ESV & PHE
BOOSTERS

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Davidson, NC 28036

ESV AND PHE BOOSTERS
SINGLE AND TWO STAGE

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BOOSTER COMPRESSORS

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BOOSTERS

Installation Considerations and Operating Conditions for Proper Performance
Sales Engineer's Responsibility to Inform Customer.

Lubrication—For lubrication specifications refer to the instruction book.

Nonlubricated—Inlet pipe should be of noncorrosive material such as aluminum, stainless steel or plastic. Steel inlet pipe tends to rust because of moisture condensation and this rust and scale can enter the compressor damaging the valves and cylinder bore. If steel piping is used a protective coating is required on the interior.

To avoid damage to the cylinder bore, due to condensation on the cylinder walls and eventual rust, the water to the cylinder jacket should be maintained 10° to 20°F (-12° to -7°C) hotter than inlet air temperature.

Cylinder jackets on units which will stand idle more than 36 hours, should be equipped with heaters to hold cylinder water temperature above the dew point. Cooling water must be shut off on units standing idle. The cylinders are cast iron and may rust if exposed to condensation, which will impair piston ring and wearing ring life.

Use only dry type inlet filters.

Cooling Water should be clean and treated. Water pressure should not exceed 75 psig (5 bar(e)). For best compressor performance incoming cooling water should be slightly warmer than the ambient inlet air to prevent condensation on the cylinder walls and subsequent loss of lubrication because of condensate contamination. It is advantageous and economical to pass the cooling water through the cooler before using it for compressor cylinder cooling.

V-Belt Drives are designed in accordance with the V-belt manufacturers' recommendations. Standard section sheaves and static-resistant belts are used. Because of the flywheel effect required, the compressor sheave is built according to I-R standards, instead of those of V-belt manufacturers, and has a special hub construction to fit our standard compressor shaft extension.

V-belt drive consists of a demountable hub type compressor and motor sheave and the necessary matched V-belts. The prices quoted apply only to the compressor operating at listed speed when driven by a motor of rating and speed specified as standard.

Belt and Coupling Guards are required to protect operating personnel from moving sheaves, belts, or couplings. The standard guard is fully enclosed and will meet California, Wisconsin and OSHA codes.

Pressure Relief Valve—Each compressor discharge line should have at least one pressure relief valve of adequate size, between the compressor discharge connection and the first air line valve or check valve. The standard air receiver pressure relief valve provides this protection only if no air line valves, check valves or coolers are located in the piping between the compressor discharge and the receiver.

Motor Sizing—Motors used in booster applications are sized differently than for standard applications. Motor sizing must adhere to the following limitations:

A. Motors rated for 1.15 SF should not be loaded into service factor.

B. Motors rated for 1.0 SF should not be loaded to within .85 of the nameplate rating.

Any slight changes in inlet pressure will change the horsepower requirements of the booster and exert excessive load on the motor.

Coupled Drive—On all coupled drive units the coupling is supplied by I-R and is suitable for motor drive only. The coupling is in accordance with I-R standards and under no circumstances is to be deleted. Performance is the same as integral induction motor driven compressors at rated speed.

General Arrangement Drawings—Drawings will be mailed from the factory and sent directly to the customer when:

1. The customer's written order has been received with a list of the number, type, and size of drawings to be sent. Also, a mailing address and contact's name must be included.

2. If the motor slide base is not being supplied by I-R, the factory will require a print of the motor or base in order to supply complete drawings. Any drive details which differ from standard must be included in the order write up.

ESV
BOOSTERS

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Davidson, NC 28036

ESV BOOSTERS
SINGLE STAGE

GENERAL PARAMETERS

Single Stage - Double Acting - Watercooled - Crosshead Type
Vertical Booster Compressors

Pressure Ratings - The listed pressure ratings are the maximum for any booster compressor service and are not to be exceeded under any circumstances.

Maximum and Minimum Speeds - The maximum speed for any booster, except for any booster using the 7" cylinder, is 648 rpm. The maximum speed for any booster using the 7" cylinder is 600 rpm. The minimum speed to provide sufficient lubrication to the frame with the standard oil pump is 250 RPM. For speeds below 350 RPM, contact Recip Marketing for approval and pricing.

Special Applications - Gases other than air, such as nitrogen, inert gas mixtures, and some other gases and mixtures can be handled by the standard ESV booster compressors. Discharge pressure must not exceed maximum listed pressure. Standard regulation, design, and materials of construction must be compatible with the gas to be handled. Each application must be referred to Recip Marketing with a complete gas analysis.

The material used for the piston, wear, and packing rings is dependent on the dewpoint of the gas; therefore, this information is required.

ESV & PHE
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ESV BOOSTER
Standard Scope of Supply

ESV Bare Compressor, Booster

- Single stage, double acting, water-cooled, vertical compressor.
- Compressor sheave.
- Low oil pressure switch.
- Oil pressure gauge.
- Lubricator for lubricated units.
- 2-step constant speed control (CSC) with auto start. Includes 3-way solenoid unloading valve (shipped loose), pressure switch (shipped loose), and regulation tubing.

ESV Packaged Compressor, Booster

- All of the following components are mounted, piped and wired on a structural steel subbase.
- Single stage, double acting, water-cooled, vertical compressor.
- Compressor sheave.
- Low oil pressure switch.
- Oil pressure gauge.
- Open dripproof 230/460/3/60 motor
- Motor slidebase
- V-belt drive: motor sheave, bushing and V-belts.
- V-belt guard in accordance with OSHA requirements.
- 2-step, auto dual control panel.
- NEMA 1, 460/3/60 full voltage starter.
- Cooling water piping with thermostatic control valve, sight flow indicator, and solenoid operated shutoff valve.
- High discharge gas temperature shutdown switch.
- Low inlet gas pressure switch.
- Discharge pressure gauge, shipped loose.
- Discharge safety valve, shipped loose.

ESV & PHE
BOOSTER
COMPRESSORS

Davidson, NC 28036

Ref: **5005.04**
Date: **01 February 2006**
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ESV BOOSTER
DETAILED SPECIFICATIONS

PERFORMANCE
Selection of the appropriate model and specific performance of the ESV booster should be determined by the use of the Recip performance program. Any warning messages should be cleared with Davidson Marketing. The final speed of the booster may be changed to utilize standard motor sheaves.

FRAME
The main frame is a one-piece, grey iron casting, ribbed for strength and designed to support the cyclic stresses of continuous heavy-duty compressor loads. It provides support for the main crankshaft bearings and contains the reservoir for lubricating oil for the running gear. The frame is completely enclosed and sealed by access covers with gaskets. Dust and dirt (the major cause of wear) can't get to the running parts.

CRANKSHAFT AND COUNTER-WEIGHT
On all machines, the crankshaft is a single piece, heat-treated steel forging. The design includes integral counterweights and rifle drilling for pressure lubrication.

FULL-FLOATING BEARINGS
Used throughout the running gear, the full floating bearings take each major thrust on a different portion of the shell. Load is evenly distributed all around both inside and outside. Main and crankpin bearings are a special aluminum alloy, which has greater load carrying capacity, heat conductivity and resistance to scoring than other bearing materials. The crosshead pin of the connecting rod has a full-floating one-piece bronze bearing. Since all bearings are full-floating design, no adjustment is ever necessary.

CONNECTING ROD
The connecting rod is die-forged steel with rifle-drilled oil passage. The crankpin end is split for assembly, held in alignment by two bushings, and secured by bolts, which are wired together. The bushings prevent incorrect assembly. The crosshead end is solid.

CROSSHEAD AND GUIDE
All units have a one piece aluminum alloy, barrel type crosshead, running in an easily accessible cast iron crosshead guide which is integral with the frame.

DISTANCE PIECE
All machines are furnished with distance pieces to prevent frame oil from entering the cylinder. All distance pieces and frame openings have bolted and gasketed covers for access to crosshead, oil wiper rings, and packing.

OIL WIPER RINGS
Located on a partition in the distance piece between the crosshead guide and piston rod packing box. The wiper rings prevent loss of frame oil, and prevent frame oil from entering the cylinder. Oil wiper rings are cast iron for both lubricated and non-lubricated machines.

PISTON AND PISTON ROD
All pistons are held on the piston rod by a locking nut. Piston rods are carbon steel. Piston rings and rider ring material is a special self-lubricating material specifically chosen for the application.

PISTON ROD PACKING
The piston rod is sealed by precision floating packing rings. These rings use gas pressure to form a seal. They automatically adjust themselves in operation, and float with the movement of the rod. Piston Rod Packing ring material is a special self-lubricating material specifically chosen for the application. Metal garter springs, which hold the assembly together, cannot come in contact with the piston rod because of built-in wear stops.

CYLINDER
Cylinder and cylinder heads are water jacketed. This provides a uniform distribution of heat for all air passages, valves, and rod packing. All cylinder air and water passages are hydrostatically tested to 1.5 times the design pressure.

VALVES
All valves are plate type valves with stainless steel seats, plates and springs. Each valve is designed for the specific operating conditions of the booster, taking into consideration the operating pressure, temperature, and speed. Each valve is designed to attain the optimum valve lift, spring load, plate thickness, and total valve height.

INLET VALVE UNLOADERS
To unload the compressor while running and to facilitate starting, piston-type unloaders hold the inlet valves open. All inlet valves are equipped with these unloaders to provide full flow area, reducing unloaded power consumption.

LUBRICATION
Positive pressure lubrication is provided for all bearings and the crosshead. Oil enters a gear pump from the sump and passes, under pressure, through an externally mounted replaceable cartridge type, full flow filter. The oil then enters the main bearing on the oil pump side and is fed through drilled passages in the crankshaft to the crankpin bearing and main bearing on the drive side. The connecting rod has a rifle-drilled passage to the crosshead, supplying all load bearing surfaces with oil under pressure.

The oil pressure shutdown switch is set at 12 psig (.08bar(g)) minimum oil pressure at the main bearing on the drive side.

ESV & PHE BOOSTER COMPRESSORS

ESV BOOSTER DETAILED SPECIFICATIONS

CYLINDER LUBRICATION
On lubricated units (optional). Force-feed lubrication is provided for the air/gas cylinder by a crankshaft driven lubricator, mounted on the frame oil pump casing. The lubricator pumping unit is adjustable to provide proper flow to the cylinder rings, packing and valves.

TWO STEP CONSTANT SPEED CONTROL
Each ESV is provided with two-step constant speed control as standard. This regulation control operates the compressor at full load and no load. This is accomplished by a pressure switch, which activates a solenoid valve that sends air/gas to the inlet valve unloaders. The motor and compressor run continuously at full speed, while the loading and unloading is regulated in accordance with demand. A pressure switch and solenoid valve are supplied with this standard feature.

TWO-STEP AUTOMATIC DUAL CONTROL PANEL
This panel allows control of the compressor with a combination of constant speed control and auto start/stop. The selection is made with a "manual-automatic" switch.

In the "manual" mode, the start button must be pressed, and the compressor will start unloaded.

Once the load-delay timer runs out, the compressor will operate in the Constant Speed Control Mode loading and unloading as required. With the selector switch in the "automatic" mode, the compressor will automatically start in response to a decay in system pressure. Once the load delay times out, the compressor will load and unload as required. When the compressor unloads, an adjustable timer monitors the length of time the compressor is unloaded. If the timer reaches its set point without loading, the motor is de-energized, and the compressor shuts down. The unit returns to the automatic start mode. The timer which monitors unloaded operation is adjustable from 5 to 60 minutes.

PROTECTIVE SWITCHES
In addition to the standard low oil pressure switch other switches can be added to protect compressor operation. A low suction pressure switch is required which will unload the compressor if the inlet pressure drops below a predetermined point.

MOTOR POLICY
Motors used in booster applications are sized differently than for atmospheric inlet applications. Care should be taken when defining operating conditions, as slight changes in inlet pressure will change the horsepower requirements, and could overload the motor. Motor sizing must adhere to the following limitations:

1) Motors must be sized for the maximum horsepower condition that the compressor may encounter.
2) Motors with a 1.15 service factor should not be loaded into the service factor.
3) Motors with a 1.0 service factor should not be loaded to within .85 of the nameplate rating.

ESV & PHE
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SAMPLE SPECIFICATION
PACKAGED ESV BOOSTER

Furnish (_____) ESV packaged, completely factory assembled and tested booster compressor(s) to deliver (_____) (scfm or Nm3/hr) of (oil free/lubricated) (air/gas) with an inlet pressure of (_____) (psig/bar (g)) and a discharge pressure of (_____) (psig/bar (g)). The source of primary (air/gas) will be (_____).

COMPRESSOR FEATURES
Frame: Frame shall be one-piece cast iron, ribbed for strength, and shall provide support for crankshaft main bearings, shall have replaceable crossheads, and a sump for lubricating oil. The frame shall be completely enclosed and provided with gasketed access covers for inspection and maintenance.

CRANKSHAFT
Crankshaft shall be one piece forged steel, heat treated, and machined. Cast materials shall not be used in place of forged steel. Passages for pressure lubrication shall be drilled into the crankshaft to direct 100% filtered lubricants to main bearings, crank pin bearings, crosshead pin, crosshead pin bushings and crosshead.

CONNECTING ROD
Connecting rod shall be of heat treated forged steel drilled for pressure lubrication and removable without removing crankshaft. Cast materials shall not be used in place of forged steel.

CROSSHEAD
Crosshead shall be replaceable, one piece aluminum. Crosshead guide may be replaceable or fixed type. Crosshead must be capable of being removed through the side access opening of the frame.

PISTON
Piston shall be lightweight to minimize unbalanced forces. Piston assembly must be removable from the rod and attached by a shoulder and lock nut design. The nut on the end of the rod must be positively locked in place. The rod shall be positively locked to the crosshead to prevent rotation.

PISTON ROD
Piston rod shall be AISI 10455 steel or comparable. Finish in the packing area shall be 10 to 20 micro inches or better.

PISTON AND ROD PACKING RINGS
The piston and rod packing ring material shall be specifically designed for the application, and shall be chosen based on gas composition, temperature, and differential pressure.

CYLINDER
Cylinder and cylinder heads shall be cast iron with integral cooling water passages. All gaskets shall be non-asbestos materials. Aircooled cylinders shall not be permitted.

VALVES
Valves shall plate type with stainless steel seats, plates, and springs. Each valve shall be designed for the specific operating conditions of the booster, taking into consideration the operating pressure, temperature, and speed. Each valve shall be designed to attain the optimum valve lift, spring load, plate thickness, and total valve height.

LUBRICATION SYSTEM
Lubrication system shall include an integral sump, shaft driven positive displacement pump, and spin on can type filter. System shall be factory assembled and tested. Main bearings, crank pin, and crosshead shall be pressure lubricated. The oil sump shall be provided with a visual level indicator.

OPTIONS
Main Electric Drive Motor: The main drive motor for each compressor shall be a polyphase, (ODP/TEFC/IP23/IP55), induction motor, (_____) (HP/kW), with a continuous service factor of (1.15/1.0). Electrical service will be (_____) Volt, 3 phase, (50/60) Hertz. The motor shall meet the requirements of (NEMA MG-1/IEC).

DRIVE
V-belt drive shall be provided with a totally enclosed OSHA approved belt guard. The drive system must include flywheel effect sufficient to limit current pulsations as stipulated by U.S. standards.

STARTER
The starter shall be (A.A.L./star delta) type. It must be equipped with a control voltage transformer.

CONTROLS
A control panel with a two position manual-automatic switch and start/stop push buttons shall be provided. In the "manual" position, the compressor shall be manually started and stopped and operate in two-step, load/no-load, constant speed control. In the "auto" mode, the compressor shall automatically stop in the "auto" mode if it runs unloaded for a 5-60 minute field adjustable time period. Low oil pressure, low suction pressure, and high air temperature shutdown switches shall be provided.

WATER SYSTEM
Water piping shall be provided with a solenoid operated water shut off valve, sight flow indicators, and thermostatic water control.

PACKAGING
All components shall be mounted, piped, and wired on a common steel base with single point air inlet, air discharge, electrical, water inlet, water discharge, and condensate connections. The compressor and all options shall be factory assembled and mechanically tested as a complete package.

PHE BOOSTERS
SINGLE AND TWO STAGE

GENERAL PARAMETERS

Double Acting - Watercooled - Crosshead Type
Balanced Opposed Booster Compressors

Pressure Ratings - The listed pressure ratings are the maximum for any standard compressor booster service. They should not be exceeded under any circumstances.

Maximum Speed -

PHE-7	750 RPM
PHE-9	514 RPM

Minimum Speed - The minimum speed 250 RPM; however, operating speeds below 350 RPM must be approved by Recip Marketing.

Special Applications - Gases other than air, such as nitrogen, inert gas mixtures, and some other gases and mixtures can be handled by PHE boosters.

Discharge pressure must not exceed maximum listed pressure. Standard regulation, design and materials of construction, must be compatible with the gas to be handled. Each application must be referred to Recip Marketing with a complete gas analysis.

The material used for the piston, wear, and packing rings is dependent on the dewpoint of the gas; therefore, this information is required.

ESV & PHE
BOOSTER
COMPRESSORS

Davidson, NC 28036

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PHE-7 BOOSTER
Standard Scope of Supply

PHE Bare Compressor, Booster

- One or two stage, double acting, water-cooled, horizontally opposed compressor.
- Compressor sheave.
- Low oil pressure switch.
- Gauge panel, mounted on the compressor frame, with oil pressure gauge, interstage pressure gauge, and discharge pressure gauge.
- 2-Step Constant speed control (CSC), with auto start. Includes 3-way solenoid unloading valve, pressure switch (shipped loose), and regulation tubing.
- Water-cooled intercooler with condensate separator and automatic drain trap.
- Cooling water piping, series flow, with manual valves and sight flow indicators.
- Lubricator for lubricated units.
- Overhead motor mounting plate for use with motors, frame size 445T and below.
- Outboard bearing with pedestal support is required for 7 inch stroke PHE with motor horsepower greater than 150 HP. Drive components will be shipped loose.

PHE Packaged Compressor, Booster

- All of the following components are mounted, piped and wired on a structural steel subbase.
- One or two stage, double acting, water-cooled, horizontally opposed compressor.
- Compressor sheave.
- Open dripproof 230/460/3/60 motor for motor horsepower 100 HP and below; open dripproof 460/3/60 motor for motor horsepower greater than 100 HP.
- Motor slidebase or sliderails.
- Overhead motor mounting arrangement for motors, frame size 445T and below.
- V-belt drive: motor sheave, bushing, and V-belts.
- V-belt guard in accordance with OSHA requirements.
- Outboard bearing with pedestal support for 7 inch stroke PHE with motor horsepower greater than 150 HP.
- Intellisys control panel with 460/3/60 full voltage starter in NEMA 4 enclosure. See separate listing for operation and monitoring/protection points of Intellisys control panel.
- Water-cooled intercooler with condensate separator and automatic drain trap or valve.
- Water-cooled aftercooler with condensate separator and automatic drain valve. .
- Cooling water piping, series flow, with thermostatic control valves, sight flow indicators, and solenoid operated shutoff valve.
- Lubricator for lubricated units.

ESV & PHE
BOOSTER
COMPRESSORS

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7" STROKE PHE BOOSTER
DETAILED SPECIFICATIONS

FRAME
The main frame is a one-piece, grey iron casting, ribbed for strength and designed to support the cyclic stresses of continuous heavy-duty compressor loads. It provides support for the main crankshaft bearings and contains the reservoir for lubricating oil for the running gear. The frame is completely enclosed and sealed by access covers with gaskets. Dust and dirt (the major cause of wear) can't get to the running parts.

CRANKSHAFT AND COUNTERWEIGHT
On all machines, the crankshaft is a single piece, heat-treated steel forging. The design includes two crankthrows - 180 degrees apart and rifle drilled for pressure lubrication.

FULL-FLOATING BEARINGS
Used throughout the running gear, the full floating bearings take each major thrust on a different portion of the shell. Load is evenly distributed all around both inside and outside. Main and crankpin bearings are a special aluminum alloy, which has greater load carrying capacity, heat conductivity and resistance to scoring than other bearing materials. The crosshead pin of the connecting rod has a full-floating one-piece bronze bearing. Since all bearings are full-floating design, no adjustment is ever necessary.

CONNECTING ROD
The connecting rod is die-forged steel with rifle-drilled oil passage. The crankpin end is split for assembly, held in alignment by two bushings, and secured by bolts, which are wired together. The bushings prevent incorrect assembly. The crosshead end is solid.

