changes as outlined in the maintenance section of this manual. The filter system of your Joy compressor has been specifically designed to remove particular contaminant down to tolerable levels. It is therefore essential to use only genuine Joy replacement parts, since substitutes could impair performance.

To detect these contaminants and to further optimize lubricant life, we recommend an oil sampling program. When properly applied, it will confirm continued useful lubricant life. It will also indicate symptoms of problems, i.e., reactive gas intake, which should be addressed for continued good operation.

NOTICE

YOUR DISTRIBUTOR WILL PROVIDE YOU WITH AN OIL SAMPLE KIT. WE PROPOSE SAMPLING INTERVALS OF EVERY SIX MONTHS, CONDITIONS OR THE OIL ANALYSIS COMPANY MAY DICTATE SHORTER SAMPLING INTERVALS.

NOTICE

JOY MANUFACTURING COMPANY DOES NOT RECOMMEND MIXING DIFFERENT TYPES OR BRANDS OF LUBRICANTS DUE TO THE POSSIBILITY OF A DILUTION OF THE ADDITIVES OR A REACTION BETWEEN ADDITIVES OF DIFFERENT TYPES.

PRIME LUBRICANT CHARACTERISTICS

1. Viscosity
   a. 1200 SSU or less at 50°F.
   b. 160-210 SSU at 100°F.
   c. 47 SSU or greater at 210°F.
2. Flash Point 400°F. minimum (ASTM D-92-COC).
3. Pour point must be at least 20°F. lower than the lowest expected ambient temperature.
4. Contain rust and oxidation inhibitors.
5. Contain foam suppressors if required.

TYPES OF OIL TO BE CONSIDERED

*Industrial* Type Oils

Industrial oils should be of premium quality nondetergent mineral oil, viscosity grade SAE 10. Generally, industrial oils are better for high humidity and/or low load factor where condensed moisture and emulsification may occur.

Water, which will separate, must be drained from the oil sump. In addition to the prime oil characteristics, good water separation, therefore, is preferred.
Heavy Duty Detergent Motor Oils

Heavy duty detergent motor oils should be SAE viscosity Grade 10. The following have proven by experience to be satisfactory for use:

<table>
<thead>
<tr>
<th>API Designation</th>
<th>Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD/SC</td>
<td>MIL-L-2104C</td>
</tr>
<tr>
<td>CC/SE</td>
<td>MIL-L-45152</td>
</tr>
<tr>
<td>CG/SC</td>
<td>MIL-L-2104B</td>
</tr>
</tbody>
</table>

Generally, detergent motor oils are better where severe oil oxidation can occur due to heavy duty, high temperature conditions.

Automatic Transmission Fluids

Automatic transmission fluid (ATF) can be used. Generally, ATF fluids are used in heavy duty, high temperature conditions or in ambients consistently below 20°F.

Synthetic Lubricants

Insofar as known, all elastomeric components and all metals used in the compressor are fully compatible with synthetic lubricants. The viscosity grade chosen for synthetic lubricants should be based upon the suggested viscosity ranges listed under prime lubricant characteristics and the lubricant supplier. However, the synthetic lubricant should not employ viscosity index improver additives. These will precipitate out plugging oil passages and filters, ultimately causing unit failure.

Oil Sump Capacity

The compressor oil sump capacity is given in “Specifications” — Section 1. Maintain oil level at center of sight gauge (2, Figure 16). Do not overfill. An overfilled sump could cause hydraulic locking of the compressor. Oil level must be checked either prior to start up or after shutdown when oil has had a few minutes to settle.

Adding or Changing Oil

The oil sump contains all the oil required for compressor operation. Oil is added through the fill fitting (3, Figure 16) located on the side of the oil sump.

