



Simplicity

Serviceability

Reliability

Medium Industrial Systems
Davidson, North Carolina 28036

SG
Control System

Technicians Guide

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Printed in U.S.A.

Form APDD672A
August 2000

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SG INTELLISYS CONTROLLER INTRODUCTION

WORLDWIDE EPROM REVISION LEVEL 1.3 AND HIGHER

The Intellisys control system is an exclusive Ingersoll-Rand design developed for reliable compressor operation. The controller display can be programmed in nine languages and various units of measure for the pressure and temperature readings.

The microprocessor based controller uses a finger touch membrane for operation of the compressor and setting control parameters.

Information about the current operating status is available on a Liquid Crystal Display (LCD) from a 15-item list of temperature, pressure and filter condition readings.

The Intellisys monitors the compressor and should any pre-programmed limit be exceeded, the controller automatically displays a warning or issues an alarm to shut the compressor down.

The major components of the control system include the Intellisys, the Power Supply Board and a Stepping Motor to position the compressor's inlet valve.

A group of pressure and temperature sensors, relays and switches support the decision making process.

Operation of the control system will be easy after the following explanation of the control system components is read and understood. The explanation follows a logical path and begins at the primary side of the control voltage transformer. Use the electrical schematics provided in this publication or the Operator's Manual as a guide.

COMPONENT REVIEW

1FU - Fuses

1FU is the schematic designation for identical fuses designed for control transformer applications. A fuse is installed in each of the two wires connecting line voltage to the primary side of the control voltage transformer (T1). These fuses provide a degree of protection should a short-circuit develop in the transformer.

The fuses have a time-delay feature to handle the short duration, but very high, inrush current when power is first applied to the transformer. For an instant, the inrush current drawn by the transformer can be several times greater than the full-load rating.

These fuses are also current limiting to protect downstream components from damage and the magnetic effects of short-circuit currents. Current limiting is defined as being able to cut off a short-circuit current in less than one-half cycle (.008 second, 60 Hz). Generally speaking, this is long before damaging current levels are reached.

The fuses are Class CC high performance and have a unique shape on one end to fit into a corresponding shaped fuse holder. The shape is intended to prevent slower response fuses from being installed in the circuit.

The current rating of the fuses depends on the size of the control voltage transformer applied to the starter of the compressor. A chart is provided on the electrical schematic of the compressor to select replacement fuses.

T1 - Control Transformer

A step-down transformer (T1) reduces the incoming line voltage to levels suitable as the power source for the Intellisys control system.

The reduced voltage levels are called secondary connections and there are two.

One secondary circuit is rated at 120 VAC-1-60 (110 VAC-1-50) and is basically used to energize solenoid valves and starter coils. The "hot" connection is X2 and the neutral connection X1 is grounded to the starter chassis.

The other secondary circuit is rated at 24 VAC and the connections are X3 and X4. This circuit is described as an isolated secondary because neither X3 nor X4 is grounded to the chassis at this point.

The voltage is connected to a bridge rectifier located on the Power Supply Board and converted to approximately 33 VDC. A portion of the 33 VDC powers the stepping motor and a portion is

regulated down to 12 VDC and sent onward to the Intellisys.

A connection diagram for possible primary voltages is shown on the transformer and in the Operator's Manual. The transformer must be connected properly to avoid control system damage.

120/110 VAC Circuit - Transformer (T1) to Intellisys

The Intellisys controller receives 120/110 VAC power from T1 and, depending on operating conditions, sends the voltage onward to specific areas at specific times. Examples: energizing a starter coil at start-up or energizing a solenoid valve when the compressor loads.

The circuit begins at X2 and connects to the Intellisys in the following sequence.

2FU - Fuse

A dual element fuse in the 120/110 VAC secondary side of the control voltage transformer circuit to provide a degree of protection for the Intellisys controller.

Dual element fuses have two individual elements inside the fuse body.

One element, a spring actuated trigger assembly, operates on overloads up to 5-6 times the fuse current rating. When the overload has lasted long enough to soften a soldered area, the spring pulls the area apart to break the circuit.

The other element, the short-circuit section, operates on short-circuits up to the interrupting rating of the fuse.

A chart on the compressor's electrical schematic is provided to select a replacement fuse.

RFI Filter

A device within the 120/110 VAC circuit used to filter Radio Frequency Interference (RFI) and prevent undesirable electrical disturbances from entering the Intellisys.

In extreme instances, RFI can cause erratic control problems because the power supply is not steady.

Emergency Stop Switch

Located next to the Intellisys controller in the starter door and intended to stop the compressor in an emergency.

The switch has two sets of normally closed contacts that open when the red button is pressed. Refer to the electrical schematic and observe one contact to be in the 120/110 VAC circuit (ES-1) and the other contact in the 12 VDC logic circuit (ES-2) at P3 terminals 17 and 18.

These parallel contacts ensure power is removed from the starter coils and solenoids to cause the compressor to stop immediately.

The switch remains in the open position until manually reset by rotating the red button clockwise.

1TB - Terminal Block

A double row terminal block having 14 poles that serve as common connection points for wires within the control system. A decal identifies the terminal block (1TB) and each pole is numbered 1 through 14 reading from left to right.

When reading an electrical schematic, wires connecting to 1TB indicate which pole the wire connects to. Examples: 1TB-1 is the first pole and 1TB-7 is the seventh pole.

1ATS - High Air Temperature Switch

A normally closed switch installed in the discharge port of the airend that opens when the discharge temperature rises above 245°F (118°C). The mechanical switch serves as a back-up for the usual Intellisys temperature shutdown at 228°F (109°C).

1ATS is connected in the 120/110 VAC circuit and should it open, the Intellisys shuts the compressor down in an ALARM condition and causes the words "Control Power Loss" to appear in the display.

1PS - Interstage Pressure Switch (2-Stage Units / 250-450 Horsepower)

A normally closed switch monitoring interstage pressure on 2-stage airends and opens should pressure exceed approximately 100 psi. When the switch opens, the Intellisys stops the compressor in an ALARM condition and "Control Power Loss" appears in the display. 1PS must be manually reset.

This switch is not used on single stage compressors and a jumper wire is installed at the 1TB connection points.

P1 through P10 - Quick Connect/Disconnect Plugs

A group of different size plug-type connectors and mating receptacles used to attach wires to the Intellisys. The plugs and their receptacles are identified on the electrical schematic and back cover of the Intellisys. The plugs are designed to be inserted in one direction only.

The large receptacles at the lower edge of the Intellisys are a double-row design and care must be taken to ensure the single row plugs are inserted at the correct location.

As an example: P3 receptacle has two rows and each row has 16 connections.

The first row is close to the sheet metal starter door and numbered 1 through 16 reading left to right. The second row is away from the sheet metal starter door and numbered 17 through 32 reading left to right.

Remember.... the small numbers are close to the door, the large numbers are away from the door and the number sequence reads from left to right.

The 120/110 VAC circuit passes through a filter and a series of switches to connect to the Intellisys with the X2 "hot" wire at P1-1 and the X1 neutral wire at P1-10.

24 VAC Circuit - Transformer (T1) to Power Supply Board (PCB1)

The 24 VAC power from T1 connects to a bridge rectifier on the Power Supply Board and is converted to 33 VDC. A portion of the 33 VDC is used to power the stepping motor and a portion is regulated down to 12 VDC and sent onward to the Intellisys controller.

The circuit is between X3 and X4 and connects to the Power Supply board in the following sequence.

3FU - Fuse

A fast-blow fuse on the 24 VAC secondary side of the control voltage transformer provides a degree of protection for the Power Supply Board. The fuse is rated at 5 amps for compressors fitted with either 4 inch or 6 inch diameter inlet valves. The fuse is rated at 6 amps for compressors fitted with 8 inch diameter inlet valves.

The fuse is a non-time delay type and is intended to blow instantly when either a short-circuit is experienced or the voltage exceeds approximately 38 volts AC.

The short-circuit protection is basic but the high voltage protection works with the help of a Silicon Control Rectifier (SCR) on the Power Supply Board. When the SCR senses high voltage (approximately 38 volts AC), it diverts the circuit to ground and 3FU quickly blows before components beyond the fuse, such as the stepping motor drive chips, are damaged by high voltage.