CROSSHEAD AND GUIDE
All units have a one piece aluminum alloy, barrel type crosshead, running in an easily accessible cast iron crosshead guide, which is integral with the frame.

DISTANCE PIECE
All machines are furnished with distance pieces to prevent frame oil from entering the cylinder. All distance pieces and frame openings have bolted and gasketed covers for access to crosshead, oil wiper rings, and packing.

OIL WIPER RINGS
Located on a partition in the distance piece between the crosshead guide and piston rod packing box. The wiper rings prevent loss of frame oil, and prevent frame oil from entering the cylinder. Oil wiper rings are cast iron for both lubricated and non-lubricated machines.

PISTON AND PISTON ROD
All pistons are held on the piston rod by a locking nut. Piston rods are carbon steel. Piston rings and rider ring material is a special self-lubricating material specifically chosen for the application.

PISTON ROD PACKING
The piston rod is sealed by precision floating packing rings. These rings use air or gas pressure to form a seal. They automatically adjust themselves in operation, and float with the movement of the rod. Piston Rod Packing ring material is a special self-lubricating material specifically chosen for the application. All packing cases are watercooled to ensure uniform heat distribution. Metal garter springs, which hold the assembly together, cannot come in contact with the piston rod because of built-in wear stops.

CYLINDER
All units use barrel or block type cylinders with water jacket for cooling of the cylinders and heads. This cooling provides a uniform distribution of heat for all air passages, valves, and rod packing. All cylinder air and water passages are hydrostatically tested to 1.5 times the design pressure.

VALVES
All valves are plate type valves with stainless steel seats, plates and springs. Each valve is designed for the specific operating conditions of the booster, taking into consideration the operating pressure, temperature, and speed. Each valve is designed to attain the optimum valve lift, spring load, plate thickness, and total valve height.

INLET VALVE UNLOADERS
To unload the compressor while running and to facilitate starting, piston-type unloaders hold the inlet valves open. All inlet valves are equipped with these unloaders to provide full flow area, reducing unloaded power consumption.

LUBRICATION
Positive pressure lubrication is provided for all bearings and the crosshead. Oil enters a gear pump from the sump and passes, under pressure, through an externally mounted replaceable cartridge type, full flow filter. The oil then enters the main bearing on the oil pump side and is fed through drilled passages in the crankshaft to the crankpin bearing and main bearing on the drive side. The connecting rod has a rifle-drilled passage to the crosshead, supplying all load bearing surfaces with oil under pressure.

The oil pressure shutdown switch is set at 12 psig (.08bar(g)) minimum oil pressure at the main bearing on the drive side.

CYLINDER LUBRICATION
On lubricated units (optional). Force-feed lubrication is provided for the air/gas cylinder by a crankshaft driven lubricator, mounted on the frame oil pump casing. The lubricator pumping unit is adjustable to provide proper flow to the cylinder rings, packing and valves.

7" STROKE PHE BOOSTER
DETAILED SPECIFICATIONS (Continued)

TWO STEP CONSTANT SPEED CONTROL

Each 7" stroke PHE is provided with two-step constant speed control as standard. This regulation operates the compressor at full load and no load. This is accomplished by a pressure switch, which activates a solenoid valve that sends air/gas to the inlet valve free air unloaders. The motor and compressor run continuously at full speed, while the loading and unloading is regulated in accordance with demand. A pressure switch and solenoid valve are supplied with this standard feature.

TWO-STEP AUTOMATIC DUAL CONTROL PANEL

This panel allows control of the compressor with a combination of constant speed control and auto start/ stop. The selection is made with a "manual-automatic" switch.

In the "manual" mode, the start button must be pressed, and the compressor will start unloaded.

Once the load-delay timer runs out, the compressor will operate in the Constant Speed Control Mode loading and unloading as required. With the selector switch in the "automatic" mode, the compressor will automatically start in response to a decay in system pressure. Once the load delay times out, the compressor will load and unload as required. When the compressor unloads, an adjustable timer monitors the length of time the compressor is unloaded. If the timer reaches its set point without loading, the motor is de-energized, and the compressor shuts down. The unit returns to the automatic start mode. The timer which monitors unloaded operation is adjustable from 5 to 60 minutes.

PROTECTIVE SWITCHES

In addition to the standard low oil pressure switch, other protective switches can be provided. A low suction pressure switch and high gas discharge temperature switch are recommended.

GAUGE BOARD

Mounted on the compressor distance piece, the gauge board includes 2 1/2 inch (63.5 mm) liquid filled pressure gauges. Standard gauges are oil pressure, interstage pressure, and final discharge pressure.

MOTOR POLICY

Motors used in booster applications are sized differently than for atmospheric inlet applications. Care should be taken when defining operating conditions, as slight changes in inlet pressure will change the horsepower requirements, and could overload the motor. Motor sizing must adhere to the following limitations:

1) Motors must be sized for the maximum horsepower condition that the compressor may encounter.
2) Motors with a 1.15 service factor should not be loaded into the service factor.
3) Motors with a 1.0 service factor should not be loaded to within .85 of the nameplate rating.

ESV & PHE
BOOSTER
COMPRESSORS

Davidson, NC 28036

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PHE-9 BOOSTER
Standard Scope of Supply

PHE Bare Compressor, Booster

- One or two stage, double acting, water-cooled, horizontally opposed compressor.
- Compressor sheave.
- Low oil pressure switch.
- Gauge panel, mounted on the compressor frame, with oil pressure gauge, interstage pressure gauge, and discharge pressure gauge.
- 3-Step Constant speed control (CSC), with auto start. Includes (2)3-way solenoid unloading valves, pressure switch (shipped loose), and regulation tubing.
- Water-cooled intercooler with condensate separator and automatic drain trap.
- Cooling water piping, series flow, with manual valves and sight flow indicators.
- Lubricator for lubricated units.
- Outboard bearing with pedestal support is required for 9 inch stroke PHE with motor horsepower greater than 250 HP. Drive components will be shipped loose.

PHE Packaged Compressor, Booster

- All of the following components are mounted, piped and wired on a structural steel subbase.
- One or two stage, double acting, water-cooled, horizontally opposed compressor.
- Compressor sheave.
- Open dripproof 230/460/3/60 motor for motor horsepower 100 HP and below; open dripproof 460/3/60 motor for motor horsepower greater than 100 HP.
- Motor slidebase or sliderails.
- V-belt drive: motor sheave, bushing, and V-belts.
- V-belt guard in accordance with OSHA requirements.
- Outboard bearing with pedestal support for 9 inch stroke PHE with motor horsepower greater than 250 HP.
- Intellisys control panel with 460/3/60 full voltage starter in NEMA 4 enclosure. See separate listing for operation and monitoring/protection points of Intellisys control panel.
- Water-cooled intercooler with condensate separator and automatic drain trap or valve.
- Water-cooled aftercooler with condensate separator and automatic drain valve. .
- Cooling water piping, series flow, with thermostatic control valves, sight flow indicators, and solenoid operated shutoff valve.
- Lubricator for lubricated units.

ESV & PHE BOOSTER COMPRESSORS

Davidson, NC 28036

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9" STROKE PHE BOOSTER DETAILED SPECIFICATIONS

FRAME
The main frame is a one-piece, grey iron casting, ribbed for strength and designed to support the cyclic stresses of continuous heavy-duty compressor loads. It provides support for the main crankshaft bearings and contains the reservoir for lubricating oil for the running gear. The frame is completely enclosed and sealed by access covers with gaskets. Dust and dirt (the major cause of wear) can't get to the running parts.

CRANKSHAFT AND COUNTER-WEIGHT
On all machines, the crankshaft is a single piece, heat-treated steel forging. The design includes two crankthrows - 180 degrees apart and rifle drilled for pressure lubrication.

FULL-FLOATING BEARINGS
Used throughout the running gear, the full floating bearings take each major thrust on a different portion of the shell. Load is evenly distributed all around both inside and outside. Main and crankpin bearings are a special aluminum alloy, which has greater load carrying capacity, heat conductivity and resistance to scoring than other bearing materials. The crosshead pin of the connecting rod has a full-floating one-piece bronze bearing. Since all bearings are full-floating design, no adjustment is ever necessary.

CONNECTING ROD
The connecting rod is die-forged steel with rifle-drilled oil passage. The crankpin end is split for assembly, held in alignment by two bushings, and secured by bolts, which are wired together. The bushings prevent incorrect assembly. The crosshead end is solid.

CROSSHEAD AND GUIDE
All units have a cast iron crosshead with adjustable and replaceable aluminum shoes. The crosshead guide is an integral part of the crosshead guide extension casting.

DISTANCE PIECE
All machines are furnished with distance pieces to prevent frame oil from entering the cylinder. All distance pieces and frame openings have bolted and gasketed covers for access to crosshead, oil wiper rings, and packing.

OIL WIPER RINGS
Located on a partition in the distance piece between the crosshead guide and piston rod packing box. The wiper rings prevent loss of frame oil, and prevent frame oil from entering the cylinder. Oil wiper rings are cast iron for both lubricated and non-lubricated machines.

PISTON AND PISTON ROD
All pistons are held on the piston rod by a locking nut. Piston rods are carbon steel. Piston ring and rider ring material is a special self-lubricating material specifically chosen for the application.

PISTON ROD PACKING
The piston rod is sealed by precision floating packing rings. These rings use air or gas pressure to form a seal. They automatically adjust themselves in operation, and float with the movement of the rod. Piston Rod Packing ring material is a special self-lubricating material specifically chosen for the application. All packing cases are watercooled to ensure uniform heat distribution. Metal garter springs, which hold the assembly together, cannot come in contact with the piston rod because of built-in wear stops.

CYLINDER
All units use barrel or block type cylinders with water jacket for cooling of the cylinders and heads. This cooling provides a uniform distribution of heat for all air passages, valves, and rod packing. All cylinder air and water passages are hydrostatically tested to 1.5 times the design pressure.

VALVES
All valves are plate type valves with stainless steel seats, plates and springs. Each valve is designed for the specific operating conditions of the booster, taking into consideration the operating pressure, temperature, and speed. Each valve is designed to attain the optimum valve lift, spring load, plate thickness, and total valve height.

INLET VALVE UNLOADERS
To unload the compressor while running and to facilitate starting, piston-type unloaders hold the inlet valves open. All inlet valves are equipped with these unloaders to provide full flow area, reducing unloaded power consumption.

LUBRICATION
Positive pressure lubrication is provided for all bearings and the crosshead. Oil enters a gear pump from the sump and passes, under pressure, through an externally mounted replaceable cartridge type, full flow filter. The oil then enters the main bearing on the oil pump side and is fed through drilled passages in the crankshaft to the crankpin bearing and main bearing on the drive side. The connecting rod has a rifle-drilled passage to the crosshead, supplying all load bearing surfaces with oil under pressure.

The oil pressure shutdown switch is set at 12 psig (.08bar(g)) minimum oil pressure at the main bearing on the drive side.

CYLINDER LUBRICATION
On lubricated units (optional). Force-feed lubrication is provided for the air/gas cylinder by a crankshaft driven lubricator, mounted on the frame oil pump casing. The lubricator pumping unit is adjustable to provide proper flow to the cylinder rings, packing and valves.

9" STROKE PHE BOOSTER
DETAILED SPECIFICATIONS (Continued)

TWO STEP CONSTANT SPEED CONTROL

Each 9" stroke PHE is provided with two-step constant speed control as standard. This regulation operates the compressor at full load and no load. This is accomplished by a pressure switch, which activates a solenoid valve that sends air/gas to the inlet valve free air unloaders. The motor and compressor run continuously at full speed, while the loading and unloading is regulated in accordance with demand. A pressure switch and solenoid valve are supplied with this standard feature.

TWO-STEP AUTOMATIC DUAL CONTROL PANEL

This panel allows control of the compressor with a combination of constant speed control and auto start/stop. The selection is made with a "manual-automatic" switch.

In the "manual" mode, the start button must be pressed, and the compressor will start unloaded.

Once the load-delay timer runs out, the compressor will operate in the Constant Speed Control Mode loading and unloading as required. With the selector switch in the "automatic" mode, the compressor will automatically start in response to a decay in system pressure. Once the load delay times out, the compressor will load and unload as required. When the compressor unloads, an adjustable timer monitors the length of time the compressor is unloaded. If the timer reaches its set point without loading, the motor is de-energized, and the compressor shuts down. The unit returns to the automatic start mode. The timer which monitors unloaded operation is adjustable from 5 to 60 minutes.

PROTECTIVE SWITCHES

In addition to the standard low oil pressure switch, other protective switches can be provided. A low suction pressure switch and high gas discharge temperature switch are recommended.

GAUGE BOARD

Mounted on the compressor distance piece, the gauge board includes 2 1/2 inch (63.5 mm) liquid filled pressure gauges. Standard gauges are oil pressure, interstage pressure, and final discharge pressure.

MOTOR POLICY

Motors used in booster applications are sized differently than for atmospheric inlet applications. Care should be taken when defining operating conditions, as slight changes in inlet pressure will change the horsepower requirements, and could overload the motor. Motor sizing must adhere to the following limitations:

1) Motors must be sized for the maximum horsepower condition that the compressor may encounter.
2) Motors with a 1.15 service factor should not be loaded into the service factor.
3) Motors with a 1.0 service factor should not be loaded to within .85 of the nameplate rating.

ESV & PHE
BOOSTER
COMPRESSORS

Davidson, NC 28036

Ref: **5005.14**
Date: **01 February 2006**
Cancels: **30 March 2001**

SAMPLE SPECIFICATION
PACKAGED PHE-9 BOOSTER

Furnish (_____) PHE-9 (one/two) stage, horizontally opposed, watercooled, doubleacting, reciprocating compressor(s). Compressor(s) to deliver (_____) (scfm or Nm3/hr) of (lubricated/oil free) (air/gas) with an inlet pressure of (_____) (psig/bar (g)) and a discharge pressure of (_____) (psig/bar(g)). Compressor shall operate at (_____) rpm. The source of primary (air/gas) will be (_____).

FRAME
Frame shall be one-piece cast iron, ribbed for strength, provide support for crankshaft main bearings, and a sump for lubricating oil. The frame shall be completely enclosed and provide gasketed access covers for inspection and maintenance.

CRANKSHAFT
Crankshaft shall be one-piece forged steel, heat treated, and machined. Cast materials shall not be used in place of forged steel. Passages for pressure lubrication shall be drilled into the crankshaft to direct 100% filtered lubricants to main bearings, crankpin bearings, crosshead pin, cross head pin bushings and crosshead.

CONNECTING ROD
Connecting rod shall be of heat treated, forged steel, drilled for pressure lubrication and removable without removing crankshaft. Cast materials shall not be used in place of forged steel.

CROSSHEAD
Crosshead shall be cast iron with adjustable and replaceable aluminum shoes. Crosshead guide shall be an integral part of the crosshead guide extension casting, which shall be replaceable. Crosshead must be capable of being removed through the side access opening of the frame.

PISTONS
Pistons shall be lightweight to minimize unbalanced forces. Piston assembly must be removable from the rod and attached by a shoulder and lock nut design. The nut on the end of the rod must be positively locked to the crosshead to prevent rotation.

PISTON ROD
Piston rod shall be AISI 1055 steel or comparable. Finish in the packing area shall be 10 to 20 micro inches or better.

PISTON AND ROD PACKING RINGS
The piston and rod packing ring material shall be specifically designed for the application, and shall be chosen based on gas composition, temperature, and differential pressure.

CYLINDERS
Cylinders and cylinder heads shall be cast iron with integral cooling water passages. All gaskets shall be non-asbestos materials. Aircooled cylinders shall not be permitted.

VALVES
Valves shall be plate type with stainless steel seats, plates, and springs. Each valve shall be designed for the specific operating conditions of the booster, taking into consideration the operating pressure, temperature, and speed. Each valve shall be designed to attain the optimum valve lift, spring load, plate thickness, and total valve height.

LUBRICATION SYSTEM
Lubrication system shall include an integral sump, shaft driven positive displacement pump, and spin-on can type filter. System shall be factory assembled and tested. Main bearings, crankpin, and crosshead shall be pressure lubricated. The oil sump shall be provided with a visual level indicator.

OPTIONS
Main Electric Drive Motor: The main drive motor for each compressor shall be a polyphase (ODP/TEFC/IP23/IP55), induction motor, (_____) (horsepower/kW) with a continuous service factor of (1.15/1.0). Electrical service will be (_____)Volt, 3 phase, (50/60) Hertz. The motor shall meet the requirements of (NEMA/IEC).

DRIVE
V-belt drive shall be provided with a totally enclosed belt guard. The drive system must include flywheel effect sufficient to limit current pulsations as stipulated by U.S. standards.

INTERCOOLER
A (15 degree Fahrenheit/ 8.3 degree Celsius) CTD, shell and tube, watercooled intercooler shall be provided with (ASME/EC92) code stamp. The intercooler shall be equipped with a moisture separator with automatic condensate trap assembly.

AFTERCOOLER (optional)
A (15 degree Fahrenheit/ 8.3 degree Celsius) CTD, shell and tube, watercooled aftercooler shall be provided with (ASME/EC92) code stamp. The aftercooler shall be equipped with a moisture separator with automatic condensate trap assembly.

CONTROL PANEL AND SAFETY SHUTDOWNS
The compressor package shall include a microprocessor based control and protection panel. A membrane touch panel shall control all functions, operation and setpoints of the panel. The panel shall include a (full voltage/reduced voltage) starter incorporated a NEMA 4 enclosure. The panel shall offer selection of either “constant speed control” or “auto dual control”. In the “constant speed control” mode, the

SAMPLE SPECIFICATION
PACKAGED PHE-9 BOOSTER (Continued)

compressor shall start and operate in either two-step or three-step constant speed control, loading and unloading as required. In the "auto dual control" mode, the compressor shall start automatically on falling pressure and then load and unload as required. The compressor shall automatically stop in the "auto dual control" mode if it runs unloaded for a maximum of 15 minutes. The panel shall indicate run time for all load conditions (0%, 50%, 100%).

The panel shall include the following standard warning and alarm (shutdown) points:

- Low suction pressure warning and shutdown
- High 1st stage discharge pressure warning and shutdown
- High package discharge pressure warning and shutdown
- Low frame oil pressure warning and shutdown
- Low inlet water pressure warning and shutdown
- High inlet water pressure warning and shutdown
- Low water pressure drop warning and shutdown
- High package inlet temperature shutdown
- High 1st stage discharge temperature warning and shutdown
- High 2nd stage inlet temperature warning and shutdown
- High 2nd stage discharge temperature warning and shutdown
- High package discharge gas temperature warning and shutdown
- High frame oil temperature warning and shutdown
- Low package inlet water temperature warning and shutdown
- High package inlet water temperature warning and shutdown
- High package outlet water temperature shutdown
- Sensor failure shutdown
- Starter fault shutdown
- Motor overload shutdown

The following warning and shutdown points shall be available as options:

- High vibration shutdown
- Lubricator line alert shutdown (lubricated units only)
- Low lubricator oil level shutdown (lubricated units only)
- Low frame oil level shutdown
- High intercooler condensate level shutdown
- High aftercooler condensate level shutdown

WATER SYSTEM

Water piping shall be provided with a solenoid operated water shut off valve, sight flow indicators, and thermostatic water control.

PACKAGING

All components shall be mounted, piped, and wired on a common steel base with single point air inlet, air discharge, electrical, water inlet, water discharge, and condensate connections. The compressor and all options shall be factory assembled and mechanically tested as a complete package.

NOTE: Choices must be made for parentheses.