**WARNING**

DO NOT ATTEMPT TO ADD OIL WHEN THE COMPRESSOR IS OPERATING OR WHEN SUMP IS UNDER PRESSURE. LIFT THE HANDLE OF SAFETY RELIEF VALVE TO RELIEVE SYSTEM OF ALL PRESSURE. FAILURE TO COMPLY WITH THIS WARNING MAY CAUSE SERIOUS BODILY HARM.

Motor

Grease lubricated motors are properly lubricated at the time of manufacture and it is not necessary to relubricate prior to initial start-up. However, if motor has not been run for a period of six months or longer, it is recommended that it be lubricated before starting. For the type of lubricant to use and the method of lubrication, contact local manufacturer's representative. See motor nameplate for motor identification.

Initial Oil Change

Regardless of the care taken during machine assembly, there are impurities that enter the machine. In the initial hours of operation, these impurities are flushed out and caught by the oil filter. Because of this, it is recommended that the oil filter be changed and the separator element be checked after the first 300-400 hours of operation. Thereafter the element change interval should be as indicated by the maintenance indicators and in accordance with the following periodic maintenance schedule.
**PERIODIC MAINTENANCE SCHEDULE**

**DAILY OR EVERY 8 HOURS**

Prior to Start Up:

Check for correct sump oil level. Level should be at center of bulls-eye sight glass.

In Operation:

Observe oil return line tubing for oil flow.

The following gauges and indicators should be checked for normal indication of operation.

1. Oil Filter Indicator
2. Air Filter Indicator
3. Discharge Air Temperature
4. Discharge Air Pressure
5. Separator Service Gauge

**PERIODICALLY**

1. Inspect air intake filter element for clogging or holes.
2. Clean oil return line orifice, Figure 16.
3. Drain condensate from oil sump (Figure 16). Depending on the humidity of the climate, this may be necessary daily. Prior to draining, the compressor should be shut down for two hours to allow the water and oil to separate.
4. Lubricate water temperature regulating valve stem (Option item).
5. Clean cooling system heat exchangers.
6. Check sump pressure relief valve for operation. This valve is factory set and no attempt should be made to adjust it.
7. Check machine for oil leaks and loose fastenings/connections. Also, hose condition and correct or replace if necessary.
8. Check maintenance indicators and clean if necessary, to insure reliable operation.
DO NOT OPERATE MACHINE WITHOUT ALL FILTRATION ELEMENTS PROPERLY INSTALLED. MACHINE FAILURE WILL RESULT THAT CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

For water cooled heat exchangers, it may be necessary to have the tubes rodded out or steam cleaned occasionally. This need will be a direct reflection on the kind of water used. See "Cooling Water" Section 1. Air cooled heat exchangers may be cleaned with a rag and solvent or compressed air directed through the units.

EVERY SIX MONTHS OR 1000 HOURS
1. Change oil filter, air filter, and air-oil separator elements when maintenance indicators show change out pressure drop has been reached.
2. Change compressor oil, or as indicated by sampling program.
3. Check air/oil separator element and replace if damaged or extremely dirty.

THE USE OF SYNTHETIC LUBRICANTS HAVING EXTENDED USEFUL LIFE DOES NOT CHANGE THE OIL FILTER ELEMENT CHANGE INTERVAL.

DANGER
SUMP FIRES CAN CAUSE SEVERE INJURY, DEATH, OR PROPERTY DAMAGE. AIR/OIL SEPARATOR + DIRT + OXIDIZED OIL PRODUCTS + INCREASED AIR VELOCITY = FIRE. MAKE SURE AIR/OIL SEPARATOR, OIL, OIL FILTER, AND AIR FILTER ELEMENTS ARE INSPECTED AND REPLACED AS STATED IN THIS MANUAL.
A MACHINE OPERATING FOR AN EXTENDED PERIOD OF TIME WITH AN EXCESSIVELY DIRTY ELEMENT WILL REQUIRE AIR FILTER SERVICE. IF THIS IS NOT INDICATED BY THE SERVICE INDICATOR, CHECK THE FOLLOWING.

