SAFETY PRECAUTIONS ENCLOSED

DO NOT DESTROY

This manual contains important safety information and should be made available to all personnel who operate and/or maintain this product. Carefully read this manual before attempting to operate or perform maintenance.

PRECAUCIONES DE SEGUIRIDAD

NO DESTRUIR

Este manual contiene información importante y debe estar al alcance de todo el personal que opera y/o mantiene este producto. Lea cuidadosamente este manual antes de intentar operar o efectuar cualquier mantenimiento a este producto.

INSTRUCTION MANUAL

Model 23A
Model 234
Model 235
Model 242
Model 244
Model 253
Model 255

1.0 Through 7.5 Horsepower

Finger Valve

Air Compressors

INGERSOLL-RAND®

AIR COMPRESSORS

Refer all communications to the nearest Ingersoll-Rand Full Service Distributor.
Para cualquier consulta, contacte a su Distributor Ingersoll-Rand más cercano.

Form SCD-196
July 1981

NOTICE

THE USE OF REPAIR PARTS OTHER THAN THOSE INCLUDED WITHIN THE INGERSOLL-RAND COMPANY APPROVED PARTS LIST MAY CREATE UNSAFE CONDITIONS OR MECHANICAL FAILURES OVER WHICH INGERSOLL-RAND COMPANY HAS NO CONTROL. INGERSOLL-RAND COMPANY SHALL BEAR NO RESPONSIBILITY FOR EQUIPMENT ON WHICH NON-APPROVED REPAIRS PARTS ARE INSTALLED.

The manufacturer reserves the right to make changes or add improvements without notice and without incurring any obligation to make such changes or add such improvements to products previously sold.

GLOSSARY

Group Assembly Parts List
Parts are listed in disassembly sequence, where applicable. Each assembly is broken down into subassemblies and detail parts which are idented with "bullet" (•) symbols in the DESCRIPTION column to indicate the relationship to the next higher assembly:

Assemblies and Detail Parts

- • Attaching Parts for Assemblies and Detail Parts
- • • Subassemblies
- • • • Detail Parts for Subassemblies, etc.

Reference Number Column
The reference number is the number assigned to the part in the listing. The reference number corresponds to the item on the associated illustration. Where applicable, the following abbreviations might appear in this column:

NI	Not Illustrated.
REF	Reference Only. Refer to the figure and page noted in the description column.

Part Number Column
All numbers listed in this column are INGERSOLL-RAND part numbers, and must be specified when ordering replacement parts. The following abbreviations appear in this column:

NA	Not Applicable. This abbreviation indicates items which are not used on particular models or packages.
NSS	Not Sold Separately. These items must be ordered under the next higher assembly, or, where applicable, as part of a Step Saver Kit.
*	Consumable Materials (lubricants, sealants, etc.). Purchase directly from your local INGERSOLL-RAND Air Center or Full Service Distributor.
**	Part Number Varies. Specify the compressor bare speed and complete nameplate data when ordering.

Description Column
The description column indicates the item by standard name followed by modifiers. The modifiers identify specific characteristics (i.e. dimensions, capacity, pressure setting, etc.), and/or the particular location or function on the compressor. Always include the description when ordering replacement parts or kits.

Quantity Per Assembly Column
Quantities listed in this column reflect the number used in the next higher assembly, and are not necessarily the total quantity of the part used in the complete package. Specify the desired quantity when ordering replacement parts.

Recommended Spares Column
Quantities listed in this column reflect the number of each item which we recommend be kept on hand for maintenance or repair:

CLASS 1	MINIMUM. Recommended quantity for Domestic Service where interruptions in service are not important.
CLASS 2	AVERAGE. Recommended quantity for Domestic Service where interruptions in continuity of service are not objectionable.
CLASS 3	MAXIMUM. Recommended quantity for International or Domestic Service where interruptions in service are not acceptable.

Step Saver Kits
Step Saver Kits are available for all compressor models. These kits are designed to provide all of the parts you will need to perform routine maintenance and repair tasks. A list of available Step Saver Kits is included in the Parts List manual which came with your compressor. When ordering Step Saver Kits, please follow the instructions set out below for ordering replacement parts.

ORDERING INSTRUCTIONS

All parts listed in the Part List manual for your compressor are available through your local INGERSOLL-RAND Air Center or Full Service Distributor. Consult the Directory of Distributors included with your compressor to locate the distributor in your area.

When ordering replacement parts or Step Saver Kits, please specify:

1. The MODEL and SERIAL NUMBER as stamped on the compressor nameplate.
2. The FORM NUMBER of the Parts List manual.
3. The QUANTITY, DESCRIPTION and PART NUMBER exactly as listed.

EXAMPLE

Send the following parts for model	7100
Serial Number	T30000000
Literature Form Number	SCD-478A
1 Switch, Pressure - NEMA 1	37005907
2 Element, Filter	32012957
1 Gauge, Pressure	32013872

NOTA

EL USO DE PARTES PARA REPARACION DIFERENTES A LAS INCLUIDAS EN LA LISTA DE PARTES APROBADA DE INGERSOLL-RAND PUEDE CREAR CONDICIONES INSEGURAS O FALLAS MECANICAS SOBRES LAS CUALES INGERSOLL-RAND NO TIENE CONTROL. POR LO TANTO INGERSOLL-RAND NO PUEDE SER RESPONSABLE POR EQUIPOS EN LOS QUE SE HAN USADO PARTES NO APROBADAS.

El fabricante se reserva el derecho a hacer cambios o adicionar mejoras sin notificación y sin incurrir en la obligación de hacer dichos cambios o adicionar tales mejoras a productos vendidos previamente.

GLOSARIO

Lista de Partes de Conjuntos de Ensamble
Las partes están listadas en secuencia de desarme en donde sea aplicable. La relación de un artículo con su más alto e inmediato ensamble está indicado por una indentación (•). Por ejemplo en la columna de DESCRIPCIÓN:

Ensambles y partes detalladas

- • Partes para ensambles y partes detalladas
- • • Subensambles
- • • • Partes detalladas para sub-ensambles etc.

Columna de Items
El número de item es el asignado a la parte en el listado. Este número de Item identifica la parte en la ilustración asociada. Las abreviaturas siguientes podrían aparecer en esta columna:

NI	No ilustra.
REF	Para la referencia. Refiera a la página e ilustración apropiada.

Columna de Numero de Parte
Todos los números son números de parte INGERSOLL-RAND los cuales deben ser especificados cuando se ordenen los repuestos. Las abreviaturas siguientes podrían aparecer en esta columna:

NA	Significan que la parte no es aplicable a determinados modelos.
NSS	Indican que la parte no se vende por separado para determinados modelos. Las letras
*	Los Materiales Consumibles (lubricantes, adhesivos, etc.). Compredirectamente desde un INGERSOLL-RAND Distribuidor de Servicio o Air Center.
**	El Número de Parte Varía. Especifique los datos completos de compresor cuandoordenación.

Columna de Descripcion
Esta columna de descripción contiene el nombre del artículo estándar con modificadores. La relación de un artículo con su próximo ensamble más alto se muestra en esta columna por una indentación. Siempre incluir la descripción cuando ordenadora conjuntos o partes dereemplazo.

Columna de Cantidad Por Ensamble
Las cantidades especificadas en esta columna son el número de partes usadas por cada ensamble superior y no necesariamente son el número total de partes del modelo en general. Especifique la cantidad deseada cuando partes ordenadoras de reemplazo.

Como Seleccionar Repuestos Recomendados
Este catálogo contiene una lista de partes que está incluidas en cada una de las siguientes clases de repuestos recomendados:

CLASE 1	MINIMA. Sugerida para uso doméstico donde interrupciones en la continuidad del servicio no son importantes.
CLASE 2	PROMEDIO. Sugerida para servicio doméstico donde algunas interrupciones en la continuidad del servicio no son objetables.
CLASE 3	MAXIMA. Sugerida para exportación o para servicio doméstico donde la interrupción en el servicio es objetable.

Conjuntos de Partes
Los conjuntos de Partes son disponibles para todos los compresors. Estosconjuntos se diseñan para proveer todas las partes usted necesitará desempeñarel mantenimiento de rutina y repara tareas. Una lista de Conjuntosdisponibles se incluye en el lista de partes que vino con su compresor. Cuando se ordenen repuestos recomendados o kits prácticos, siga el procedimiento descrito para partes del compresor.

INSTRUCCIONES DE ORDEN DE COMPRA

Todas las partes enumeraron en el Lista de Partes para su compresor son disponibles mediante su Air Center o Distribuidor de Servicio de INGERSOLL-RAND. Consulte el Directorio de Distribuidores incluyócon su compresor para ubicar el distribuidor en su área.

Cuando se ordenen repuestos, por favor especifique:

1. El MODELO y NUMERO DE SERIE como está impreso en la placa del compresor
2. El NUMERO DE FORMATO de la lista de partes.
3. La CANTIDAD, DESCRIPCION y NUMERO DE PARTE exactamente como fue listado.

EJEMPLO

Envíe las siguientes partes para un modelo	7100
Número de Serie	T30000000
Número de formato de la literatura	SCD-478A
1 Interruptor, Presión	37005907
2 Elemento, Filtro	32012957
1 Manómetro	32013872

WARNING

STATEMENT CONCERNING THE USE OF THIS EQUIPMENT FOR BREATHING AIR AND/OR AQUA LUNG SERVICE.

IF THE MODEL NUMBER ON THIS AIR COMPRESSOR CONTAINS THE LETTERS "BAP", THE COMPRESSOR IS SUITABLE FOR USE IN BREATHING AIR SERVICES. IN THE ABSENCE OF SUCH A DESIGNATION, THE COMPRESSOR IS NOT CONSIDERED AS CAPABLE OF PRODUCING AIR OF BREATHING QUALITY. FOR A COMPRESSOR TO BE CAPABLE OF USE IN BREATHING AIR SERVICES, IT MUST BE FITTED WITH ADDITIONAL SPECIALIZED EQUIPMENT TO PROPERLY FILTER AND/OR PURIFY THE AIR TO MEET ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, RULES, REGULATIONS AND CODES, SUCH AS, BUT NOT LIMITED TO, OSHA 29 CFR 1910.134, COMPRESSED GAS ASSOCIATION COMMODITY SPECIFICATION G-7.1-1966, GRADE D BREATHING AIR, AND/OR CANADIAN STANDARDS ASSOCIATION. SHOULD THE PURCHASER AND/OR USER FAIL TO ADD SUCH SPECIALIZED EQUIPMENT AND PROCEEDS TO USE THE COMPRESSOR FOR BREATHING AIR SERVICE, THE PURCHASER/USER ASSUMES ALL LIABILITY RESULTING THEREFROM WITHOUT ANY RESPONSIBILITY OR LIABILITY BEING ASSUMED BY INGERSOLL-RAND COMPANY.

THE PURCHASER IS URGED TO INCLUDE THE ABOVE PROVISION IN ANY AGREEMENT FOR ANY RESALE OF THIS COMPRESSOR

FOR ADDITIONAL INFORMATION AND WARNINGS, SEE THE PARTS LIST FOR THIS MACHINE.

SAFETY PRECAUTIONS

WHERE LUBRICATING OIL IS PRESENT IN THE COMPRESSOR DISCHARGE, AN AFTER-COOLER SHOULD BE INSTALLED IN THE FINAL COMPRESSOR DISCHARGE LINE; IT SHOULD BE MOUNTED AS CLOSE AS POSSIBLE TO THE COMPRESSOR.

WHEN INSTALLING A NEW COMPRESSOR IT IS ESSENTIAL TO REVIEW THE TOTAL PLANT AIR SYSTEM. THE USE OF PLASTIC OR NON-METALLIC BOWLS ON LINE FILTERS WITHOUT METAL GUARDS CAN BE HAZARDOUS.

A PRESSURE RELIEF VALVE MUST BE INSTALLED IN THE DISCHARGE PIPING BETWEEN THE COMPRESSOR AND ANY POSSIBLE RESTRICTION, SUCH AS A BLOCK VALVE, CHECK VALVE, AFTERCOOLER, OR AIR DRYER. FAILURE TO INSTALL A PRESSURE RELIEF VALVE COULD RESULT IN OVERPRESSURE, PIPE RUPTURE, DAMAGE TO THE COMPRESSOR AND PERSONAL INJURY. REFER TO INSTRUCTION BOOK FOR SPECIFIC INFORMATION.

THOSE RESPONSIBLE FOR INSTALLATION OF THIS EQUIPMENT MUST PROVIDE SUITABLE GROUNDS, MAINTENANCE CLEARANCE AND LIGHTNING ARRESTORS FOR ALL ELECTRICAL COMPONENTS AS STIPULATED IN O.S.H.A. 1910.208 THROUGH 1910.329.

WHEN A RECEIVER IS INSTALLED, IT IS RECOMMENDED THAT OCCUPATIONAL SAFETY AND HEALTH STANDARDS AS COVERED IN THE FEDERAL REGISTER, VOLUME 36 NUMBER 105 PART II PARAGRAPH 1910.169 BE ADHERED TO IN THE INSTALLATION AND MAINTENANCE OF THIS RECEIVER.

ALL ELECTRICAL INSTALLATION MUST BE IN ACCORDANCE WITH RECOGNIZED ELECTRICAL CODES. BEFORE WORKING ON THE ELECTRICAL SYSTEM, BE SURE TO CUT OFF THE ELECTRICAL SUPPLY FROM THE SYSTEM BY USE OF A MANUAL DISCONNECT SWITCH. DO NOT RELY ON THE STARTER TO CUT OFF THE ELECTRICAL SUPPLY.

FAILURE TO HEED ANY OF THESE WARNINGS MAY RESULT IN AN ACCIDENT CAUSING PERSONAL INJURY OR PROPERTY DAMAGE.

METRICATION

THIS MANUAL HAS BEEN METRICATED

ALL PRESSURE UNITS ARE GIVEN IN Pounds/Square Inch (bar)

To convert bar to kilopascal (kPa) multiply bar x 100

To convert bar to kilogram/centimeter squared (kg/cm^2) multiply bar x 1.02.

INDEX

SECTION I

GENERAL DESCRIPTION 5
- Application 5
  - Single-Stage Compressors 5
  - Two-Stage Compressors 5

SECTION II

INSTALLATION AND START-UP RECOMMENDATIONS 7–13
- Location and Foundation 6
- Inlet Piping 6
- Electrical 7
- Wiring 7
- Fuses 7
- Starting Switch 7
- Compressor Lubrication 9
- Operation Check 9
- Low Oil Level Switch 9
- Discharge Piping 10
- Gasoline Engine Driven Units 11

SECTION III

REGULATION 12–13
- Automatic Start & Stop Control 12
  - Pressure Switch Adjustment 12
- Constant Speed Control 12
  - Discharge Unloader Valve 13
- Dual Control 13
- Intermittent Duty Formula 13
  - Units Operating Above 200 PSIG 13

SECTION IV

OPERATION 14–16
- Operating Checks 14
- Compressor Lubrication 14
  - Frame Oil Change 14
  - Lubricating Oil Recommendations 14
- Motor Lubrication & Care 14
  - Sleeve Bearing Motors 14
  - Ball Bearing Motor with Grease Fittings 14
  - Ball Bearing Motors Pre-lubricated 14
- Air Inlet Muffler & Cleaner 14
- Breather Tube 15
- Intercooler 15
- Safety Valve 15
  - Operation of Starting Unloading System 15
- Pilot Valve Adjustment 16
- Check Valve 16

SECTION V

TROUBLE GUIDE 17

SECTION VI

MAINTENANCE ROUTINE INSPECTION & SERVICE 18
- General 19
- Torque Values 19
- Air Valve Cleaning 19
- Belt Installation & Adjustment 19
- Piston Ring Replacement 20
- Separating the Piston from the Rod 23
- Crankshaft Bearing Replacement 24
- Crankpin Bushing Replacement 24
- Crankshaft Assembly Replacement 24
- Oil Seal Replacement 24
- Precautions for Extended Shutdown 24

SECTION VII

OPTIONAL EQUIPMENT ACCESSORIES AND PIPING ARRANGEMENT 26–29
- Aftercoolers 26
  - Air-Cooled Aftercoolers 26
  - Water-Cooled Aftercoolers 26
  - Aftercooler Servicing 26
- Automatic Water Valve 26
- Automatic Drain Trap 27
- Air Receiver 28
- Schematics–Typical Mounting and Piping 28–29

SECTION I
GENERAL DESCRIPTION

Application — Ingersoll–Rand's 1 through 7½ H. P. units are either single or two-stage, single-acting, air-cooled compressors that do not require installation on a special foundation. All models can be furnished as compact, self-contained, receiver-mounted units, automatically regulated and driven by either an electric motor or gasoline engine. A water or air-cooled aftercooler along with an automatic condensate drain valve can be furnished as optional equipment. The units are also sold as bare or baseplate-mounted compressors.

These compressors may be used for any compressed air application requiring air from 10 to 250 psi. (703 to 17.5 kg/cm^2) with delivery from 5.0 to 45.9 cfm 6141 to 1.299 m^3/min.)

Application of these compressors as either a primary or supplementary source of air is virtually unlimited in industrial plants, service stations and auto repair shops. Supplementary service includes such uses as furnishing air at pressure not carried in regular shop lines, air at isolated locations, standby service for air when larger compressors are shut down.

In addition to the many advantages offered by compact, air-cooled construction, moderate compressor speeds along with time proven, efficient finger valves, and solid-end connecting rods, two-stage machines are equipped with highly efficient intercooler tubes that obtain maximum heat dissipation between stages of compression, resulting in more air per horsepower and less trouble from oil carbonization. Also, simplified design permits rapid access to any part of the unit for inspection or replacement of parts.

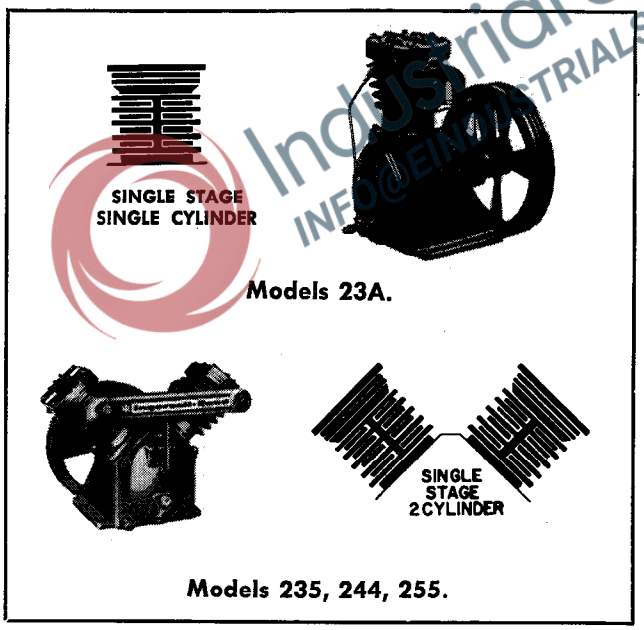


Figure 1–1, Single-Stage Compressors.