ESV & PHE ENGINEERING
BOOSTER COMPRESSORS

Davidson, NC 28036

Ref: **5005.16**
Date: **01 February 2006**
Cancels: **30 March 2001**

ENGINEERING DATA
ENGLISH

MODEL		4 x 5	4 x 7	5 x 7	7 x 7
Normal BHP	—	*	*	*	*
Maximum Discharge Pressure	psig	500	1000	550	330
A. General Compressor Data					
Bore and Stroke	inches	4 x 5	4 x 7	5 x 7	7 x 7
Number of Cylinders	—	1	1	1	1
Number of Stages	—	1	1	1	1
Piston Displacement @ Maximum RPM	psig	43.8	61.3	98.5	182.8
Maximum operating pressure	psig	500	1000	550	330
Normal operating pressure	psig	*	*	*	*
Minimum operating pressure (std)	psig	*	*	*	*
Maximum Compressor Speed	rpm	675	600	600	600
Standard Motor HP	HP	*	*	*	*
Shaft Input At No Load	BHP	*	*	*	*
Efficiencies: (at discharge pressure)					
—Volumetric, percent	%	*	*	*	*
—Mechanical, percent	%	*	*	*	*
B. COOLING DATA (Basis 70 °F					
Ambient; 70 °F water)					
Transferred Heat					
—Cylinder jackets - Total	BTU/min	*	*	*	*
—Aftercooler	BTU/min	*	*	*	*
—Convection and Radiation	BTU/min	*	*	*	*
Recommended water flow and temperature Rise					
—Jackets (both) (est.)	gpm/°F	*	*	*	*
—Total (est.)	gpm/°F	*	*	*	*
—Aftercooler (Fixed coded))	gpm/°F	*	*	*	*
Cold Temperature Difference (CTD)					
—Aftercooler (est.)	°F	75	75	75	75
Maximum water pressure	psig	75	75	75	75
Minimum water pressure	psig	30	30	30	75
Water pressure drop (approximately)					
—Jackets (each)	psig	*	*	*	*
—Total drop (including piping)	psig	*	*	*	*
—Aftercooler	psig	*	*	*	*
C. Compressor Frame Data					
Maximum operation speed	rpm	675	600	600	600
Max. Rated BHP at maximum speed	BHP	68	68	68	68
Shaft diameter	inches	3.75	3.75	3.75	3.75
Bearing sizes (i.d. x length)					
—Main	inches	3.75 x 3.75	3.75 x 3.75	3.75 x 3.75	3.75 x 3.75
—Crankpin	inches	4.00 x 3.00	4.00 x 3.00	4.00 x 3.00	4.00 x 3.00
—Crosshead	inches	2.75 x 3.11	2.75 x 3.11	2.75 x 3.11	2.75 x 3.11

* Varies with application

ENGINEERING ESV & PHE BOOSTER COMPRESSORS

Ref: 5005.17
Date: **01 January 2008**
Cancels: **01 February 2006**

Davidson, NC 28036

ENGINEERING DATA
ENGLISH

MODEL		4 x 5	4 x 7	5 x 7	7 x 7
Normal BHP	—	*	*	*	*
Maximum Discharge Pressure	psig	500	1000	550	330
D. Cylinder Data					
Average percent clearance	%	32.2	20.1	15.9	9.3
Safety valve setting first stage	psig	*	*	*	*
Cylinder test pressure					
a) Water jackets	psig	115	115	115	115
b) Air side	psig	800	1650	825	555
E. Drive Data					
Minimum required break away torque	Lb/Ft	*	*	*	*
Minimum required pull-up torque	Lb/Ft	*	*	*	*
V-Belt Drive:					
Compressor Sheave (at Compressor Speed)	rpm	*	*	*	*
— Outer diameter (Ultra-V) (est.)	inches	*	*	*	*
— Pitch diameter (Standard-V) (est.)	inches	*	*	*	*
— Number of Grooves	—	*	*	*	*
— Inertia WR ^{2} (est.)	Lb/Ft^2	*	*	*	*
Motor Sheave (Basis 1480 rpm motor, 50 Hz)					
— Outer diameter (Ultra-V)	inches	*	*	*	*
— Pitch diameter (Standard-V)	inches	*	*	*	*
— Belts (number/section/length)	—	*	*	*	*
Motor Sheave (Basis 1750 rpm motor, 60 Hz)					
— Outer diameter (Ultra-V)	inches	*	*	*	*
— Pitch diameter (Standard-V)	inches	*	*	*	*
— Center distance	inches	*	*	*	*
— Belts (number/section/length)	—	*	*	*	*
F. Foundation and Mounting Data		REF. ONLY; SEE DRAWING			
G. Lubrication Data					
a) Running Gear Lubrication					
—Nominal oil pressure	psig	15 to 40	15 to 40	15 to 40	15 to 40
—Frame sump capacity	micron	4.4	4.4	4.4	4.4
—Operating oil temperature (maximum)	° F	180	180	180	180
—Filter Rating	micron	25	25	25	25
—Recommend oil (Non-detergent)	—		SEE OPERATORS MANUAL		
—Nominal oil consumption	—	NIL	NIL	NIL	NIL
b) Cylinder Lubrication					
—Oil Check Valve Relief pressure	psig	40	40	40	40
—Lubricator capacity	gallons	1.0	1.0	1.0	1.0
—Number of feeds	—	2	2	2	2
—Recommended oil	—		SEE OPERATORS MANUAL		
—Maximum oil flow rate (Break-in)			SEE OPERATORS MANUAL		
H. Noise Level Data			CONTACT RECIP MARKETING		

* Varies with application

ESV & PHE BOOSTER COMPRESSORS

ENGINEERING

Davidson, NC 28036

Ref: 5005.18
Date: 01 January 2008
Cancels: 01 February 2006

ENGINEERING DATA
ENGLISH

MODEL		4 x 5	4 x 7	5 x 7	7 x 7
Normal BHP	—	*	*	*	*
Maximum Discharge Pressure	psig	500	1000	550	330
I. Piping					
a) Air Connections					
—Inlet	inches	2.5 - 900#	3 - 900#	3 - 900#	3 - 900#
—Discharge	inches	3 - 300#	3 - 900#	3 - 300#	3 - 300#
b) Water Connections					
—Inlet, Bare Unit	inches	.75	.75	.75	.75
—Outlet, Bare Unit	inches	.75	.75	.75	.75
c) Control Air Connection	inches	.50	.38	.38	.38
Inlet Pipe Lengths to be Avoided.	ft.	*	*	*	*
Discharge pipe lengths to be avoided	ft.	*	*	*	*
J. Piston and Rod					
Piston Speed Maximum RPM	fpm	700	750	750	700
Rod Diameter	inches	1.50	1.50	1.50	1.50
Maximum design rod load	lbs	10,000	10,000	10,000	10,000
K. Unbalanced Inertia (@ Maximum RPM)					
Maximum Horizontal Primary Force	lbs	468	698	698	608
Maximum Horizontal Secondary Force	lbs	0	0	0	0
Maximum Vertical Primary Force	lbs	1476	2812	3744	3479
Maximum Vertical Secondary Force	lbs	587	877	1110	1021
Maximum Horizontal Primary Moment	ft-lbs	0	0	0	0
Maximum Horizontal Secondary Moment	ft-lbs	0	0	0	0
Maximum Vertical Primary Moment	ft-lbs	0	0	0	0
Maximum Vertical Secondary Moment	ft-lbs	0	0	0	0
L. Valves					
Inlet					
—Number per cylinder	—	2	2	2	2
Discharge					
—Number per cylinder	—	2	2	2	2
M. Dimensions					
a) With motor and complete V-belt drive					
1) Length	ft-in	9'-6"	12'-0"	12'-0"	12'-0"
2) Width (estimate)	ft-in	4'-10"	5'-0"	5'-0"	5'-0"
3) Height	ft-in	7'-0"	7'-0"	7'-0"	7'-0"
b) Distance to Pull					
1) Piston and Rod	ft-in	3'-2"	3'-6"	3'-4"	3'-6"
2) Compressor sheave	ft-in	1'-11"	1'-11"	1'-11"	1'-11"
3) Crankshaft	ft-in	2'-1"	2'-1"	2'-1"	2'-1"
N. Shipping Data: Compressor (Bare Unit)					
a) Weights					
1) Domestic	lbs.	2250	3650	2205	2325
2) Export	lbs.	2810	4170	2725	2945

* Varies with application

ENGINEERING

ESV & PHE
BOOSTER COMPRESSORS

Ref: 500**5**.19
Date: 01 January 2008
Cancels: 01 February 2006

Davidson, NC 28036

ENGINEERING DATA
ENGLISH

MODEL		4 x 5	4 x 7	5 x 7	7 x 7
Normal BHP	—	*	*	*	*
Maximum Discharge Pressure	psig	500	1000	550	330
O. Electrical Data					
1) Standard Motor Driver	HP	*	*	*	*
2) Frame size	—	*	*	*	*
3) Full load speed	rpm	*	*	*	*

* Varies with application

ESV & PHE ENGINEERING
BOOSTER COMPRESSORS

Davidson, NC 28036

Ref: **5005.20**
Date: **01 February 2006**
Cancels: **30 March 2001**

ENGINEERING DATA
ENGLISH

MODEL		5 & 4 x 7	7 & 4 x 7	7 & 5 x 7
Normal BHP	—	*	*	*
Maximum Discharge Pressure	psig	1000	1000	550
A. General Compressor Data				
Bore and Stroke	inches	5 & 4 x 7	7 & 4 x 7	7 & 5 x 7
Number of Cylinders	—	2	2	2
Number of Stages	—	2	2	2
Piston Displacement @ Maximum RPM	cfm	113.9	228.5	228.5
Maximum operating pressure	psig	1000	1000	500
Normal operating pressure	psig	*	*	*
Minimum operating pressure (std)	psig	*	*	*
Standard Compressor Speed	rpm	600	600	600
Standard Motor HP	HP	*	*	*
Shaft Input At No Load	BHP	*	*	*
Efficiencies: (at discharge pressure)				
—Volumetric, percent	%	*	*	*
—Mechanical, percent	%	*	*	*
B. COOLING DATA (Basis 70°F Ambient; 70°F water)				
Transferred Heat				
—Cylinder jackets - Total	BTU/min	*	*	*
—Intercooler	BTU/min	*	*	*
—Aftercooler	BTU/min	*	*	*
—Convection and Radiation	BTU/min	*	*	*
Recommended water flow and temperature Rise				
—Jackets (both) (est.)	gpm/°F	*	*	*
—Intercooler	BTU/min	*	*	*
—Total (est.)	gpm/°F	*	*	*
—Aftercooler (Fixed coded))	gpm/°F	*	*	*
Cold Temperature Difference (CTD)				
—Intercooler	BTU/min	15	15	15
—Aftercooler (est.)	°F	15	15	15
Maximum water pressure	psig	75	75	75
Minimum water pressure	psig	30	30	30
Total Intercooler Surface (air side)	sq. ft.	*	*	*
Water pressure drop (approximately)				
—Jackets (each)	psig	*	*	*
—Intercooler	BTU/min	*	*	*
—Total drop (including piping)	psig	*	*	*
—Aftercooler	psig	*	*	*
C. Compressor Frame Data				
Maximum operation speed	rpm	600	600	600
Max. Rated BHP at maximum speed	BHP	250	250	250
Shaft diameter	inches	3.75	3.75	3.75
Bearing sizes (i.d. x length)				
—Main	inches	3.75 x 3.75	3.75 x 3.75	3.75 x 3.75
—Crankpin	inches	4.00 x 3.00	4.00 x 3.00	4.00 x 3.00
—Crosshead	inches	2.75 x 3.11	2.75 x 3.11	2.75 x 3.11

* Varies with application

ESV & PHE ENGINEERING
BOOSTER COMPRESSORS

Davidson, NC 28036

Ref: **5005.21**
Date: 01 February 2006
Cancels: 30 March 2001

ENGINEERING DATA
ENGLISH

MODEL		9 & 6 x 9	7 & 4.5 x 9
Normal BHP	—		
Maximum Discharge Pressure	psig		
A. General Compressor Data			
Bore and Stroke	inches	9 & 6 x 9	7 & 4.5 x 9
Number of Cylinders	—	2	2
Number of Stages	—	2	2
Piston Displacement @ 514 RPM	cfm	332.2	197.6
Maximum operating pressure	psig	1000	1500
Normal operating pressure	psig	*	*
Minimum operating pressure (std)	psig	*	*
Maximum Compressor Speed	rpm	514	514
Standard Motor HP	HP	*	*
Shaft Input At No Load	BHP	*	*
Efficiencies: (at discharge pressure)			
—Volumetric, percent	%	*	*
—Mechanical, percent	%	*	*
B. COOLING DATA (Basis 70 °F Ambient; 70 °F water)			
Transferred Heat			
—Cylinder jackets - Total	BTU/min	*	*
—Aftercooler	BTU/min	*	*
—Convection and Radiation	BTU/min	*	*
Recommended water flow and temperature Rise			
—Jackets (both) (est.)	gpm/°F	*	*
—Total (est.)	gpm/°F	*	*
—Aftercooler (Fixed coded))	gpm/°F	*	*
Cold Temperature Difference (CTD)			
—Aftercooler (est.)	°F	15	15
Maximum water pressure	psig	75	75
Minimum water pressure	psig	30	30
Water pressure drop (approximately)			
—Jackets (each)	psig	*	*
—Total drop (including piping)	psig	*	*
—Aftercooler	psig	*	*
C. Compressor Frame Data			
Maximum operation speed	rpm	514	514
Max. Rated BHP at maximum speed	BHP	350	350
Shaft diameter	inches	5.00	5.00
Bearing sizes (i.d. x length)			
—Main	inches	5.00 x 5.31	5.00 x 5.31
—Crankpin	inches	5.50 x 4.00	5.50 x 4.00
—Crosshead	inches	4.25 x 4.19	4.25 x 4.19

* Varies with application

ENGINEERING

ESV & PHE

BOOSTER

COMPRESSORS

Ref: 5005.22
Date: 01 February 2006
Cancels: 30 March 2001

Davidson, NC 28036

ENGINEERING DATA
ENGLISH

MODEL		9 & 6 x 9	7 & 4.5 x 9
Normal BHP	—	*	*
Maximum Discharge Pressure	psig	1000	1500
D. Cylinder Data			
Average percent clearance	%	*	*
Safety valve setting first stage	psig	*	*
Cylinder test pressure			
a) Water jackets	psig	115	115
b) Air side	psig	990/2475	1650/2475
E. Drive Data			
Minimum required break away torque	Lb/Ft	1196	1196
Minimum required pull-up torque	Lb/Ft		
V-Belt Drive:			
Compressor Sheave (at Compressor Speed)	rpm	*	*
—Outer diameter (Ultra-V) (est.)	inches	*	*
—Pitch diameter (Standard-V) (est.)	inches	*	*
—Number of Grooves	—	*	*
—Inertia WR ^{2} (est.)	Lb/Ft^2	*	*
Motor Sheave (Basis 1480 rpm motor, 50 Hz)			
—Outer diameter (Ultra-V)	inches	*	*
—Pitch diameter (Standard-V)	inches	*	*
—Belts (number/section/length)	—	*	*
Motor Sheave (Basis 1750 rpm motor, 60 Hz)			
—Outer diameter (Ultra-V)	inches	*	*
—Pitch diameter (Standard-V)	inches	*	*
—Center distance	inches	*	*
—Belts (number/section/length)	—	*	*
Couple Drive		*	*
F. Foundation and Mounting Data		REF. ONLY; SEE DRAWING	
G. Lubrication Data			
a) Running Gear Lubrication			
—Nominal oil pressure	psig	15 to 40	15 to 40
—Frame sump capacity	gallons	10.0	10.0
—Operating oil temperature (maximum)	°F	180	180
—Filter Rating	micron	25	25
—Recommend oil (Non-detergent)	—	SEE OPERATORS MANUAL	
—Nominal oil consumption	—	NIL	NIL
b) Cylinder Lubrication			
—Oil Check Valve Relief pressure	psig	40	40
—Lubricator capacity	gallons	1.0	1.0
—Number of feeds	—	2	2
—Recommended oil	—	SEE OPERATORS MANUAL	
—Maximum oil flow rate (Break-in)		SEE OPERATORS MANUAL	
H. Noise Level Data		CONTACT RECIP MARKETING	

* Varies with application

ESV & PHE ENGINEERING
BOOSTER COMPRESSORS

Davidson, NC 28036

Ref: 5005.23
Date: 01 February 2006
Cancels: 30 March 2001

ENGINEERING DATA
ENGLISH

MODEL		9 & 6 x 9	7 & 4.5 x 9
Normal BHP	—	*	*
Maximum Discharge Pressure	psig	1000	1500
I. Piping			
a) Air Connections			
—Inlet	inches	6 - 400#	4 - 600#
—Discharge	inches	6 - 400#	3 - 900#
b) Water Connections			
—Inlet, Bare Unit	inches	.75	.75
—Outlet, Bare Unit	inches	.75	.75
c) Control Air Connection	inches	.38	.38
Inlet Pipe Lengths to be Avoided.	ft.	*	*
Discharge pipe lengths to be avoided	ft.	*	*
J. Piston and Rod			
Piston Speed @ 514 RPM	fpm	771	771
Rod Diameter	inches	2.00	2.00
Maximum design rod load	lbs	18,000/18,000	18,000
K. Unbalanced Inertia @ 514 RPM			
Maximum Horizontal Primary Force	lbs	3275	1654
Maximum Horizontal Secondary Force	lbs	632	319
Maximum Vertical Primary Force	lbs	0	0
Maximum Vertical Secondary Force	lbs	0	0
Maximum Horizontal Primary Moment	ft-lbs	8590	7689
Maximum Horizontal Secondary Moment	ft-lbs	1299	1125
Maximum Vertical Primary Moment	ft-lbs	1857	1857
Maximum Vertical Secondary Moment	ft-lbs	0	0
L. Valves			
Inlet			
—Number per cylinder	—	2/2	2/2
Discharge			
—Number per cylinder	—	2/2	2/2
M. Dimensions			
a) With motor and complete V-belt drive			
1) Length	ft-in	*	*
2) Width (estimate)	ft-in	*	*
3) Height	ft-in	*	*
b) Distance to Pull			
1) Piston and Rod	ft-in (lp/hp)	5'-5"/3'-9"	5'-5"/5'-0"
2) Compressor sheave	ft-in	0'-9"	0'-9"
3) Crankshaft	ft-in	3'-4"	3'-4"
N. Shipping Data: Compressor (Bare Unit)			
a) Weights			
1) Domestic	lbs.	12430	11110
2) Export	lbs.	14465	12705

* Varies with application

ENGINEERING DATA
ENGLISH

MODEL		9 & 6 x 9	7 & 4.5 x 9
Normal BHP	—	200	200
Maximum Discharge Pressure	psig	1000	1500
O. Electrical Data			
1) Standard Motor Driver	HP	200	200
2) Frame size	—*	44ST	44ST
3) Full load speed	rpm	514	514