1. Make sure the element is installed properly.
2. Check the element for holes or breaks.
3. Check all inlet piping and connections for leaks.
4. Check maintenance indicator for proper functioning.

**Air Intake Filter**

Service the air intake filter element (Figure 17) only when indicated by the service filter indicator. Scheduled service based on a set number of operating hours is not required nor recommended.

**DO NOT WORK ON THE AIR INTAKE FILTER WHILE THE MACHINE IS IN OPERATION.**

**Oil Filter**

Service oil filter element every 1000 hours or sooner as indicated by the restriction indicator.

This oil filter (Figure 16) is the replaceable element type. To install new element, simply remove and replace. Ascertain that element is secure and gasket is serviceable and in place.

**HOT OIL UNDER PRESSURE WILL CAUSE SEVERE INJURY, DEATH, PROPERTY DAMAGE. BE SURE COMPRESSOR IS SHUT DOWN AND RELIEVED OF ALL PRESSURE BEFORE ATTEMPTING ANY WORK ON COMPRESSOR.**
Air/Oil Separator
The procedure for servicing the separator filter element is as follows:
1. Disconnect necessary piping at separator cover. The oil return line must be first separated at coupling B, Figure 18, loosened at fitting A on the separator cover and then the tube pulled up out of the separator.
2. Unbolt cover and remove.
3. Lift out separator element.
4. Install new element (gaskets are attached). Make sure flange surfaces are clean. All elements will have either a staple in the gasket or a sheet metal tab attached to the inside of the separator. These items are attached to provide metal to metal contact between the element and the sump head. It has been proven that these items reduce the possibility for sump fires.
5. Refer to Table A for Torque Values.
6. Reconnect all piping. Ascertain that oil return tube is “bottomed” at C in the separator.

Thermal Valve
The thermal valve, (Figure 16), should be inspected if the unit shuts down due to high compressor discharge air temperature. A piece of sediment may lodge on the valve seating surface and prevent it from closing and allowing the hot oil to pass into the compressor.

The valve may be inspected by removal and disassembly.

Oil Return Line
The oil return line tubing (Figure 18) serves to visually ascertain that any oil accumulation at the bottom of the air/oil separator is being removed. This tubing should be observed daily (during operation) for an indication of oil flow, a light air/oil mist is normal. If the tube shows completely full of oil, it indicates that the oil line is clogged and oil is not being removed. If the tube shows no flow at all, the oil line may be clogged or the drop tube may not be properly “bottomed” in the separator element. This results in excessive oil consumption and oil in service lines. If clogging is indicated, remove and clean the orifice (Figure 18) by blowing with a reverse flow of air. The plastic tubing will sometimes discolor with age due to the lubricant. If it becomes impossible to distinguish oil flow in the tube, it will be necessary to clean the tube or replace it. A bright light placed behind the tube may also reveal oil flow in a discolored tube.

NOTICE

A NEW AIR/OIL SEPARATOR MAY NOT SHOW OIL IN TUBING FOR APPROXIMATELY THE FIRST 90 HOURS OF OPERATION.

Control Valve
Proper adjustment of the control valve can be ascertained when on rising pressure venting starts, at the control valve vent hole, immediately after discharge pressure reaches the low limit of the control range. For example, if a machine has a maximum operating pressure of 110 psig, the normal control range is from 100 psig to 110 psig. Thus, venting should start at 100 psig.

If the control pressure is indicated too soon, turn the adjustment screw inward to raise the level at which the control pressure starts. Turn the screw outward to start the control pressure at a lower level.

There are three operating conditions under which control valve venting will vary as follows:
1. When the compressor is operating within the Normal Control Range, venting will modulate — that is, low venting will indicate that the inlet valve is open wide. As venting increases, the inlet valve will gradually close.
2. When the compressor reaches its maximum operating limit, it will be unloaded by action of the air pressure switch and venting will, in a short period, stop.
3. At any time that the compressor is operating at a pressure below the Normal Control Range, there should be no venting.
IF THE AIR PRESSURE SWITCH SETTING IS CHANGED, READJUST THE-control AIR
VALVE. ALSO TIGHTEN THE LOCKNUT ON THE ADJUSTING SCREW AFTER THE COR-
RECT SETTING IS OBTAINED.