Single-Stage Compressors — Any compressor with cylinders of the same bore size (regardless of the number of cylinders) may be a single-stage machine. See Figure 1–1.

The basic principle of operation is as follows: On the suction stroke of the individual piston, air at atmospheric pressure enters the cylinder through the inlet filter and the valve located in each air head. On the compression stroke of each piston, air is forced out through the valve and passes into a common discharge manifold (on two cylinder compressors) from where it is piped to the receiver or system.

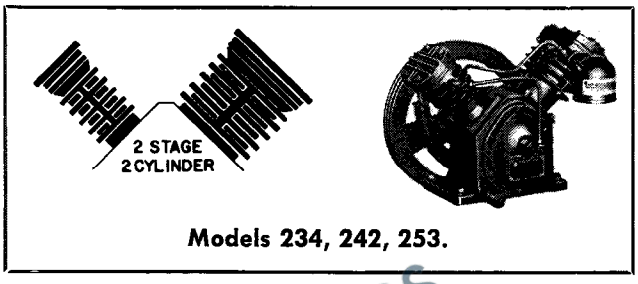


Figure 1–2, Two-Stage Compressors.

Two-Stage Compressors — Compressors with different size cylinder bores may be two-stage machines.

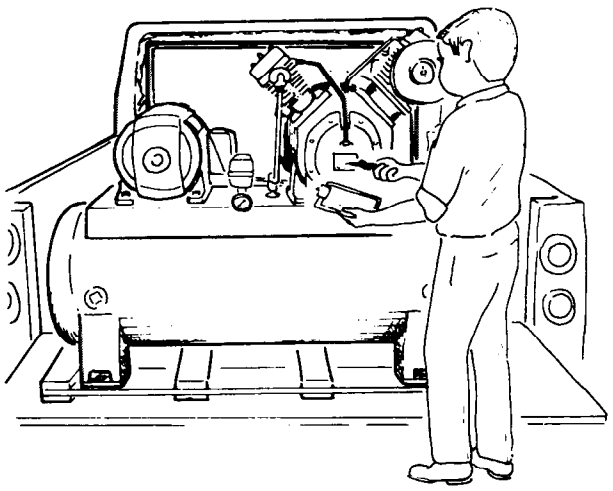
The basic principle of operation of a two-stage machine is as follows: On the suction stroke of the first-stage piston, air at atmospheric pressure enters the cylinder through the inlet filter and valve located in the air head. On the compression stroke of the first-stage piston, the air is compressed to an intermediate pressure and discharged through the valve into the intercooler tubes, where the heat of first-stage compression is removed by the action of the fan passing cool air over the intercooler tubes. On the suction stroke of the second-stage piston this cooled air enters the second-stage cylinder through the inlet valve. The compression stroke of the second-stage piston compresses the air to the final discharge pressure and forces it out through the valve into the receiver or system. If cooling of the discharged air is required, a water or air-cooled aftercooler should be installed between the compressor discharge and the receiver or system.

SECTION II
INSTALLATION AND START–UP RECOMMENDATIONS

Step 1.

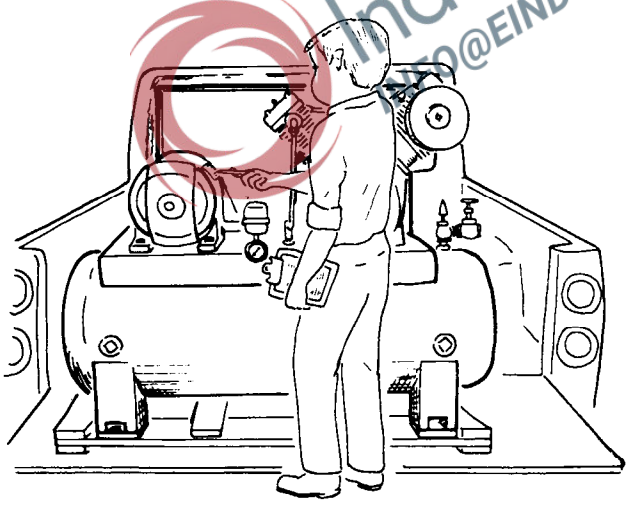
Unload the compressor from delivering vehicle — the purchaser must arrange for adequate lifting equipment at the job site.

IMPORTANT NOTE: The purchaser assumes title to the compressor equipment at the manufacturers shipping dock. Immediately upon receipt of the equipment, it should be inspected for any damage that may have occurred during shipment. If damage is present, demand an inspection immediately by an inspector from the carrier. Ask him how to file a claim for damages.



Step 2

Check compressor nameplate to be sure the unit is the model and size ordered. Do this before uncrating. Check Receiver Nameplate to be sure the tank is adequate for pressure at which you intend to operate.



Step 3.

Check motor nameplate to be sure motor is suitable for your electrical conditions. (Volts–Phase–Hertz).

IMPORTANT NOTE: Do Not Use Triple Voltage 3 Phase Motor For 200–208 Voltage 3 Phase Application. Must Use 200 Volt Motor Only.

Step 4.
LOCATION & FOUNDATION

NOTE: Ideal ambient temperature is (70°F)

In cold climates, it is desirable to install the compressor within a heated building. Choose a clean, relatively cool location, and provide ample space around the unit for cooling and general accessibility. Place the beltwheel side toward the wall, leaving at least 15" (380 mm) for air circulation to the beltwheel fan. The location should also be near a source of water and a drain line to simplify piping connections if a water-cooled aftercooler is to be used. (Note: If a detached receiver is to be used, consider placing the receiver outdoors to provide more effective heat dissipation, keeping in mind that condensed water in the receiver may freeze).

Provide adequate fresh air and exhaust ventilation from area in which compressors are located. Provide 1,000 cu. ft. fresh air per minute per 5 horsepower. Ventilation by gravity or mechanical means is approved.

INLET PIPING — If the air in the vicinity of the compressor is unduly dirty or contains corrosive fumes, we recommend piping the air cleaner to a source of cleaner air or use a special heavy duty filter. If it is found necessary to install inlet piping, make the line as short and direct as possible and as large, or larger than the diameter of the inlet connection at the compressor. The inlet piping must increase in diameter for every 50' (15.25 m) of length. If the total length is between 50' (15.25 m) and 100' (30.5 m), increase the pipe diameter at the mid-point in the length, i.e., if the total length is 80' (24.4 m), increase the pipe diameter at the 40' (12.2 m) point. Attach the air cleaner to the end of the inlet air line, and if the inlet is piped outdoors, it should be hooded to prevent the entrance of rain or snow. See Figure 2–1. Fine airborne dust, such as cement and rock dust, require special filtration equipment not furnished as standard equipment on these compressors. Such filtration equipment is available from Ingersoll-Rand Company.

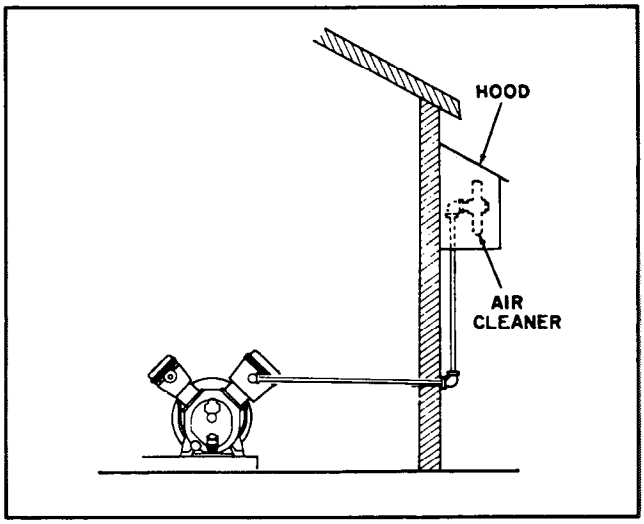


Figure 2–1. Inlet piping arrangement.

A well ventilated location should be selected for machines operating in very damp climates or under conditions of high humidity. These atmospheric conditions are conducive to the formation of water in the frame, and if adequate operation and ventilation are not provided, rusting, oil sludging and rapid wear of running parts will result. This is particularly true for compressors operating on very intermittent duty applications.

The unit may be bolted to any substantial, relatively level floor or base. If such a surface is not available, an adequate base must be constructed. Should a concrete base be necessary, make certain the foundation bolts are positioned correctly to accept the receiver feet, and that these bolts project at least 1" (25.4 mm) above the surface of the foundation.

The unit must be levelled and bolted in a manner which avoids pre-stressing the receiver in order to prevent vibration and insure proper operation. The following technique is recommended for anchoring the compressor to its base:

A. Tighten evenly, and to a moderate torque, the nuts of any three of the four receiver feet. Check the unit for level. If the unit is not level, insert metal shims, as shown in Figure 2–2, under one or two of the feet to obtain level, and retighten the nuts.

B. Note the distance the unanchored foot is elevated above the base and insert a metal shim of equal thickness under this foot to provide firm support. Shims must be at minimum the same dimension as bottom of foot.

C. After all shims are inserted and the unit is level, pull up the nuts on all receiver feet to a moderate (not excessively tight) torque.

D. Check for receiver stress by loosing nuts (one at a time), and note any upward movement of the mounting foot. Any noticeable movement indicates that step B must be repeated.

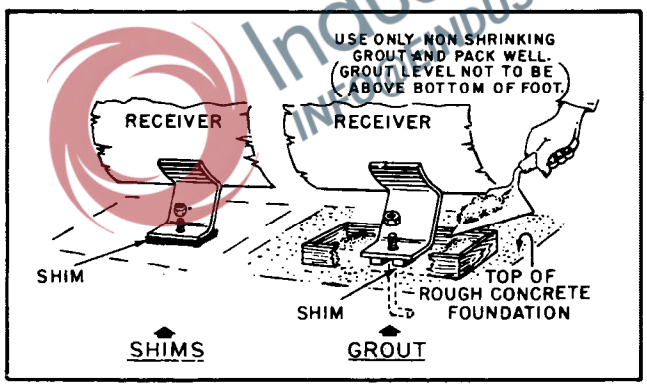


Figure 2–2. Methods of Leveling Unit.

Severe vibration will result when nuts are pulled down tightly and feet are not level. This can lead to welds cracking or fatigue failure of receiver. This is a very important part of installation.

IMPORTANT
DO NOT OPERATE UNIT WHILE MOUNTED TO SHIPPING CRATE SKID.

Step 5
ELECTRICAL WIRING

To avoid invalidating your fire insurance, it is advisable to have the electrical work done by a licensed electrician who is familiar with the regulations of the National Board of Fire Underwriters and the requirements of the local code.

Before wiring the compressor to the power supply, the electrical rating of the motor, as shown on the motor nameplate, must be checked against the electrical supply. If they are not the same, do not connect the motor.

It is important that the wire used be the proper size and all connections secured mechanically and electrically. The size of the wire shown in the table is a safe guide if the distance from the feeder does not exceed 100 feet (30.5 m).

If the distance is more than 100 feet (30.5 m.), larger wire will probably be necessary and your electrical contractor or local electric company should be consulted for recommendations. The use of too small wire results in sluggish operation, unnecessary tripping of the overload relays or blown fuses.

FUSES

The momentary starting current of an electric motor is greater than its full-load current; therefore, use a dual element fuse with a capacity 1.75 greater than the full-load motor current. For example: If the full-load current of a 5 hp compressor is 14.2 amperes, 25 ampere fuses should be used. Fuse failure usually results from the use of fuses of insufficient capacity. If fuses are the correct size and still fail, check for conditions that cause local heating, such as bent, weak or corroded fuse clips.

STARTING SWITCH

The electrical wiring between the power supply and the electric motor varies according to the type of regulation used and the horsepower of the motor.

Compressors regulated by automatic start and stop or dual control may use a manual starter and be wired as shown in Figure 2–3, if the motor does not exceed 1½ H.P. on 115 volts, single-phase; 3 H.P. on 230 volts, single-phase; or 3 H.P. on 230 or 460 volts, three-phase. Note that these ratings permit the pressure switch to be wired in series with the motor leads, since the motor current does not exceed the rating of the pressure switch.

Compressors regulated by constant speed control may use a manual starter and be wired as shown in Figure 2–4 if the motor does not exceed 1½ H.P. on 115 volts, single-phase; 3 H.P. on 230 volts, single-phase; or 5 H.P. on 230 or 460 volts, three-phase.

Compressors using motors with higher horsepower ratings than those listed above, must be equipped with a magnetic starter. Figure 2–4 illustrates the method of wiring the magnetic starter to the selector switch on a compressor regulated by constant speed control; Figure 2–3 illustrates the method of connecting the pressure and oil level switch to the starter on a unit regulated by automatic start & stop or dual control. Note that both the selector switch in Figure 2–4 and the pressure switch and oil level switch in Figure 2–3 are wired to the operating coil of the magnetic starter and serve to interrupt current flow to the motor.

All starters, both manual and magnetic, must include thermal overload protection to prevent possible motor damage from overloading. These starting switches are furnished with the manufacturer's instructions for installation. Ingersoll-

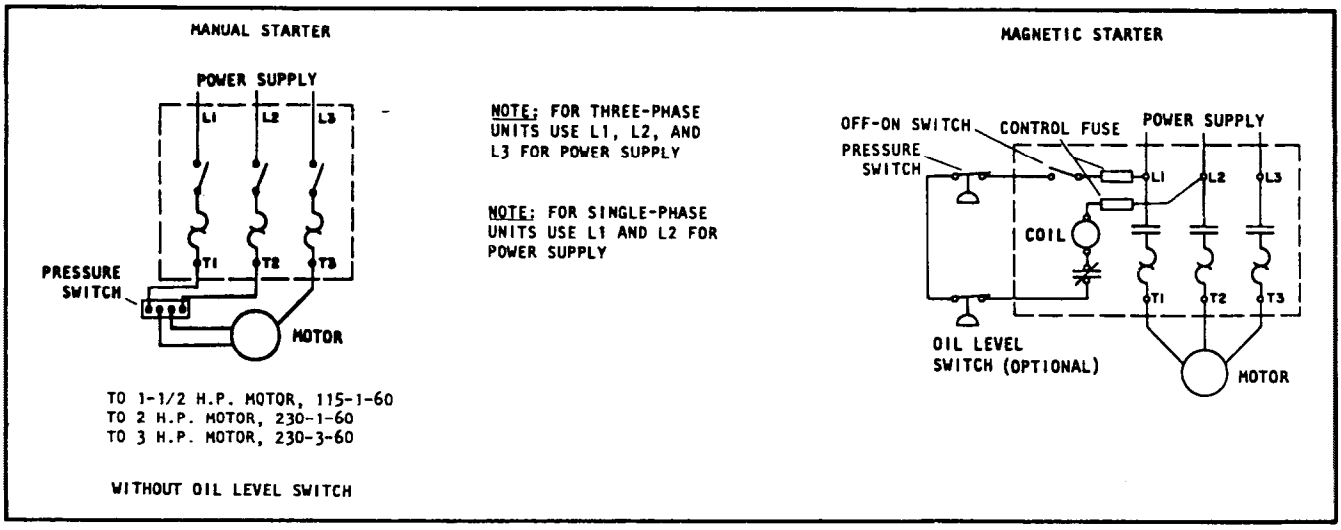


Figure 2-3. Schematic Wiring Diagram for Automatic Start & Stop or Dual Control Regulation.

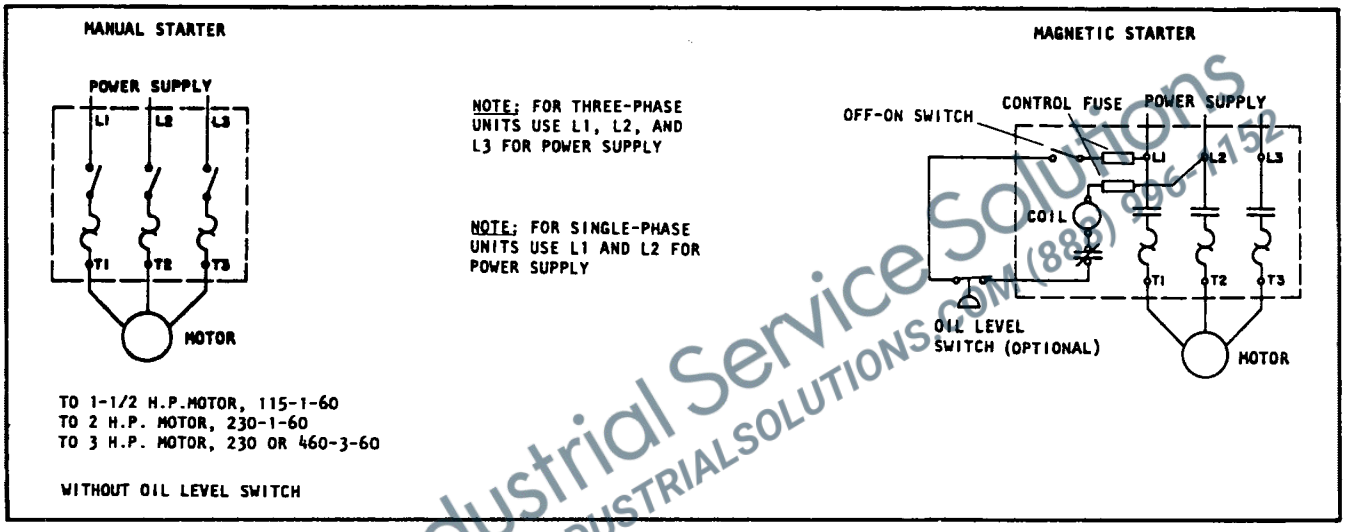


Figure 2-4. Schematic Wiring Diagram for Constant Speed Control Regulation.

Sizes of wire to use for distances up to 100 feet (30.5 m) from the feeder.