Always use a BBS type fuse (or equivalent) rated for the amperage required by the specific compressor.

Power-On Light (24 VAC - Starter Door) (2LT)

A "Power-On" light is located on the starter box door next to the Intellisys controller.

When incoming power has been applied to the control voltage transformer and 3FU is in good condition, this light indicates 24 VAC is available to the Power Supply Board at J1 terminals 1 and 2.

As indicated, a "Power-On" condition exists and care must be taken to prevent injury or damage from contact with any part of the electrical circuit.

NEVER use an indicator light to confirm power has been turned off! A faulty bulb or loose wire will give a false indication.

Power Supply Board (PCB1)

A printed circuit board is located in the main starter box to supply power to the stepping motor and Intellisys controller.

Major items on the board include diodes, a bridge rectifier to convert 24 VAC to 33 VDC, two voltage regulators, capacitors, resistors, two drive chips for the stepping motor and a programmable (PAL) chip to provide logic for the drive chips.

There are four plug-in junctions (J1, J2, J3 and J4) on the board. J1 brings 24 VAC to the board from T1 transformer, J2 sends a 12 VDC power supply

to the Intellisys and J4 receives input from the Intellisys to tell the drive chips how far and in which direction to rotate the stepping motor. J3 sends power from the two drive chips on the Power Supply Board to the stepping motor.

Stepping Motor (3MTR)

The stepping motor is directly connected to the inlet valve of the compressor and operates on a DC voltage supply. The motor is bi-directional and as it rotates, the inlet valve is either opened or closed.

The stepping motor has multiple North/South permanent magnet poles on the rotor and two sets of interlaced windings in the housing. As the drive chips send variable strength electrical pulses to the two sets of windings, the windings are rapidly turned on and off in an exact sequence.

As the variable pulse is applied to the two sets of windings, one winding has an increase in pulse strength while the other set of windings has reduction of pulse strength. The combination of pulse sequence and strength causes the motor to turn in very short and precise .45° steps. The motor can rotate either clockwise or counter-clockwise.

The direction, distance and speed of rotation are a result of the drive chips varying the pulse strength in response to input from the Intellisys.

Stepper Limit (PCB2)

The Stepper Limit PCB2 is a printed circuit board located on the inlet valve that limits the inlet valve

rotation to approximately 90 degrees. The board has two optical limit switches and each emits an infrared light beam. When the light beam is interrupted, the controller receives an indication of valve position (open or closed).

Auxiliary Contacts

Small switches mounted directly on the side of the main motor contactors that serve to confirm the position of the contactor or energize electrical components.

There is a mechanical linkage between the auxiliary contact and the main contactor. As the main contactor closes, or opens, the mechanical linkage causes small switches within the auxiliary contact to change position.

The internal switches, usually two, can be normally open, normally closed or a combination of the two.

Auxiliary contacts are identified on electrical schematics according to which contactor they are attached. Examples... auxiliary contact 1Sa is attached to contactor 1S and auxiliary contact 2Ma is attached to contactor 2M.

When a contactor has more than one auxiliary contact attached, each auxiliary will be identified on the electrical schematic as 2Ma, 2Mb, etc.

Overload Relays (1OL/2OL)

The main motor and the fan motor are each equipped with overload relays that monitor the

current drawn by the motors. Should either motor draw excessive current, the relay will open to cause the compressor to stop. The relays are normally closed, operate on a 12-volt DC circuit and are shipped from the factory in the automatic reset position. The relays are identified on electrical schematics as 1OL for the main motor and 2OL for the fan motor.

Basically, the overload relay has a heat-generating element for each of the three phases supplying current to the motor. The heater element is sized for the current drawn by the motor at full load conditions. Should an overload condition develop to draw higher than normal current, the heater elements produce additional amounts of heat.

The additional heat is sensed by a small strip made of two dis-similar metals bonded together having different rates of expansion. As the bi-metal strip heats up, it bends as a result of the two different expansion rates until it trips the overload relay contacts to the open position. As the contacts open, the compressor is shut down in an alarm condition.

After cooling, the relay can be reset manually or automatically.

Coolant Filter Differential Pressure Switch (CPS)

A differential pressure-sensing switch is installed to monitor the condition of the coolant filter. The switch is normally open and closes across a 12 volt DC circuit when the filter differential exceeds 20 psi.

Emergency Stop - Logic Circuit (ES-2)

A normally closed contact in the 12 volt DC circuit that opens when the Emergency Stop button is pressed. As the contact opens, power is removed from the controller circuit. See the emergency stop switch section for further information.

Remote Stop Button (RSP) (Optional)

The button is intended to stop a running compressor from a remote location.

When the Remote Start/Stop option is installed and turned on in the set point routine, a normally closed switch must be connected between P3 terminals 19 and 20. The switch must be a momentary opening type (approximately .1 second). If a start attempt is made while the switch remains open, the controller will issue a Remote Stop alarm.

Remote Start Button (RST) (Optional)

The button is intended to start a stopped compressor from a remote location.

When the Remote Start/Stop option is installed and turned on in the set point routine, a normally-open switch must be connected between P3 terminals 21 and 22. The switch must be a momentary closing type (approximately 2 seconds).

A Remote Start alarm will be issued by the controller if the button is not released by the end of the star-delta transition time on star-delta units or 7

seconds after the button is pressed on full-voltage starters.

Pressure Sensors - 1AVPT, 3APT, 4APT, 5CPT and 6APT

Pressure transducers used to convert air pressure signals to a voltage signal between .5 and 4.5 volts DC.

The transducer contains a metal diaphragm connected to a small piece of steel called the beam which in turn has a strain gauge attached. As pressure pushes the diaphragm, the beam flexes and bends the strain gauge.

A continuous 5 volt DC supply is attached to the strain gauge assembly.

As the strain gauge bends due to the changing pressure on the diaphragm, the resistance value through the strain gauge changes a corresponding amount. The result is a variable output signal that ranges from .5 volts DC to 4.5 volts DC.

The output signal is processed by an analog-to-digital converter within the Intellisys controller. Depending on the voltage level, decisions are made by the Intellisys that may cause a change in the pressure reading on the display panel, unload the compressor or possibly shut the compressor down if conditions dictate.

If a pressure sensor is replaced, it is important to calibrate the new sensor. Basically, calibration allows the controller to read the sensor's output signal with the diaphragm in a totally relaxed state

and then correct for any minor deviations from .5 volts DC. Calibration directions are included in the Operator's Manual.

There are no adjustments to the pressure sensors.

1AVPT - Inlet Vacuum

A pressure sensor having a range between 0 and 15 psi vacuum connected to the airend inlet to provide vacuum information for the controller. The output voltage is .5 volts DC at 0 psi vacuum and 4.5 volts DC at 15 psi vacuum.

The controller uses inlet vacuum information to confirm the drive motor is rotating in the correct direction, to indicate the condition of the inlet air filter and to provide logic for positioning the inlet valve during modulation or unloaded operation.

3APT - Separator Tank Pressure

A pressure sensor applied to a range between 0 and 225 psi used to provide information about pressure within the compressor's receiver-separator tank. The connection point in the receiver-separator tank is referred to as sump pressure. The sump pressure is taken on the wet side (before air enters) the separator element.

The sump pressure is monitored for several reasons to include comparison to line pressure during the separator element differential check and to provide logic for the controller to position the inlet valve during unloaded operation.

The normal unloaded sump pressure is maintained

within a range of 24 to 33 psi to ensure adequate coolant flow and allow the unloaded compressor to operate at a low horsepower condition.

4APT - Package Discharge Pressure

A pressure sensor applied to a range between 0 and 225 psi used to provide information about the discharge pressure just prior to the compressed air leaving the package. The connection is downstream of the aftercooler and in the top of the moisture separator.

Package discharge pressure provides logic to load or unload the compressor and is compared with the sump pressure during the separator element differential check.

5CPT - Injected Coolant Pressure (2 Stage Compressors Only)

A pressure sensor phased into production approximately mid-May, 2000 and applied to a range between 0 and 225 psi to provide information about the pressure of the coolant/lubricant at the injection port on 2 stage compressors.