Air Pressure Switch
The air pressure switch is factory set to the limit indicated on the compressor nameplate. It
may be set lower if desired, however, it will keep the minimum pressure valve shut if set below
70 psig. The normal control range is 10 psi. See instructions inside cover of switch for details
on adjustment.

Time Delay Relay
The time delay relay, (Figure 9), is set at the factory for a minimum delay of 20 minutes. It can
be reset for a longer delay. See Section 1.

Minimum Pressure Valve
The minimum pressure check valve is designed to open at approximately 70 psig. It is not in-
tended to be adjustable.

WHEN REMOVING AIR END OR MOTOR, SUPPORT THE REMAINING COMPONENTS.
FAILURE TO COMPLY WITH THIS WARNING CAN RESULT IN PERSONAL INJURY OR
PROPERTY DAMAGE.

| TABLE A |
| RECOMMENDED TORQUE SPECIFICATIONS |

<table>
<thead>
<tr>
<th>CAPSCREW SIZE</th>
<th>GRAYE</th>
<th>DRY TIGHTENING TORQUE</th>
<th>LUBRICATED TIGHTENING TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4-20 UNC</td>
<td>5</td>
<td>96 IN LBS</td>
<td>75 IN LBS</td>
</tr>
<tr>
<td>5/8-18 UNC</td>
<td>5</td>
<td>17 FT LBS</td>
<td>13 FT LBS</td>
</tr>
<tr>
<td>3/8-16 UNC</td>
<td>5</td>
<td>30 FT LBS</td>
<td>23 FT LBS</td>
</tr>
<tr>
<td>1/2-13 UNC</td>
<td>5</td>
<td>75 FT LBS</td>
<td>55 FT LBS</td>
</tr>
<tr>
<td>3/4-10 UNC</td>
<td>5</td>
<td>260 FT LBS</td>
<td>200 FT LBS</td>
</tr>
<tr>
<td>3/4-10 UNC</td>
<td>8</td>
<td>380 FT LBS</td>
<td>280 FT LBS</td>
</tr>
</tbody>
</table>

* These are sump head capscrews
# MAINTENANCE SCHEDULE

<table>
<thead>
<tr>
<th>INTERVAL</th>
<th>ACTION</th>
</tr>
</thead>
</table>
| PERIODICALLY DURING OPERATION | 1. CHECK HOSES, GASKETS, AND CONNECTIONS FOR LEAKS  
 | | 2. CHECK ROTOR COOLANT INJECTION TEMPERATURE  
 | | 3. CHECK DISCHARGE AIR TEMPERATURE  
 | | 4. CHECK DISCHARGE AIR PRESSURE  
 | | 5. CHECK DELIVERY AIR TEMPERATURE  
 | | 6. CHECK NORMAL OPERATION  
 | | 7. CHECK AIR FILTER VISUAL INDICATOR  
 | | 8. CHECK OIL FILTER VISUAL INDICATOR  
 | | 9. CHECK AIR/OIL SEPARATOR INDICATOR  
 | | 10. CHECK DELIVERY AIR PRESSURE |
| DAILY OR EVERY 10 OPERATING HOURS (PRIOR TO START-UP) | 1. DRAIN CONDENSATE FROM OIL SUMP  
 | | 2. MAINTAIN OIL LEVEL AT CENTER OF SUMP SIGHT GLASS |
| 6 MONTHS OR EVERY 1000 OPERATING HOURS | 1. CHANGE COMPRESSOR OIL OR AS INDICATED BY OIL SAMPLING PROGRAM  
 | | 2. CHANGE OIL FILTER ELEMENTS |
| PERIODICALLY OR AS REQUIRED | 1. INSPECT AIR INTAKE FILTER ELEMENT FOR CLOGGING  
 | | 2. LUBRICATE WATER TEMPERATURE REGULATING VALVE STEM  
 | | 3. CHECK COOLING WATER HEAT EXCHANGERS  
 | | 4. CHECK FOR CLEANLINESS OF HEAT EXCHANGERS (AIR COOLED) |