MOTOR HORSEPOWER	SINGLE PHASE				THREE PHASE			
	115V		230V		230V		460V	
	AWG	SWG	AWG	SWG	AWG	SWG	AWG	SWG
Less than 1	14	16	14	16	14	16	14	16
1	12	14	14	16	14	16	14	16
1½	10	12	14	16	14	16	14	16
2	8	10	14	16	14	16	14	16
3	8	10	12	14	14	16	14	16
5	4	6	8	10	12	14	14	16
7½	—	—	6	8	10	12	14	16

Figure 2-5. The wire sizes recommended in the above table are suitable for the compressor unit. If other electrical equipment is connected to the same circuit, the total electrical load must be considered in selecting the proper wire sizes. A burned out motor may result unless it is properly protected.

AWG–American Wire Gauge

SWG–British Imperial Standard Wire Gauge

Rand cannot accept responsibility for damages arising from failure to provide adequate motor protection.

Step 6

COMPRESSOR LUBRICATION

Fill crankcase to proper level, bottom thread of oil filler opening. Tighten oil plug **HAND TIGHT ONLY.**

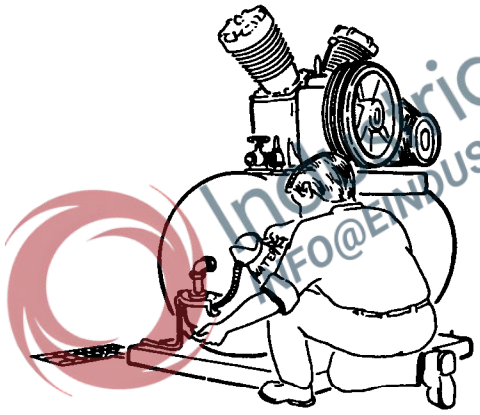
After the initial four hours of operation at full load, the oil is to be drained while it is hot and the frame refilled with new oil.

Although Ingersoll-Rand does not recommend any particular brand of lubricating oil, a non-detergent, petroleum lubricating oil containing only rust, oxidation, and anti-foaming inhibitors may be used in any TYPE 30 product. The petroleum lubricating oil may be Naptenic or Pariffin based. (SEE PAGE 14 FOR RECOMMENDATIONS)

Diester based synthetic oil may be used in all TYPE 30 standard single and two stage compressors. When a diester synthetic oil is to be used in a TYPE 30 product, petroleum oil should be used for the first 200 hours of operation to allow for proper piston ring seating. Upon changing to the diester synthetic oil, the petroleum oil should be thoroughly drained and the compressor frame wiped clean to remove break-in debris. (Flushing is not necessary).

Step 7

Check compressor rotation by flicking "Start–Stop" switch. Rotation is shown by arrow on belt guard back. If rotation is incorrect, interchange two of the three leads on three phase motors. On single phase motors, refer to reverse wiring diagram on motor name plate.



Step 8

PRIME CONDENSATE TRAP (WHEN SUPPLIED). (SEE PAGE 27 FOR PRIMING INSTRUCTIONS)

STEP 9

Provide a floor drain in a nearby location for condensate drainage. A floor drain is desirable whether the compressor is equipped with an automatic condensate trap or not. All compressors will have water condensed in the receiver tank.

Step 10

To check operation:

A. Close service valve and start compressor.

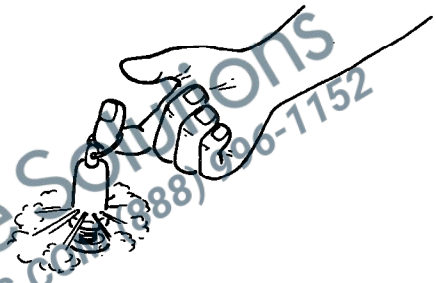
NOTE: If equipped with (OPTIONAL) Water Cooled Aftercooler, turn on cooling water flow. (SEE PAGE 26 FOR ADJUSTMENT PROCEDURES.)

B. Allow the receiver (tank) to build up to pressure for which you ordered the machine. At this pressure, if the unit is equipped with Automatic Start and Stop regulation, the pressure switch should cause the unit to stop. If the unit is equipped with Constant Speed Control, it should unload (run without compressing air). Run for about ten minutes by bleeding air from receiver to let unit warm up and observe for excess vibration, any unusual noise, and verify operation of Low Oil Level Switch (OPTIONAL) as explained in Step 15.

NOTE: If the unit does not operate properly, shut down immediately, and call local Ingersoll-Rand Distributor.

Step 11

Open service valve and/or drain valve to let pressure in receiver drop. Note the pressure at which compressor starts or reloads.



Step 12

Pull ring on all safety valves to be sure they relieve and reseat. Do this several times.

Step 13

Adjust pressure switch on Automatic Start and Stop or Discharge Line Unloader on Constant Speed Control, if necessary. (If any adjustments are necessary, see manufacturer's instruction book.)

Step 14

Check tightness of all bolts and fittings. (SEE BOLT TORQUE CHART ON PAGE 19).

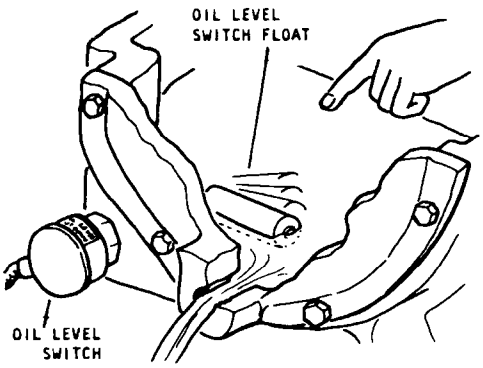
Step 15

OPTIONAL–LOW OIL LEVEL SWITCH

During the initial run, stop unit and drain oil from crankcase into clean can until switch clicks or breaks circuit with continuity tester.

This is a "float" type switch which sometimes gets cocked in shipping. If cocked or stuck, open disconnect switch, drain remaining oil, remove crankcase cover and then free the float. Re-assemble and then reuse the same oil.

NOTE: If float is cocked in the low position, compressor cannot start.



WARNING

NEVER CONNECT THE LOW OIL LEVEL SWITCH LEADS IN SERIES WITH THE MOTOR. THE SWITCH MUST ALWAYS BE CONNECTED THROUGH THE CONTROL CIRCUIT OF A MAGNETIC STARTER. SEE FIGURE 2-3 and 2-4.

Step 16

DISCHARGE PIPING

The following general instructions cover only the installation of discharge piping and placement of the pressure switch and safety valves in systems using a detached receiver. Discharge piping should be the same size as the compressor discharge connection or the receiver discharge connection. All pipe and fittings must be certified safe for the pressures involved. Pipe thread lubricant is to be used on all threads, and all joints are to be made up tightly, since small leaks in the discharge system are the largest single cause of high operating costs. If your compressor runs more than you believe it should, the most likely cause is a leaky pipe line. Leaks are easily located by squirting soap and water solution around all joints and watching for bubbles.

Where a sub-base mounted unit or a bare compressor is supplied, it is very important to observe the following points when installing the piping between the compressor and the receiver.

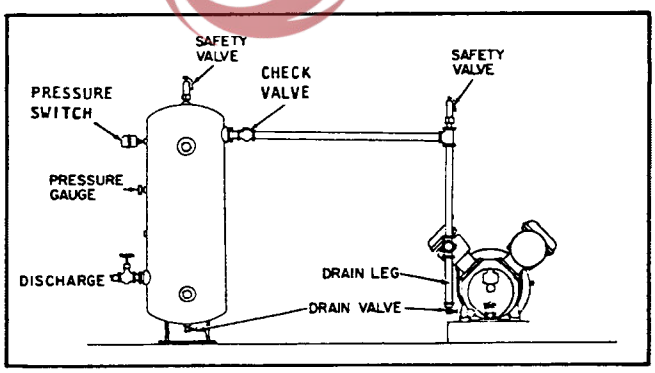


Figure 2-6. Typical piping arrangement for bare compressor and detached receiver regulated by automatic start and stop control.

WARNING

A PROPERLY-SIZED PRESSURE RELIEF VALVE MUST BE INSTALLED IN THE DISCHARGE PIPING BETWEEN THE COMPRESSOR AND ANY POSSIBLE RESTRICTION SUCH AS A BLOCK VALVE, CHECK VALVE, AFTERCOOLER, OR AIR DRYER. FAILURE TO INSTALL A PRESSURE RELIEF VALVE COULD RESULT IN OVERPRESSURE, PIPE RUPTURE, DAMAGE TO COMPRESSOR AND PERSONAL INJURY.

A. Install check valve as close to the receiver as possible. DO NOT INSTALL IN COMPRESSOR CYLINDER DISCHARGE HOLE. CHECK FOR PROPER AIR FLOW DIRECTION.

   NOTE: Check Valve shipped loose with bare compressors and base plate mounted units.

B. If possible, run the piping down from the compressor discharge to permit condensate to drain into the receiver. If this is not possible, install a "drain leg". The drain leg should project down from the compressor discharge and be at least 10" long (254 mm). Put a drain valve at the end of this pipe and drain at least weekly, or as often as necessary.

INSTALLING AND CONNECTING REGULATION ASSEMBLIES

The type of regulation used with your compressor, i.e., automatic start & stop control, constant speed control or dual control, determines which regulation assemblies are to be used. The necessary assemblies must be installed and connected by the customer. Details regarding the various types of regulation available are given in the "Regulation" section of this book.

AUTOMATIC START & STOP CONTROL

Requires installation of pressure switch at a high point on the receiver to prevent condensate from draining into it. The switch may be mounted in any position. Wire the switch to the motor starter according to the schematic diagram on page 8.

CONSTANT SPEED CONTROL

Requires installation of an unloader valve and tubing between the valve and compressor discharge. The valve is to be assembled in a vertical position preferably, and is to be located on the receiver inlet from compressor discharge.

Due to pressure drop in the tube line, the length of the tube line connecting the valve to the compressor discharge will have a bearing on the operation of the regulation system (preferably 8 to 10 feet maximum.) Determine the maximum tube length experimentally, and if it is necessary to install the unloader valve closer to the compressor, select a pulsation free point in the discharge line that registers actual receiver pressure and mount the valve in an upright position. If necessary, the unloader valve may be connected to a small surge tank installed in the discharge line close to the compressor discharge.

IMPORTANT

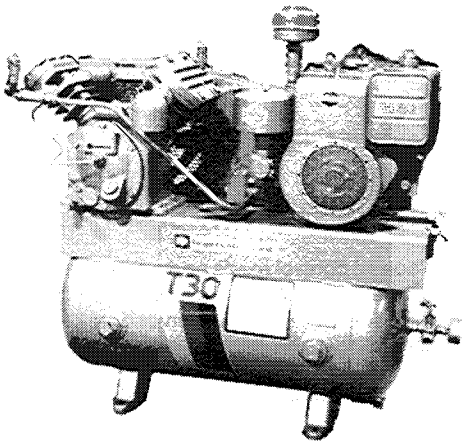
DO NOT PLACE ANY VALVE BETWEEN DISCHARGE UNLOADER AND RECEIVER. DO NOT USE CHECK VALVE WITH DISCHARGE UNLOADER.

DUAL CONTROL

Permits a manual selection between automatic start and stop control and constant speed control, depending upon the air requirements. Dual control requires installation of pressure switch for automatic start and stop operation, in addition to a tube connection between the actuating source of air and the unloader valve for constant speed control operation. To install the pressure switch and connect the unloader valve, refer to the instructions given under Section III.

Step 17

GASOLINE ENGINE DRIVEN UNITS

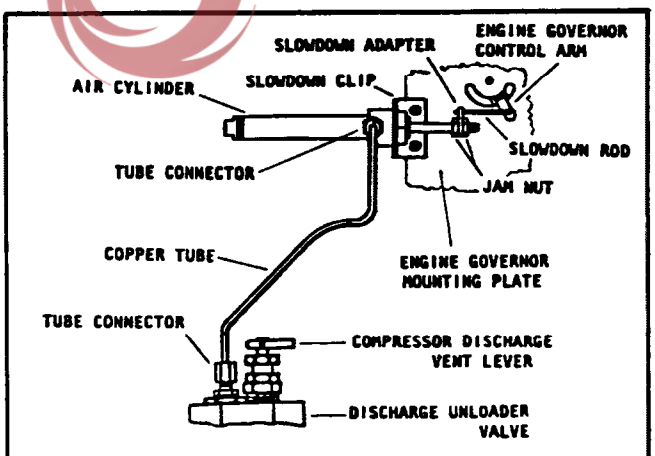


The operation of a gasoline Engine driven unit is the same as an electrical driven unit except for the electrical components.

Gasoline engine driven units covered by this manual, that are supplied with Constant Speed Control regulation, run continuous without compressing air when discharge unloader valve setting is reached.

OPTIONAL: Engine Slow Down Device reduces engine speed when running unloaded, therefore increasing fuel economy and decreases maintenance and wear to unit.

TO START ENGINE bleed receiver to 0 psig. Flip compressor discharge vent lever on discharge unloader to "up" or vertical position. (This position automatically vents the compressor discharge to atmosphere).

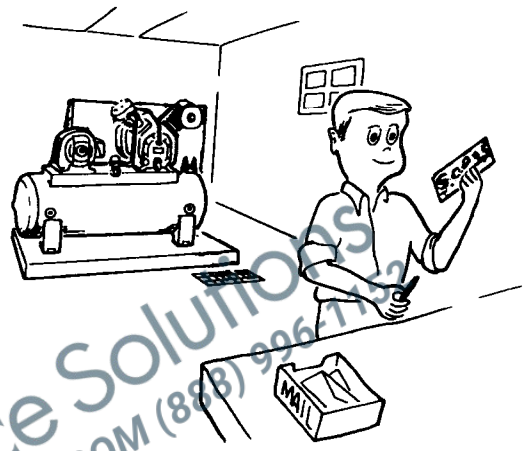


(TYPICAL) MOUNTING FOR ENGINE SLOWDOWN FOR BRIGGS & STRATTON ENGINE

Start the engine and allow it to warm up for two to three minutes. Then lower the lever on the discharge unloader to its normal position.

HARD TO START ENGINE may be experienced in cold climates or at high altitudes (4500+ above sea level). A distributor installed engine clutch may be required with this type of application, contact your nearest Ingersoll-Rand distributor for details.

Instructions for gasoline engine drive are contained in a separate booklet published by the engine manufacturer. A copy of this is included with the compressor unit when shipped.



Step 18

COMPLETE WARRANTY REGISTRATION

Completion of the registration form indicates satisfactory installation and performance of start-up operations. If any defects are apparent in the equipment; contact the nearest I-R Distributor or Ingersoll-Rand District office. The I-R service literature included with the unit has instructions for minor adjustments. Minor adjustments are not considered warranty.

SECTION III
REGULATION

AUTOMATIC START AND STOP CONTROL

Automatic Start & Stop Control is obtained by means of a pressure switch which makes and breaks an electrical circuit, starting and stopping the driving motor, thereby maintaining the air receiver pressure within definite limits. The pressure switch is piped to the receiver and is actuated by changes in air receiver pressure.

NOTE: With automatic start and stop control, motor must be limited to six (6) starts per hour, otherwise unit must be operated at constant speed control.

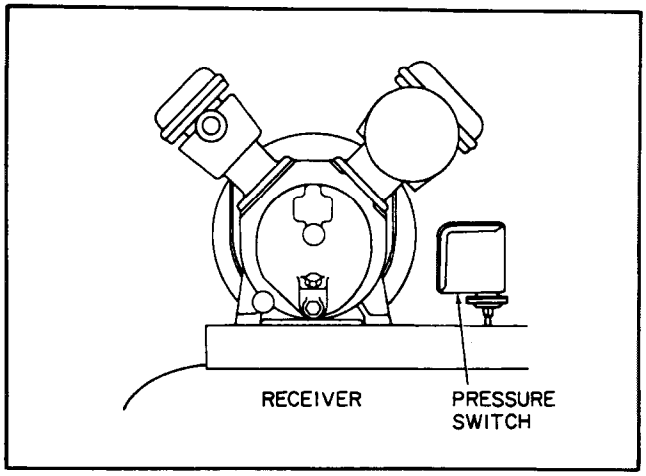


Figure 3–1. Typical automatic stop and start arrangement.

PRESSURE SWITCH ADJUSTMENT

The pressure switch has a Range Adjustment and a Differential Adjustment. See Figure 3–2. The Cut-out (Compressor Shutdown) is the pressure at which the switch contacts open, and the Cut-in (Compressor Restart) is the pressure at which the switch contacts close.

The cut-out point may be increased by screwing the range adjustment clockwise. Screwing the range adjustment counterclockwise decreases the cut-out point. Note the pressure gauge reading at which the compressor cuts-in and out and re-establish pressure setting if necessary.

The differential pressure may be increased by screwing the differential adjustment clockwise. Backing off the differential adjustment will narrow the span. It is advisable to have as wide a differential as possible to avoid frequent starting and stopping of the compressor. Note the pressure gauge reading at which the compressor cuts-out and re-establish this point if necessary.

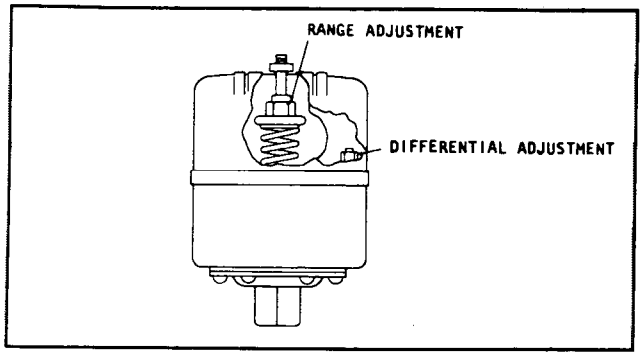


Figure 3–2. Typical pressure switch cut–in and cut–out adjustment.

CONSTANT SPEED CONTROL

Constant speed control loads and unloads the compressor discharge while the compressor continues to run. The unloader valve, located at the receiver intake, controls this operation according to the rise and fall of air receiver pressure.

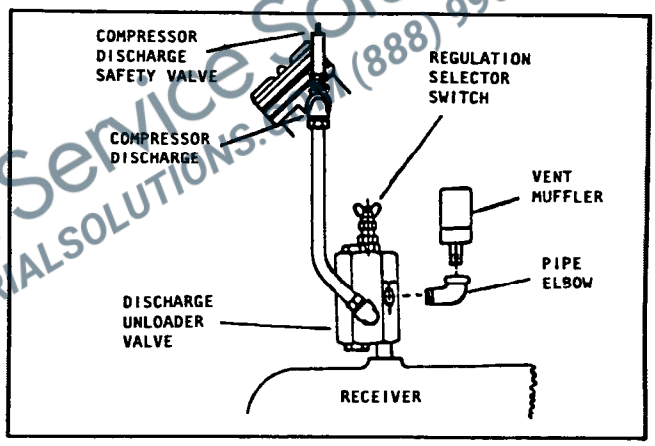


Figure 3–3. Typical Constant speed control arrangement.