* Varies with application

Ingersoll Rand

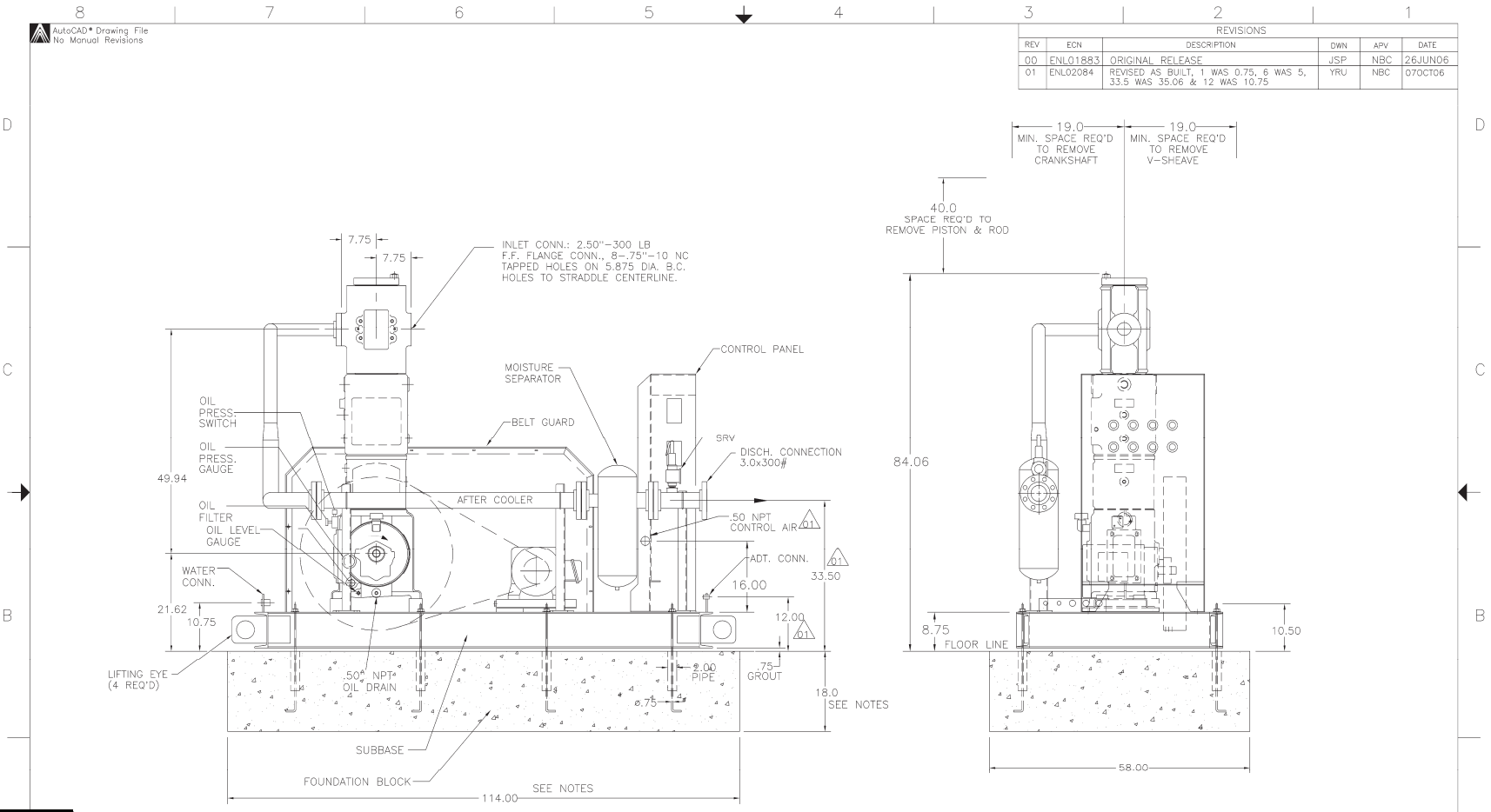
Davidson, NC 28036

BOOSTER

FOUNDATION PLAN
4 x 5 ESV

DRAWINGS

Ref: **5005.25**
Date: **01 January 2008**
Cancels: **01 February 2008**



NOTE: Preliminary For Reference Only

Do not use for planning purposes

Ingersoll Rand
Davidson, NC 28036

BOOSTER

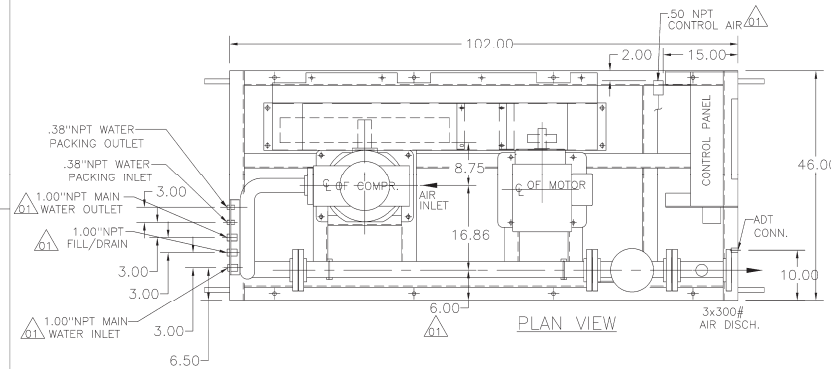
FOUNDATION PLAN
4 x 5 ESV

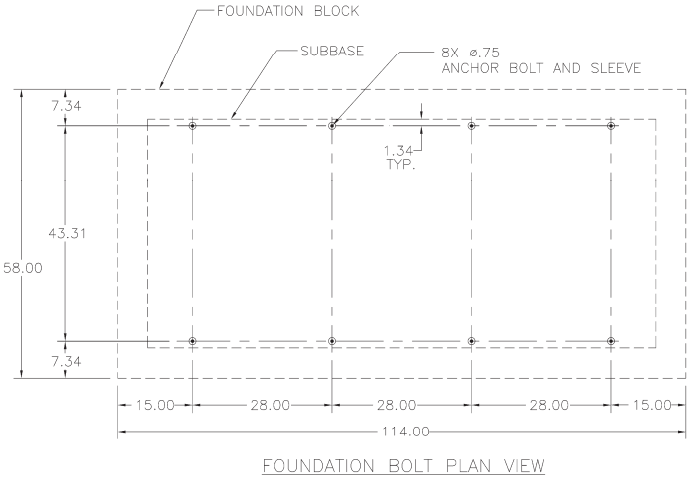
DRAWINGS

Ref: **5005.26**
Date: **01 January 2008**
Cancels: **01 February 2006**

AutoCAD® Drawing File
No Manual Revisions

REVISIONS					
REV	ECN	DESCRIPTION	DWN	APV	DATE
00	ENL01883	ORIGINAL RELEASE	JSP	NBC	26JUL06
01	ENL02084	REVISED AS BUILT, 1 WAS 0.75, 6 WAS 5, 33.5 WAS 35.06 & 12 WAS 10.75	YRU	NBC	07OCT06

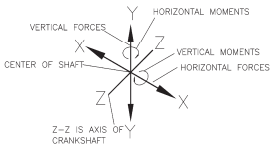


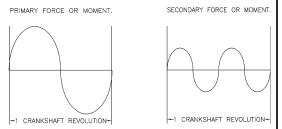


V-BELT DRIVE DETAIL

QTY OF BELTS	SIZE OF BELTS	O.D. DIA. MOTOR PULLEY	O.D. DIA. COMPR. SHEAVE	COMPR. SPEED R.P.M.	CENTER DISTANCE OF DRIVE
2	5V-150	5.75	34.0	300	36.0

MOTOR & SLIDEBASE: 254T FR ODP w/ SLIDEBASE
H.P. RATING: 15 HP SPEED: 1800 (SYN)





UNBALANCED INERTIA FORCES ON FOUNDATION

THE FOUNDATION MUST BE DESIGNED TO RESIST THE FOLLOWING FORCES:
MAXIMUM HORIZONTAL PRIMARY FORCE 26 LBS.
MAXIMUM HORIZONTAL SECONDARY FORCE 0 LBS
MAXIMUM VERTICAL PRIMARY FORCE 328 LBS
MAXIMUM VERTICAL SECONDARY FORCE 86 LBS
MAXIMUM HORIZONTAL PRIMARY MOMENT (ABOUT AXIS Y-Y) 0 LBS-FT
MAXIMUM HORIZONTAL SECONDARY MOMENT (ABOUT AXIS Y-Y) 0 LBS-FT
MAXIMUM VERTICAL PRIMARY MOMENT (ABOUT AXIS X-X) 0 LBS-FT
MAXIMUM VERTICAL SECONDARY MOMENT (ABOUT AXIS X-X) 0 LBS-FT

NOTES :
1 : MOMENTS TAKEN ABOUT AXES THROUGH CENTER OF SHAFT. FORCE TAKEN AS ACTING AT CENTER OF SHAFT.
2 : PRIMARY FORCES & MOMENTS CHANGE FROM ZERO TO MAXIMUM GIVEN ABOVE TO ZERO TO SAME MAXIMUM IN RECIPROCATING DIRECTION & BACK TO ZERO ONCE IN A CRANKSHAFT REVOLUTION. SECONDARY FORCES & MOMENTS GO THROUGH THIS CYCLE TWICE IN A REVOLUTION. THE SKETCH SHOWS THIS.
3 : CUSTOMER TO SUPPORT ALL PIPINGS AS CLOSE AS POSSIBLE BEYOND THE BATTERY LIMITS SUCH THAT FORCES & MOMENTS DUE TO EXPANSION OR CONTRACTION OR WEIGHTS INTRODUCED AT THE BATTERY LIMITS ARE MINIMUM.

INLET & DISCHARGE PIPE CONSTRUCTION

THE INLET PIPE MUST BE AT LEAST THE SIZE SHOWN ON THIS PLAN. IT SHOULD BE AS SHORT AND DIRECT AS POSSIBLE, WITH LONG RADIUS BENDS, AS REQUIRED. SHARP ELBOWS AND TURNS SHOULD BE AVOIDED. ALSO, PROVISIONS FOR EXPANSION OF PIPING MUST BE MADE.

TO REDUCE POSSIBILITIES OF PIPE SHAKE OR SUPERCHARGING, THE INLET PIPE LENGTHS TO BE AVOIDED FOR THIS COMPRESSOR AT 300 RPM ARE 17 TO 35.5 FEET AND 75 TO 93.6 FEET.

TO REDUCE POSSIBILITIES OF PIPE SHAKE OR SUPERCHARGING, THE DISCHARGE PIPE LENGTHS TO BE AVOIDED FOR THIS COMPRESSOR AT 300 RPM ARE 20.6 TO 42.6 FEET AND 89.4 TO 111.4 FEET.

NOTES:
DO NOT SCALE THIS DRAWING, USE FIGURES GIVEN.

THE FOUNDATION SHOWN IS MIN., SUITABLE ONLY FOR FIRM SOIL BACKED UP BY BEDROCK. WE RECOMMEND THAT YOU INVESTIGATE THE SOIL CONDITION IN THE PROSPECTIVE LOCATION AND IF THERE IS ANY DOUBT ABOUT ITS SUITABILITY, WE URGE CONSULTATION WITH A FOUNDATION EXPERT.

SEE GENERAL FOUNDATION INSTRUCTION FORM AP 0250-C.

DO NOT USE THIS DRAWING FOR CONSTRUCTION PURPOSES UNLESS OFFICIALLY ENDORSED.

BE SURE TO READ THE INSTRUCTION BOOK BEFORE CONSTRUCTION.

FOR MOVEMENT USE FORKLIFT HOLES ON COMPRESSOR END OF PACKAGE.

MAX. WATER PRESSURE 75 PSI. DO NOT INSTALL WATER CHECK VALVES BEFORE WATER INLET CONNECTION POINT UNLESS EXPANSION TANK IS USED IN SYSTEM.

FOR GROUTING INSTRUCTIONS SEE 14002D1D.

CUSTOMER TO SUPPLY 2 GPM OF FILTERED, TREATED COOLING WATER FOR ROD PACKING AT 90° F MAX. TEMPERATURE.

RECOMMENDED CLEARANCE ON THREE SIDES 36.00 AND 42.00 IN FRONT OF CONTROL PANEL OR MIN. AS REQUIRED BY LATEST NATIONAL ELECTRICAL CODE OR APPLICABLE LOCAL CODE.

SEE AX-2172 FOR CLOSED LOOP COOLING SYSTEM DIRECTIVE.

CUSTOMER TO PROVIDE DRAIN LOCATED LOWER THAN BOOSTER INLET CONNECTION. SEE BOOSTER INTAKE ARRANGEMENT DRAWING 39475991.

INDICATES CENTER OF GRAVITY

NOTE: Preliminary For Reference Only
Do not use for planning purposes

DRAWING CONFORMS TO ASME Y14.5M -1994

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ON DIMENSIONS ARE AS FOLLOWS:
ONE PLACE: (.X) = ±.25
TWO PLACES: (.XX) = ±.12
THREE PLACES: (.XXX) = ±.06
ANGLES: = ±1°

PROPRIETARY NOTICE

MICROFILM BLOWBACK SCALE 0 1"

THIRD ANGLE PROJECTION

DRAWN	JSP	26JUL06
CHECKED	NBC	26JUL06
APPRVD	NBC	26JUL06
DWG. NOS.	42, 99	
SCALE	1:12	
	FSCM 6R484	

Ingersoll-Rand
INDUSTRIAL AIR SOLUTIONS, HEAVY INDUSTRIAL SYSTEMS
NARODA PLANT, AHMEDABAD.

TITLE: ARRANGEMENT, 4X5 ESV-NL PKG.

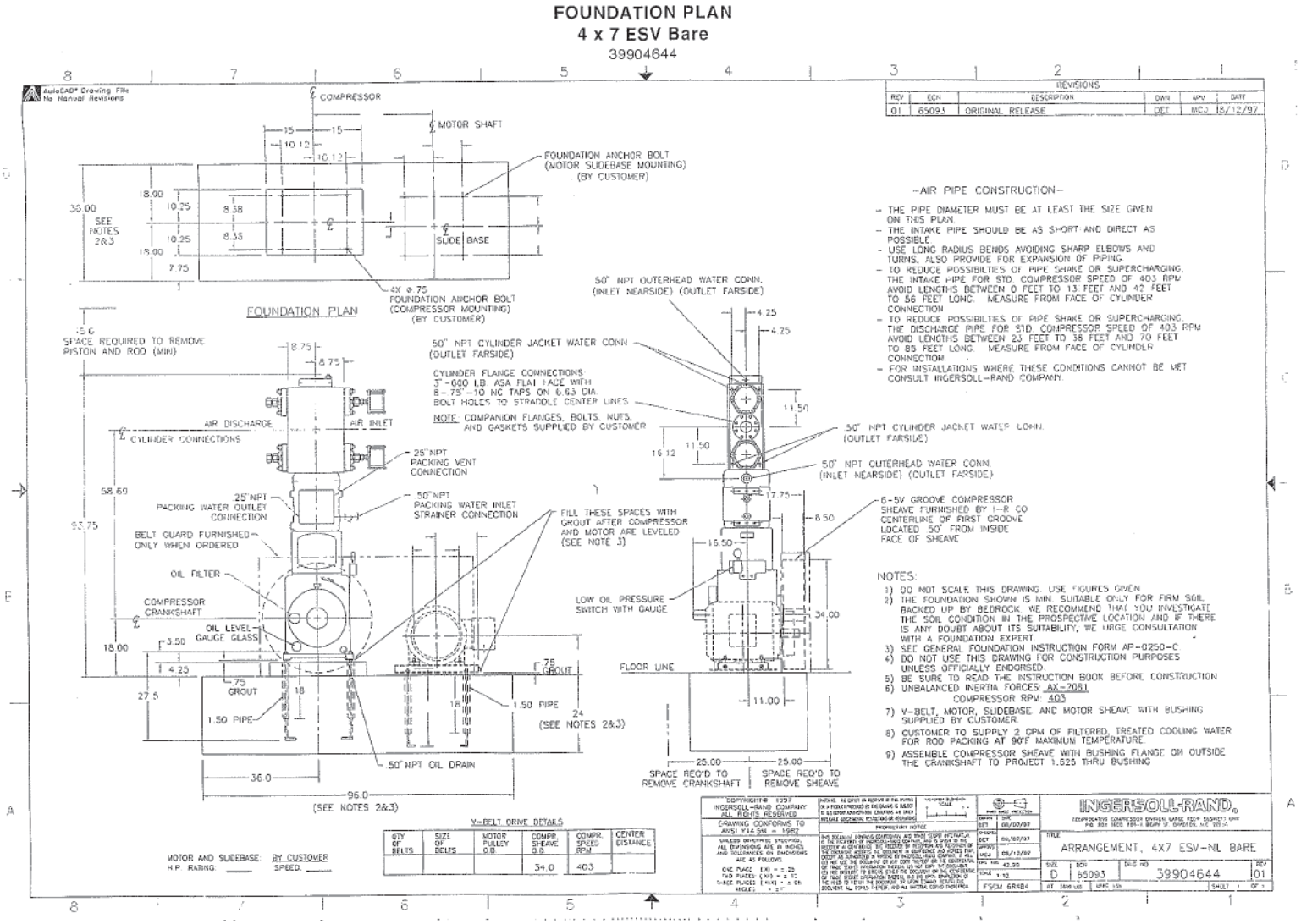
SIZE	ECN	DWG NO.	REV
D	ENL02084	17294034	01