**FIGURE 19**

*Maintenance Schedule*
INTRODUCTION
This section contains instructions for trouble shooting the equipment following a malfunction to permit selection of the maintenance procedure which must be utilized to restore the equipment to operating condition.

The troubleshooting procedures to be performed on the equipment are listed (SEE TROUBLE SHOOTING CHART). Each symptom of trouble for a component or system as listed is followed by a list of probable causes of the trouble and suggested procedures to be followed to eliminate the cause.

In general, the procedures listed should be performed in the order in which they are listed, although the order may be varied if the need is indicated by conditions under which the trouble occurred. In any event, the procedures which can be performed in the least amount of time and with the least amount of removal or disassembly of parts should be performed first.

AUTOMATIC SHUTDOWN
If the compressor discharge temperature exceeds 235°F., the unit will automatically shut down. To determine the cause of this excessive high discharge temperature, SEE CHART.

It should be noted that the recommended water flow in “Specifications” is based on 80°F. inlet water. Should the inlet temperature be significantly less than 80°F., the recommended water flow could result in a cold boundary layer of oil insulating the hot oil from the cold water. In this case the water flow should be reduced to prevent over temperature shutdown. See “Cooling Water”, Section 1.

FREQUENT SEPARATOR PLUG-UP OR COLLAPSE
If the separator element has to be replaced frequently because it is plugging up, it is an indication the compressor oil filter is faulty, oil is breaking down, or dirt is entering the inlet system.

Oil Filter
1. Make sure filter has the correct element.
2. Make sure filter is not leaking.

Oil Breakdown (Causes)
1. Extreme operating conditions such as high compressor discharge temperature and high receiver pressure.
2. Wrong type of oil.
3. Ingestion of chemically active gases.

Inlet System
1. Check all piping joints leading to inlet valve for leaks.
2. Check air filter element for breaks.

If the separator element collapses, it could be an indication the element is plugging and should be treated as outlined above.