Air flows from the compressor discharge to the inlet port, through the check valve and exits from air outlet to receiver. When the receiver pressure reaches the preset unload pressure of the valve, a stainless steel ball snaps up and opens, and high pressure air passes through to actuator chamber forcing the unloader valve to open. At this point the check valve will close and the compressor discharge is vented to atmosphere through air vent. When receiver pressure reaches the load pressure, the stainless steel ball will snap down and close venting high pressure air in chamber to atmosphere, the unloader valve will close and the check valve will open permitting air to pass directly into the receiver.

IMPORTANT

DO NOT PLACE ANY VALVE BETWEEN DISCHARGE UNLOADER AND RECEIVER. DO NOT USE CHECK VALVE WITH DISCHARGE UNLOADER VALVE.

Valves are factory set for the range of cut-out pressures ordered and have a standard differential pressure of 15% cut-out pressure.

To change the cut-out pressure hold nut under adjustment lock nut and loosen adjustment lock nut. Turn adjustment screw clockwise to raise pressure and counter-clockwise to lower pressure.

Retighten adjustment lock nut when desired pressure setting is reached. Different pressure will change slightly when cut-out pressure is changed. There is no differential adjustment.

IMPORTANT

IF YOUR UNIT IS REGULATED BY DUAL CONTROL, THE CUT-OUT POINT OF THE PRESSURE SWITCH IS TO BE SET 5 psi (.35 kg/cm^2) ABOVE THE UNLOAD POINT OF THE DISCHARGE UNLOADER VALVE.

DUAL CONTROL

Dual Control is accomplished by adjusting the regulation selector screw on the top of the unloader valve. Loosen the lock nut and turn the socket head screw "IN" hand tight for automatic start-stop operation. In this position, the stainless steel ball is held down on its seat which prevents the unloader valve from operating and the pressure switch will control the operation of the motor to start and stop. Turn regulation selector screw "OUT" two full turns for constant speed operation. Lock each position with a lock nut.

INTERMITTENT DUTY FORMULA

Compressors operating above 200 psig (14 kg/sq. cm) are to be operated according to the "Intermittent Duty Formula."

INTERMITTENT DUTY FORMULA

Pump-up time should not ordinarily exceed thirty (30) minutes or be less than ten (10) minutes. Shut-down periods between cycles of operation should be at least equal to the pump-up time. Note: When the compressor is regulated by constant speed control, the shut-down period is the time the compressor is operating unloaded.

A pump-up time limit with the following cool-down period is recommended to protect the valves and heads against stabilized high opeating temperatures, which could rapidly build up carbon in these areas.

All inquiries for high-pressure compressor application where the "use" cycle differs from the "Intermittent Duty Formula" should be referred to the nearest Ingersoll-Rand branch office.

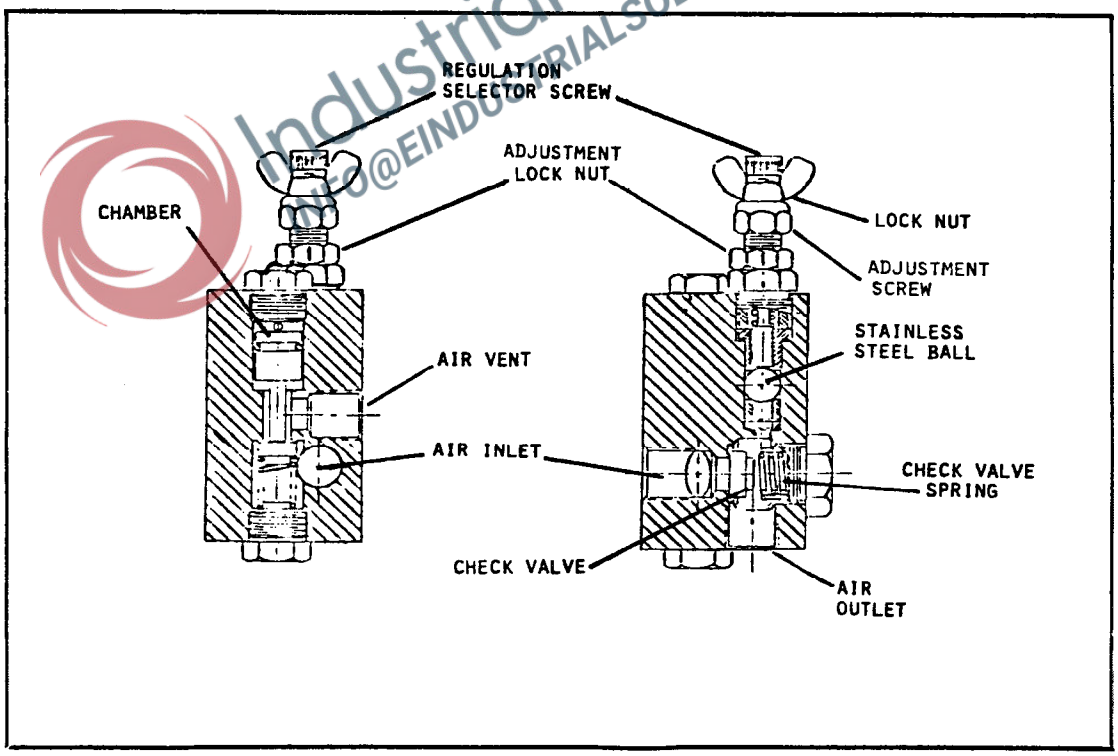


Figure 3–4. Discharge unloader valve.

SECTION IV
OPERATION

OPERATING CHECKS

Satisfactory operation of any piece of mechanical equipment depends, to a large degree, upon adherence to a preventative maintenance schedule.

To obtain optimum performance at minimum cost, observe the "Maintenance" guide on page 18.

COMPRESSOR LUBRICATION

FRAME OIL CHANGES — Oil changes should be made every 500 hours of operation or every 90 days, whichever occurs first. Important: For maximum removal of impurities, drain only when frame oil is hot. After the operator has observed

WARNING
WHEN CHANGING OIL, NEVER USE KEROSENE OR GASOLINE TO FLUSH OUT THE FRAME. THE USE OF SUCH CLEANING AGENTS IS DANGEROUS AND IS ABSOLUTELY PROHIBITED. USE A REGULAR FLUSHING OIL FOR THIS PURPOSE.

the condition of the oil from a number of changes, the length of time between changes may be extended if so warranted. Frame oil capacities for the various models are as follows:

Model	Qts.	Liters	Model	Qts.	Liters
23A	⅞	.827	242	1¾	1.65
234	⅞	.827	244	1¾	1.65
235	⅞	.827	253	2½	2.37
			255	2½	2.37

LUBRICATING OIL RECOMMENDATIONS

The viscosity should be selected for the temperature immediately surrounding the unit when it is in operation.

OIL VISCOSITY TABLE

Temp. Range	Viscosity at 100°F (37.8°C)	
	SSU	Centistokes
40°F & Below (4.4°C & Below)	150	32
40°F to 80°F (4.4°C to 26.7°C)	500	110
80°F to 125°F (26.7°C to 51.7°C)	750	165

The viscosities given in the table are intended as a general guide only. Heavy-duty operating conditions require heavier viscosities, and where borderline temperature conditions are encountered the viscosity index of the oil should be considered. Always refer your specific operating conditions to your industrial lubricant supplier for recommendations.

MOTOR LUBRICATION & CARE

Depending upon the type of electric motor driving your unit, the following lubricating schedule should be observed.

SLEEVE BEARING MOTORS — Are to be oiled at least once every three months with an oil of a viscosity of 150 to 230 SSU at 100°F (32 to 55 centistokes at 37.8°). Note: Do not fill the oil reservoir with an excessive amount of oil, since it may work onto the commutator.

BALL BEARING MOTORS WITH GREASE FITTINGS — Ball bearing motors that have grease fittings and plugs near the bearings are to be repacked with grease once a year. Use a very good grade of ball bearing grease.

BALL BEARING MOTORS PRELUBRICATED FOR LIFE — These motors have no grease fittings or plugs near the bearings and do not require lubrication.

Several major points contributing to proper motor operation and care are given in the following paragraphs. For more detailed instructions, refer to the motor manufacturers' specific recommendations.

On some types of motors, such as direct current and single-phase motors, the commutator and brushes should be cleaned periodically with a piece of canvas or non-linting cloth. If the commutator of any motor becomes contaminated with oil or grease, it should be cleaned immediately by a competent electrician, otherwise serious damage will result.

It is also a good practice to monthly blow off the motor windings with a jet of air to prevent an accumulation of dirt. An occasional re-varnishing of the windings will greatly prolong the life of the motor.

If it is ever necessary to renew the brushes, they must be carefully sanded to fit the contour of the commutator, and the brushes must be made to fit loosely in their holders. Do not use emery cloth for fitting purposes.

If the motor is located in an atmosphere where it is exposed to appreciable quantities of water, oil, dirt or fumes, it must be specially constructed.

AIR INLET FILTER

It is very important that the air inlet muffler and cleaner be kept clean at all times. A dirty inlet filter reduces the capacity of the compressor.

WARNING
WE RECOMMEND THE USE OF SAFETY SOLVENT FOR CLEANING. NEVER USE GASOLINE, KEROSENE, OR SIMILAR FLUIDS TO CLEAN THE AIR INLET MUFFLER AND CLEANER.

Either clean the pads as often as your experience indicates necessary, or replace them with new ones. The filtering element should be taken out at least once a month and cleaned. As the dirt collects on the outside, the outside surfaces should be brushed.

The standard inlet air filter is suitable only for normal industrial applications. Should the compressor be located in an area where the atmosphere contains a heavy concentration of dust and dirt, an air cleaner utilizing a specially designed, high capacity element should be used.

All applications of this nature should be referred to the nearest Ingersoll-Rand branch office.

BREATHER TUBE

The breather tube connects the interior of the frame to the inboard side of the inlet muffler. This connection permits pulsations, created by the reciprocating action of the pistons, to be vented to atmosphere, thus preventing any pressure build up within the frame.

INTERCOOLER (TWO-STAGE UNITS ONLY)

Two-stage compressors are equipped with an intercooler between the first and second-stage.

The purpose of the intercooler is to remove most of the heat of the first-stage compression from the air before it enters the second-stage, thus improving efficiency and decreasing the final discharge air temperature.

The intercooler consists of one or more finned tubes connecting the discharge of the first-stage to the inlet of the second-stage. The compressed air flows through these tubes and its heat is transferred to the cooling fins, where the air from the belt wheel fan passing over the fins dissipates the heat to atmosphere.

Never permit the air flow to these tubes to become obstructed, and clean the surfaces of the tubes whenever deposits of oil, dirt or grease are observed. Use a non-flammable safety solvent for cleaning purposes. During regular overhaul periods, the tubes should be removed from their headers and inspected internally.

If the interior of the tubes requires cleaning, cap one end and fill it with a non-flammable safety solvent to help loosen internal deposits of oil, dirt and carbon. Always flush the tubes with warm water and permit them to dry thoroughly before replacing.

SAFETY VALVE

Safety valves are designed to protect against damage from over pressure.

A safety valve is provided in the intercooler of all two-stage units.

This valve is set to blow at approximately 60 psig.

If the valve blows, and continues to blow for more than a minute, the compressor should be stopped at once. Refer to the trouble chart on page 17 to determine the cause of the blowing safety valve.

Units that are supplied mounted on a receiver will be furnished with a receiver safety valve. This valve is set at the factory to blow off at the pressure rating of the air receiver or 10 to 20 psig. above the compressor operating pressure.

If a hand valve is installed between the compressor and receiver, a safety valve must be installed between the compressor and hand valve.

WARNING

DO NOT CHANGE THE BLOW-OFF PRESSURE OF A SAFETY VALVE. DO NOT REMOVE THE SAFETY VALVE AND REPLACE IT WITH A PLUG, SINCE THIS WILL ELIMINATE THE PROTECTION PROVIDED AND MAY RESULT IN SERIOUS INJURY TO PERSONNEL AND DAMAGE TO THE COMPRESSOR AND RECEIVER. SAFETY CODES REQUIRE A SAFETY VALVE TO PROTECT THE RECEIVER FROM OVER-PRESSURE.

STARTING UNLOADING

IMPORTANT

FOR UNITS SHIPPED AFTER SEPTEMBER 1, 1981 WITHOUT CENTRIFUGAL UNLOADER AND PILOT VALVE ASSEMBLIES, SEE FIGURE 4-4.

OPERATION OF STARTING UNLOADING SYSTEM — The purpose of the system is to relieve cylinder pressure when the compressor stops permitting it to start against a light load; increasing the life of the driver and belts and also reducing the possibility of tripping the overload relay. The system operates in the following manner:

As shown in Figure 4-1, the centrifugal unloader is attached to the end of the crankshaft, thus when the compressor is in operation, centrifugal force acts upon the unloader weights and they swing outward. (See Figure 4-2). When the compressor stops, these weights retract, (Figure 4-1) permitting the thrust pin spring to move the plunger and thrust pin outward. The thrust pin opens the pilot valve and pressure bleeds from the cylinders to atmosphere via the path shown in Figure 4-1. The cylinders and intercooler are now relieved of all pressure and the compressor is unloaded.

When the compressor starts, centrifugal force acts upon the unloader weights and they swing outward. This permits the plunger and thrust pin to move inward and the pilot valve to close. The escape path to atmosphere for the cylinder pressure is now closed and the compressor pumps air in a normal manner.

If the pilot valve tube line is excessively hot, it is a good indication that the pilot valve is leaking and adjustment is required.

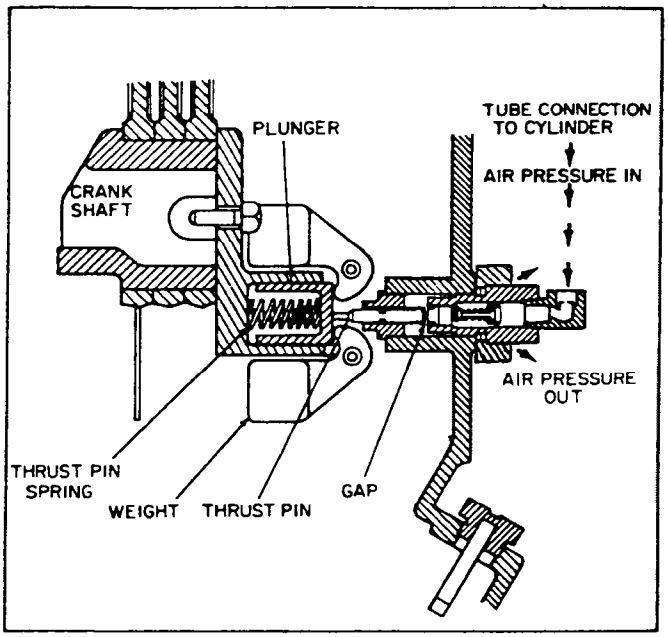


Figure 4–1. Position of weight and core when compressor is stopped.

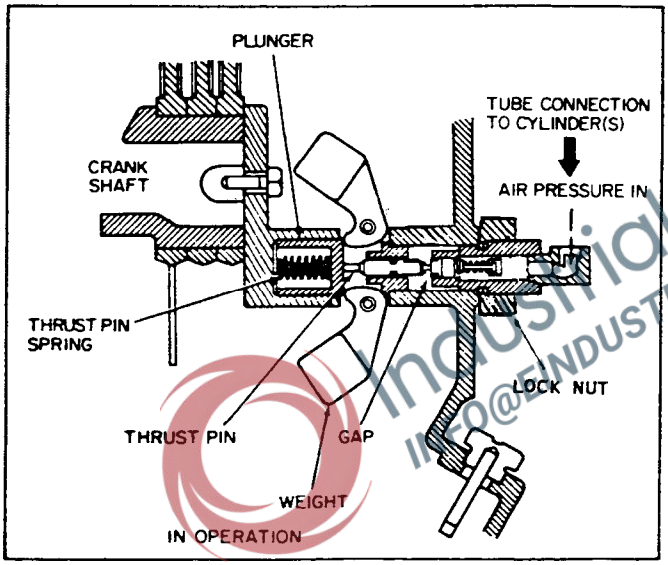


Figure 4–2. Position of weights and core when compressor is operating.

PILOT VALVE ADJUSTMENT — To adjust the outside exhaust pilot valve, refer to Figure 4–3, and proceed as follows:

1. Stop the compressor. Remove the pilot valve tube, fittings, and loosen lock nut.
2. Screw pilot valve assembly into frame cover until thrust pin is felt. Advance valve assembly to ¼ to ½ turn.
3. Hold valve assembly at this position and tighten lock nut.
4. Reconnect pilot valve tubing and start the compressor. Place hand over front side of lock nut.
5. If there is no flow of air, pilot valve is adjusted properly. If air flow is evident, re-adjust valve starting with step (1.).

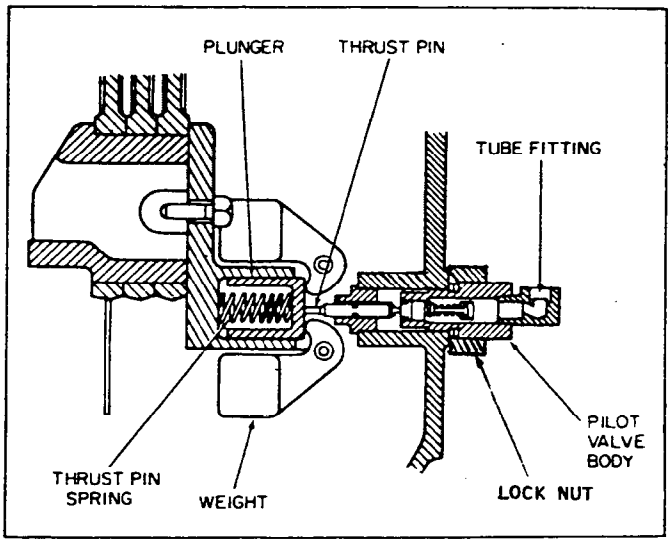


Figure 4–3. Pilot valve adjustment.