WT. | UNIT ESV | SHEET 2 OF 2

BOOSTER

DRAWINGS

Ref: **5005.27**
Date: **01 February 2006**
Cancels: **30 March 2001**



NOTE: Preliminary For Reference Only Do not use for planning purposes

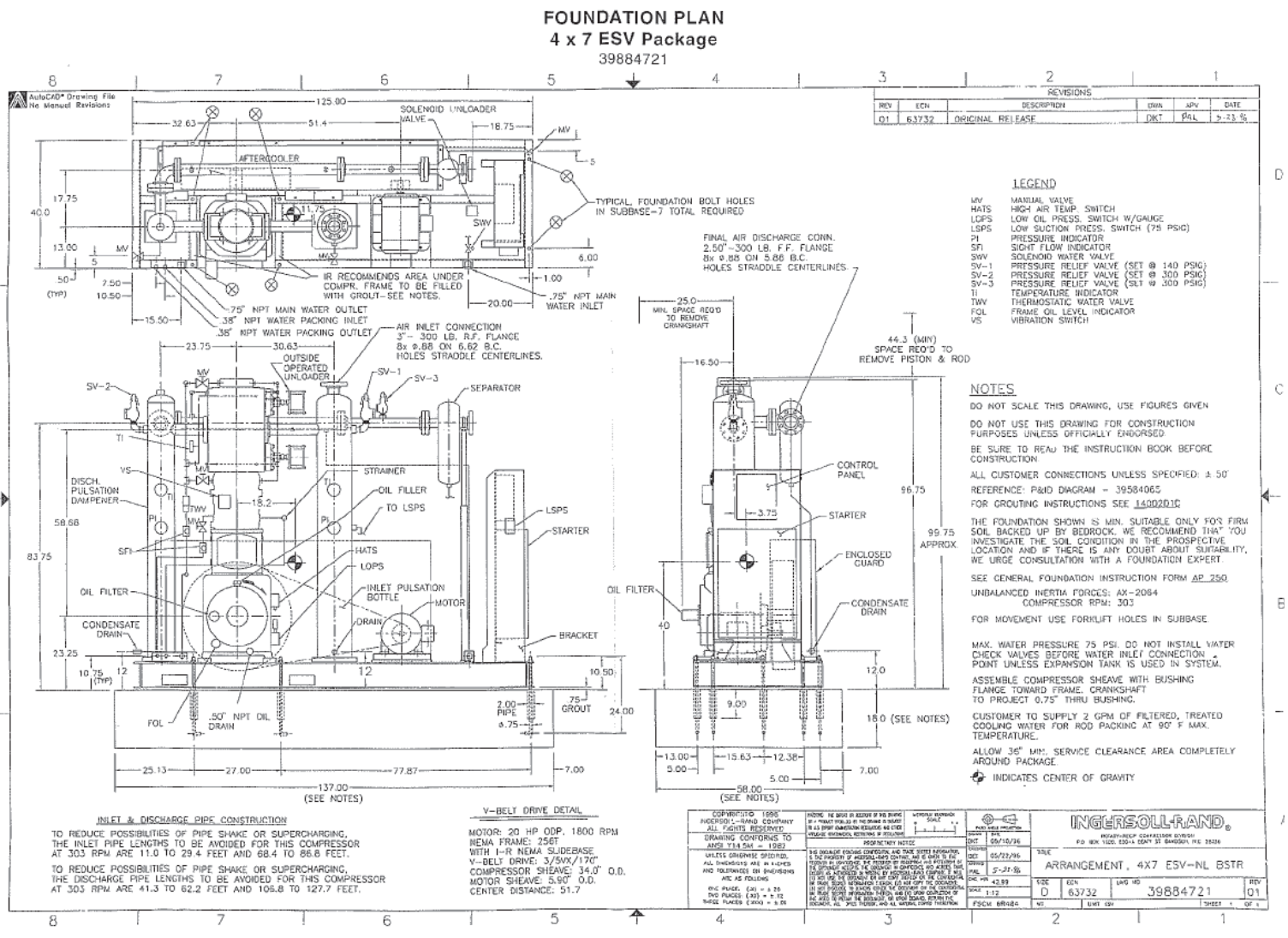
Ingersoll Rand

Davidson, NC 28036

BOOSTER

DRAWINGS

Ref: **5005.28**
Date: **01 February 2006**
Cancels: **30 March 2001**



NOTE: Preliminary For Reference Only Do not use for planning purposes

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Davidson, NC 28036

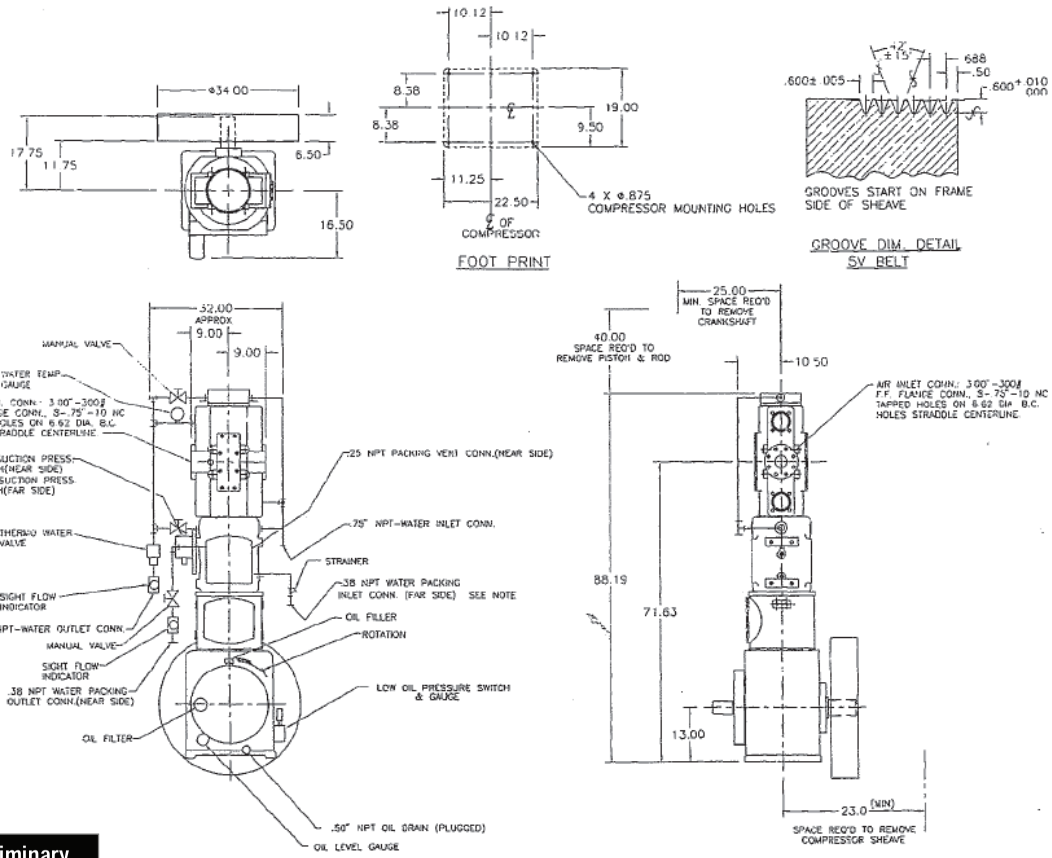
ESV

BOOSTER COMPRESSORS

DRAWINGS

Ref: **5005.29**
Date: **01 February 2006**
Cancels: **30 March 2001**

FOUNDATION PLAN
5 x 7 ESV Bare
39905575



NOTE: Preliminary For Reference Only Do not use for planning purposes

RECOMMENDED DRIVE

MOTOR: 100HP(BY CUSTOMER) FOR 750 RPM
75 HP(BY CUSTOMER) FOR 505 RPM

INLET & DISCHARGE PIPE CONSTRUCTION

THE CUSTOMER MUST COLLECT CONDENSATE AND DEBRIS PRIOR TO THE COMPRESSOR BOOSTER INLET. SEE DRAWING 39475991 FOR RECOMMENDED ARRANGEMENT. THE INLET PIPE MUST BE AT LEAST THE SIZE SHOWN ON THIS PLAN. IT SHOULD BE AS SHORT AND DIRECT AS POSSIBLE, WITH LONG RADIUS BENDS, AS REQUIRED. SHARP ELBOWS AND TURNS SHOULD BE AVOIDED. ALSO, PROVISIONS FOR EXPANSION OF PIPING MUST BE MADE.

TO REDUCE POSSIBILITIES OF PIPE SHAKE OR SUPERCHARGING, THE INLET PIPE LENGTHS TO BE AVOIDED FOR THIS COMPRESSOR AT 750 RPM ARE 0 TO 6 FEET AND 22 TO 29 FEET.

TO REDUCE POSSIBILITIES OF PIPE SHAKE OR SUPERCHARGING, THE DISCHARGE PIPE LENGTHS TO BE AVOIDED FOR THIS COMPRESSOR AT 750 RPM ARE 12 TO 21 FEET AND 39 TO 48 FEET.

TO REDUCE POSSIBILITIES OF PIPE SHAKE OR SUPERCHARGING, THE INLET PIPE LENGTHS TO BE AVOIDED FOR THIS COMPRESSOR AT 505 RPM ARE 0 TO 10 FEET AND 33 TO 44 FEET.

TO REDUCE POSSIBILITIES OF PIPE SHAKE OR SUPERCHARGING, THE DISCHARGE PIPE LENGTHS TO BE AVOIDED FOR THIS COMPRESSOR AT 505 RPM ARE 19 TO 32 FEET AND 60 TO 73 FEET.

NOTES

DO NOT SCALE THIS DRAWING, USE FIGURES GIVEN.

DO NOT USE THIS DRAWING FOR CONSTRUCTION PURPOSES UNLESS OFFICIALLY ENDORSED.

BE SURE TO READ THE INSTRUCTION BOOK BEFORE CONSTRUCTION.

UNBALANCED INERTIA FORCES:	AX-1748	AX-1903
COMPRESSOR RPM:	750	505

MAX. WATER PRESSURE 75 PSI. DO NOT INSTALL WATER CHECK VALVES BEFORE WATER INLET CONNECTION POINT UNLESS EXPANSION TANK IS USED IN SYSTEM.

ASSEMBLE COMPRESSOR SHEAVE WITH BUSHING FLANGE TOWARD FRAME. CRANKSHAFT TO PROJECT 1.50" THRU BUSHING.

CUSTOMER TO SUPPLY 2 GPM OF FILTERED, TREATED COOLING WATER FOR ROD PACKING AT 90° F MAX TEMPERATURE.

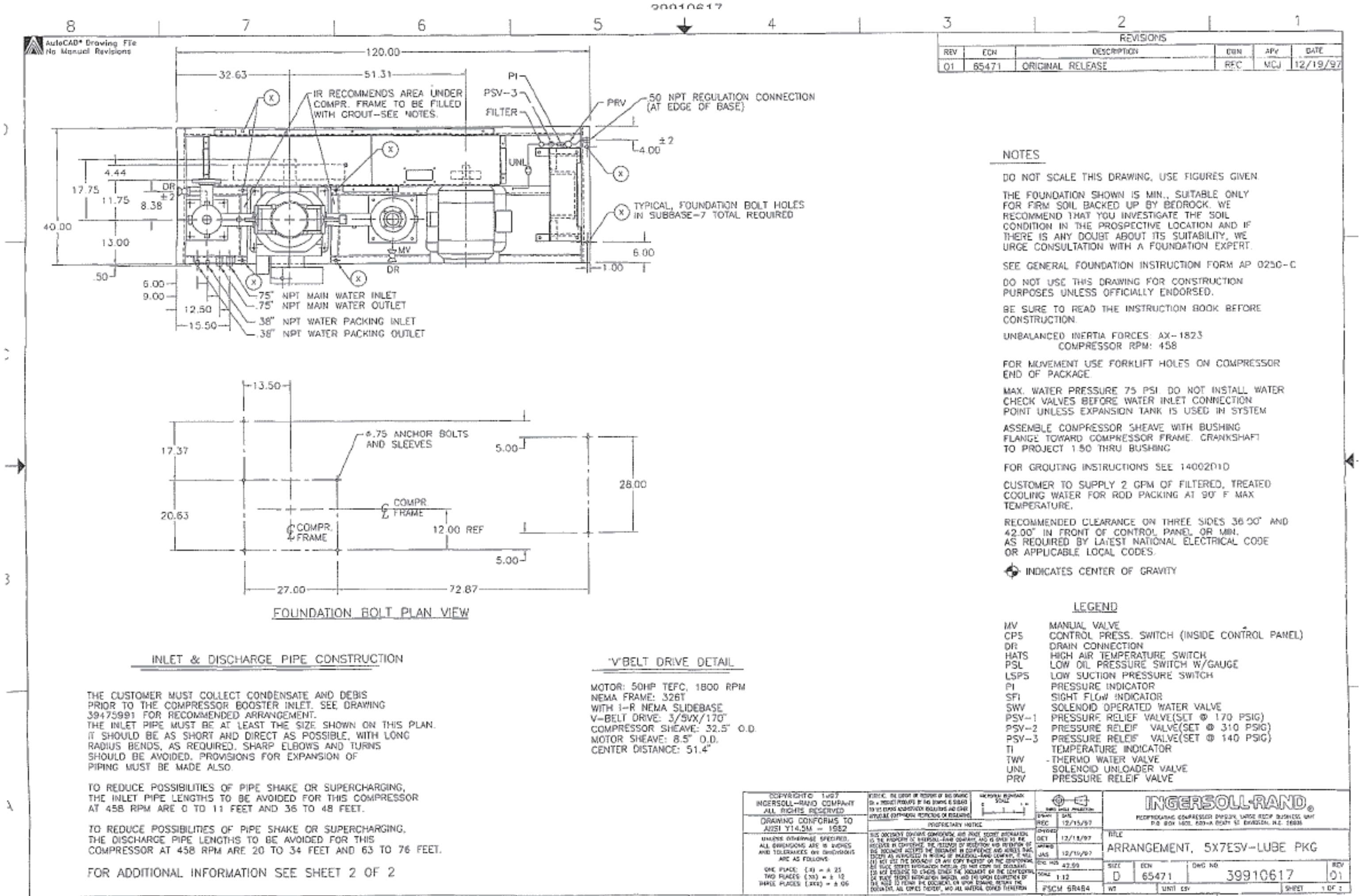
ALLOW 36" MIN. SERVICE CLEARANCE AREA COMPLETELY AROUND COMPRESSOR.

FOR PIPING AND INSTRUMENTATION SEE DWG. 39586527.

COMPONENTS WEIGHTS
COMPRESSOR 3300 LBS.
SHEAVE 770 LBS. MAX.

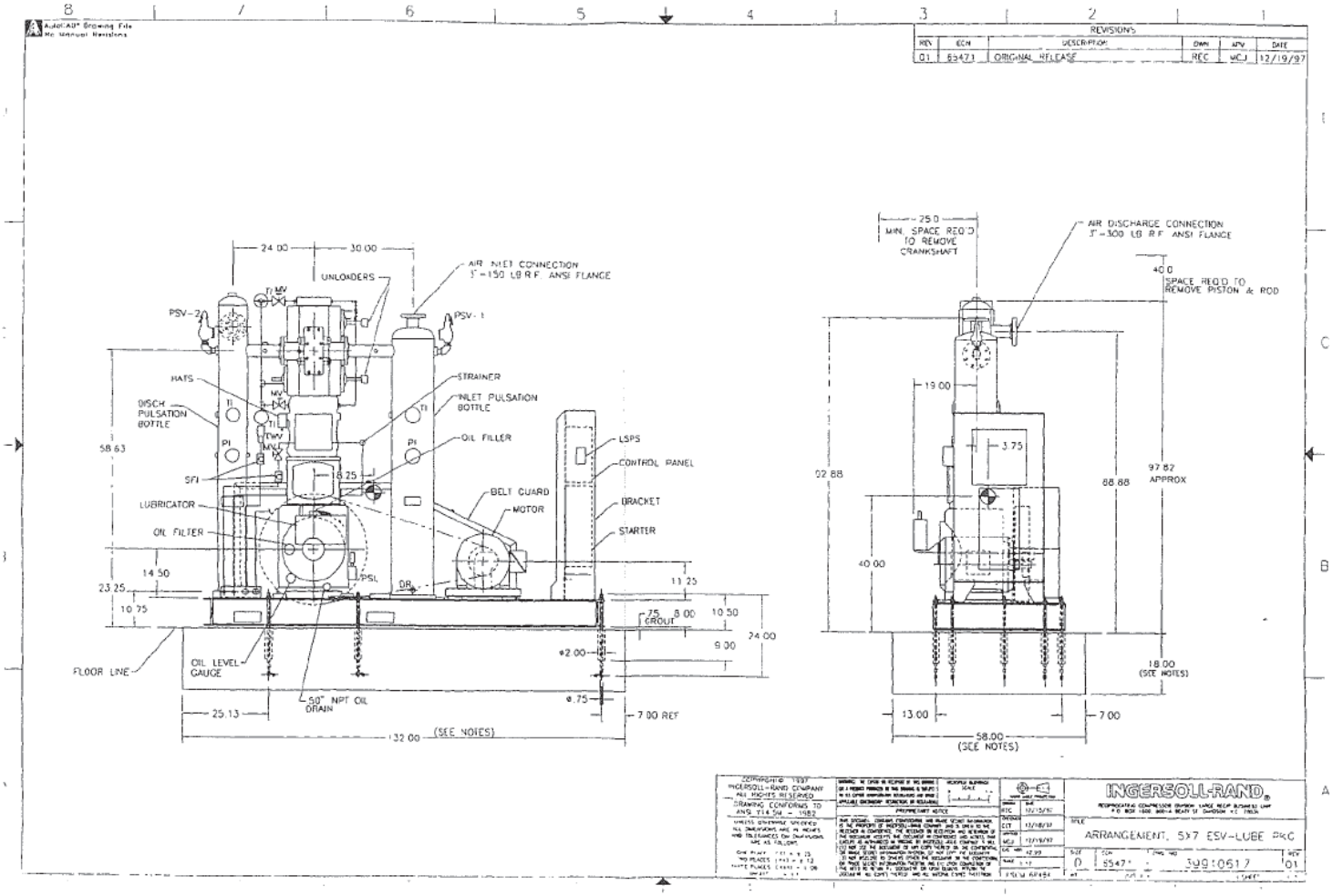
SHIPPED LOOSE COMPRESSOR SHEAVE: 34" O.D.

FOUNDATION PLAN
5 x 7 ESV Package



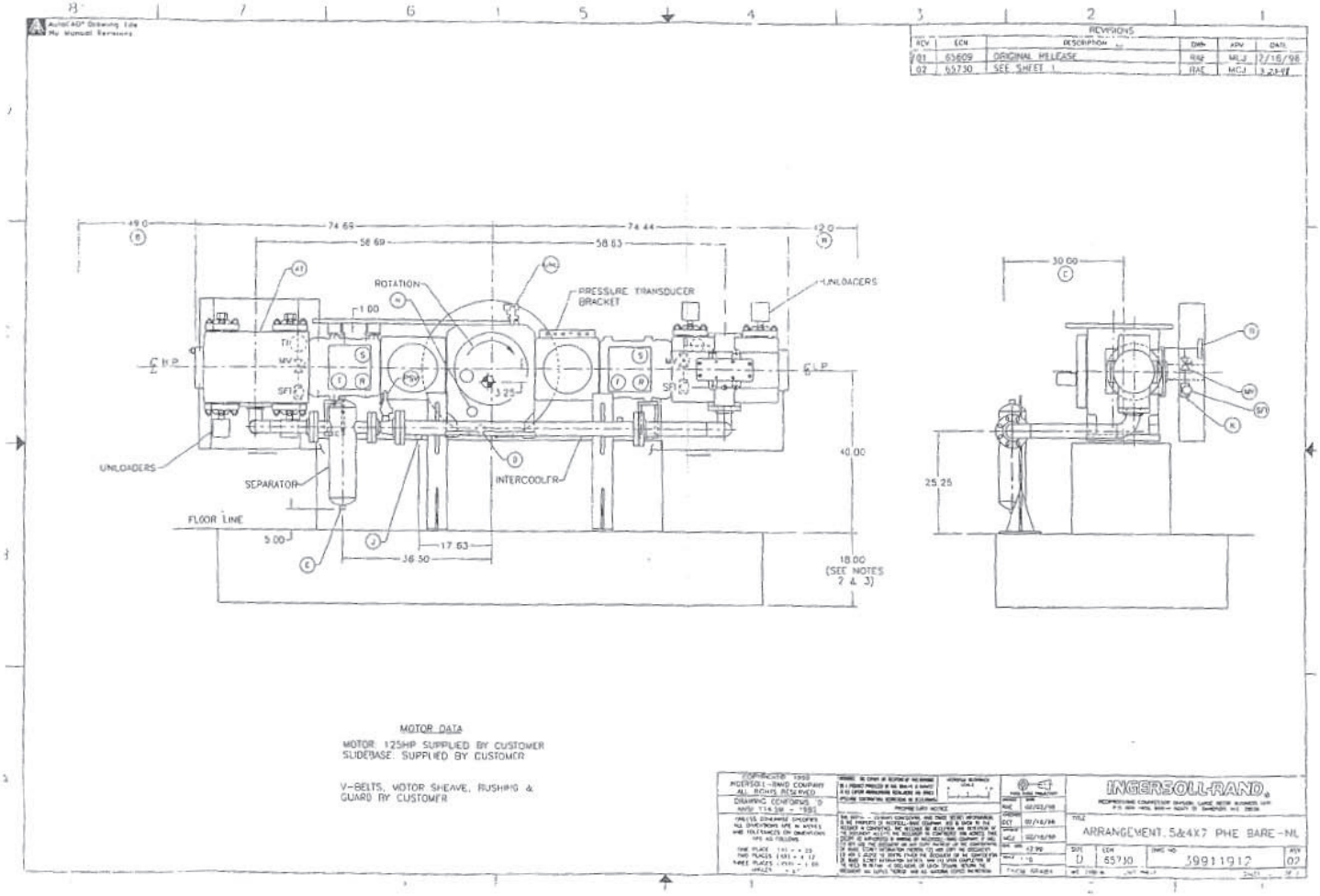
NOTE: Preliminary
For Reference Only
Do not use for
planning purposes