Starting-up in cold ambient conditions when the unit has an immediate air demand can collapse the element. Allow unit to warm-up.
<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBABLE CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAILURE TO START</td>
<td>1. MAIN SWITCH DISCONNECTED</td>
</tr>
<tr>
<td></td>
<td>2. POWER FAILURE</td>
</tr>
<tr>
<td></td>
<td>3. SAFETY CIRCUIT SHUTDOWN</td>
</tr>
<tr>
<td></td>
<td>4. FAULTY START SWITCH OR CONNECTION</td>
</tr>
<tr>
<td></td>
<td>5. OVERLOADS OUT</td>
</tr>
<tr>
<td></td>
<td>6. RESET BUTTON OUT</td>
</tr>
<tr>
<td></td>
<td>7. FAULTY ICR COIL</td>
</tr>
<tr>
<td>HIGH AIR TEMPERATURE</td>
<td>1. LOW SUMP OIL LEVEL</td>
</tr>
<tr>
<td>SWITCH (W/C UNITS)</td>
<td>2. CLOGGING OF HEAT EXCHANGER</td>
</tr>
<tr>
<td>AUTOMATIC SHUTDOWN</td>
<td>3. LEAKY THERMAL BY-PASS VALVE</td>
</tr>
<tr>
<td></td>
<td>4. PLUGGED OIL FILTER</td>
</tr>
<tr>
<td></td>
<td>5. INSUFFICIENT SUPPLY OR COOLING WATER</td>
</tr>
<tr>
<td></td>
<td>6. HIGH AIR TEMPERATURE SWITCH</td>
</tr>
<tr>
<td>HIGH AIR TEMPERATURE</td>
<td>1. LOW SUMP OIL LEVEL</td>
</tr>
<tr>
<td>SWITCH (A/C UNITS)</td>
<td>2. LEAKY THERMAL BY-PASS VALVE</td>
</tr>
<tr>
<td>AUTOMATIC SHUTDOWN</td>
<td>3. RESTRICTION OF HEAT EXCHANGER AIR FLOW</td>
</tr>
<tr>
<td></td>
<td>4. PLUGGED OIL FILTER</td>
</tr>
<tr>
<td></td>
<td>5. HIGH AIR TEMPERATURE SWITCH</td>
</tr>
<tr>
<td></td>
<td>6. IMPROPER FAN ROTATION</td>
</tr>
<tr>
<td>IMPROPER LOW DISCHARGE PRESSURE</td>
<td>1. EXCESSIVE AIR DEMAND</td>
</tr>
<tr>
<td></td>
<td>2. SERVICE VALVE OPEN</td>
</tr>
<tr>
<td>*IMPROPER HIGH DISCHARGE PRESSURE</td>
<td>3. LEAKY SERVICE LINE</td>
</tr>
<tr>
<td></td>
<td>4. IMPROPER INLET VALVE OPENING*</td>
</tr>
<tr>
<td></td>
<td>5. PLUGGED AIR CLEANER</td>
</tr>
<tr>
<td></td>
<td>6. FAULTY SAFETY VALVE*</td>
</tr>
<tr>
<td></td>
<td>7. PLUGGED UP OIL SEPARATOR</td>
</tr>
<tr>
<td></td>
<td>8. MALAJUSTED CONTROL VALVE</td>
</tr>
<tr>
<td></td>
<td>9. MALAJUSTED AIR PRESSURE SWITCH</td>
</tr>
<tr>
<td>EXCESSIVE OIL CONSUMPTION</td>
<td>1. OVERFILLED OIL SUMP</td>
</tr>
<tr>
<td></td>
<td>2. BROKEN OIL LINE</td>
</tr>
<tr>
<td></td>
<td>3. PLUGGED OIL RETURN LINE</td>
</tr>
<tr>
<td></td>
<td>4. OIL RETURN LINE NOT BOTTOMED IN SEPARATOR</td>
</tr>
<tr>
<td></td>
<td>5. OPERATING BELOW RATED PRESSURE</td>
</tr>
<tr>
<td></td>
<td>6. FAULTY COMPRESSOR SHAFT SEAL</td>
</tr>
<tr>
<td></td>
<td>7. DAMAGED SEPARATOR</td>
</tr>
<tr>
<td>FREQUENT SEPARATOR PLUG-UP</td>
<td>1. DIRT IS ENTERING THE INLET SYSTEM</td>
</tr>
<tr>
<td></td>
<td>2. FAULTY AIR FILTER ELEMENT</td>
</tr>
<tr>
<td></td>
<td>3. FAULTY OIL FILTER</td>
</tr>
<tr>
<td></td>
<td>4. OIL IS BREAKING DOWN OR OF WRONG VICOSITY</td>
</tr>
<tr>
<td>HIGH DISCHARGE AIR TEMPERATURE SHUTDOWN</td>
<td>1. LOW SUMP OIL LEVEL</td>
</tr>
<tr>
<td></td>
<td>2. PLUGGED OIL FILTER ELEMENT</td>
</tr>
<tr>
<td></td>
<td>3. INSUFFICIENT AIR CIRCULATION AT A/C OIL COOLER</td>
</tr>
<tr>
<td></td>
<td>4. PLUGGED OR DIRTY OIL COOLER FINS</td>
</tr>
<tr>
<td></td>
<td>5. CONTAMINATED WATER COOLED OIL COOLER</td>
</tr>
<tr>
<td></td>
<td>6. INSUFFICIENT COOLING WATER (W/C)</td>
</tr>
<tr>
<td></td>
<td>7. LEAKY THERMAL VALVE</td>
</tr>
</tbody>
</table>