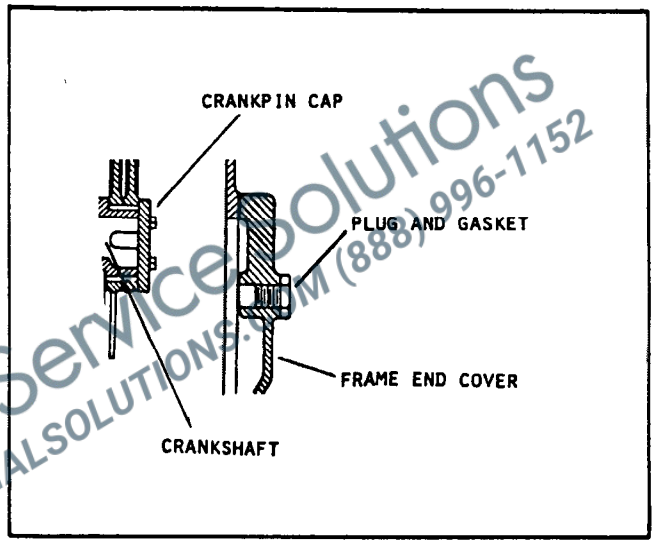


Figure 4–4. Showing arrangement of crankshaft and frame end cover on unit without centrifugal unloader and pilot valve assemblies.

CHECK VALVE

The check valve is located in the discharge line and acts to check the flow of air from the air receiver to the cylinder when the compressor is stopped.

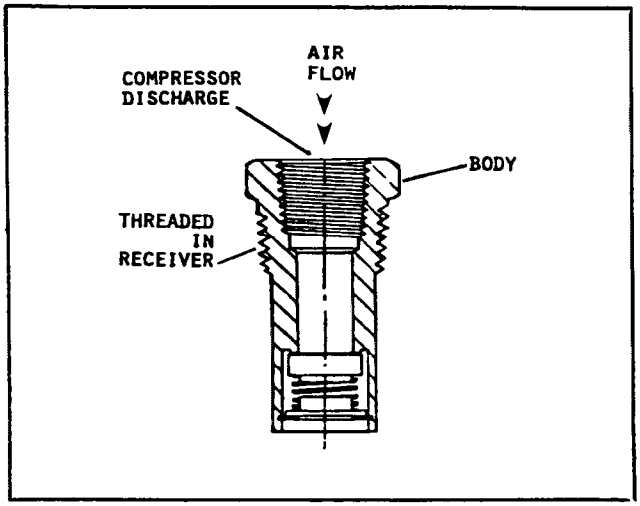


Figure 4–5. Check Valve.

SECTION V
COMPRESSOR TROUBLE CHART

TROUBLE	CHECK POINT NOS.
Oil pumping	1–8–10–12–18–24–25
Knocks or rattles	2–3–19–20–21–22–23–25
Water hammer (on units equipped with water-cooled aftercoolers)	26
Air delivery has dropped off	1–2–6–18–20–24–25
Intercooler safety valve pops	20–21–29
Trips motor overload or draws excessive current	9–14–15–16–17–18–20–22–23–25
Water in frame or rusting in cylinders	12–13
Machine won't unload	21
Excessive starting and stopping (auto start)	4–6–7–14
Compressor doesn't unload when stopped	18
Compressor runs excessively hot	2–5–7–11–20–27
Compressor won't come up to speed	15–18
Lights flicker when compressor runs	15–16
Abnormal piston, ring or cylinder wear	8–11–12–28

Check Point Nos. **Trouble Cause**

1. Clogged intake filter.
2. Relief valve of single cylinder unit not operating properly.
3. Loose belt wheel or motor pulley or motor with excessive end play in shaft.
4. Receiver needs draining.
5. Air to fan wheel blocked off.
6. Air leaks in piping. (on machine or in outside system)
7. Receiver check valve leaking.
8. Oil viscosity too low.
9. Oil viscosity too high.
10. Oil level too high.
11. Oil level too low.
12. Detergent type oil being used. Change to non-detergent type with rust and oxidation inhibitor.
13. Extremely light duty or located in damp humid spot.
14. Should be equipped with constant speed control due to steady air demand.
15. Check line voltage, motor terminals for good contact, tight starter connections, proper starter heaters.
16. Poor power regulation (unbalanced line). Consult with power company.
17. V-Belts pulled excessively tight.
18. Leaking or maladjusted centrifugal unloader pilot valve, or defective "O" Ring in pilot valve.
19. Carbon on top of piston.
20. Leaking, broken, carbonized or loose valves or restricted air passages.
21. Discharge unloader valve dirty, seats worn.
22. Worn or scored connecting rod, piston pin or crankpin bushings.
23. Defective ball bearing on crankshaft or on motor shaft. Loose motor fan.
24. Piston rings broken or not seated in, end gaps not staggered, stuck in grooves, rough, scratched or excessive end gap (over .020" worn) (.508 mm) when the ring is under 5" in diameter, or (over .032" worn) (.812 mm) when the rings are over 5" diameter, or side clearance (over .006") (.152 mm).
25. Cylinders or pistons scratched, worn or scored.
26. Adjust rate of water flow through aftercooler.
27. Wrong direction of rotation.
28. Extremely dusty atmosphere. Need more effective air inlet muffler and cleaner.
29. Defective safety valve.

SECTION VI
MAINTENANCE

WARNING

BEFORE ATTEMPTING ANY REPAIR WORK ON THE UNIT, BE CERTAIN THE ISOLATION SWITCH IS LOCKED IN THE "OFF" POSITION, OR THE WIRING IS DISCONNECTED FROM THE LINE. COMPLETE ELECTRICAL ISOLATION IS NOT ACCOMPLISHED BY HAVING THE MOTOR STARTER IN THE "OFF" POSITION; THE CONTROL CIRCUIT MAY STILL BE "HOT". BLOW DOWN THE PRESSURE FROM THE RECEIVER, ISOLATE THE UNIT FROM ANY OUTSIDE SOURCE OF AIR PRESSURE. THESE SIMPLE PRECAUTIONS WILL PREVENT ACCIDENTS.

MAINTENANCE OPERATION	SERVICE INTERVAL Operating Hours/Months – whichever comes first				
	500/3	1000/6	1500/9	2000/12	2500/15
COMPRESSOR					
Air Inlet Filter – Inspect and Clean	Weekly				
Frame Oil Level – Check	Daily				
Inspect Oil for Contamination —Change if necessary	Monthly				
Petroleum Lube	X	X	X	X	X
Frame Oil – Change Keystone or Anderol® 500 EVERY 1500 HOURS OR 12 MONTHS WHICHEVER IS FIRST					
Compressor Valves – Inspect and Clean	X	X	X	X	X
Intercooler – Clean Exterior	Weekly				
Low Oil Level Switch – Check Operation	X	X	X	X	X
Operate Safety Valves – Manually	Weekly				
Clean Cylinder Cooling Fins	Weekly				
V-BELT DRIVE					
Belt Tension – Check	Monthly				
MOTOR					
Motor Bearings – Check and Lubricate				X	
Clean	Monthly — (Weekly in Dusty Locations)				
AFTERCOOLER					
Aircooled: Clean externally	Monthly — (Weekly in Dusty Locations)				
Clean air flow internally		X		X	
Watercooled: Check discharge water temp.–120°F max		X		X	
Check water flow rate	Weekly				
RECEIVER					
Drain Condensate – Manual	Daily				
Operate Safety Valves	Monthly				
GENERAL					
Tighten or check all bolts	Monthly				
Check for Unusual Noise and Vibration	Daily				
Inspect for Air Leaks	Monthly				

GENERAL

The maintenance section of this book covers only those operations with which maintenance personnel may not be too familiar. It is expected that the average mechanic's training and experience will permit him to perform the more common maintenance functions without the need for detailed instructions.

AIR VALVE CLEANING

Ingersoll-Rand stainless steel finger valves are quick-acting, durable, reliable and easily serviced. Valves are readily accessible and may be removed without disturbing piping. See Figure 6–1.

To clean the valves, take out the air head cap screws and remove the head and valve plate from the cylinder. Remove the valves from the valve plate and clean both the valve and seat by brushing with a stiff bristle brush (not wire). If necessary, use a non-flammable safety solvent to loosen dirt, oil or carbon deposits. Should it be necessary to scrape, do so lightly to prevent marring the valve or seating surface.

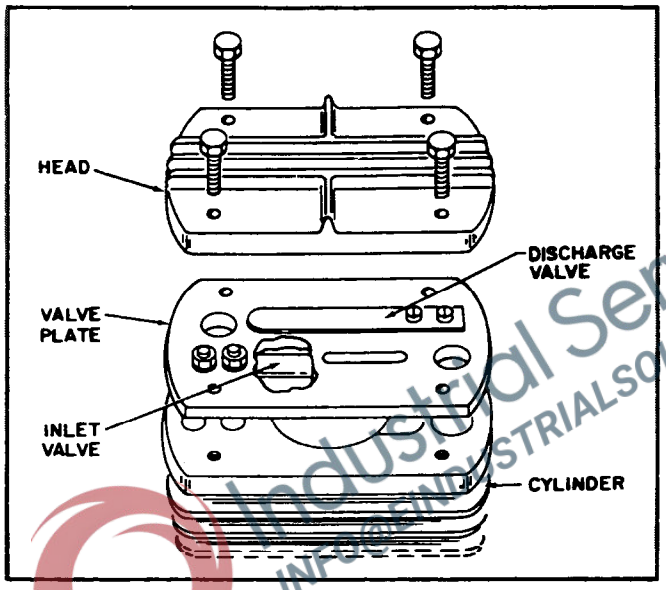


Figure 6–1. Finger Valves.

TORQUE VALUES

We recommend the use of a torque wrench. The following table gives the torque for tightening with the different size capscrews and nuts.

Handle the valves with care and be careful not to nick or scratch them. When replacing a valve, make certain it will lie flat against the seating surface surround the port hole; otherwise, the valves will leak air, resulting in carbonization and reduced compressor output.

BELT INSTALLATION & ADJUSTMENT

When installing new belts, do not pry the belts over the pulley grooves. The proper method of removing and installing new belts is to loosen the anchor screws and the belt tightener screw, Figure 6–3 and push the motor toward the compressor. Use the tightener screw to adjust belt tension on new belts.

When more than one belt is used to drive the compressor, the belt set must be matched to permit equal load distribution. For details, consult the belt supplier.

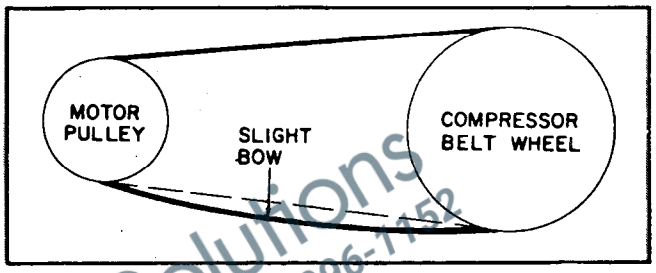


Figure 6–2. Visual Method.

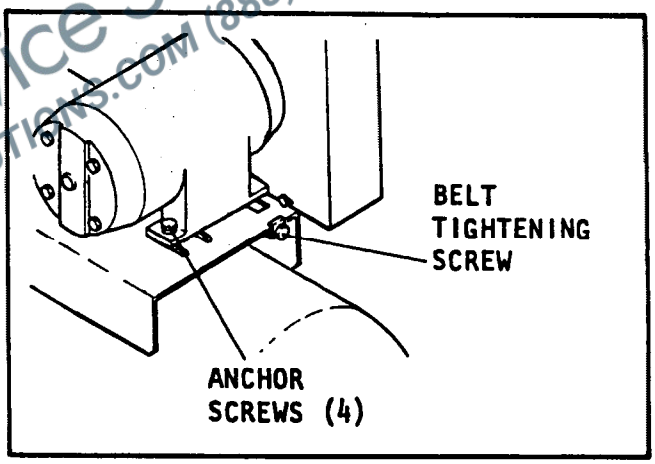


Figure 6–3. Belt Adjustment.

TORQUE VALUE TABLE

NATIONAL COARSE GRADE 1 & 2				NATIONAL COARSE GRADE 5			
Dia. Pitch	Ft. Lbs.	Meter Kilograms		Dia. Pitch	Ft. Lbs.	Meter Kilograms	
1/4" — 20	6	.83		1/4" — 20	8	1.1	
5/16" — 18	11	1.52		5/16" — 18	16	2.21	
3/8" — 16	18	2.49		3/8" — 16	30	4.1	
7/16" — 14	29	4.0		7/16" — 14	48	6.6	
1/2" — 13	44	6.1		1/2" — 13	72	10.0	
9/16" — 12	63	8.7	GRADE 2	9/16" — 12	105	14.50	GRADE 5
5/8" — 11	88	12.2		5/8" — 11	144	20.0	
3/4" — 10	144	20.0		3/4" — 10	240	33.2	

Note: Values given are for threads lubricated with light oil. Reduce torque values by 20% if threads lubricated with Never-Seez thread compound.

It is important that the belts be properly adjusted. A belt that is too loose will slip and cause heating and wear, and a belt that is too tight may overload the bearings. A quick check to determine if belt adjustment is proper may be made by observing the slack side of the belt for a slight bow when the unit is in operation. See Figure 6–2. If a slight bow is evident, belts are usually adjusted satisfactorily. However, the recommended method of checking belt tension is by the more accurate spring scale measurement method that follows:

A. Measure the belt span (t) as shown in Figure 6–4.

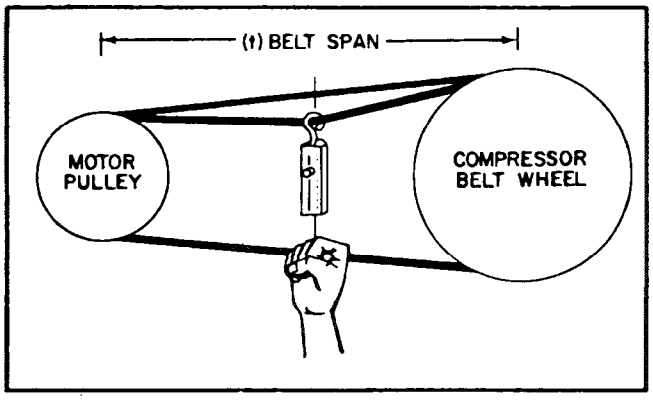


Figure 6–4. Spring Scale Method.

B. At the center of the span (t), apply a force (perpendicular to the span) by attaching a spring scale to both belts when two belts are used, or to the two outside belts when three are used. The force applied to the spring scale should be sufficient to deflect the belts 1/64" (.396 mm) for every inch of span length (t). For example: The deflection of 100" (2540 mm) span would be 100/64" or 1 9/16" (39.6 mm), thus, the force applied to the spring scale should deflect the belts to 1 9/16" (39.6 mm).

C. When the belts are deflected the necessary distance, compare (in lbs. force) with the values given in the following table.

STANDARD BELTS

Belt Type	Normal Tension	150% Normal Tension
A	1¼ lbs. (.565 kg)	1⅞ lbs (.85 kg)

If the reading is between the value for normal tension and 150% normal tension, the belt tension should be satisfactory. A reading below the value for normal tension indicates the belt slack should be reduced, and conversely, a reading exceeding the value for 150% normal tension indicates the belt slack should be increased. Experience has shown that a new drive can be tightened initially to two times normal tension to allow for any drop in tension during run in.

PISTON RING REPLACEMENT

Piston ring replacement is usually considered necessary when a compressor does not meet its normal air delivery or when its oil consumption is considered to be too great. If the compressor's normal air delivery has dropped off or if the oil consumption of the compressor is considered to be excessive, it may be an indication of several possible causes of trouble, one of which may be that the piston rings could either be broken or worn. Worn piston rings can often be a contributing factor in a decline in performance of a compressor that has been in service for a long period of time.

A general rule in determining if a compressor's oil consumption is excessive is to consider a minimum oil consumption to be approximately (50) horse-power-hours per ounce. To apply this rule, consider the size of a compressor, for example; a five horse-power unit uses four ounces of oil in twenty hours of operation. Five horse-power multiplied by twenty hours equals one-hundred horsepower hours, divided by four equals twenty-five horse-power-hours per ounce. Any compressor using more than two ounces of oil per one hundred horse-power-hours would be classed as not meeting commercial standards and would require corrective action, such as replacement of the piston rings. If it has been determined that replacement of the piston rings is necessary, Ingersoll-Rand Company recommends that a complete new set of rings be installed and that these instructions be used as a guide for piston ring replacement.

New replacement piston rings are of the quick-seating-type in that they are distinguished by their narrow seating edge where they contact the cylinder wall. Compression rings are classed as "B" type rings and are a single piece, taper-faced style in that they have a slight taper machined on their outer surface to provide line contact with the cylinder wall for quicker seating and better oil control. See figure 6–5.

Figure 6–5. Illustration of "B" Type or Single-Piece, Taper-Faced Style Compression Ring.

One or several of these compression rings may be used depending on the pressures involved. Oil rings are classified as "H" type, or "M" type rings. The "H" type ring is a single-piece, non-ventilated, beveled-scraper style which allows it to act as a combination oil-scraper and compression sealing ring. See Figure 6–6.

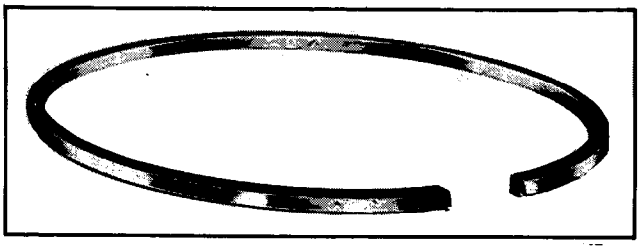


Figure 6–6. Illustration of "H" Type or Single-Piece, Non-Ventilated Beveled-Scraper Style Oil Control Wiper Ring.

Either one or two of these oil rings may be used on a piston.

The "M" type ring is a three piece, ventilated, chrome plated, steel rail style ring. This style ring utilizes an expander which exerts a uniform pressure all the way around two independent, thin, cylinder contacting rails, the rails being held apart by an open separator. The style of ring provides maximum oil drainage with the most uniform and positive conformability. See Figure 6–7.