FOUNDATION PLAN
5 x 7 ESV Package
39910617



NOTE: Preliminary For Reference Only Do not use for planning purposes

FOUNDATION PLAN
5 & 4 x 7 PHE Bare
39911912

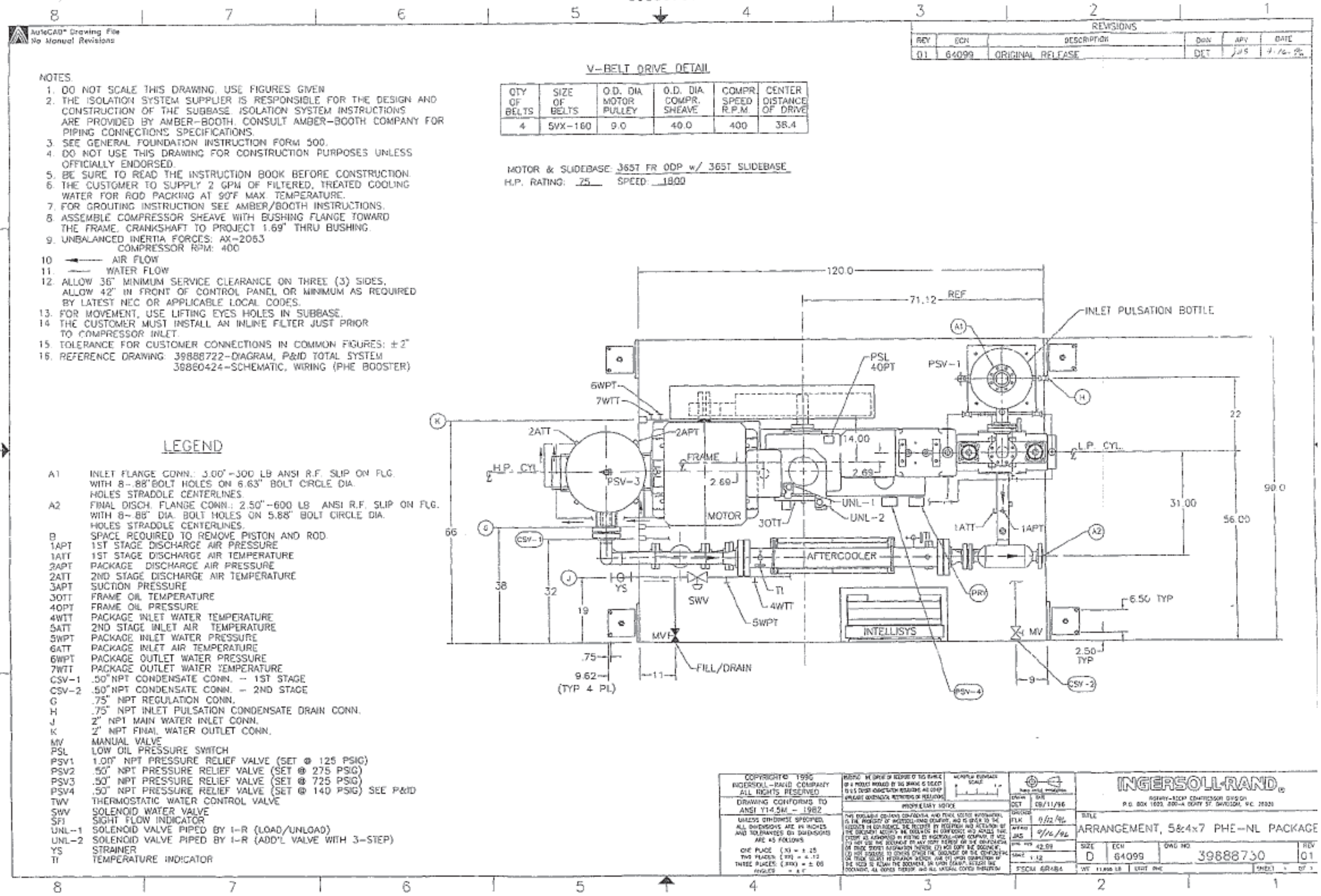


NOTE: Preliminary For Reference Only Do not use for planning purposes

BOOSTER

DRAWINGS

FOUNDATION PLAN
5 & 4 x 7 PHE Package
39888730



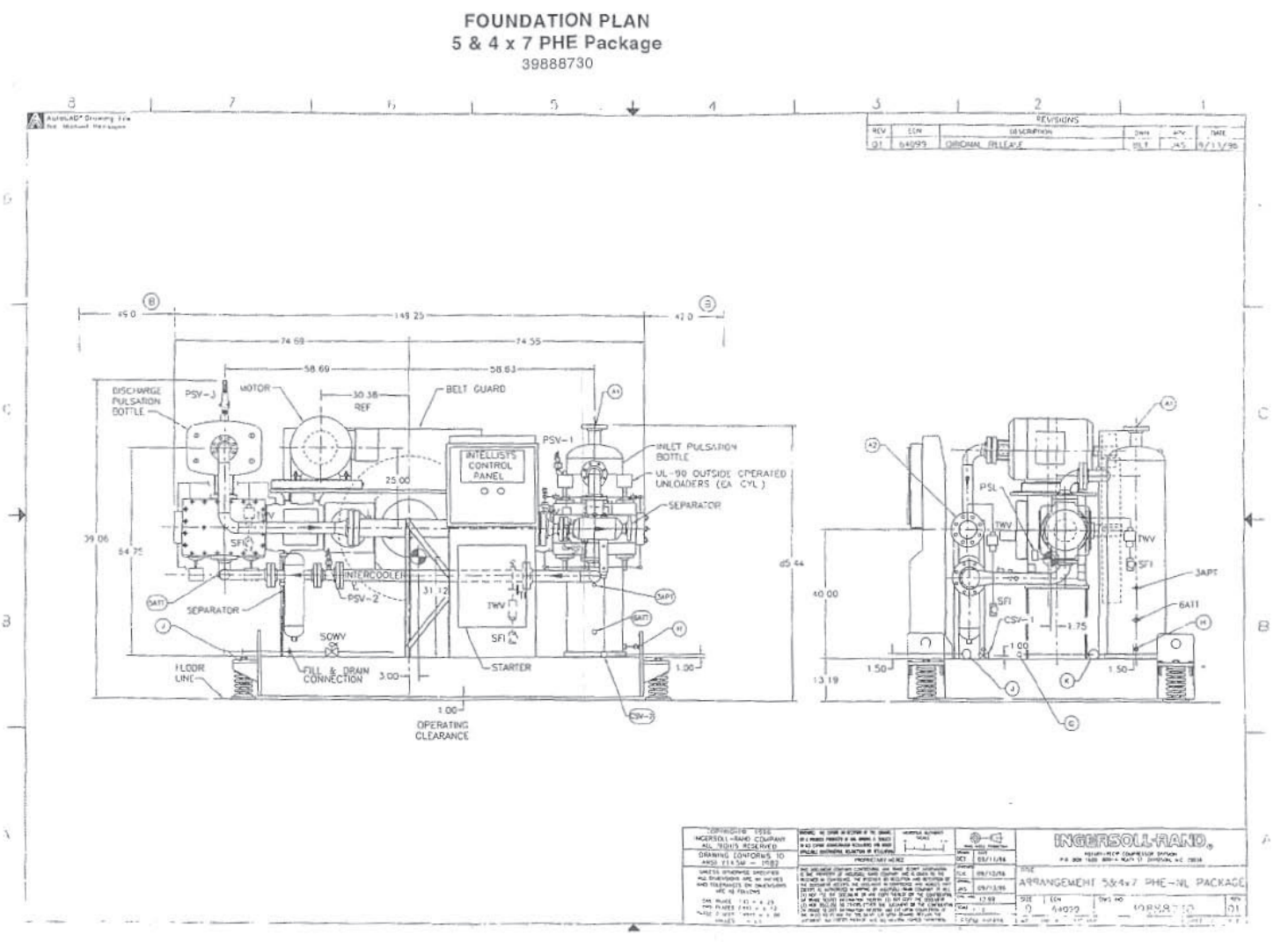
Ingersoll Rand

Davidson, NC 28036

BOOSTER

DRAWINGS

Ref: **5005.34**
Date: **01 February 2006**
Cancels: **30 March 2001**



NOTE: Preliminary For Reference Only Do not use for planning purposes

Ingersoll Rand

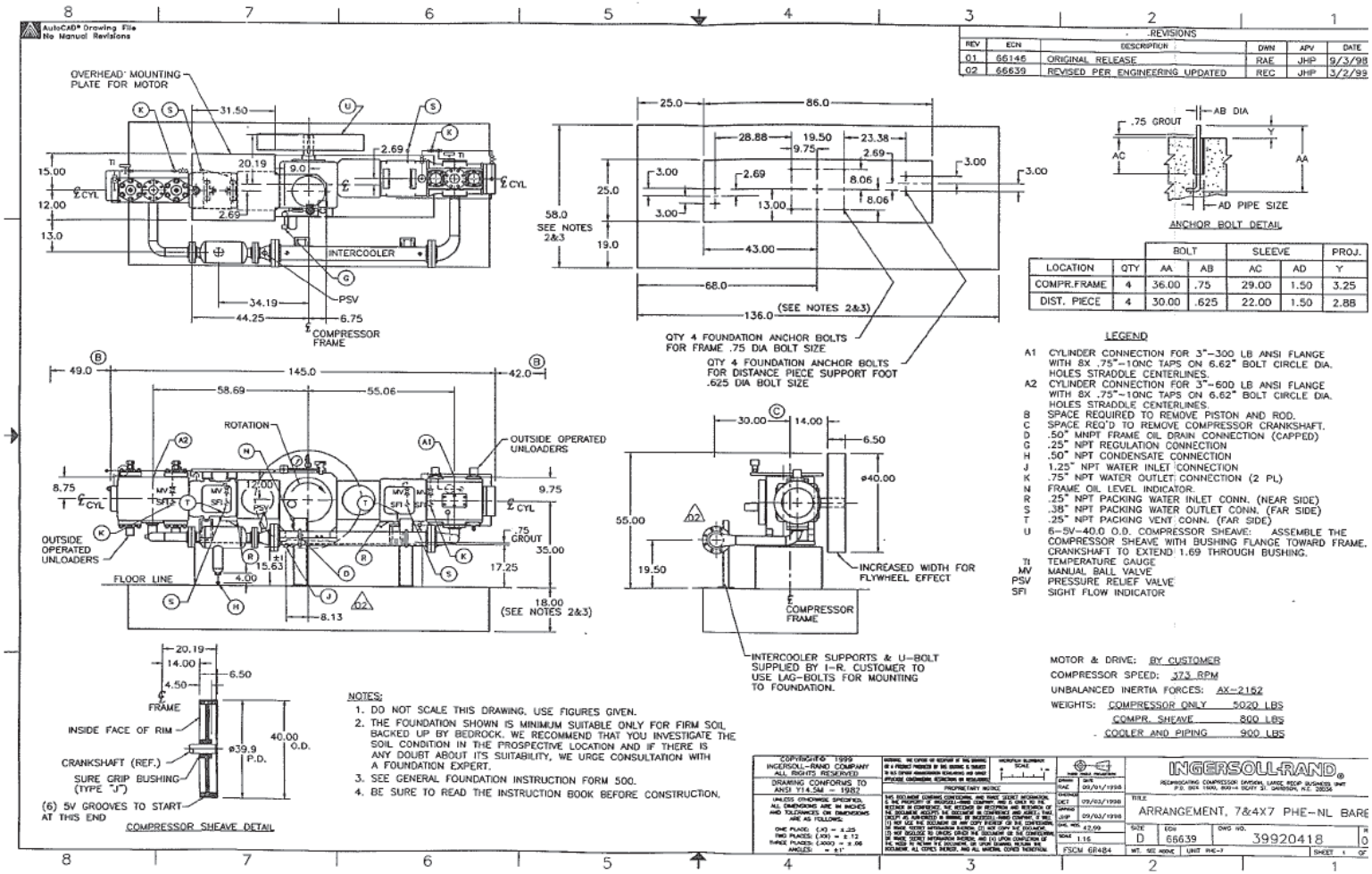
Davidson, NC 28036

BOOSTER

DRAWINGS

Ref: **5005.35**
Date: **01 February 2006**
Cancels: **30 March 2001**

FOUNDATION PLAN
7 & 4 x 7 PHE Bare
39920418



REVISIONS

REV	ECN	DESCRIPTION	DWN	APV	DATE
01	66146	ORIGINAL RELEASE	RAE	JHP	9/3/98
02	66639	REVISED PER ENGINEERING UPDATED	REC	JHP	3/2/99

LOCATION	QTY	BOLT AA	BOLT AB	SLEEVE AC	SLEEVE AD	PROJ. Y
COMPR.FRAME	4	36.00	.75	29.00	1.50	3.25
DIST. PIECE	4	30.00	.625	22.00	1.50	2.88

LEGEND

A1 CYLINDER CONNECTION FOR 3"-300 LB ANSI FLANGE WITH 8X .75"-10NC TAPS ON 6.62" BOLT CIRCLE DIA. HOLES STRADDLE CENTERLINES.
A2 CYLINDER CONNECTION FOR 3"-600 LB ANSI FLANGE WITH 8X .75"-10NC TAPS ON 6.62" BOLT CIRCLE DIA. HOLES STRADDLE CENTERLINES.
B SPACE REQUIRED TO REMOVE PISTON AND ROD.
C SPACE REQ'D TO REMOVE COMPRESSOR CRANKSHAFT.
D .50" MNPT FRAME OIL DRAIN CONNECTION (CAPPED)
G .25" NPT REGULATION CONNECTION
H .50" NPT CONDENSATE CONNECTION
J 1.25" NPT WATER INLET CONNECTION
K .75" NPT WATER OUTLET CONNECTION (2 PL)
N FRAME OIL LEVEL INDICATOR.
R .25" NPT PACKING WATER INLET CONN. (NEAR SIDE)
S .38" NPT PACKING WATER OUTLET CONN. (FAR SIDE)
T .25" NPT PACKING VENT CONN. (FAR SIDE)
U 6-5V-40.0 O.D. COMPRESSOR SHEAVE: ASSEMBLE THE COMPRESSOR SHEAVE WITH BUSHING FLANGE TOWARD FRAME. CRANKSHAFT TO EXTEND 1.69 THROUGH BUSHING.
TI TEMPERATURE GAUGE
MV MANUAL BALL VALVE
PSV PRESSURE RELIEF VALVE
SFI SIGHT FLOW INDICATOR

NOTES:
1. DO NOT SCALE THIS DRAWING. USE FIGURES GIVEN.
2. THE FOUNDATION SHOWN IS MINIMUM SUITABLE ONLY FOR FIRM SOIL BACKED UP BY BEDROCK. WE RECOMMEND THAT YOU INVESTIGATE THE SOIL CONDITION IN THE PROSPECTIVE LOCATION AND IF THERE IS ANY DOUBT ABOUT ITS SUITABILITY, WE URGE CONSULTATION WITH A FOUNDATION EXPERT.
3. SEE GENERAL FOUNDATION INSTRUCTION FORM 500.
4. BE SURE TO READ THE INSTRUCTION BOOK BEFORE CONSTRUCTION.

MOTOR & DRIVE: BY CUSTOMER
COMPRESSOR SPEED: 373 RPM
UNBALANCED INERTIA FORCES: AX-2162
WEIGHTS: COMPRESSOR ONLY 5020 LBS
COMPR. SHEAVE 800 LBS
COOLER AND PIPING 900 LBS

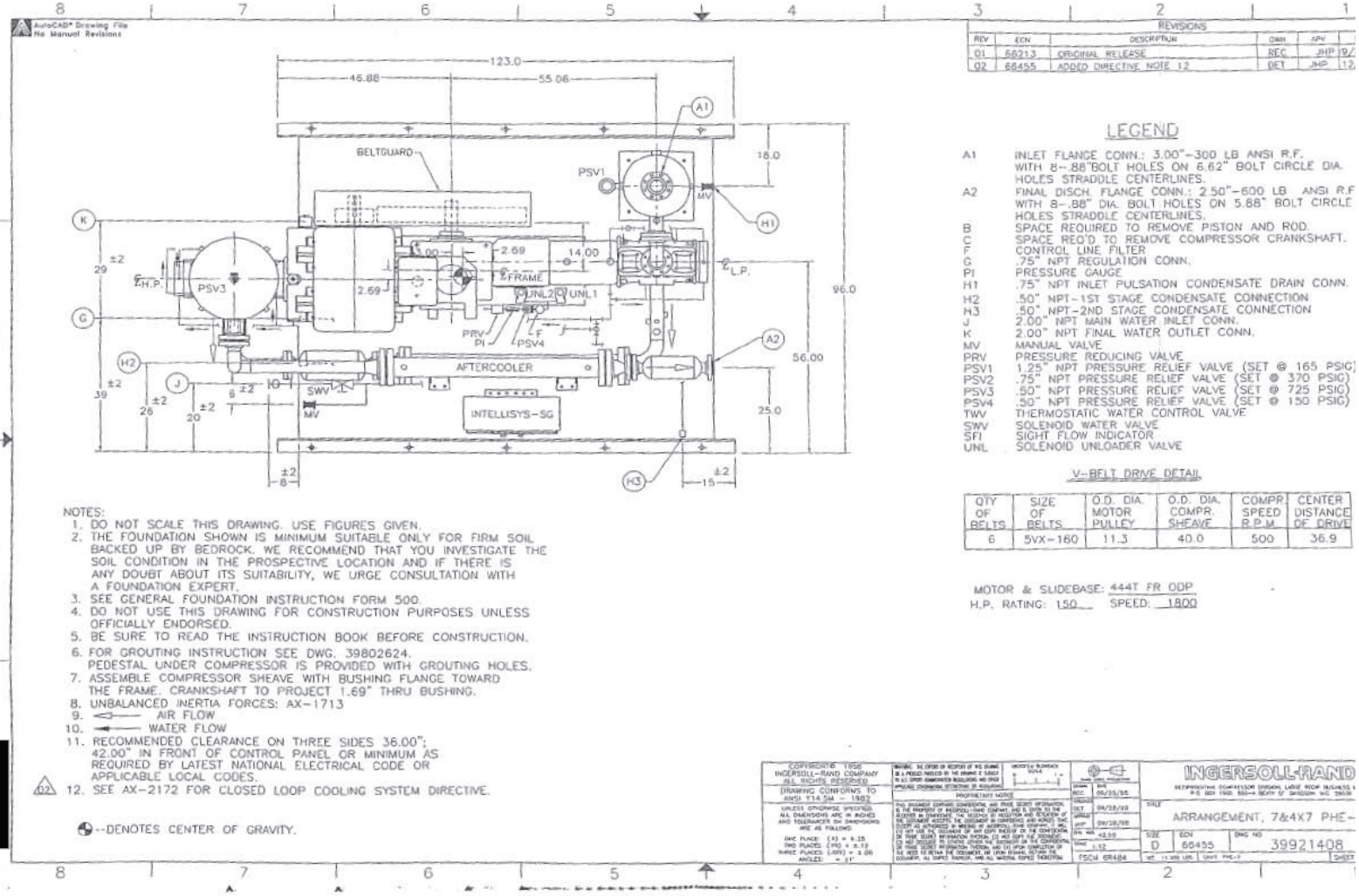
DRAWING CONFORMS TO ANSI Y14.5M - 1982
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES AND TOLERANCES ON DIMENSIONS ARE AS FOLLOWS:
ONE PLACE: (.X) = ±.25
TWO PLACES: (.XX) = ±.12
THREE PLACES: (.XXX) = ±.06
ANGLES: = ±1°

INGERSOLL-RAND
RECIPROCATING COMPRESSOR DIVISION, LARGE ROOP BUSINESS UNIT
P.O. BOX 1600, 800-H EIGHTY ST. DAVIDSON, N.C. 28036

TITLE: ARRANGEMENT, 7&4X7 PHE-NL BARE
SIZE D | ECN 66639 | DWG NO. 39920418 | REV 0
FSCM 6R484 | WT. SEE NOTE | UNIT PHE-7 | SHEET 1 OF

NOTE: Preliminary For Reference Only Do not use for planning purposes

FOUNDATION PLAN
7 & 4 x 7 PHE Package
39921408



NOTES:
1. DO NOT SCALE THIS DRAWING. USE FIGURES GIVEN.
2. THE FOUNDATION SHOWN IS MINIMUM SUITABLE ONLY FOR FIRM SOIL BACKED UP BY BEDROCK. WE RECOMMEND THAT YOU INVESTIGATE THE SOIL CONDITION IN THE PROSPECTIVE LOCATION AND IF THERE IS ANY DOUBT ABOUT ITS SUITABILITY, WE URGE CONSULTATION WITH A FOUNDATION EXPERT.
3. SEE GENERAL FOUNDATION INSTRUCTION FORM 500.
4. DO NOT USE THIS DRAWING FOR CONSTRUCTION PURPOSES UNLESS OFFICIALLY ENDORSED.
5. BE SURE TO READ THE INSTRUCTION BOOK BEFORE CONSTRUCTION.
6. FOR GROUTING INSTRUCTION SEE DWG. 39802624. PEDESTAL UNDER COMPRESSOR IS PROVIDED WITH GROUTING HOLES.
7. ASSEMBLE COMPRESSOR SHEAVE WITH BUSHING FLANGE TOWARD THE FRAME. CRANKSHAFT TO PROJECT 1.69" THRU BUSHING.
8. UNBALANCED INERTIA FORCES: AX-1713
9. ⟵ AIR FLOW
10. ⟵ WATER FLOW
11. RECOMMENDED CLEARANCE ON THREE SIDES 36.00"; 42.00" IN FRONT OF CONTROL PANEL OR MINIMUM AS REQUIRED BY LATEST NATIONAL ELECTRICAL CODE OR APPLICABLE LOCAL CODES.

△02 12. SEE AX-2172 FOR CLOSED LOOP COOLING SYSTEM DIRECTIVE.

⊕ --DENOTES CENTER OF GRAVITY.