5CPT will cause a "Low Coolant Pressure" alarm (!) to be issued if the compressor is running and the coolant pressure falls below 1 psi and either the sump pressure is greater than 10 psi or the inlet vacuum is less than 12 psi.

DO NOT enable this option if coolant pressure 5CPT is not installed. This will cause a 5CPT Failure alarm (!).

6APT Separator Delta-P Sensor

A sensor phased into production approximately mid-May, 2000 to replace the Separator Solenoid (8SV). The separator delta-p-sensor is enabled through the Options set point routine.

When the sensor is enabled, the Intellisys will measure the separator element pressure drop by subtracting the dry side sump pressure (6APT) from the wet side sump pressure (3APT).

DO NOT enable this option if the separator element sensor (6APT) is not installed. This will result in an incorrect measurement and a 6APT warning (?).

Temperature Sensors - 2CTT, 2ATT and 4ATT

Temperature sensitive resistors called thermistors used to monitor temperature changes at various points within the compressor package. They operate on a 5 volt DC circuit.

As the temperature of the sensor changes, either higher or lower, the resistance through the sensor changes a corresponding amount.

As the output voltage varies due to the temperature changes, the voltage strength is processed by an analog to digital converter within the controller.

Depending on the output voltage from the various sensors, the controller makes decisions that may change a number on the panel display, delay a differential pressure reading until the compressor warms up, reposition the inlet valve slightly during

cold unloaded operation, provide a Warning about rising temperature or could possibly shut the compressor down with an Alarm if operating conditions dictate.

2CTT - Injected Coolant Temperature Sensor

A temperature sensor monitoring the injected coolant flow into the airend. The injected coolant absorbs heat generated during the air compression, lubricates moving parts and seals clearances between the rotors and the housing.

When Injected Temperature has been selected on the Current Status display, 2CTT provides the information to the controller.

When a compressor is operating unloaded and the injected coolant temperature is below 120°F (49°C), 2CTT provides information to the controller which automatically opens the inlet valve a small amount. Opening the inlet valve a small amount raises the unloaded sump pressure approximately 20 psi to promote flow of the cold coolant.

As the injected coolant temperature rises above 120°F (49°C), the controller recloses the inlet valve the small amount to return the unloaded sump pressure to the 24 to 33 psi range.

2CTT also provides information to the controller during checks of the Coolant Filter condition on the Current Status display.

When the injected coolant temperature is below 120°F (49°C) during the Coolant Filter check on a

running unit, the controller assumes the cold coolant will be more viscous and the pressure differential across the filter will be higher than normal. As a result, the controller will advise "Unit Too Cold" in the display until the injected coolant temperature rises above 120°F (49°C).

2ATT - Airend Discharge Temperature Sensor

A temperature sensor monitoring the temperature of the air/coolant mixture as the flow leaves the airend discharge port. Typically, this sensor is located adjacent to the flange area of the discharge housing and just before the air/coolant mixture enters the airend discharge check valve.

When Airend Discharge Temperature has been selected on the Current Status display, 2ATT provides the information to the controller.

Should 2ATT observe the airend temperature exceed 97% of the 228°F (109°C) High Airend Discharge Temperature alarm, the controller will place the symbol (?) and the airend discharge temperature in the Current Status display. The compressor continues to run during the temperature Warning.

If the airend discharge temperature continues to rise, 2ATT advises the controller of the condition and when the temperature exceeds 228°F (109°C), the controller shuts the compressor down. The Current Status display will show the symbol (!) followed by the words High Airend Discharge Temperature and the shutdown temperature.

4ATT - Package Discharge Temperature Sensor

Monitors the temperature of the compressed air downstream of the compressor's aftercooler. Typically, this sensor is located in the top of the moisture separator.

When Package Discharge Temperature has been selected on the Current Status display, 4ATT provides the information to the controller.

This sensor is for temperature information only and has no Warning or Alarm feature.

P7 - Communications Port

A plug-in port to connect the controller to an Intellisys System Controller (ISC) or an Intellisys Remote Interface (IRI).

P8 - Expansion Port

Used for Integral Sequencing.

P9 - Option Module Port

This plug-in port receives the 5-pin option modules that add logic to the controller. The modules can be factory or field installed and are indexed to be inserted in one direction only. After the module has been installed, it must be activated in the setpoint routine. See the Operator's Manual for details.

Four option modules are available for compressors built with Intellisys controllers containing

EPROM revision level 1.23 and lower:

Automatic Start/Stop
Remote Start/Stop
Automatic Start/Stop with Remote Start/Stop
Automatic Start/Stop with Remote Start/Stop and Power Outage Restart Option (PORO)

Compressors equipped with Worldwide EPROM revision level 1.3 and higher require an option module for power outage restart option (PORO) only.

P1 - Power and Triac Output Plug

A ten terminal plug that receives 120/110 VAC from control transformer T1 and sends 120/110 VAC power to starter and solenoid coils. The power to the coils is controlled by a group of triacs under the direction of the controller.

Triacs are solid-state devices that act as switches to energize or de-energize the starter and solenoid coils.

The power circuit begins with the "hot" wire connected at P1-1 and the neutral, or ground wire, is connected at P1-10.

The presently used triac outputs to the star-delta starter coils are indicated on the electrical schematic as Output 1 and Output 2. Full-voltage starters use Output 1 only.

The blowdown solenoid valve (3SV) is energized and de-energized by Output 4 on either type starter.

Larger units may have two solenoids (3SVa and 3SVb) wired parallel.

Triac output 3 is for the fan motor starter (if used), output 8 operates the optional PORO horn. Outputs 5, 6 and 7 are reserved for other special uses.

Starter Logic - Full Voltage

When the controller places the message “Ready To Start” in the left side of the display and the Start button is pressed, the following takes place.

Triac output 1 sends 120/110 volts AC to the coil of 1M. As 1M pulls in, the mechanical action of the main contactor causes auxiliary contact 1Ma to close between P3 terminals 7 and 8. This closure of 1Ma confirms 1M physically pulled in as directed.

At the instant 1Ma closes, 1Mc also closes to energize the coolant stop solenoid (5SV). Had the compressor been water-cooled, the water shut-off solenoid (4SV) would also be energized at this time.

1Mc has an arc suppressor (RC-3) wired across the contacts to eliminate any power surges that might disrupt adjacent low voltage circuits. Refer to the full-voltage electrical schematic in the Operator’s Manual.

The compressor motor (1MTR) and the fan motor (2MTR) are now running.

Had the controller not seen 1Ma close, it assumes

there is a problem within the starter coil circuit (such as a loose wire or faulty triac) and issues an alarm. At that time, the words “ALARM” and “Starter Fault” appear in the Current Status display.

When the Stop button is pressed, 1M contactor becomes de-energized and opens. As 1M opens, the controller confirms 1Ma also opened or a Starter Fault alarm will be issued.

The coolant stop solenoid (5SV) is de-energized as 1Mc opens at the same time.

The previously described starting and stopping activity is basically the same for Automatic Start/Stop, Remote Start/Stop or Power Outage Restart (PORO).

Starter Logic - Star-Delta

When the controller places “Ready To Start” in the left side of the display and the Start button is pressed, the following takes place.

Triac output 2 sends 120/110 volts AC through a set of normally closed auxiliary contacts (2Mb) to the coil of contactor 1S.

As 1S pulls in, the mechanical action of the contactor causes auxiliary contact 1Sa to close between P3 terminals 9 and 10. The closure of 1Sa confirms to the controller that 1S did physically pull in as directed.

Contactor 1S has a total of four auxiliary contacts and the function of the remaining three must be

understood.

At the same instant 1Sa closed, auxiliary contact 1Sb also closed to complete a yet to be energized circuit to the coil of contactor 1M.

Also at the same instant, auxiliary contacts 1Sc and 1Sd opened to electrically isolate the coil of contactor 2M.

At this time, the only energized contactor coil is 1S and triac output 2 energized it. Refer to the star-delta electrical schematic in the Operator's Manual.

However, just 50 milliseconds after 1S pulled in, triac output 1 activates to send 120/110 volts through the now closed auxiliary contact 1Sb to the coil of contactor 1M.