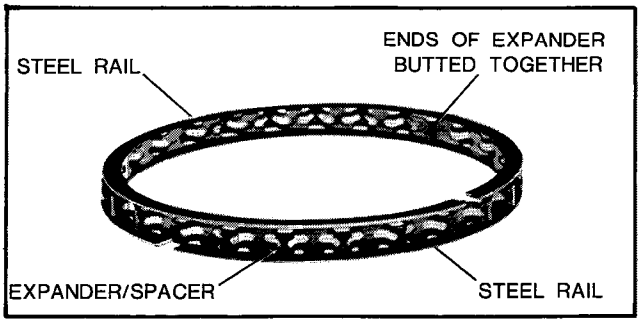


Figure 6-7. Illustration of "M" Type or Three-Piece, Ventilated, Chrome Plated Steel Rail Style Oil Control Wiper Ring.

This style ring may be used in conjunction with an "H" type ring when two oil control wiper rings are required. When the combination of a "M" type ring and a "H" type ring is used, the "H" type ring is always used in the bottom ring groove.

The following paragraphs contain complete instructions, in step-by-step procedure, for the disassembly, cleaning, inspection and replacement of cylinders, piston rings and pistons; therefore, before installing new replacement piston rings, we recommend that the entire procedure be very carefully read.

1. Disconnect any tube lines to the air head. Remove the air head attaching screws and washers and then remove the entire air head assembly from the cylinder. Remove the air head gasket. If the gasket sticks, a thin blade may be used to pry the gasket loose from the air head or the cylinder.

2. Remove the cylinder attaching screws and washers and then carefully remove the cylinder from over the piston and piston rings. Remove the cylinder-to-frame gasket.

3. Remove the piston from its connecting rod and then remove all of the old piston rings from the piston.

4. Thoroughly clean the air head by brushing or scraping lightly to remove any accumulated carbon deposits. Make sure the gasket surface is thoroughly cleaned of any gasket particles.

5. Thoroughly clean the cylinder of any accumulated oil, using a non-flammable safety solvent. Pay particular attention to the cleaning of the cylinder bore. Make sure the cylinder-to-air head and the cylinder-to-frame gasket surfaces are thoroughly cleaned of any gasket particles.

6. Thoroughly clean the piston of any accumulated oil, using a non-flammable safety solvent. Pay particular attention to the cleaning of the piston ring grooves and the oil return holes in the oil control wiper ring grooves.

7. Inspect the cylinder bore for any signs of scoring and scuffing. If the cylinder bore shows any signs of being scored or worn, as indicated by visible ridging at the end of the ring travel, it must be replaced; otherwise, effective oil control will not be established even with new piston rings.

8. Inspect the piston for any signs of scoring or for any indication of cracked or broken lands which would require replacement of the piston. If the piston shows no signs of being scored or of having any cracked or broken lands, check the general condition of the ring grooves for any signs of excessive wear. Wearing of the ring grooves may cause "tapering" of the grooves, which would result in excessive clearance between the piston ring and their corresponding grooves.

9. Assemble the new piston rings on the piston by first applying compressor lubricating oil to the piston ring grooves. To eliminate the possibility of breaking or distorting a piston ring, always use a piston ring expander and never pass one ring over another. If a piston ring expander is not available, spread the piston rings only far enough to allow them to be placed over the piston.

"H" TYPE RINGS — To install the "H" type or single piece, non-ventilated, beveled-scraper style ring, slip the ring into the ring groove, making sure that the bevel is toward the head of the piston and the undercut groove is toward the bottom of the piston. When two oil control wiper rings are required, the "H" type ring is always installed in the bottom ring groove.

"M" TYPE RINGS — Install the "M" type or three piece, ventilated, chrome plated steel rail style ring by first placing the expander in the ring groove with the free ends toward you. Push the ends of the expander to the inside of the ring groove, butting the ends together. Make sure the ends of the expander do not overlap. Caution: do not clip or cut the ends of the expander or the tension will be destroyed. Thread one of the two steel rails over the expander and into the bottom side of the ring groove. This rail will hold the expander in position. Thread the second steel rail around the expander and into the remaining clearance at the top of the ring groove. Again be certain that the free ends of the expander are butted together and are not overlapping. The end gap for rails should be 180° apart.

"B" TYPE RINGS — Install the "B" type or single piece, taper-faced style compression rings by placing each ring into its groove, starting with the bottom compression ring and working towards the top. Each taper-faced style compression ring is identified in some manner, usually with the word "top", the letter T, a dash, a dot or a paint mark to aid in making sure that the ring will be positioned properly in the ring groove. That is, each compression ring must be installed so that the top of the rings is towards the head or top of the piston.

10. After all of the piston rings have been installed on the piston, it may then be replaced on its corresponding connecting rod, making sure the ring gaps are staggered and not lined up.

11. When a new replacement piston ring set has been installed and the original cylinder is to be reused, the cylinder wall must be "deglazed" or slightly roughened to provide a proper "seating-in" surface for the piston rings. Use an automotive type deglazing hone. The hone should be wetted with some type of oleum spirits or safety solvent during deglazing to reduce the harshness of its surface and to keep feathered edges to a minimum. Do not overdo the deglazing; dulling the glaze is usually sufficient and can be accomplished with a very light pressure. After deglazing, the cylinder wall should be thoroughly cleaned by scrubbing the bore with a good stiff bristle (not wire) brush, using ordinary soap or detergent and hot water. Rinse thoroughly with hot water and then check the cleanliness of the cylinder bore by wiping with a soft white paper cloth. If the paper shows more than slight discoloring, the cylinder bore has not been completely cleaned.

NOTE: If the piston rings, the piston and the cylinder meets all required conditions and proper "deglazing" and cleaning technique of the cylinder bore has been followed, the use of an abrasive or lapping compound to seat the piston rings is not necessary and is not recommended.

12. After the cylinder has been thoroughly cleaned, apply compressor lubricating oil to the cylinder bore and replace it on the compressor frame, making sure a new gasket is used between the cylinder and frame. Extreme care must be used when replacing the cylinder over the piston rings to avoid distorting or breaking the rings.

    An entrance bevel is machined at the bottom of the cylinder to guide the piston and ring assembly into the bore. The cylinder can easily be installed by twisting the cylinder with a slight downward pressure.

    Replace the cylinder attaching screws, tightening each screw to the recommended torque value. Hand tighten across cylinder corners before final torque.

13. Apply a liberal amount of compressor oil to the cylinder bore and then replace the air head on the cylinder, making sure a new gasket is used between the air head and the cylinder. Replace the air head attaching screws, tightening each screw to its recommended torque value.

14. After new replacement piston rings have been installed, the compressor should be operated for at least 10 hours at full load before checking for proper air delivery and oil consumption.

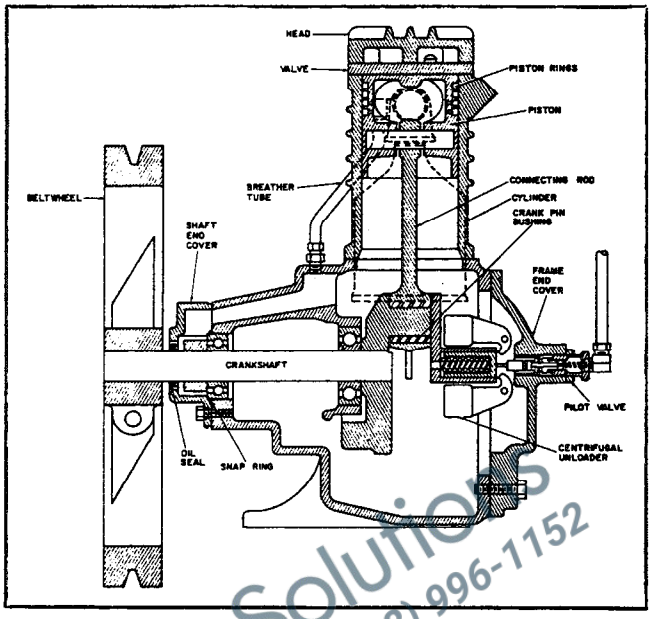


Figure 6–8. Single-Stage, Single-Cylinder Compressor. (Model 23A)

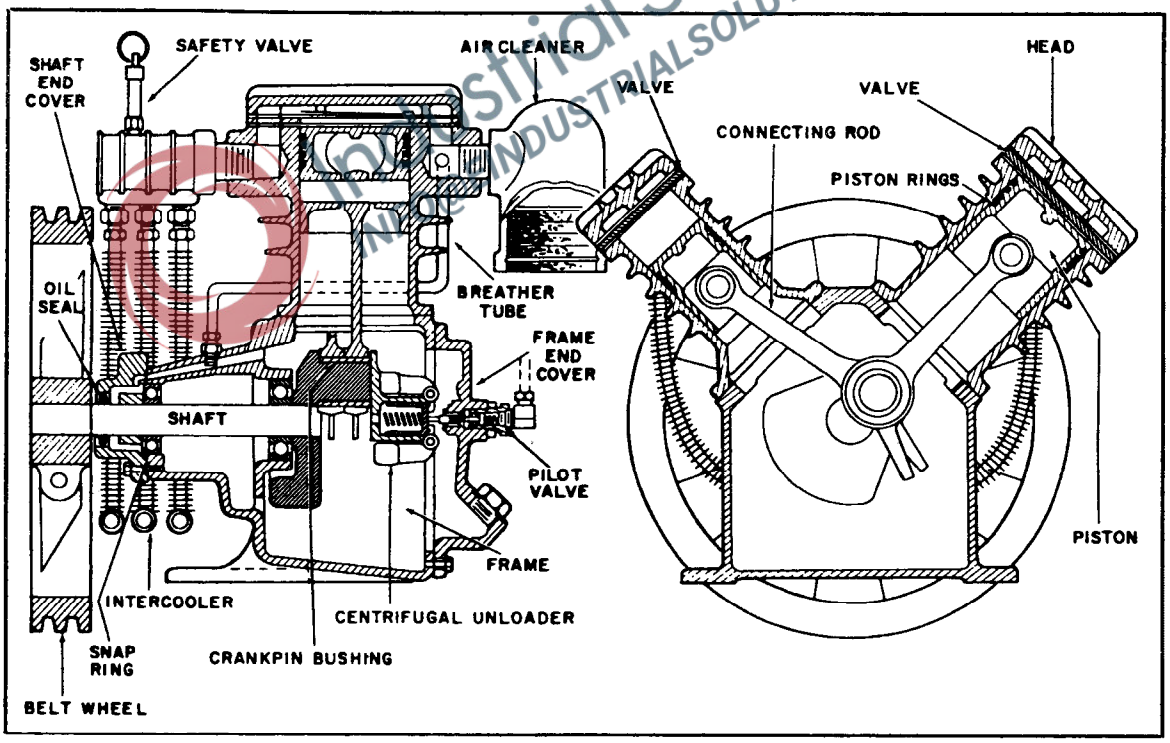


Figure 6–9. Two-Stage Compressors. (Models 234, 242, 253)

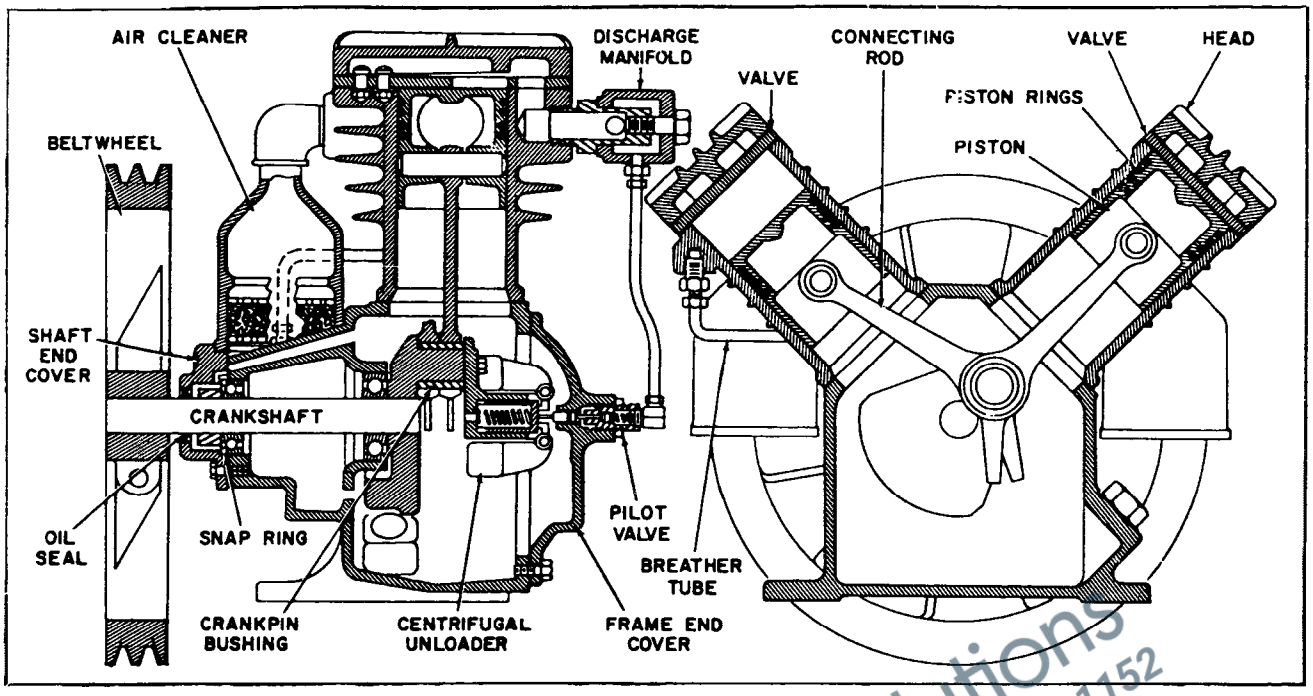


Figure 6–10. Single-Stage, Two-Cylinder Compressors. (Models 235, 244, 255)

SEPARATING THE PISTON FROM THE ROD

To separate the piston from the connecting rod; proceed as follows:

A. Disconnect any assemblies or piping that may prevent removing the cylinder. Now, take out the cap screws securing the cylinder to the frame and pull the cylinder over the piston.

B. To avoid bending the connecting rod when driving out the piston pin, we recommend removing the piston and rod assembly from the crankshaft. To do this, drain the oil from the frame and remove the frame end cover. Then, take the centrifugal unloader assembly off the end of the crankshaft and pull the connecting rod off its throw.

C. Remove the piston pin lock rings from their grooves and, with a dowel of approximate size and a soft hammer, drive out the piston pin. Important: To prevent piston distortion during this operation, play between the piston pin bosses and connecting rod must be eliminated by inserting fork-type shims of the necessary thickness between the rod and boss. See Figure 6–11.

D. Before installing the new pin, oil the walls of the pin, align the connecting rod in the piston and drive in the new pin using an appropriate dowel and a soft hammer.

E. When the piston pin is in place put the lock rings back in their grooves.

F. Put the connecting rod back on the crankpin and replace the centrifugal unloader or crankpin cap and frame end cover.

G. Oil the cylinder bore and replace the cylinder. Replace the air head and any other assemblies or piping that were removed.

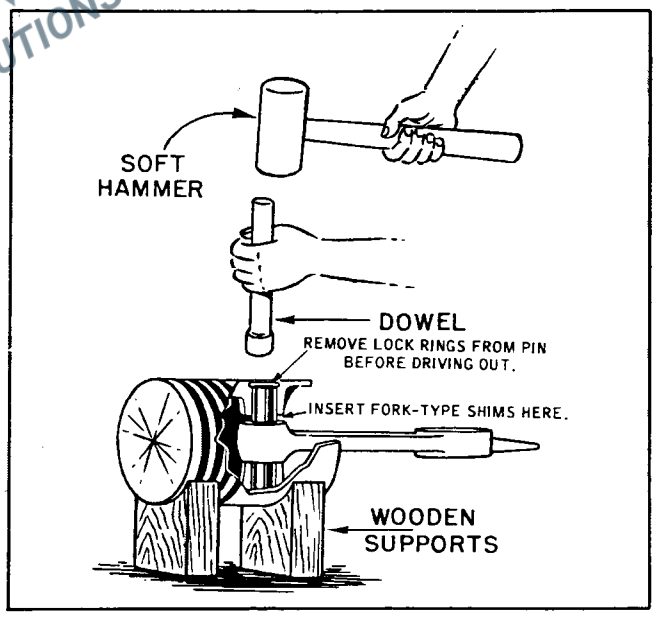


Figure 6–11. Recommended Method of Removing or Replacing Piston Pin.

CRANKSHAFT BEARING REPLACEMENT

If bearing replacement is necessary, we recommend the installation of a new crankshaft complete (with bearings attached.) Ingersoll-Rand cannot accept responsibility for the successful operation of the compressor unless a genuine I-R crankshaft complete is used as a replacement. Refer to the appropriate parts list for ordering instructions.

CRANKPIN BUSHING REPLACEMENT

To replace the crankpin bushing:

A. Drain oil from the frame.

*B. Disconnect the tubing from the pilot valve and remove the frame end cover.

C. Remove the air head and cylinder to frame cap screws.

D. Pull the cylinder up over the piston.

*E. Remove the centrifugal unloader assembly or crankpin cap from the end of the crankshaft and pull the connecting rods off the crankpin bushing.

F. Remove the old crankpin bushing from the crankshaft throw and place a new bushing on the crankpin.

*G. Replace the connecting rods, centrifugal unloader assembly or crankpin cap and frame end cover.

H. Oil the cylinder bore and replace the cylinder.

I. Replace the air head and any other assemblies or piping that were removed.

J. Refill the frame with oil.

*If furnished on your compressor.

CRANKSHAFT ASSEMBLY REPLACEMENT

A new crankshaft assembly includes bearings, spacers, crank disc, etc., all of which are installed as a unit. To remove the old crankshaft and install a new one, proceed as follows:

A. First remove the beltwheel, beltwheel key and shaft end cover. Next, drain the frame oil and remove the frame end cover and centrifugal unloader assembly.

B. Remove the cylinder to frame cap screws and pull the cylinders over the pistons. Remove the centrifugal unloader and connecting rods from the end of the crankshaft, and take the snap ring from the outer bearing. It may be necessary to drive the crankshaft endwise before removing snap ring.

C. The crankshaft assembly is a moderate press fit in the frame and may be forced out by tapping the beltwheel end of the shaft with a lead hammer.

D. Prepare the new crankshaft assembly for installation by removing the snap ring from the outer bearing by grasping it near the end and springing it from the groove.