REVISIONS

REV	ECN	DESCRIPTION	DWN	APV	
01	66213	ORIGINAL RELEASE	REC	JHP	9/
02	66455	ADDED DIRECTIVE NOTE 12	DET	JHP	12

LEGEND

A1	INLET FLANGE CONN.: 3.00"-300 LB ANSI R.F. WITH 8-.88"BOLT HOLES ON 6.62" BOLT CIRCLE DIA. HOLES STRADDLE CENTERLINES.
A2	FINAL DISCH. FLANGE CONN.: 2.50"-600 LB ANSI R.F WITH 8-.88" DIA. BOLT HOLES ON 5.88" BOLT CIRCLE HOLES STRADDLE CENTERLINES.
B	SPACE REQUIRED TO REMOVE PISTON AND ROD.
C	SPACE REQ'D TO REMOVE COMPRESSOR CRANKSHAFT.
F	CONTROL LINE FILTER
G	.75" NPT REGULATION CONN.
PI	PRESSURE GAUGE
H1	.75" NPT INLET PULSATION CONDENSATE DRAIN CONN.
H2	.50" NPT-1ST STAGE CONDENSATE CONNECTION
H3	.50" NPT-2ND STAGE CONDENSATE CONNECTION
J	2.00" NPT MAIN WATER INLET CONN.
K	2.00" NPT FINAL WATER OUTLET CONN.
MV	MANUAL VALVE
PRV	PRESSURE REDUCING VALVE
PSV1	1.25" NPT PRESSURE RELIEF VALVE (SET @ 165 PSIG)
PSV2	.75" NPT PRESSURE RELIEF VALVE (SET @ 370 PSIG)
PSV3	.50" NPT PRESSURE RELIEF VALVE (SET @ 725 PSIG)
PSV4	.50" NPT PRESSURE RELIEF VALVE (SET @ 150 PSIG)
TWV	THERMOSTATIC WATER CONTROL VALVE
SWV	SOLENOID WATER VALVE
SFI	SIGHT FLOW INDICATOR
UNL	SOLENOID UNLOADER VALVE

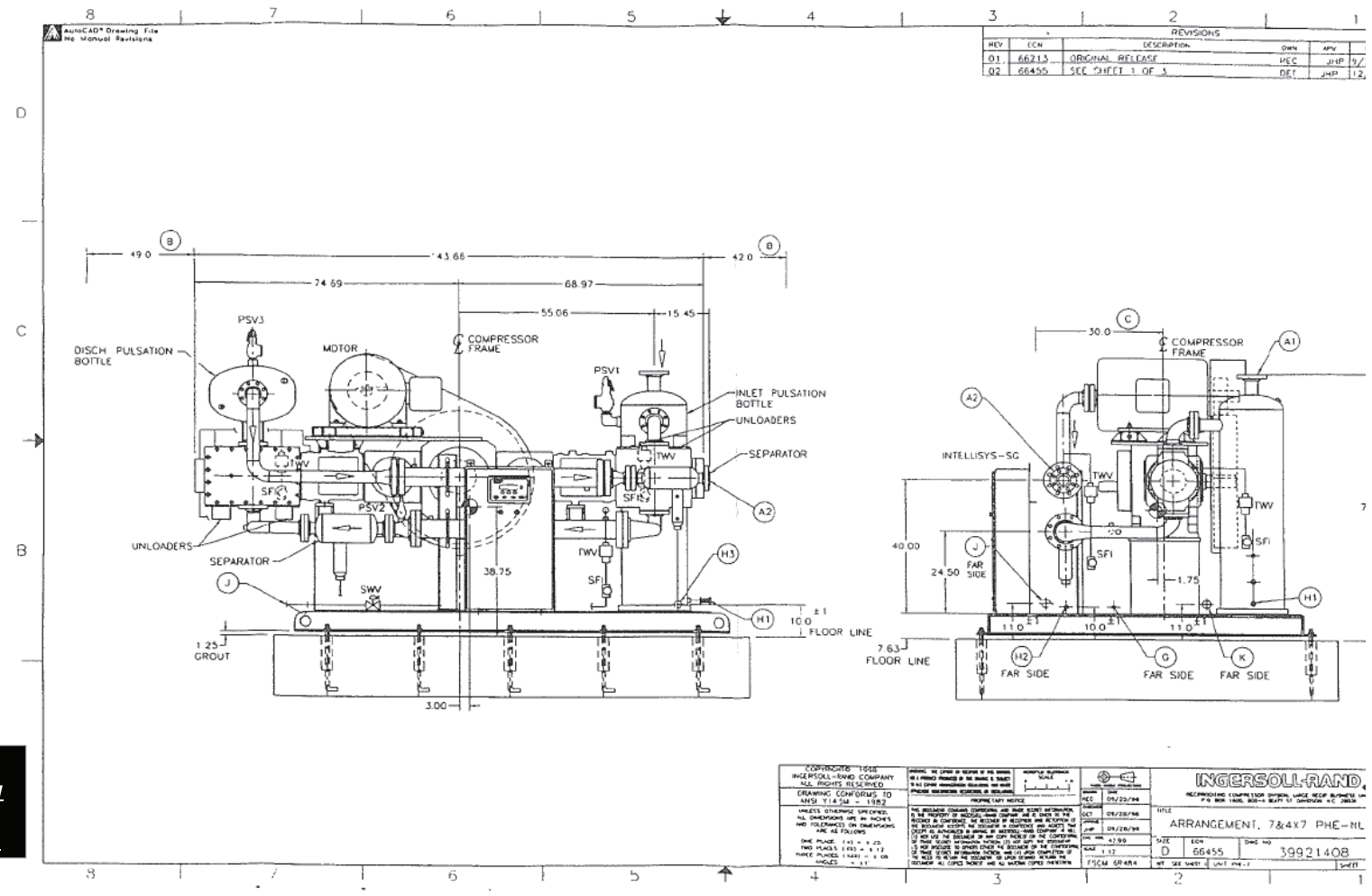
V-BELT DRIVE DETAIL

QTY OF BELTS	SIZE OF BELTS	O.D. DIA. MOTOR PULLEY	O.D. DIA. COMPR. SHEAVE	COMPR SPEED R.P.M.	CENTER DISTANCE OF DRIVE
6	5VX-160	11.3	40.0	500	36.9

MOTOR & SLIDEBASE: 444T FR ODP
H.P. RATING: 150 SPEED: 1800

INGERSOLL-RAND
STYLE ARRANGEMENT, 7&4X7 PHE-
SIZE D | ECN 66455 | DWG NO 39921408

FOUNDATION PLAN
7 & 4 x 7 PHE Package
39921408



NOTE: Preliminary For Reference Only Do not use for planning purposes

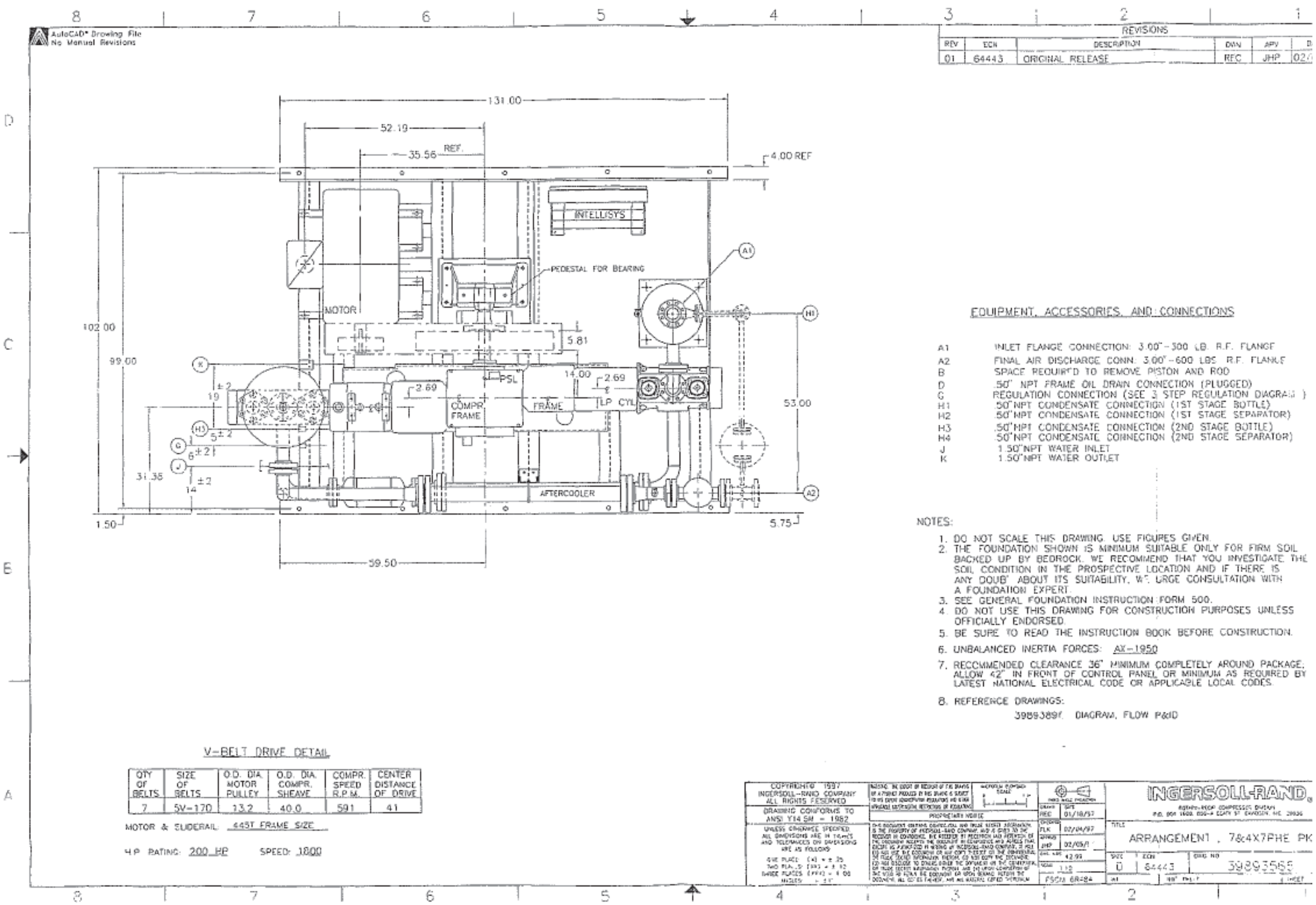
BOOSTER

DRAWINGS

Ingersoll Rand
Davidson, NC 28036

Ref: **5005.38**
Date: **01 February 2006**
Cancels: **30 March 2001**

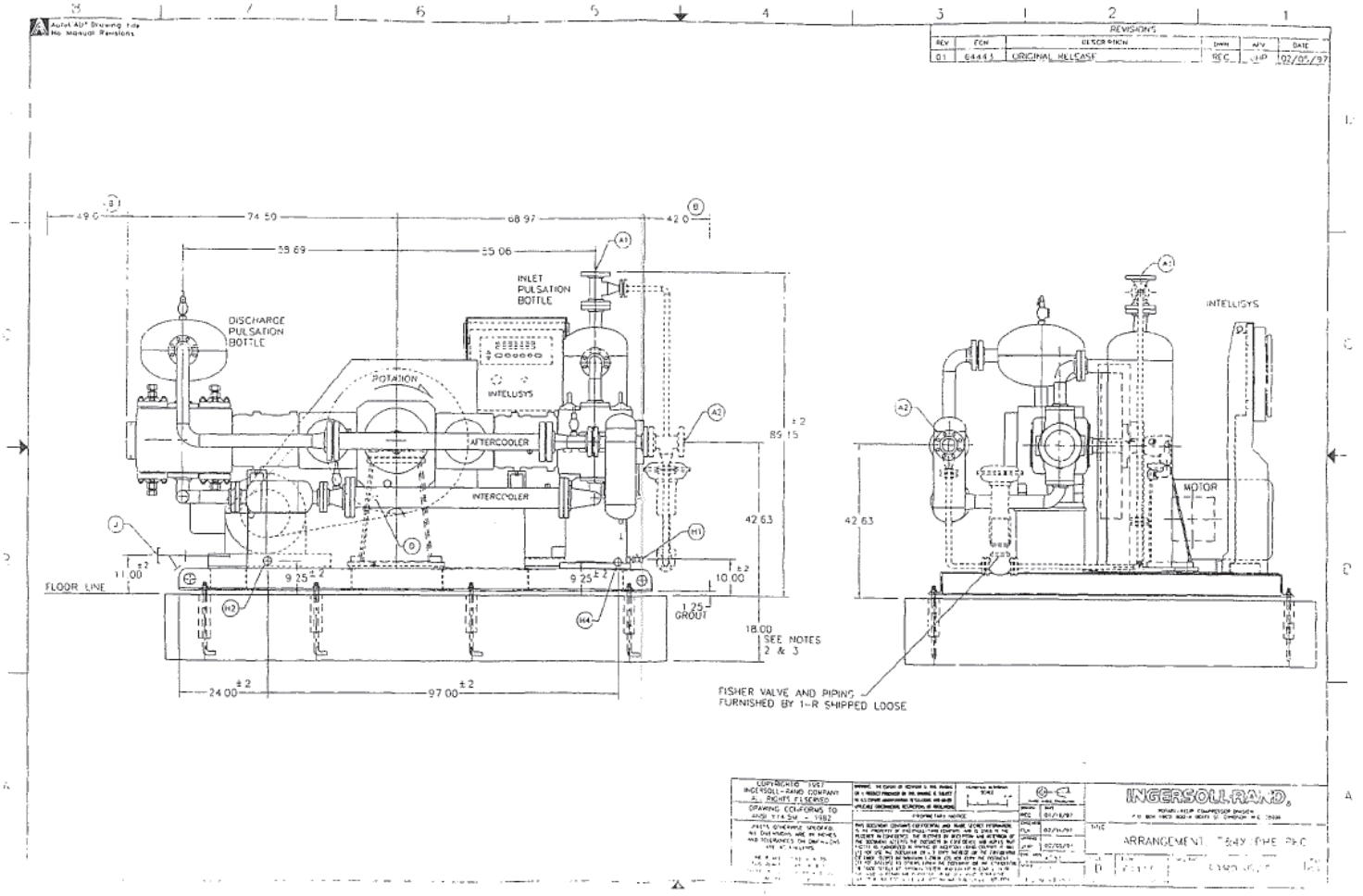
FOUNDATION PLAN
7 & 4 x 7 PHE Package with Outboard Bearing
39893565



REVISIONS
REV | ECN | DESCRIPTION | DWN | APV
01 | 64443 | ORIGINAL RELEASE | REC | JHP
131.00
52.19
35.56 REF.
4.00 REF
INTELLISYS
PEDESTAL FOR BEARING
MOTOR
COMPR FRAME
FRAME
LP CYL
PSL
AFTERCOOLER
102.00
99.00
53.00
59.50
1.50
5.75
5.81
14.00
2.69
31.35
EQUIPMENT, ACCESSORIES, AND CONNECTIONS
A1 INLET FLANGE CONNECTION: 3.00"-300 LB. R.F. FLANGE
A2 FINAL AIR DISCHARGE CONN. 3.00"-600 LBS. R.F. FLANGE
B SPACE REQUIRED TO REMOVE PISTON AND ROD
D .50" NPT FRAME OIL DRAIN CONNECTION (PLUGGED)
G REGULATION CONNECTION (SEE 3 STEP REGULATION DIAGRAM)
H1 .50"NPT CONDENSATE CONNECTION (1ST STAGE BOTTLE)
H2 .50"NPT CONDENSATE CONNECTION (1ST STAGE SEPARATOR)
H3 .50"NPT CONDENSATE CONNECTION (2ND STAGE BOTTLE)
H4 .50"NPT CONDENSATE CONNECTION (2ND STAGE SEPARATOR)
J 1.50"NPT WATER INLET
K 1.50"NPT WATER OUTLET
NOTES:
1. DO NOT SCALE THIS DRAWING. USE FIGURES GIVEN.
2. THE FOUNDATION SHOWN IS MINIMUM SUITABLE ONLY FOR FIRM SOIL BACKED UP BY BEDROCK. WE RECOMMEND THAT YOU INVESTIGATE THE SOIL CONDITION IN THE PROSPECTIVE LOCATION AND IF THERE IS ANY DOUBT ABOUT ITS SUITABILITY, WE URGE CONSULTATION WITH A FOUNDATION EXPERT.
3. SEE GENERAL FOUNDATION INSTRUCTION FORM 500.
4. DO NOT USE THIS DRAWING FOR CONSTRUCTION PURPOSES UNLESS OFFICIALLY ENDORSED.
5. BE SURE TO READ THE INSTRUCTION BOOK BEFORE CONSTRUCTION.
6. UNBALANCED INERTIA FORCES: AX-1950
7. RECOMMENDED CLEARANCE 36" MINIMUM COMPLETELY AROUND PACKAGE. ALLOW 42" IN FRONT OF CONTROL PANEL OR MINIMUM AS REQUIRED BY LATEST NATIONAL ELECTRICAL CODE OR APPLICABLE LOCAL CODES.
8. REFERENCE DRAWINGS:
39893897 DIAGRAM, FLOW P&ID
V-BELT DRIVE DETAIL
QTY OF BELTS | SIZE OF BELTS | O.D. DIA. MOTOR PULLEY | O.D. DIA. COMPR. SHEAVE | COMPR. SPEED R.P.M. | CENTER DISTANCE OF DRIVE
7 | 5V-170 | 13.2 | 40.0 | 591 | 41
MOTOR & SLIDERAIL: 445T FRAME SIZE
H.P. RATING: 200 HP SPEED: 1800
INGERSOLL-RAND
ARRANGEMENT, 7&4X7PHE PK
39893565