As 1M pulls in, the mechanical action of the contactor causes auxiliary contact 1Ma to close between P3 terminals 7 and 8. The closure of 1Ma confirms to the controller that 1M contactor did physically pull in as directed.

Contactor 1M has a total of three auxiliary contacts and the function of the remaining two must be understood.

At the same instant 1Ma closed, auxiliary contact 1Mb also closed and, in effect, created a parallel circuit with auxiliary contact 1Sb.

Also at the same instant, auxiliary contact 1Mc closed to energize the coolant stop solenoid (5SV). If the compressor is water or remote air cooled, the

water shut-off (4SV) and remote cooler pressure relief solenoid (7SV) would also be energized. Auxiliary contact 1Mc has an arc suppressor (RC 3) wired across the contacts to eliminate any power surges that might disrupt adjacent low voltage circuits. Refer to the star-delta electrical schematic in the Operator's Manual.

At this time, contactor 1S is energized by triac output 2 and contactor 1M is energized by triac output 1.

The compressor motor (1MTR) is now connected in the star connection and accelerating at a reduced internal voltage and reduced torque. The acceleration time is generally in the ten second range and controlled by an adjustable timer in the controller's setpoint routine.

The fan motor (2MTR) is running at full voltage conditions.

At the end of the ten second time interval, triac output 2 removes the 120/110 volt AC supply to de-energize the coil of contactor 1S.

As contactor 1S opens, the mechanical action causes auxiliary contacts 1Sa and 1Sb to open and auxiliary contacts 1Sc and 1Sd to close.

1Sa opened the confirmation circuit at P3 terminals 9 and 10 and 1Sb opened half of the parallel circuit originally supplying voltage to the coil of contactor 1M.

The closing of 1Sc and 1Sd cause contactor 2M to become energized.

Auxiliary contacts 1Sc and 1Sd each have an arc suppressor wired across the contacts to eliminate any power surges that might disrupt adjacent low voltage circuits.

As 2M becomes energized, auxiliary contact 2Ma closes between P3 terminals 9 and 10. The closure of 2Ma confirms to the controller that 2M did pull in as directed.

Note: there is a short delay between the opening of 1Sa and the closing of 2Ma to prevent nuisance Starter Fault alarms during the transition period.

Contact 2M has a total of two auxiliary contacts and the function of the remaining auxiliary contact must be understood.

At the same instant auxiliary contact 2Ma closed, auxiliary contact 2Mb opened to electrically isolate the coil of contactor 1S.

The compressor motor (1MTR) is now connected in the delta connection at full speed and full torque.

P2 - Remote Alarm Contact

A relay having a normally-open contact and a normally closed contact that change position when the controller issues an Alarm.

Customer supplied voltage through the contacts can operate a remote light or horn. The contact is rated at 5 amps and 250 volts AC.

When the alarm condition has been corrected and the Intellisys reset, the contacts return to their original position.

SG INTELLISYS INPUT/OUTPUT INFORMATION

WORLDWIDE EPROM REVISION LEVEL 1.3 AND HIGHER

The standard Intellisys controller requires input from several sources to control the compressor.

Analog-To-Digital Inputs *

- Inlet Vacuum - 1AVPT
- Separator Tank Pressure - 3APT
- Package Discharge Pressure - 4APT
- Injected Coolant Pressure - 5CPT
- Separator Delta-P Sensor - 6APT
- Injected Coolant Temperature - 2CTT
- Airend Discharge Temperature - 2ATT
- Package Discharge Temperature - 4ATT

* Analog-To-Digital inputs are voltage measurements that have been converted to digits (numbers) for the display.

Switched Inputs *

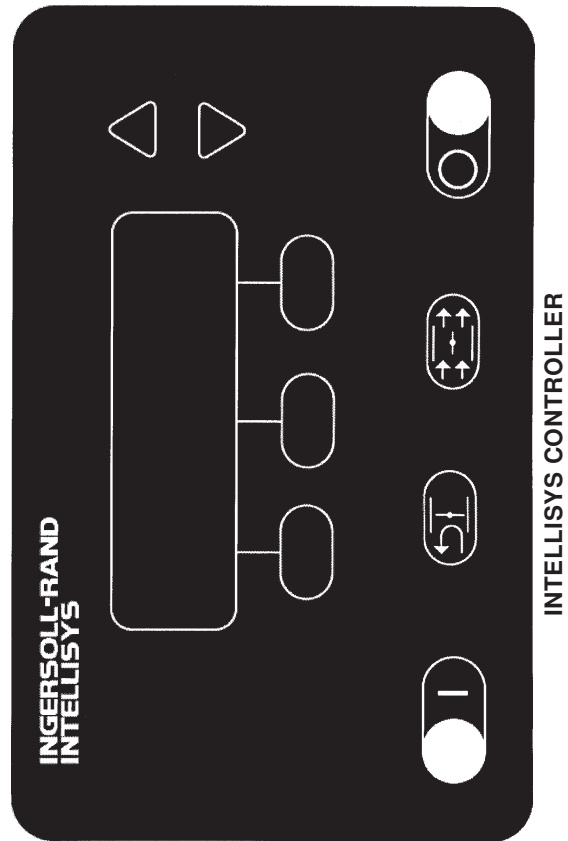
- Starter Interlock - 1Ma (N.O.)
- Starter Interlocks - 1Sa and 2Ma (N.O.)
- Main Motor Overload - 1OL (N.C.)
- Fan Motor Overload - 2OL (N.C.)
- Emergency Stop Button - 2 contacts - (N.C.)
- Coolant Filter Differential Switch (N.O.)
- Remote Start (N.O.)
- Remote Stop (N.C.)
- Stepper Limit Switches (2)
- Interstage Pressure Switch (2 Stage Only) - (N.C.)
- Line Voltage Monitor (Optional) - (N.O.)

- * Switched inputs are the action of contacts opening or closing within the circuit. The Stepper Limit switches are solid-state devices but the effect is the same. There is a 1-second delay on all switched inputs.

Triac Outputs *

- Out 1 - Energizes contactor coils 1M and 2M
- Out 2 - Energizes contactor coil 1S
- Out 4 - Energizes solenoid(s) 3SVa and 3SVb
- Out 7 - Energizes Remote Warning (?) Relay
- Out 8 - Energizes Optional PORO Horn

- * Triacs are solid-state switches to energize or de-energize starter and solenoid coils.



EMERGENCY STOP

Pressing this switch stops the compressor immediately. The compressor can not be restarted until the switch is manually reset. Turn the switch knob clockwise to reset.



POWER ON LIGHT

This indicates the control voltage and the line voltage are available for starting.



The operator panel is divided into two areas. The bottom row of four buttons provides direct control over the starting, stopping, unloading and loading of the compressor. These are defined by the symbols printed on the buttons themselves, as shown here.

START

Pressing this button will start the compressor if the display shows "Ready To Start". The compressor will start and load if there is sufficient demand for air.



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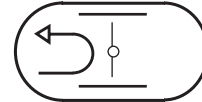
STOP

Pressing this button will activate the unloaded stop sequence. If the compressor is running loaded, it will unload and continue to run unloaded for an adjustable 10 to 30 seconds and then stop. If the compressor is running unloaded, it will stop immediately.



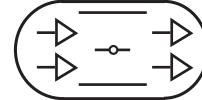
UNLOAD

Pressing this button will cause the compressor to unload and remain unloaded. The display will indicate the machine is "Running Unloaded", and "Mode: UNLOAD".



LOAD

Pressing this button will cause the compressor to load if the compressor is running and if the "Discharge Pressure" is less than the "Online Pressure". This also returns the machine to the operating mode that is specified by the "Mode of Operation" set point.



The other five buttons provide access to various operator-selectable functions and machine operating conditions. The purpose of each of these buttons is defined by the display screen and the particular function being performed at that time.

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ARROWS

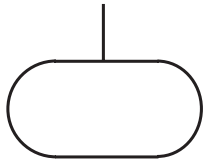
These up and down buttons have multiple functions relating to the right half of the display screen. When lists are presented, the buttons are used to move up or down through the items on the list. The small arrow(s) displayed in the upper right corner of the display screen indicate when you can move up (designated by arrow head pointing up) and/or down (designated by arrow head pointing down) through the list.