E. The new crankshaft may be inserted into the frame from the frame end cover side. Since the assembly is a moderate press fit, it may be forced into position by tapping it with a lead hammer. (Be careful to strike the center of the shaft since an off center blow may spring it.)

F. The assembly must be driven in until the snap ring groove in the outer bearing clears the end of the frame by about 1/16" (1.59 mm). Replace the snap ring by putting one end in the groove and springing the ring into place.

G. Tap the crankshaft back until the snap ring is tight against the frame.

H. Before replacing the shaft end cover (includes oil seal), make certain that there are no burrs on the beltwheel end of the crankshaft and that the edges of the keyway are smooth and slightly rounded to prevent damage to the oil seal. When satisfied that the crankshaft is smooth, replace the shaft end cover. As an added precaution against cutting the oil seal, an assembly tool can easily be made in the form of a truncated cone of .003" (.076 mm) brass shim stock. See Figure 6-12.

I. Re-assemble the rest of the compressor, using caution when replacing the cylinders over the pistons. We recommend the use of a piston ring compressor in this operation.

J. Fill the frame with oil.

OIL SEAL REPLACEMENT

A. Remove the beltwheel, key and shaft end cover. The oil seal may be removed from the cover by prying under the inside lip with a pinch bar, or driving it out with a metal rod.

B. Insert the new seal with the sealing lip facing toward the inside of the frame and coat the outside diameter of the seal with shellac or pipe compound. Press the seal into the shaft end cover with a vise or in a press. Note: Protect the parts from damage by serrated vise jaws by padding the vise jaws.

C. After the seal has been installed in the shaft end cover, it is returned to its original location by sliding it over the end of the crankshaft, as described in paragraph (H) of Crankshaft Assembly Replacement.

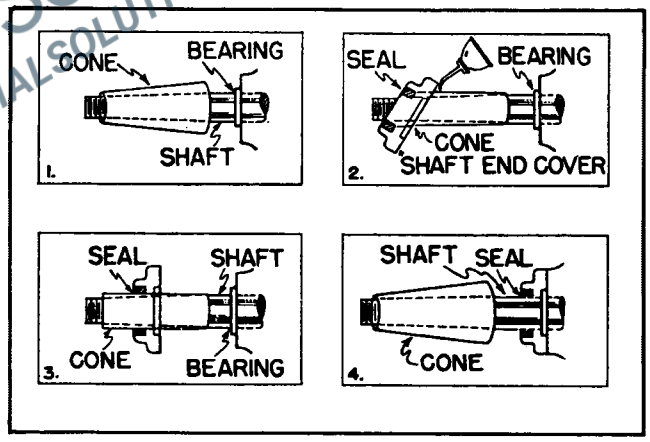


Figure 6-12. Oil Seal Replacement.

PRECAUTIONS FOR EXTENDED SHUTDOWN

Whenever the unit is taken out of service for long periods of time, certain precautions must be taken to prevent general deterioration.

A. All interior surfaces of the unit should be protected against rust by draining the frame and refilling it with a rust inhibiting oil. The unit should now be operated for fifteen minutes and the oil should be fogged into the unit's intake, thus coating all internal surfaces. Leave the rust inhibiting oil in the frame. Note: When putting

the unit back into service, replace the rust inhibiting oil with conventional lubricating oil.

B. After this operation, all openings are to be taped shut to prevent moisture from entering the unit.

C. Drain the air receiver of all moisture and store the unit in a dry sheltered location.

D. Follow the manufacturer's instructions for storing the electric motor or gasoline engine.

SECTION VII
OPTIONAL EQUIPMENT
ACCESSORIES AND PIPING ARRANGEMENTS

AFTERCOOLERS

Two types of aftercoolers are used; air-cooled and water-cooled. The purpose of an aftercooler is to reduce the discharge temperature of the compressed air and to facilitate removal of water vapor and oil vapor.

AIR-COOLED AFTERCOOLER

The cooler consists of finned tubing through which compressed air passes on its way to the air receiver. Cooling air drawn over these tubes by the fan-type flywheel cools the compressed air and condenses moisture. This moisture passes on to the receiver and is drained either manually or by an automatic drain trap.

This type aftercooler also acts as a belt guard.

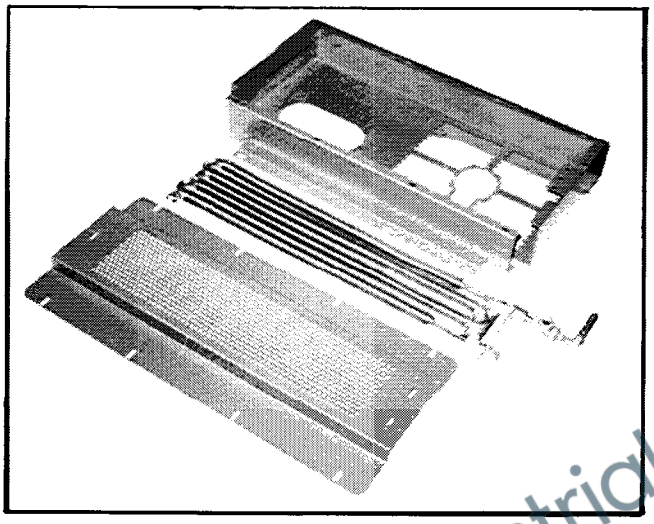


Figure 7-1. Typical Air-Cooled Aftercooler with Belt Guard. (Disassembled)

WATER-COOLED AFTERCOOLER

One of two types of water-cooled aftercoolers may be furnished: A-20R or A-42R. The water, air and condensate taps from these single-shell aftercoolers are shown in Figure 7-6.

The standard water-cooled aftercooler consists of a copper tube with multiple quill-type spines located within a steel shell. Headers on each end of the aftercooler provide pipe connections for water, air and condensate piping. A hex shaped rod in the center of the tube forces the water to flow along the outer wall for better heat transfer.

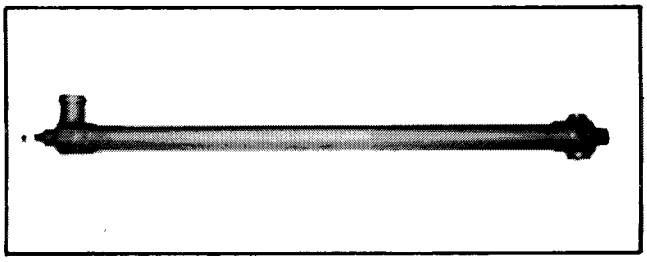


Figure 7-2. A-20R and A-42R Aftercooler.

Mount the aftercooler as close to the air receiver as possible, using pipe of the same diameter as the compressor discharge port, if the total length is less than 10 feet (3.04 m). If the total length is more than 10 feet (3.04 m), use the next larger diameter size pipe. The aftercooler must be adequately supported.

Air piping from the compressor discharge to the aftercooler should be sloped in such a manner to prevent the condensate from draining into the compressor, but if overhead piping is used, a drain leg, to trap condensed moisture, should be mounted next to the compressor.

An automatic water shut-off valve is available as optional equipment for controlling the flow of water through the aftercooler in synchronization with the operation of the compressor. This valve is always used in conjunction with a manually operated valve for regulating the rate of water flow. The water flow should be adjusted to allow a maximum discharge water temperature of 120°F.

If an automatic water valve is not used, merely install a hand operated valve in the water inlet line.

AFTERCOOLER SERVICING — The air-cooled aftercooler will require very little maintenance. The tubes should be blown clean with compressed air weekly.

The required maintenance for the water-cooled aftercooler consists of keeping the spines free from lacquer and carbon. This condition may occur because of high air temperature, and/or the use of a high residue lubricating oil and/or excessive oil consumption. This carbonized condition of the cooler may be detected by noting changes in cooler efficiency as indicated by the increasing quantity of water required to cool the air. Maximum performance of the aftercooler can be insured by cleaning the aftercooler as soon as there is any indication of loss of efficiency.

To clean the spines, disconnect all piping from the headers, plug the necessary openings and fill the shell with carbon solvent. (A chlorinated, hydrocarbon type of solvent is a good cleaner.) Permit the spines to soak overnight, drain and flush with hot water to remove the carbon deposits. Very heavy deposits will require repeated applications of the carbon solvent.

AUTOMATIC WATER VALVE

The automatic water valve permits water to flow through the aftercooler only when the compressor is operating, or operating loaded in the case of units regulated by constant speed control.

The top of the water valve is piped to either the intercooler or directly to the compressor discharge depending upon whether the compressor is single or two-stage. Note that in all cases the top of the water valve is piped to a point on the compressor where a change in pressure is transferred immediately to diaphram "B" in the water valve. See Figure 7-3.

When the compressor stops or unloads, cylinder pressure is lost. The loss of cylinder pressure relieves the pressure against diaphragm "B" in the water valve and the spring "D" closes valve "C". This action shuts off water flow to the aftercooler.

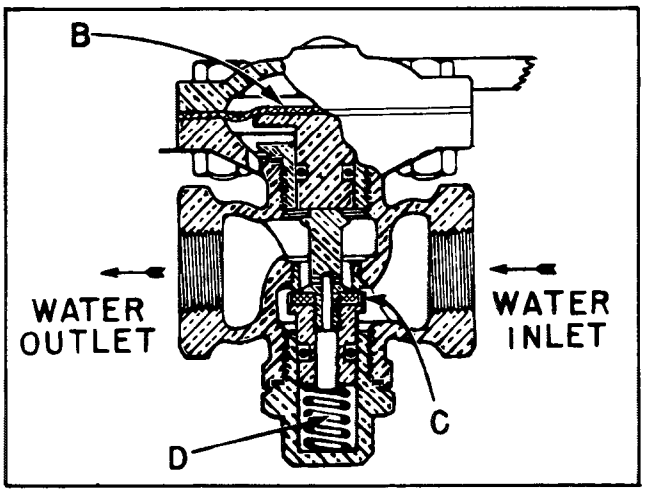


Figure 7–3. Automatic Water Shutoff Valve

When the compressor starts or loads, pressure builds up in the compressor and also against the diaphragm in the water valve. The air pressure against the diaphragm "B" now overcomes the pressure of spring "D", opening the valve, permitting water to flow through the valve and aftercooler.

The automatic water valve is furnished only when specified, and it is to be installed in the water inlet line ahead of the aftercooler. Always install a globe valve in the line to control the rate of water flowing through the aftercooler.

AUTOMATIC DRAIN TRAP

When specified on the purchase order, units are provided with an automatic condensate drain trap. The purpose of the drain trap is to expel the condensate from the receiver and/or the aftercooler.

WARNING
DO NOT PRIME CONDENSATE TRAP WITH AIR PRESSURE IN RECEIVER

TO PRIME CONDENSATE TRAP: (See Figure 7–7. for typical mounting and piping arrangement.) Close manual shut-off valve installed bottom side of pipe tee. Remove pipe plug installed top of pipe tee, and pour water into top opening of pipe tee until trap and pipe tee are filled with water. Open manual shut-off valve releasing water in pipe tee into air receiver. Re-install pipe plug using pipe thread lubricant and tighten to prevent air leak.

When the inverted-bucket-style, automatic condensate drain trap is properly primed, and as pressure is built up in the air receiver, condensate is forced into the trap and out the trap outlet. However, if the trap is not properly primed, the inverted bucket remains in its down position. This causes the valve to remain open, allowing air pressure leakage to atmosphere.

The top of the inverted bucket contains a small orifice, which allows some air pressure to pass through to the top of the trap.

As the air pressure in the top of the trap gradually increases, it displaces some of the condensate around the outside of the inverted bucket; this causes the bucket to lose buoyancy. However, air pressure over the valve seat will continue to keep the trap closed until the inverted bucket has lost sufficient buoyancy to allow the weight of the bucket to open the valve. When the valve opens, the air pressure in the top of the trap is purged through the trap outlet, this permits air pressure and condensate from the air receiver to enter the trap.

Because the condensate lies in the bottom of the air receiver, air pressure, over the condensate, forces it into the trap first; thus expelling the condensate through the trap outlet. Air pressure from the receiver, after purging the condensate, causes the inverted bucket to recover its buoyancy; thus the cycle repeats itself.

Where there is little or no condensate present in the air receiver, the trap will continue to expel a small amount of air pressure each time the inverted bucket loses buoyancy. The amount of air pressure lost by the cycling of the inverted bucket is negligible; however, it may present the appearance of a faulty automatic condensate drain trap if this cycling is not properly understood. It is very important to understand that this small amount of intermittent air leakage is perfectly normal and should not give cause for alarm. However, if air leakage occurs on a continuous basis, it could be an indication the trap has lost its prime or that the trap may be faulty.

IMPORTANT
TO PREVENT REPRIMING TRAP, CLOSE MANUAL SHUT-OFF VALVE ON TRAP BEFORE COMPLETE AIR LOSS OF RECEIVER.

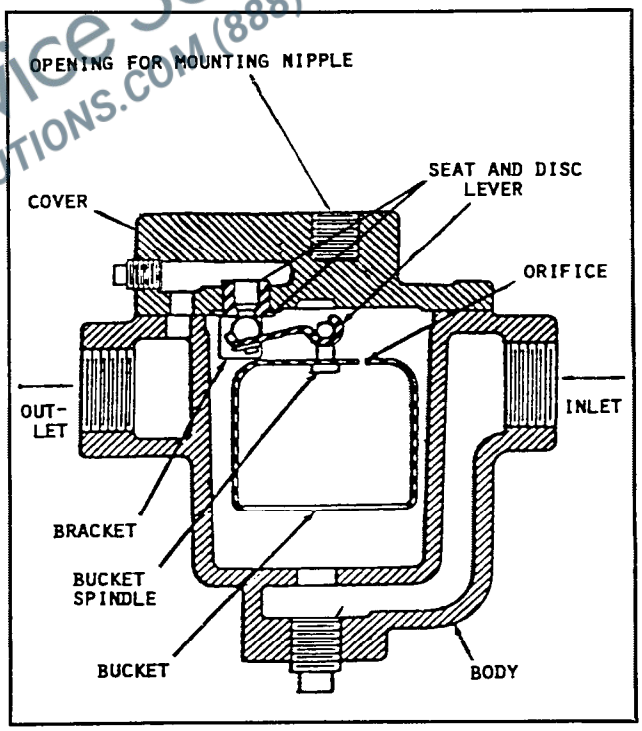


Figure 7–4. Inverted-Bucket, Automatic Condensate Drain Trap.

WARNING
DO NOT OPERATE THE COMPRESSOR ABOVE THE MAXIMUM WORKING PRESSURE OF THE RECEIVER

AIR RECEIVER

If the air system into which the compressor discharges does not have sufficient volume, the compressor will cycle too frequently. In this case, an air receiver must be used to provide enough volume to operate the regulation system of the compressor.

Air receivers must meet the safety requirement of the state in which they are used.

IMPORTANT
AIR RECEIVER MUST BE ASME CODED

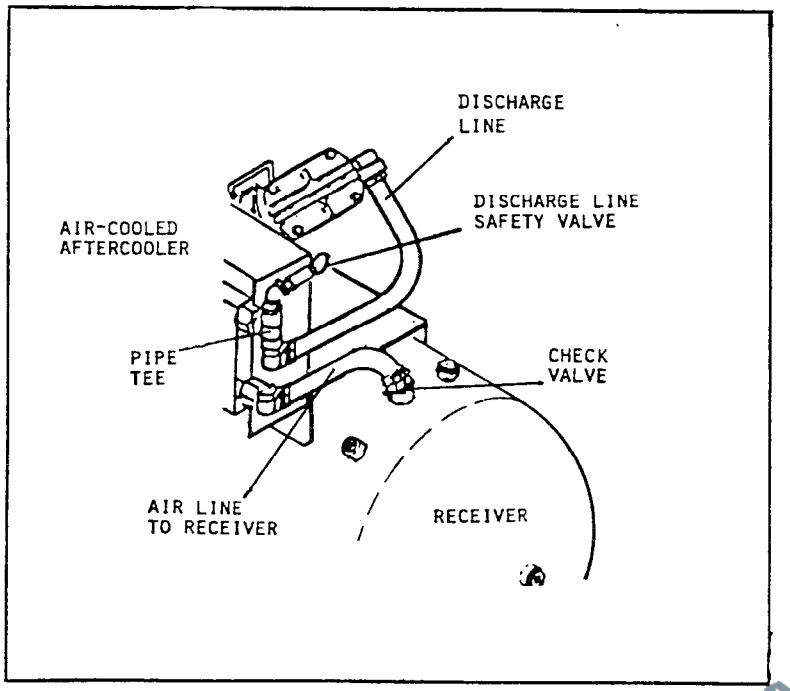


Figure 7–5. Typical Mounting and Piping Arrangement for Air-Cooled Aftercooler.

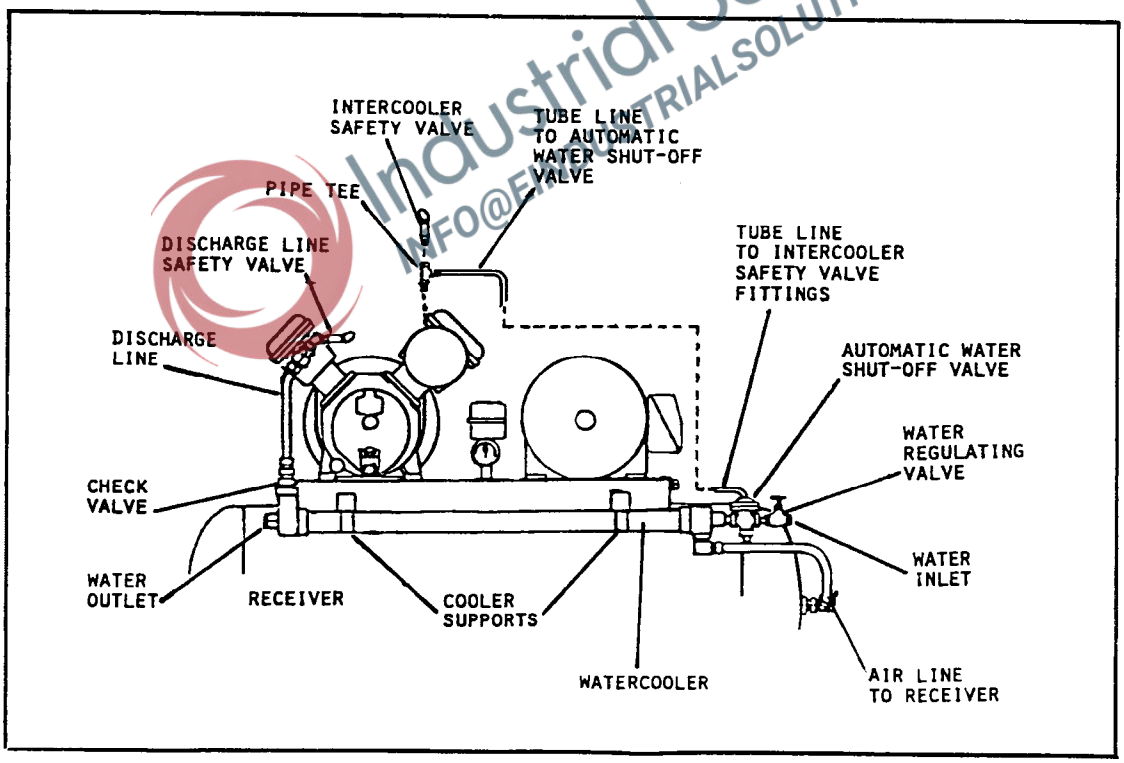


Figure 7–6. Typical Mounting and Piping Arrangement for Water-Cooled Aftercooler and Automatic Water Shut-Off Valve.