NOTE: Preliminary For Reference Only Do not use for planning purposes

FOUNDATION PLAN
7 & 4 x 7 PHE Package with Outboard Bearing
39893565



NOTE: Preliminary For Reference Only Do not use for planning purposes

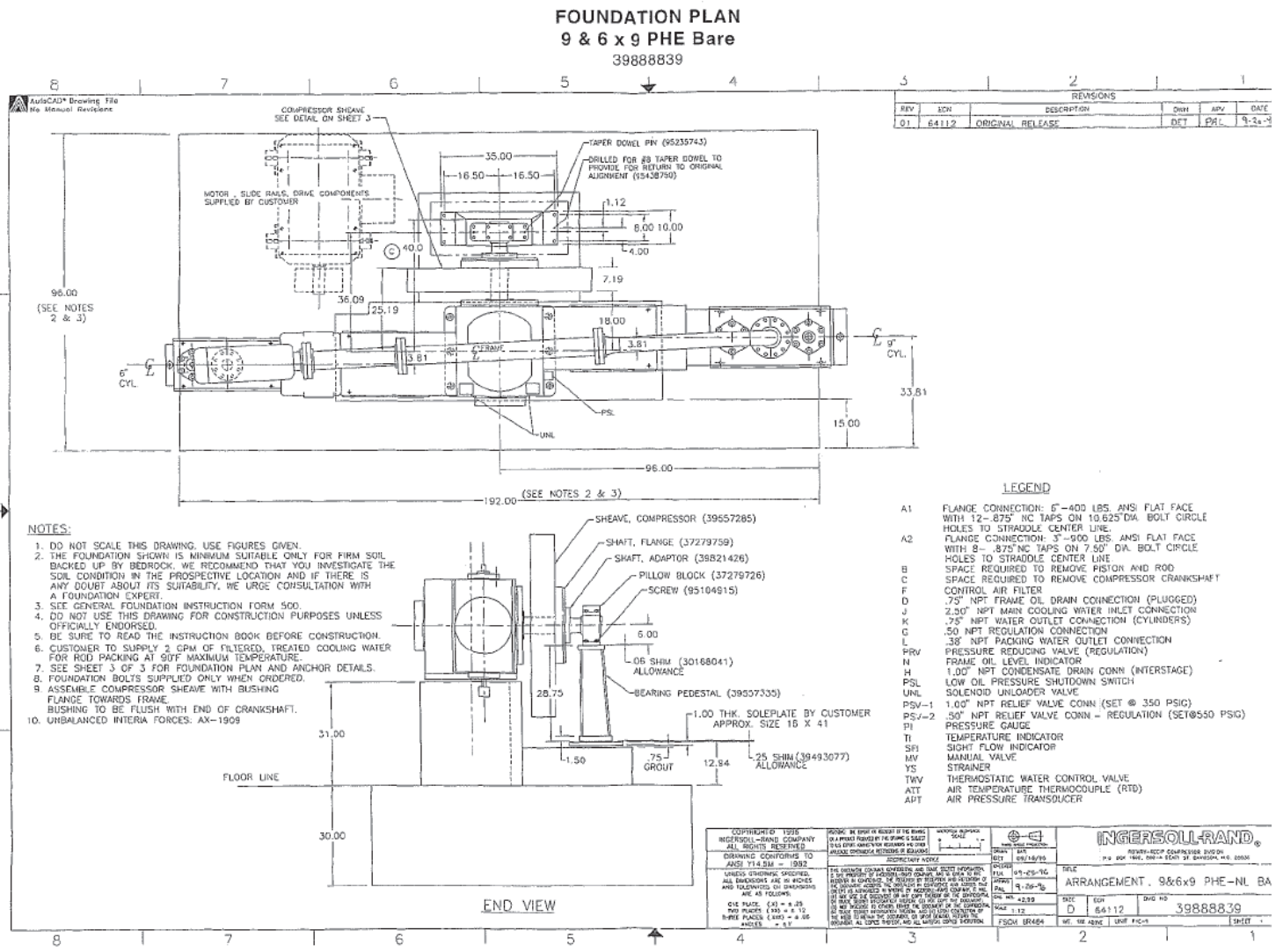
Ingersoll Rand

Davidson, NC 28036

BOOSTER

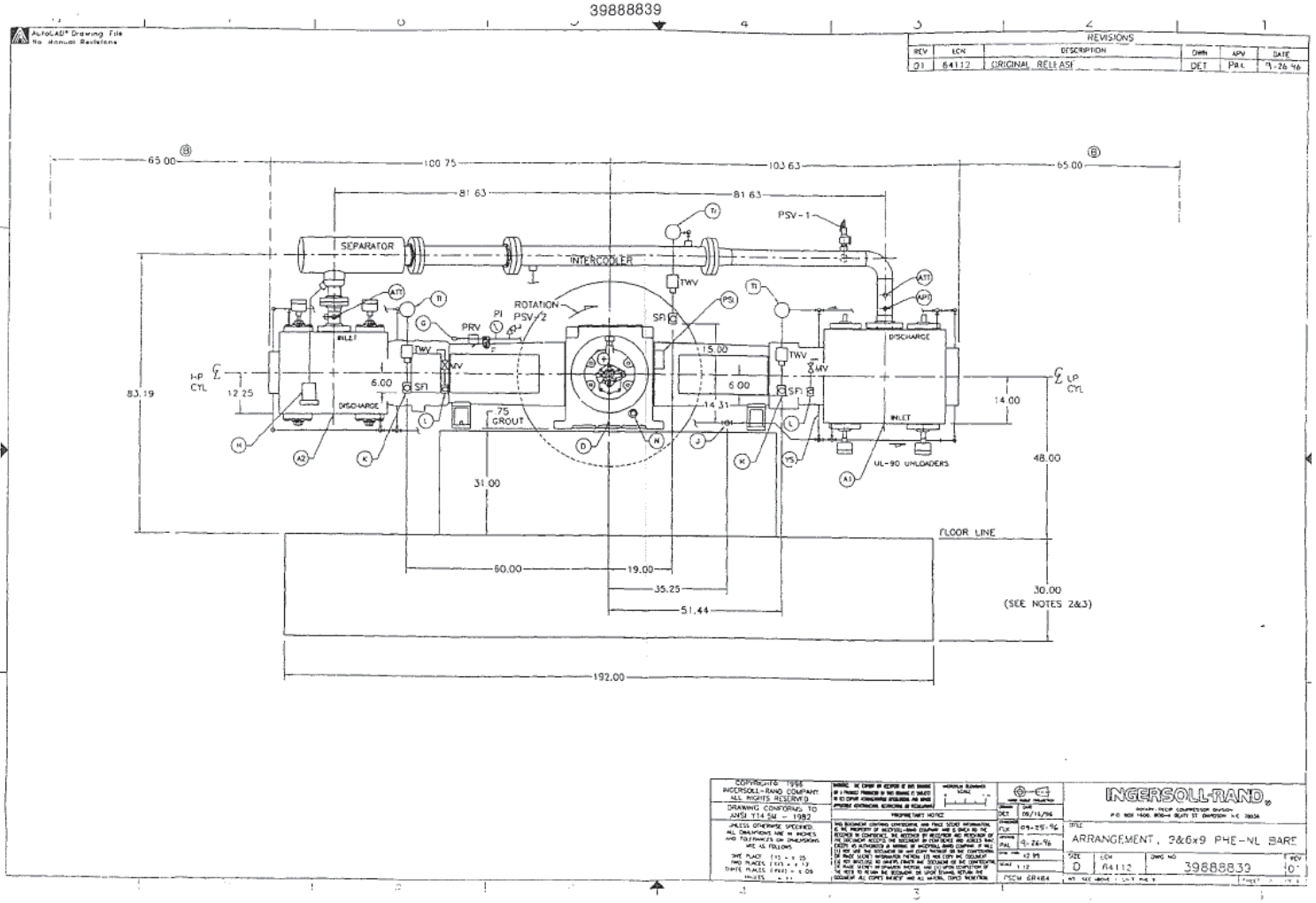
DRAWINGS

Ref: **5005.40**
Date: **01 February 2006**
Cancels: **30 March 2001**



NOTE: Preliminary For Reference Only Do not use for planning purposes

FOUNDATION PLAN
9 & 6 x 9 PHE Bare
39888839



NOTE: Preliminary For Reference Only Do not use for planning purposes

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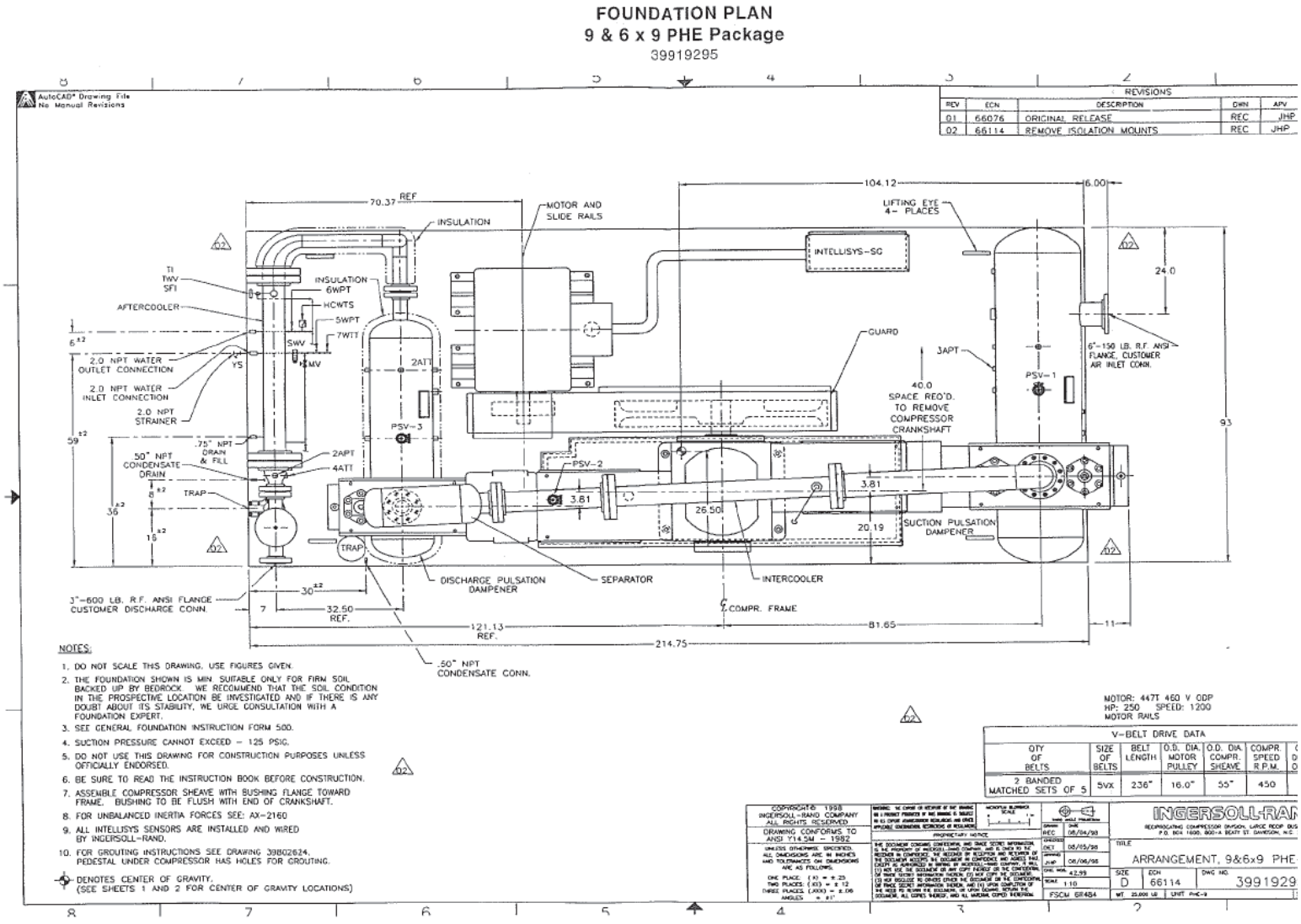
Davidson, NC 28036

BOOSTER

DRAWINGS

Ref: **5005.42**
Date: **01 February 2006**
Cancels: **30 March 2001**



NOTE: Preliminary For Reference Only Do not use for planning purposes

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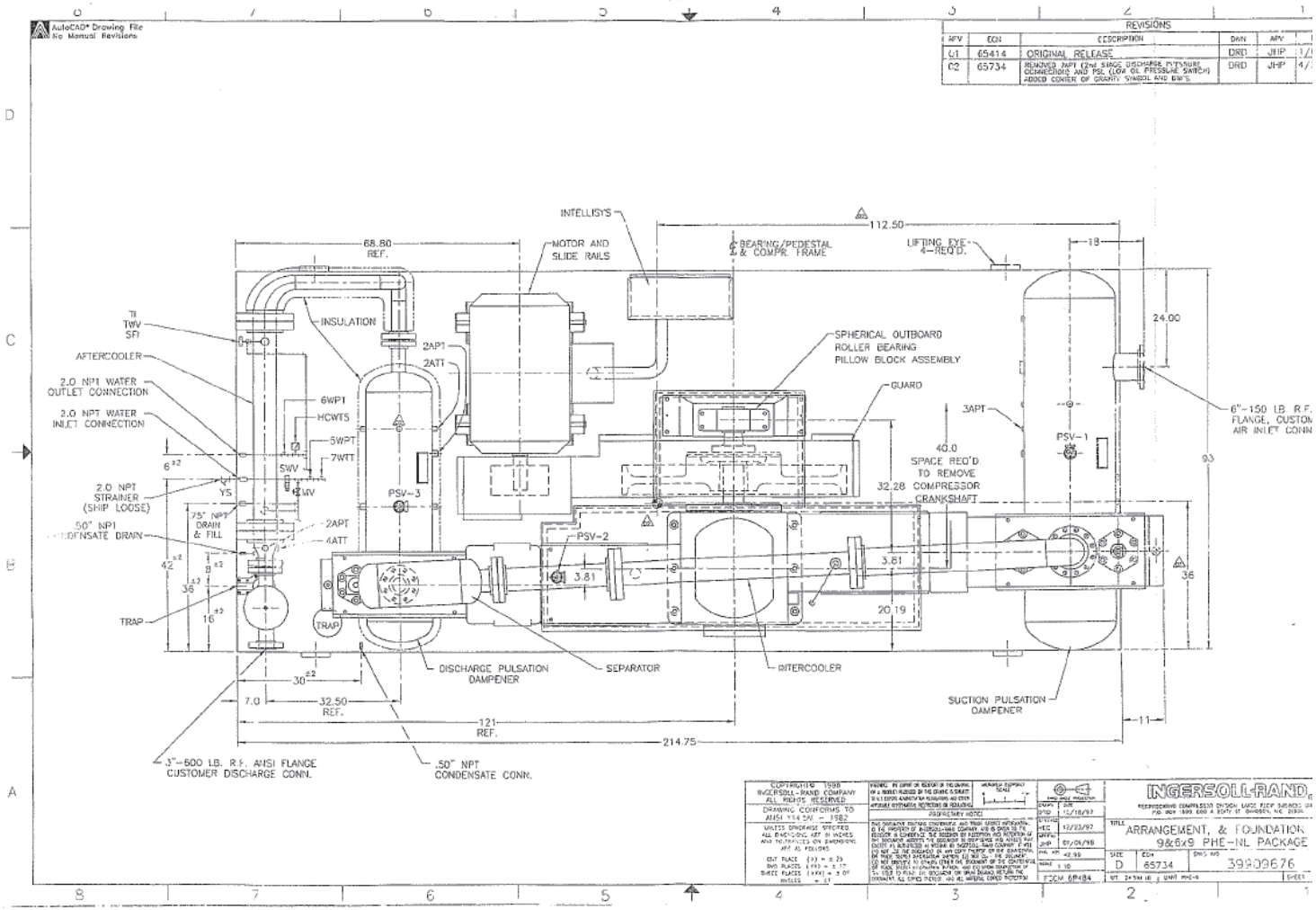
BOOSTER

DRAWINGS

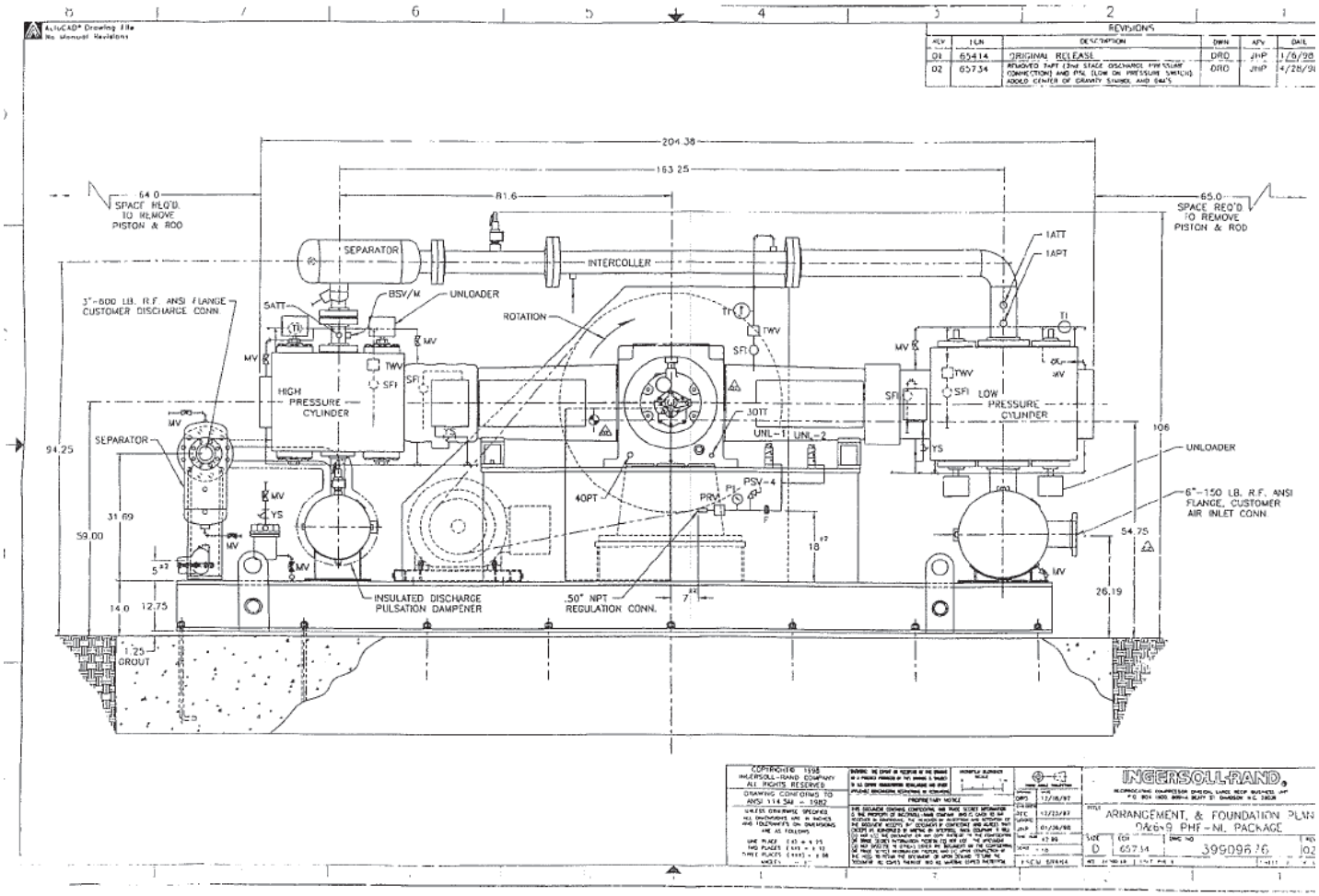
Ref: **5005.43**
Date: **01 February 2006**
Cancels: **30 March 2001**

FOUNDATION PLAN
9 & 6 x 9 PHE Package withOutboard Bearing
39909676



NOTE: Preliminary For Reference Only Do not use for planning purposes

FOUNDATION PLAN
9 & 6 x 9 PHE Package withOutboard Bearing
39909676



NOTE: Preliminary For Reference Only Do not use for planning purposes

Ingersoll Rand

Davidson, NC 28036

BOOSTER

DRAWINGS

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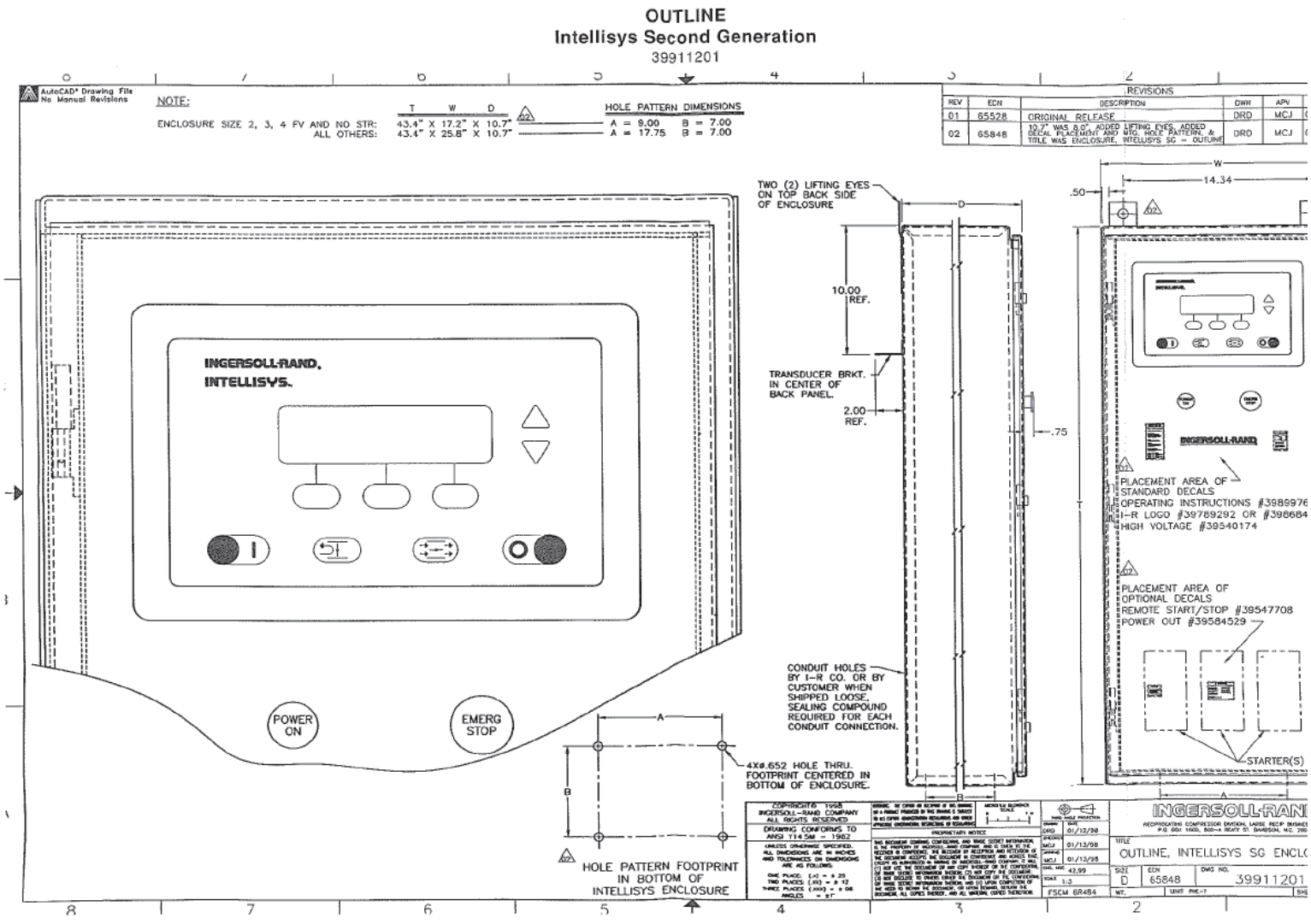
Date: **01 February 2006**
Cancels: **30 March 2001**



NOTE: Preliminary For Reference Only Do not use for planning purposes