When the value of a specific machine operating parameter is highlighted on the display screen for the purpose of changing that value, the buttons are used to change the value itself.

DISPLAY BUTTONS

The functions of the three buttons below the display screen change and are defined by the words immediately above them in the bottom line of the screen. Each function, such as MAIN MENU, STATUS, SET, etc., is described in appropriate sections in this manual.



on individual page
to large for 8-1/2 x 11

SG DISPLAY SCREEN

When power is first applied to the compressor, the Intellisys makes a check of the required inputs and displays "Checking Machine" during this time. If all inputs are correct during the three second check, the display changes to "Ready To Start". Information concerning line pressure (if any) and the software revision level is also shown. The STATUS, MAIN MENU and START buttons are now active.

This display appears once, each time power is applied and remains until either the STATUS, MAIN MENU or START button is pressed. Pressing either of these buttons will perform the normal function of the button pressed. No other buttons are active at this time.

However, when the Power Outage Restart Option (PORO) is installed and turned ON, this display appears during the PORO count down time. When the compressor restarts, the display is automatically replaced by the CURRENT STATUS items "Package Discharge Temperature" and "Airend Discharge Temperature".

A separate display continuously shows Package Discharge Pressure.

Any of the Current Status readings selected will remain on the display until another status item is chosen. Use the Up or Down buttons at the right of the display to change the selection.

The display does not scroll through the list and automatically return to the start. When either the

first or last item on the current status list has been reached, use the Up or Down button to reverse the scrolling direction. There is a small arrow prompt within the display indicating which of the two buttons to use. The ↑ prompt is for the Up button and the ↓ prompt is for the Down button. The ⇅ prompt indicates the current status display is somewhere in the middle and either the Up or the Down button can be used.

Current Status Items:

Package Discharge Temperature	↑↑
Airend Discharge Temperature	⇅
Injected Coolant Temperature	⇅
Sump Pressure	⇅
Separator Pressure Drop	⇅
Coolant Filter	⇅
Inlet Vacuum	⇅
Inlet Filter	⇅
Total Hours	⇅
Loaded Hours	⇅
% Load	⇅
Unloaded Inlet Vacuum	⇅
Coolant Pressure	⇅
Time - Date	⇅
Program Name (Revision Level)	↓↓

The controller automatically returns the display to the CURRENT STATUS screen showing Package Discharge Temperature and Airend Discharge Temperature from other MAIN MENU screens if no other buttons are pressed within 30 seconds.

OPERATOR SETPOINTS

Operator Setpoints are user-adjustable settings in the controller logic that can be changed using the OPERATOR SETPOINTS screen. Changes to the Operator Setpoints can be made while the compressor is in operation.

The Operator Setpoints listed below can be seen on the screen by moving the list up and down using the arrow buttons.

<u>Operator Setpoints</u>	<u>Range</u>	<u>Step</u>	<u>Unit</u>
Lead / Lag	Lead or Lag	1	
Off Line Pressure	75 to Rated + 3	1	PSI
On Line Pressure	65 to Off Line - 10	1	PSI
Lag Offset	0 to 45	1	PSI
Mode of Operation	Mod/ACS, On/Off Line or Modulation Only		
Maximum Modulation Pressure	On line + 10 Offline + 7	1	PSI
Load Delay Time	0 to 60	1	Sec.
Stop Delay Time	10 to 30	1	Sec.
Star-Delta Time *	10 to 20	1	Sec.
Screen Contrast	0 to 10	1	Shade

* Does not apply to full voltage or no starter applications.

The setpoint value can be changed by highlighting the item and its value and pressing the SELECT button to highlight just the value. When the value line is highlighted by itself, the value can be adjusted using the up and down arrows. The CANCEL and SET buttons appear at this time. Press the SET button to enter the new value, or press the CANCEL button to return the value to the setpoint prior to using the arrows. The displayed value will flash twice to indicate it has been entered into the setpoint, and the pair of setpoint items and value display lines will again be highlighted together.

Operator setpoints can be exited by pressing either the STATUS or MAIN MENU buttons. If no buttons are pressed within 30 seconds, the display automatically returns to the CURRENT STATUS screen showing Package Discharge Temperature and Airend Discharge Temperature.

OPTIONS

Options are turned ON or OFF and their associated values are set using the OPTION screen. Option settings can be observed but not changed when the compressor is running.

Some options require additional compressor hardware and the proper "Option Module" to plug into the Intellisys controller at P9.

The name and value of each option listed below can be seen by moving the list up and down using the arrow buttons.

<u>Option Items</u>	<u>Range</u>	<u>Step</u>	<u>Unit</u>
Automatic Restart	ON/OFF	_____	_____
Automatic Restart Time	2 to 60	1	Minutes
Automatic Restart Time	0 to 60	1	Seconds
Sequencer	ON/OFF	_____	_____
Remote Start/Stop	ON/OFF	_____	_____
Power Outage Restart	ON/OFF	_____	_____
Power Outage Restart Time	10 to 600	1	Seconds
Low Ambient	ON/OFF	_____	_____
Minimum Cooler Out Temp.	30 to 150	1	Degrees F.
Delta-P Solenoid	ON/OFF	_____	_____
Delta-P Sensor	ON/OFF	_____	_____
Lead/Lag Cycle Length	0 to 750	1	Hours
Scheduled Start	00:00 to 23:59	1	Time
Scheduled Stop	00:00 to 23:59	1	Time
High Dust Filter	On/Off	_____	_____
Modbus Protocol	On/Off/ICU	_____	_____
Modbus Address	1 to 247	1	_____

An OPTION item value can be changed and the routine exited the same as OPERATOR SETPOINTS.

FACTORY SETPOINTS

To access... Power must be applied to the compressor with READY TO START showing in the display.... press the center (MAIN MENU) display button two times and then press the LOAD button followed by the UNLOAD button, all within three seconds.

To change settings... The values of the Factory Setpoints can be changed using the same buttons and procedures used to change the Operator Setpoints. Refer to the Operator's Manual for details.

To exit... Press either the STATUS or MAIN MENU buttons. If no buttons are pressed within 30 seconds, the display will automatically return to the Current Status screen showing Package Discharge Temperature and Airend Discharge Temperature.

Contents

Language

English, Español, Portugues, Fracais, Italiano, Nederlands, Deutchland, Dansk, Norsk, Svensk, Loppu, Turkge

Unit of Measure

PSI and °F, PSI and °C, Bar and °C, kPa and °C, Kg/cm² and °C

Rated Pressure

PSI	100	125	140	150	165	200
Bar	7.0	8.5	9.8	10.5	11.6	14.0
kPa	700	850	960	1030	1140	1380
Kg/cm ²	7.0	8.5	9.8	10.5	11.6	14.0

Power

HP: 50, 60, 75, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500

Kilowatts: 75, 90, 110, 132, 150, 200, 250, 300, 350

Starter Type

Star-Delta (built in)... logic provides two 120/110 volt outputs. One output energizes 1S contactor and the second output energizes 1M contactor 50 milli-seconds later.

2M contactor is energized through a permissive circuit when 1S becomes de-energized at the end of the Star (Wye) connection. Refer to the electrical schematic for details.

Three auxiliary contacts (1Sa, 1Ma, and 2Ma) monitor and confirm the main contactors (1S, 1M and 2M) have closed, or opened, in the correct sequence.

Direct on Line (built in)... logic provides one 120/110 volt output to energize 1M contactor and one auxiliary contact (1Ma) to monitor and confirm 1M has either closed or opened.

No Starter (remote)... logic provides only one 120/110 volt output to energize the remote starter circuit. A remote direct on line starter requires only one 120/110 volt output.

(Remote) star-delta, solid-state & soft starters typically contain their own timing circuits and also require only one 120/110 volt output to begin the starting process.

There are two active inputs required by the Intellisys located at plug P3 terminals 7 & 8 and 9 & 10 that must be operated by auxiliary contacts on the remote starter. As the remote auxiliary contacts close, or open, confirmation is given to the Intellisys concerning the contactor position.