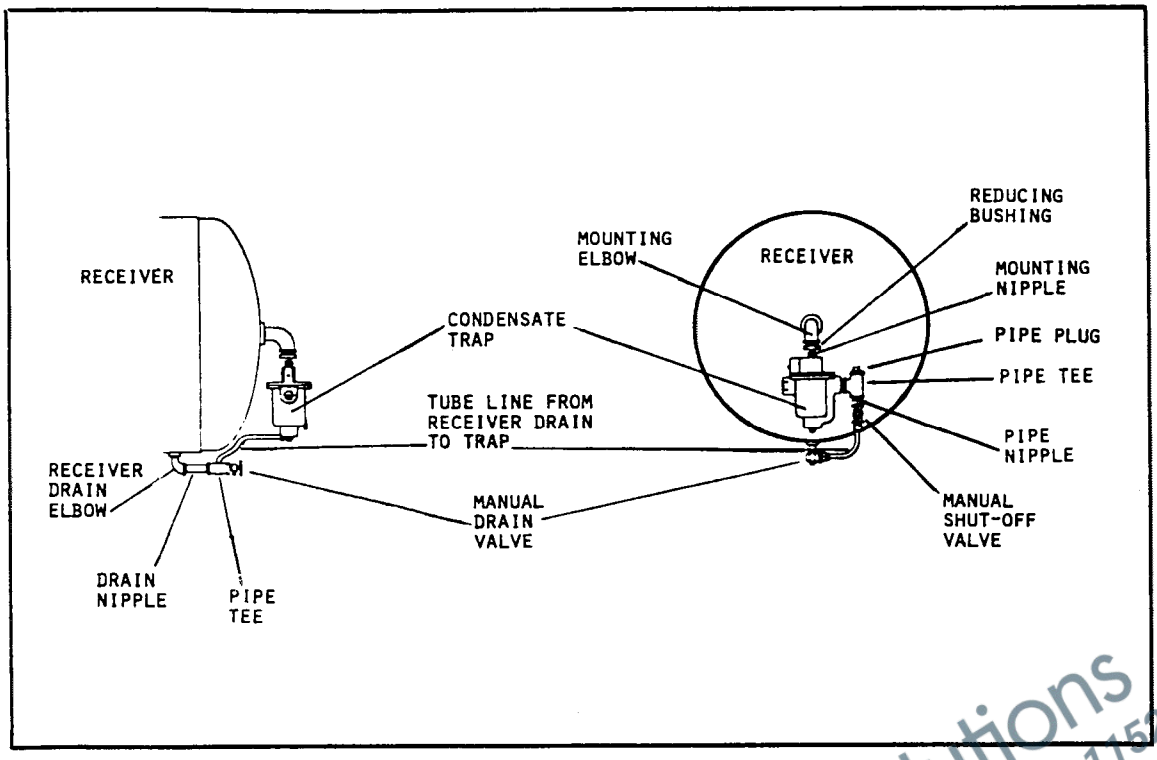


Figure 7–7. Typical Mounting and Piping Arrangement for Automatic Condensate Trap.

⚠WARNING

STATEMENT CONCERNING THE USE OF THIS EQUIPMENT FOR BREATHING AIR AND/OR AQUA LUNG SERVICE.

If the model number on a compressor contains the letters "BAP"; the air compressor is suitable for breathing air services. Compressors that DO NOT bear this designation are NOT capable of producing air of breathing quality. For use in breathing air applications, an air compressor must be fitted with additional specialized equipment to properly filter and/or purify the air to meet all applicable federal, state and local laws, rules, regulations and codes, such as, but not limited to, OSHA 29 CFR 1910.34. Compressed Gas Association Commodity Specifications G-7.1-1966. Grade D Breathing Air, and/or Canadian Standards Association. Should the Purchaser and/or User fail to add such specialized equipment, and proceed to use the air compressor for breathing air service, the Purchaser/User assumes all liability resulting therefrom without any responsibility or liability being assumed by Ingersoll-Rand Company.

The purchaser is urged to include the above provisions in any agreement for any resale of this compressor.

⚠ADVERTENCIA

DOCUMENTO CONCERNIENTE AL USO DE ESTE EQUIPO PARA EL SERVICIO DE AIRE RESPIRABLE Y/O SERVICIO DE BUCEO.

Si el número del modelo en un compresor de aire contiene las letras BAP, el compresor esta diseñado para el uso en servicios de aire respirable. En la ausencia de tal designación, el compresor no puede ser considerado adecuado para producir aire respirable. Para que un compresor sea adecuado para ser usado en aplicaciones de aire respirable, debe estar acondicionado con equipo especializado para filtrar y/o purificar apropiadamente el aire y así cumplir con las leyes, reglas y regulaciones federales, locales y estatales, no limitadas a OSHA 29 CFR 1910.34, las Especificaciones de la Asociación de Gas Comprimido G-7.1-1966 Aire respirable Grado D, y/o Asociación de Estándares Canadienses. Si el comprador y/o el usuario no añaden este equipo especializado y procede a usar el compresor para servicio de aire respirable, el Comprador/Usuario asume toda la responsabilidad resultante de esto sen que ninguna responsabilidad u obligación sea asumida por la compañía Ingersoll-Rand.

Se sugiere al comprador que incluya la anterior provisión en cualquier acuerdo por cualquier re-venta de este compresor.

Hazardous vapors. Can cause severe nausea, fainting or death.

Compressed air or gas from this compressor may contain poisonous vapors or gases.

Certain sprayed material such as paints, insecticides, weed killer, sand, etc., may be harmful if inhaled or used in a closed area.

Never directly inhale the compressed air or gas produced by this compressor.

Always read container labels when spraying paints or poisons.

Always use the compressor in a well-ventilated area.

Use a respirator or mask whenever there is a chance that you might inhale any sprayed material. If a mask is used, read all instructions provided with the mask to ensure it will protect you from the materials you are spraying.

Vapores peligrosos. Pueden causar náusea, desmayo o muerte.

El aire comprimido de este compresor puede contener monóxido de carbono venenoso.

Ciertos materiales propulsados por aire tales como pinturas, insecticidas, arena etc. pueden ser peligrosos si se inhalan o utilizan en un área cerrada.

Nunca inhale directamente el aire comprimido producido por este compresor.

Lea siempre las etiquetas de los contenedores cuando esté rociando pintura o venenos.

Siempre utilice el compresor en un área bien ventilada.

Utilice el respirador o máscara cuando haya riesgo de inhalar cualquier material que esté rociando. Si utiliza máscara, lea muy bien las instrucciones para que usted pueda saber de qué lo va a proteger mientras rocía.

Hazardous voltage. Can cause severe injury or death.

Always disconnect the power supply cord before performing any maintenance or repair work.

Always connect the power supply cord to a grounded electrical receptacle with the specified voltage and fuse protection.

Never use the compressor in rain, in a wet area, or near an explosive environment.

Voltaje peligroso. Puede causar heridas severas o muerte.

Siempre desconecte el suministro eléctrico antes de hacer cualquier mantenimiento o reparación.

Siempre conecte el suministro eléctrico a un circuito adecuado y con el voltaje especificado.

Nunca utilice el compresor en la lluvia, o en un área cerca de una atmósfera explosiva.

Flammable vapors. Can cause a fire or explosion, and result in severe injury or death.

Sparks from the motor's electrical contacts can ignite flammable vapors from gasoline, natural gas or solvents.

Do not operate the compressor in any areas where explosive or flammable vapors or liquids may exist.

Never smoke or use open flame in the vicinity of the compressor or any gas bottle or source.

Vapores inflamables. Pueden causar fuego o una explosión, y el resultado puede ser herida severa o muerte.

Chispas del motor eléctrico pueden encender vapores inflamables de gasolina, gas natural o solventes.

No operan el compresor en ningunas áreas donde vapores o los líquidosexplosivos o combustibles pueden existir.

Nunca fumar o el uso abre llama en la vecindad del compresor, botella de gas o fuente de gas.

Compressed air/gas has great force.

Over-pressurizing the bottle, tank or receiver, or using a receiver which does not meet the design limits for this compressor, can cause them to rupture or explode, and result in severe injury or death.

Changes to the bottle, tank or receiver structure will cause it to weaken and can cause it to rupture or explode, and result in severe injury or death.

Internal rusting in the bottle, tank or receiver will cause it to weaken and can cause it to rupture or explode, and result in severe injury or death.

Pressure beyond design limits can cause the bottle, tank or receiver to rupture or explode, and result in severe injury or death.

Improper use of air tools or attachments can cause an explosion, and result in severe injury or death.

The bottle, tank or receiver is equipped with a relief valve to protect against over-pressurization. DO NOT REMOVE, ADJUST OR MAKE SUBSTITUTIONS FOR THE RELIEF VALVE. Periodically pull the ring on the relief valve to ensure it operates freely. If the valve is stuck or does not operate freely, it must be replaced.

Never drill into, weld to, or alter the bottle, tank or receiver in any manner.

Drain water/condensate from the air receiver daily or before each use.

Pressure switch and unloader valve operation is related to motor/engine horsepower, air receiver rating, and relief valve setting. DO NOT ATTEMPT TO ADJUST, REMOVE OR BYPASS THE PRESSURE SWITCH, OR CHANGE OR MODIFY ANY PRESSURE CONTROL RELATED DEVICE.

Do not use any air tools or air attachments without first determining the maximum air pressure recommended for that particular piece of equipment.

Compressed natural gas compressors are equipped with explosion-proof electrical systems. Ensure any additional electrical equipment is also explosion-proof.

Gas leaks can occur in compressed natural gas compressors or associated piping. Even small leaks pose a potential hazard and should be corrected before the compressor is operated. If a maintenance function involves breaking a gas-tight joint, always recheck for gas leaks after reassembling by using a commercial gas leak detector.

El aire comprimido tiene gran fuerza.

El tanque de aire sobre-presurizado puede causar que el tanque de aire explote o se rompa, y puede resultar en heridas severas o muerte.

Cambios en la estructura del tanque de aire pueden causar que el tanque de aire se debilite causando la ruptura o explosión de este, resultando en herida severa o muerte.

El debilitamiento de la estructura del tanque de aire debido a oxidación interna puede causar rupturas o explosión del tanque y puede resultar en heridas severas o muerte.

La presión de aire fuera de sus límites puede causar que el tanque explote o se rompa, y esto causaría heridas severas o muerte.

El uso impropio de las herramientas neumáticas o sus accesorios pueden causar explosión, y resultar en heridas severas.

El tanque de aire está protegido de sobrepresurización por una válvula de seguridad. NO QUITE, HAGA AJUSTES, O SUSTITUCIONES EN ESTA VALVULA. Ocasionalmente hale el anillo en la válvula de seguridad para asegurarse de que la válvula funcione libremente. Si la válvula está atascada o no funciona, debe ser reemplazada.

Nunca perfore, suelde o cambie el tanque de aire en ninguna forma.

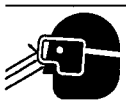
Drene el agua/condensado del tanque de aire diariamente o antes de cada uso.

NO TRATE DE AJUSTAR, REMOVER, O DERIVAR EL BOTON DEL INTERRUPTOR DE PRESION, O CAMBIE Y MODIFIQUE CUALQUIER ESTRUCTURA RELACIONADA CON EL CONTROL DE PRESION.

No utilice ninguna herramienta neumática o accesorio sin determinar la presión máxima de aire comprimido que se recomienda para esa herramienta en particular.

Los compresors comprimidos de gas natural se equipan con sistemas eléctricos que no estallarán. Asegure cualquier equipo eléctrico adicional es también incapaz de estallar.

Los escapes de gas pueden ocurrir en los compresors naturales de gas o asociados tubos. Cualquier escape es un peligro potencial y debería corregirse antes de el compresor se opera. Si una función de mantenimiento involucra quitando un sujetador, siempre detecta cualquier gas escapa después de armar nuevamente por usar un detector de escape de gas.



Rotating compressor. Can propel dirt, sand, metal shavings, etc., and result in severe injury.

Never point an air nozzle or air sprayer toward any part of the body, or toward another person.

Always wear safety glasses or goggles when servicing.

Aire comprimido. Puede expulsar polvo, metal o arena etc. y puede resultar en heridas.

Nunca apunte la boquilla hacia alguna parte del cuerpo o hacia otra persona.

Use siempre gafas protectoras.

Moving parts. Can cause severe injury.

Always disconnect the power supply before attempting to perform any maintenance or repair work.

Always ensure the pressure is released from the compressor, bottles, tanks, receiver and air attachments before performing any maintenance or repair work.

Always disconnect the power supply on electric motor models if the compressor is to be left unattended.

Never operate compressor with the fan shroud removed, or if the shroud is damaged or broken.

Las partes en movimiento pueden causar heridas severas.

Desconecte siempre el suministro eléctrico antes de cualquier mantenimiento ó reparación.

Desconecte siempre el suministro eléctrico si el compresor no va ser usado.

Asegúrese que el aire a presión es liberado del compresor, del tanque de aire, y demás accesorios de aire antes de hacer cualquier mantenimiento o reparación.

Nunca opere el compresor sin el guarda poleas. Nunca opere el compresor con una polea dañada o rota.

Hot parts. Compressors get hot while running, and can cause severe burns if touched.

Never touch the compressor, motor/engine, or tubing during or shortly after compressor operation.

Partes calientes. Los compresores de aire se calientan en operación y pueden causar quemaduras severas.

Nunca toque el compresor, el motor, o la tubería de descarga durante o poco después de operar el compresor.

WARNING: THE EXPORT OR RE-EXPORT OF THIS DRAWING OR A PRODUCT PRODUCED BY THIS DRAWING IS SUBJECT TO U.S. EXPORT ADMINISTRATION REGULATIONS AND OTHER APPLICABLE GOVERNMENTAL RESTRICTIONS OR REGULATIONS.

Look What INGERSOLL-RAND *Can Do For YOU. . .*

Vea Lo Que INGERSOLL-RAND *Puede Hacer Por USTED. . .*

EFFICIENT FIELD SERVICE
We maintain a highly trained staff of technicians to service your equipment for preventive maintenance, or to assist you should emergencies ever occur.

EFICIENTE SERVICO EN EL CAMPO
Mantenemos un grupo de mecánicos entrenados para suministrarle mantenimiento preventivo o atender cualquier emergencia que puede tener.

COMPLETE REPAIR SERVICE
Our trained technicians will repair or overhaul your equipment to factory specifications, using only genuine I-R parts.

COMPLETO SERVICIO DE REPARACION
Mecánicos entrenados repararán su compresor según los métodos recomendados por fábrica usando solamente partes genuinas Ingersoll-Rand.

SPECIAL ENGINEERING SERVICE
We can help you identify and solve your compressed air problems by evaluating your needs and recommending the proper compressor and air piping system to give you maximum efficiency.

SERVICO DE INGENIERIA ESPECIAL
Nosotros podemos ayudarlo con sus problemas de aire comprimido investigando sus necesidades y recomendando el compresor y el sistema de aire adecuados para lograr máxima eficiencia.

SPARE PARTS
By stocking genuine I-R spare parts, we can help you avoid costly delays, or substituting inferior parts. Using genuine I-R parts on your I-R equipment will help to keep even older machines running in good-as-new condition.

PARTES DE REPUESTO
Mantenemos partes genuinas Ingersoll- Rand, evitando posibles sobrecostos debido a demoras en la sustitución de partes menores. Como resultado, los equipos antiguos son mantenidos como nuevos.

COMPLETE STOCK OF EQUIPMENT
We carry a complete line of I-R equipment and accessories designed to met any compressed air application. We are backed by Ingersoll-Rand's prompt factory shipment to ensure you on-time delivery.

STOCK COMPLETO DE EQUIPOS
Nuestro stock de máquinas completas que pueden encargarse usualmente de cualquier necesidad, está soportado por un eficiente sistema de despachos de fábrica de Ingersoll-Rand para asegurarle entrega a tiempo.

A SUBSTITUTE IS NOT A REPLACEMENT

Ensure you get peak performance and longevity out of your Ingersoll-Rand compressor by insisting on genuine Ingersoll-Rand replacement parts and maintenance kits. Not only are the replacement parts made to precise dimensions and OEM-specified metallurgy, but each part is backed by the Ingersoll-Rand warranty. Your local Air Center, Full-Service distributor or direct Ingersoll-Rand salesperson will work with you to ensure you get the parts you need to do the job right. Equip your machines with only the best - Ingersoll-Rand Genuine Parts.

UN SUSTITUO NO ES UN REEMPLAZO

Asegúrese que obtiene máximo desempeño y duración de su compresor insistiendo en usar solamente partes de reemplazo genuinas y kits de mantenimiento Ingersoll-Rand. No solamente están construidas con dimensiones precisas y especificaciones exactas de metalurgia, sino que cada parte está respaldada por la garantía Ingersoll-Rand. Su Air Center, su Distribuidor de Servicio o el personal de ventas directo de Ingersoll-Rand trabajarán con Usted para asegurarle que recibe las partes para efectuar el trabajo correcto. Equipe sus máquinas sólo con lo mejor - Partes Genuinas Ingersoll-Rand.

DISTRIBUTED BY:
DISTRIBUIDO POR:

Ingersoll-Rand Company
Reciprocating Compressor Division
Small Compressor Business Unit
Campbellsville, KY 42718

Printed in the U.S.A.