FIGURE 20
Trouble shooting chart
<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>PROBABLE CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW CAPACITY</td>
<td>1. PLUGGED AIR FILTER&lt;br&gt;2. INLET VALVE STUCK, PARTIALLY CLOSED&lt;br&gt;3. PIPING LEAK&lt;br&gt;4. AFTERCOOLER LEAK&lt;br&gt;5. AIR END BEARING FAILURE</td>
</tr>
<tr>
<td>HIGH POWER CONSUMPTION</td>
<td>1. PLUGGED SEPARATOR&lt;br&gt;2. PLUGGED AFTERCOOLER&lt;br&gt;3. IMPROPER AIR PRESSURE SETTING&lt;br&gt;4. TOO LOW LINE VOLTAGE&lt;br&gt;5. ELECTRICAL PHASE IMBALANCE&lt;br&gt;6. IMMINENT AIR END FAILURE&lt;br&gt;7. IMMINENT MOTOR FAILURE</td>
</tr>
<tr>
<td>HIGH FILTER USAGE BUT NO APPARENT PLUGGING.</td>
<td>1. CHECK INDICATOR FOR ACCURACY&lt;br&gt;2. CORRECT ELEMENT INSTALLED&lt;br&gt;3. PROPER INSTALLATION OF ELEMENT</td>
</tr>
</tbody>
</table>

FIGURE 20
Trouble Shooting Chart (Continued)
NOTES
SECTION 5

OPTIONAL EQUIPMENT

INTRODUCTION

This section contains information for optional equipment that may be supplied with your compressor. Coverage of equipment other than that supplied may also be included. Check the identification plate or decal on each piece of equipment to ascertain applicable instructions. The service requirements of these components should be included with your Periodic Maintenance Schedule as outlined in Section 3.

A temperature regulating valve may be included in the cooling system to automatically regulate the cooling water flow as necessary to maintain the desired compressor operating temperature. This valve is located in the outlet water supply piping. It thermostatically modulates the water flow in response to a sensing element located in the oil outlet from the oil cooler. The valve has been factory adjusted to maintain the compressor operating temperature at approximately 90° above ambient.

An additional feature of the temperature regulating valve is that by constant modulation, maximum efficiency of the water supply is assured; thus, the amount of water used is maintained at a minimum. Upon shutdown the valve will slowly close in response to the oil temperature.

To install water control valve see Figure 22, remove plenum panel (on right side of water service connections) by taking out the four screws that hold it in place. Remove plug from tee in discharge oil port of oil cooler and install sensing probe. Careful attention to the installation instructions included with the probe will insure correct operation of the valve. It may also be necessary to remove the enclosure panel to the left of the water connections. Place capillary tube in split grommet in support panel. Replace enclosure panel and install water control valve.

NOTICE

SUGGEST GATE TYPE VALVES, OPEN NO. 2 AND CLOSE NO. 1 FOR WATER BY-PASS.
OPTIONAL GAUGE PACKAGE

Delivery Air Pressure (Optional)
The delivery air pressure gauge (7, Figure 7) measures the pressure being delivered in your system. A comparison of this reading with discharge pressure indicates aftercooler performance. An increase in this number will indicate a blockage on the air side requiring maintenance.

Delivery Air Temperature (Optional)
The delivery air temperature gauge (2, Figure 7) measures the temperature of air being delivered into your system. A comparison of this reading to the discharged temperature reading gives you a performance measure on the aftercooler. A drop off in this performance would indicate maintenance requirement on coolant side.

Rotor Coolant Injection Temperature (Optional)
This gauge (4, Figure 7) shows the temperature of the oil just prior to injection into the compression chamber. Normal temperature in operation is approximately 40-60 Deg. F. below the air discharge temperature.