In the case of a remote direct on line starter, these two inputs can be wired parallel using one auxiliary contact attached to 1M. The parallel connection would be to wire one side of the auxiliary contact to 7 & 9 and the other side to 8 & 10.

In the case of a remote star-delta, solid-state or soft starter, the two inputs are wired separately and two auxiliary contacts are required.

One auxiliary contact, (1Ma - wired across 7 & 8) closes as the main contactor pulls in to confirm the remote starting process has begun.

The second auxiliary contact (2Ma - wired across 9 & 10) closes a few seconds later to confirm the starting process is complete and the motor has reached full speed.

Total Hours...Allows the hour meter to be reset to match the total run time of the compressor.

Loaded Hours... Allows the hour meter to be reset to match the total hours the compressor has been operating in a loaded condition. The loaded hours are counted when the compressor is fully loaded in On-Line or partially loaded in Modulation.

SENSOR CALIBRATION

Pressure sensor calibration is done through the SENSOR CALIBRATION screen. Sensor calibration can only take place when the compressor is stopped. Calibration needs to be done only after a sensor has been replaced or the Intellisys controller has been replaced.

SENSOR CALIBRATION Items

Sensor 1AVPT
Sensor 3APT
Sensor 4APT

Sensor 1AVPT is the inlet vacuum, sensor 3APT is the sump pressure, and 4APT is package discharge pressure sensor.

To Calibrate... The compressor must be stopped with "Ready To Start" showing in the display. All pressure must be vented by disconnecting the tubing at the sensor. This is very important or the calibration will be incorrect and an Invalid Calibration alarm will be issued if the sensor output signal is greater than 10% of the range during calibration.

Press the MAIN MENU button and then use the down arrow to highlight SENSOR CALIBRATION. One of the three pressure sensors will appear in the display and be highlighted with the word "CALIBRATE". Use the up or down arrow to choose the sensor to be calibrated.

Press the SELECT button to highlight CALIBRATE. At this time, the SELECT button changes to a CALIBRATE button. Press the CALIBRATE button. The displayed sensor flashes twice to indicate it has been entered into the controller, and the sensor name and CALIBRATE will again be highlighted together.

The calibration routine can be exited by pressing the STATUS or MAIN MENU button. If no buttons are pressed within 30 seconds, the display will automatically return to the CURRENT STATUS screen showing Package Discharge Pressure and Aired Discharge Temperature.

WARNINGS (?)

When a Warning occurs, the symbol (?)* will flash on the screen. The display message will indicate what caused the Warning and the RESET button appears. A running compressor will continue to run and provide compressed air during a Warning.

If multiple Warnings exist, the small up and down arrows will appear in the upper right corner of the display screen. The multiple Warnings can be seen by pressing the up and down arrow buttons.

* *Revision Level L3 and larger.*

Pressing the STATUS button will display the CURRENT STATUS screen. The STATUS button changes to a WARNING button indicating other Warnings still exist. The RESET button disappears at this time. Use the up and down arrows to observe the CURRENT STATUS items associated with the Warning in the display.

Pressing the WARNING button will return the display to the WARNING screen and the RESET button returns. When the cause for the Warning has been corrected, press the RESET button twice to clear the controller. A WARNING remains on the screen until it is RESET by an operator.

Warning Messages

AIREND DISCHARGE TEMPERATURE... This will occur if the airend discharge temperature as indicated by 2ATT exceeds 97% of the High Airend Discharge Temperature alarm limit of 228°F(109°C) and is not adjustable. The Warning appears at approximately 222°F(105°C).

CHANGE COOLANT FILTER... This warning will occur if the high side pressure is 20 psi greater than the low side pressure of 1DPS, and the injected coolant temperature is greater than 120°F(49°C).

CHANGE INLET FILTER... On units equipped with standard inlet filters this will occur if the inlet vacuum (1AVPT) is greater than 0.7 psi and the compressor is fully loaded with the inlet valve in the full open position.

On units equipped with EPROM 1.3 & Higher,

enabling the High Dust Filter option causes the controller to issue a Change Inlet Filter warning.

Also, when the inlet vacuum (1AVPT) exceeds .7 psi for 50 - 100 horsepower units, .9 psi for 125 - 200 horsepower units, 1.1 psi for 250 - 300 horsepower units or 1.3 psi for 350 - 500 horsepower units while the compressor is loaded with the inlet valve in the full open position, the warning will be issued.

DO NOT enable this option unless a high dust option is installed.

CHANGE SEPARATOR ELEMENT... This warning will occur if the pressure on the wet side of the separator element (3APT) is 12 psi greater than the pressure at the package discharge (4APT) when the compressor is fully loaded with the inlet valve in the full open position.

HIGH DISCHARGE PRESSURE... This warning appears when the package discharge pressure (4APT) rises above the maximum Off Line pressure (Rated Pressure + 3 psi) for more than 3 seconds. The higher than normal pressure can result from an improperly adjusted sequencer or Intellisys System Controller (ISC). Connecting the unit into a higher pressure air system will have the same effect.

The host controller will not be able to load the compressor until the package discharge pressure falls to the compressor's rated pressure.

SENSOR FAILURE 4ATT... This will occur if the package discharge temperature sensor is recog-

nized as missing or broken.

AUXILIARY 1 (or 2)... This will occur if either of the auxiliary contacts closes.

HIGH SUMP/LINE DIF... This warning will occur if the compressor is running loaded, the injected coolant temperature is greater than or equal to 120 deg. F, the package discharge pressure is greater than 90 psig, the sump pressure is greater than the compressor's rated pressure, and the sump pressure is 25 psig or more above the package discharge pressure.

COMMUNICATION FAIL 1 (or 2-4)... This warning will occur if the compressor is the lead unit while using integral sequencing and is unable to communicate with another compressor.

SERVICE REQUIRED... The Intellisys has two levels of service. The service level can be set at the factory or by an Ingersoll-Rand service representative. Either service level will issue a "SERVICE REQUIRED" warning at 150 hours. This warning is a reminder for initial service and can be cleared by the operator.

Level 1 - If service level 1 (default) is selected, a "SERVICE REQUIRED" warning will be issued every 2000 operating hours. This warning is to serve as a reminder to have the unit serviced and can be cleared by the operator.

Level 2 - If service 2 is selected, service warnings will be issued every 2000 operating hours (default) or in 3, 6, 9, or 12 month intervals, as selected at the factory or by an IR service representative.

Service warnings at level 2 are issued in stages. First "100 HOURS TO SERVICE: or "14 DAYS TO SERVICE" (depending on the service interval type) warning will be issued. This warning will let the operator know that the time for service is approaching, and it can be cleared by the operator. Following that, 100 hours or 14 days later a "SERVICE REQUIRED" warning will be issued. This warning can be temporarily cleared by the operator, however, it will return 24 hours later if service has not been performed by an IR service representative. A new service period will start when service is performed. If another 100 hours or 14 days elapses and service has not been performed, an "ALARM-SERVICE REQUIRED" warning will be issued. This warning can only be cleared by an IR service representative.

SENSOR FAILURE 6APT... This warning will occur if the separator delta- p sensor option is installed and sensor 6APT is recognized as missing or broken.

CHECK INLET CONTROL... (E-Prom revision 1.33 and higher ONLY. Lower revision levels will display this as an alarm) This will occur if the compressor is unloaded and the inlet vacuum is less than 3 psi (.2 bar).

The inlet valve not closing far enough when the compressor is unloaded (a slipped or broken stepper motor coupling), 3APT out of calibration, a faulty closed limit switch or broken closed limit switch wire can be causes

ALARMS (!)

When an Alarm occurs, the exclamation mark (!) will appear and the display message will indicate what caused the Alarm and the RESET button appears. A running compressor will shut down as the Alarm is issued and the Remote Alarm Relay contacts change position. The compressor can not be restarted, either manually or automatically, until the cause for the Alarm is corrected and the Intellisys controller reset by an operator.

A compressor that is already stopped when the Alarm occurs can not be started either manually or automatically until the cause for the Alarm has been corrected and the Intellisys controller reset by an operator.

Pressing the STATUS button will activate the ALARM STATUS screen with the ALARM button indicating an Alarm still exists. Alarm Status is the list of compressor operating conditions that existed at the time of the Alarm.

The name and value of each of the items listed can be seen by moving the list up and down using the arrow buttons. Pressing the ALARM button will return the screen to the Alarm screen and the RESET button returns.

The Alarm can be reset by an operator pressing the RESET button twice after the cause for the alarm has been corrected.

Alarm Messages

CHECK INLET CONTROL... (E-Prom revision level

1.3 and lower. Higher revision levels will display this as a warning) This will occur if the compressor is unloaded and the inlet vacuum is less than 3 psi (.2 bar).

The inlet valve not closing far enough when the compressor is unloaded (a slipped or broken stepper motor coupling), 3APT out of calibration, a faulty closed limit switch or broken closed limit switch wire can be causes.

CHECK INLET CONTROL SYS 1 (2)... This will occur if the inlet butterfly valve fails to open or close properly. A 1 means the inlet valve failed to close properly. A 2 means the inlet valve failed to open. This will occur when the stepper motor is directed to move the inlet valve to the full open position or the full closed position. At this time, the Intellisys controller must see the infrared light beam broken by the coupling entering the appropriate switch on the Stepper Limit card.

A faulty stepper motor, drive chip failure and loose or broken wires could be causes. See the description of the Stepper Limit Card and Stepper Motor logic for further information.

CHECK MOTOR ROTATION... After applying incoming power to the compressor, this alarm occurs if 1AVPT does not sense at least 1 psi vacuum within 2 seconds after starting. The vacuum is generated when the airend rotates in the correct direction with the inlet valve closed.

When the controller has once confirmed correct rotation, this alarm will not be checked again until the

incoming power supply has been removed from the compressor.

CONTROL POWER LOSS... This alarm is issued when the controller senses loss of the 120/110 volt AC power supply to the triac circuit that energizes the starter and solenoid coils.

An open circuit between X2 terminal of control voltage transformer (T1) and terminal P1-1 of the controller is indicated. A blown fuse (2FU) or an open High Air Temperature switch (1ATS) could be a partial list of causes.

EMERGENCY STOP.. This alarm occurs when the Emergency Stop button is pressed to open both the 120/110 VAC and the 12 volt DC circuits. When the button is pressed, it remains in the open position until reset by an operator.

To reset, the Emergency Stop button must be rotated slightly in a clockwise direction to release the contacts.

FAN MOTOR OVERLOAD... An alarm that occurs when the contacts of the fan motor overload relay (2OL) open and remain open for at least one second.

Causes for this alarm could include low incoming voltage, loose wire connections, incorrect fan blade or improperly sized heater elements.

HIGH AIREND DISCHARGE TEMPERATURE... Sensor 2ATT, located in the discharge port of the airend, monitors the temperature of the air/coolant mixture leaving the airend.

Should the temperature at the discharge port rise above 228(F (109(C) in a running compressor, the controller shuts the compressor down with an alarm. The alarm can not be reset until the temperature falls below 95% of the alarm value of 217(F(103(C).

There can be several reasons for high airend temperature and a partial list includes high ambient conditions, dirty cooler, cooling air flow restrictions, low coolant level and faulty temperature control valve.

LOW SUMP AIR PRESSURE... This alarm will occur if the compressor is fully loaded for at least 8 seconds and 3APT indicates the sump pressure has not exceeded 20 psi.

The alarm protects the airend from damage due to low coolant flow at full load conditions that could result from low sump pressure.

The cause could be a minimum pressure check valve stuck in the open position while the compressor is pumping into an empty system.

LOW UNLOADED SUMP PRESSURE... An alarm issued if the compressor is running unloaded and 3APT indicates the sump pressure has fallen below 15 psi and remained there at least 15 seconds.

A cause for this alarm could be a worn inlet valve coupling, low stepper motor torque, a leaking or crimped pressure line to 3APT or 3APT out of calibration.

MAIN MOTOR OVERLOAD... This alarm occurs when the contacts of the drive motor overload relay (1OL) open and remain open for at least one second. (E-Prom revision 1.33 increases the delay from 1 second to 3 seconds)

Causes for this alarm could be low incoming voltage, operating the compressor above the rated pressure, wrong gearset, faulty motor or incorrectly sized heater elements.

CHECK SET POINTS... When the controller determines data stored in the memory contains unacceptable values, this alarm will be issued. If this alarm occurs, the pressure sensors should be recalibrated and all setpoints checked. This alarm is normally experienced when the controller software is changed.

An example of this alarm would be an Off Line pressure setting of 215 psi when the Rated pressure of the controller is 100 psi.

REMOTE START FAILURE... This alarm will be issued if the Remote Start button is pressed after the compressor is running or if the Remote Start button remains closed longer than 7 seconds when starting.

REMOTE STOP FAILURE... An alarm that occurs if the Remote Stop button remains open and either the local or remote Start button is pressed.

SENSOR FAILURE 1AVPT (or 3APT, 4APT, 5CPT, 2CTT, 2ATT or 3ATT... This alarm occurs if a sensor is recognized as missing or broken.

The alarm could be caused by a loose connection at P5 for pressure sensors or P6 for temperature sensors. Also check for a damaged sensor and broken or damaged wires.

STARTER FAULT 1SL (2SL)... This will occur if the starter contacts open while the machine is running. The Intellisys control system uses an auxiliary contact (1Sa, 1Ma and 2Ma) on each contactor to indicate when the contactor is either open or closed.

When the compressor is in operation and one of the main contactors opens while the controller logic indicates it should be closed, the auxiliary contact also opens to signal the controller there is a problem. The controller issues a STARTER FAULT alarm. A loose wire, faulty starter coil or burned triac could cause the problem. 1SL refers to the auxiliary circuit on starter contact 1M. 2SL refers to the auxiliary circuit on starter contacts 2M and 1S.

This alarm is also issued if the machine is given the stop command and the starter contacts do not open.

(E-Prom revision 1.33 changes the logic to confirm the auxiliary contacts are in the open position when the compressor is first started)

STEPPER LIMIT SWITCH... An alarm that is caused when the controller senses both limit switches to be in the closed position.

The most likely cause for this alarm is to have a bad switch or any one of the 4 wires loose or broken between the stepper limit card and P3.

INVALID CALIBRATION 1AVPT or 3APT or 4APT... this alarm is issued when the sensor output signal exceeds 10% of the range during the calibration process.

LOW COOLANT PRESSURE... This will occur if the compressor is running and the following conditions are met. The coolant pressure must be less than 1 psi and either the sump pressure is greater than 10 psi or the inlet vacuum is less than 12 psi.

STEPPER MOTOR OPERATION

The logic for the stepper motor to position the inlet valve is as follows.

As previously described, the maximum rotation of the stepper motor is limited to approximately 90° by the two optical limit switches on the stepper limit board. The two switches, one located at the open position of the inlet valve and the second located near the closed position, each emit an infrared light beam. The Intellisys uses the two limit switches as reference points when making decisions concerning the position of the inlet valve.

Note: It is important to understand the closed limit switch is approximately 10 steps away from the true full closed position of the inlet valve. At start-up and during operation, the Intellisys controller uses those few steps to make small corrections to the actual closed position of the inlet valve.

The light beam is approximately 1mm wide and a small extension tab connected to the inlet valve shaft or coupling is designed to interrupt the light

beam as the shaft rotates. When the light beam is interrupted, the Intellisys tells the drive chips to stop sending electrical pulses to the stepper motor and the motor stops rotating.

When power is first applied to the compressor or after an alarm condition is reset, the Intellisys makes a check of all control sensors to confirm they are operational. The two optical switches for the stepper motor are included within this check.

During the check, the stepper motor moves the inlet valve in the open direction until the tab on the valve shaft interrupts the infrared light beam in the open limit switch. If the tab doesn't interrupt the light beam, the Intellisys issues a CHECK INLET CONTROL SYSTEM alarm.

Had the tab entered the open limit switch and interrupted the infrared light beam, which is the normal sequence, the stepper motor would have moved the inlet valve back in the closed direction until the tab on the valve shaft interrupted the light in the switch at the closed position. If the tab is unable to break the light in the closed limit switch, the Intellisys will again issue a CHECK INLET CONTROL SYSTEM alarm.

However, if the infrared light beam in both switches is interrupted in the correct sequence by the tab on the inlet valve shaft during the check, the Intellisys is satisfied the switches are operational and places READY TO START in the display.

The following describes a normal starting process with the compressor remaining unloaded after start.

When the Start button is pressed, the Intellisys checks to confirm the tab is in the closed limit switch with the light beam interrupted. If the light beam is not interrupted, the inlet valve is either closed too far (which is the most likely) or the inlet valve is open too far. In either case, the tab has not entered the closed limit switch to interrupt the light beam.

If the light beam is not interrupted during the check, the Intellisys first assumes the inlet valve to be rotated a few steps too far closed with the tab completely through the switch and beyond the light beam.

The Intellisys immediately responds by directing the stepper motor to move the inlet valve 10 steps in the opening direction or until the closed limit switch light beam is interrupted by the tab. The tab can easily reach the switch within the 10 steps if the inlet valve is closed too far.

If the tab does not enter the closed limit switch and interrupt the light beam within the 10 opening steps, the Intellisys makes the second assumption that the inlet valve was too far opened when the Start button was pressed.

The Intellisys immediately responds to the second assumption by directing the stepper motor to reverse direction and rotate the inlet valve 200 steps in the closing direction or until the closed limit switch light beam is interrupted. The tab can reach the switch within 200 steps if the inlet valve is open too far.

If the tab does not enter the closed limit switch and interrupt the light beam as described above, the CHECK INLET CONTROL SYSTEM alarm will be issued.

During starting, had the Intellisys confirmed the tab to be in the closed limit switch with the infrared light beam interrupted when the Start button was pressed, the stepper motor immediately attempts to close the inlet valve 10 additional steps beyond the closed limit switch. The mechanical closing travel stop for the inlet valve on larger units, or the valve body itself on smaller units, may physically stop the motor before the 10 full steps are completed; but, the Intellisys controller still sends the 10 step signal. If this is the case, the inlet valve can be heard to have a rapid but short duration rattling sound as the stepper motor bounces on the closed position until the 10 step signal is complete.

When the 10 step signal is finished, the inlet valve is closed and permits the drive motor to accelerate with minimum current draw.

The Intellisys controller then energizes the drive motor contactors and as the contactors pull in, the compressor starts. The inlet valve remains fully closed.

Two seconds after Star-Delta transition or seven seconds after Direct-On-Line starting, the stepper motor moves the inlet valve toward the open position only until the tab has backed one step out of the closed limit switch. If the tab doesn't exit the closed limit switch by one step, the Intellisys will cause an alarm on CHECK INLET CONTROL SYSTEM.

However, when the tab moves one step beyond the light beam, which is the normal sequence, the Intellisys ceases to monitor the closed limit switch and begins to monitor sump pressure.

The stepper motor quickly opens the inlet valve one step at a time to establish sump pressure which promotes oil flow to the airend. Should the sump pressure not rise above 15 psig within 15 seconds, a LOW SUMP AIR PRESSURE alarm is issued by the Intellisys.

Normally the sump pressure quickly rises above 15 psig. The compressor continues to run while the stepper motor proceeds to open the inlet valve additional steps.

The Intellisys continues to monitor the sump pressure and directs the stepper motor to position the inlet valve either open or closed to maintain unloaded sump pressure within a range of 24 to 33 psig if the injected oil temperature is above 120°F (49°C).

If the injected oil temperature is less than 120°F (49°C), the controller directs the stepper motor to open the inlet valve a small additional amount to maintain sump pressure within a range of 45 to 50 psig. The slightly higher unloaded sump pressure promotes flow of the colder oil to the airend.

When the Intellisys senses the injected oil temperature has risen above 120°F (49°C), the stepper motor closes the inlet valve a slight amount to permit the unloaded sump pressure to fall to the 24 to 33 psig range.

The compressor continues to run unloaded until the control system directs the unit to load.

The following describes a normal loading process.

When the Intellisys gives the load command, whether from an operator pressing the LOAD button, a remote start, an automatic restart, or a PORO restart, the loading process remains the same.

When the load signal is received, the stepper motor opens the air inlet valve until the tab on the coupling interrupts the infrared light beam in the open limit switch. As the light beam is broken, the drive chips stop sending electrical pulses to the stepper motor causing the motor to stop rotating. The compressor is operating at full load.

It is important to understand at this point in the sequence, the Intellisys also stops monitoring the open limit switch until the next load command is given.

Had the open limit light beam not been broken, the Intellisys would have issued a CHECK INLET CONTROL SYSTEM alarm.

The following describes a normal unloading process.

When the system air pressure rises to the OFF-LINE setting or the UNLOAD button is pressed, the Intellisys directs the stepper motor to move the inlet valve to the closed limit switch and requires the light beam to be interrupted once again. If the light beam is not interrupted, a CHECK INLET CONTROL SYSTEM alarm is issued.

As the closed limit switch light beam is interrupted during the normal unload sequence, the stepper motor stops at the light beam. At this time, the Intellisys stops monitoring the closed limit switch and begins to monitor sump pressure.

Depending on the pressure in the sump, the Intellisys directs the stepper motor to move farther into the closed limit switch as required to maintain the sump pressure in the 24 to 33 psig range. This is unloaded operation.

The following describes the sequence of events when the compressor is operating in modulation control.

Modulation control attempts to match the delivery of air from the compressor to the demand of the customer's system by slowly opening, or closing, the inlet valve a step at a time in response to the rise or fall of system air pressure.

The Intellisys controller uses the OFF-LINE setting as a reference point and tries to maintain system air pressure within a 10 psi range centered around the OFF-LINE setting.

The psi modulation range begins 3 psi below and is completed at 7 psi above the OFF-LINE pressure setting programmed into the Intellisys. As an example, if a compressor has an OFF-LINE setting of 100 psi, modulation begins at 97 psi and is complete at 107 psi.

The air inlet valve does not fully close during modulation and the compressor is delivering approximately 60% of full flow volume when the

unload point is reached.

During modulation, the Intellisys monitors Package Discharge Pressure and inlet vacuum to direct the stepper motor to open or close the inlet valve.

Remember...during modulation, neither the closed limit switch nor the open limit switch is being monitored.

When system air pressure rises to the unload point (OFF-LINE pressure + 7 psi), the Intellisys directs the stepping motor to move the inlet valve to the closed limit switch and requires the light beam to be interrupted once again.

When the closed limit switch is entered during the normal unloading sequence, the stepper motor stops at the closing limit switch for a moment as the light beam is first interrupted. Immediately thereafter, the Intellisys directs the stepper motor to move additional steps into the switch to maintain the unloaded sump pressure in the 24 to 33 psi range.

The compressor is now operating unloaded, the closed limit switch light beam has been interrupted; the stepper motor has moved additional steps into the closed limit switch; the sump pressure is in the 24 to 33 psi range; and the closed limit switch is no longer being monitored.

The additional steps into the closed limit switch light beam require explanation to understand how the Intellisys determines the air inlet valve position to hold the unloaded sump pressure in the 24 to 33 psig range. An explanation follows.

The compressor is designed to run with the unloaded sump pressure in the 24 to 33 psig range to save power. However, oil flow to the airend depends on sump pressure and a range of 24 to 33 psig is required.

To set the pressure, the Intellisys gathers information about positive pressure in the sump and vacuum below the air inlet valve after the compressor has unloaded and then directs the stepper motor to position the inlet valve as required.

The process of determining the number of steps into the closed limit light beam takes approximately 5 minutes and when complete, the compressor is considered to be "smart." The next time the compressor unloads, the Intellisys directs the stepper motor to return the inlet valve to within a few steps of the "smart" position and then hesitate for a few seconds.

The hesitation allows the sump pressure to drop almost to the normal unloaded sump pressure, but still gives the Intellisys a short time to update the sump pressure and inlet vacuum. When the information is updated, the controller directs the stepper motor to close the inlet valve to the "smart" setting. The sump pressure falls to the 24 to 33 psig range.

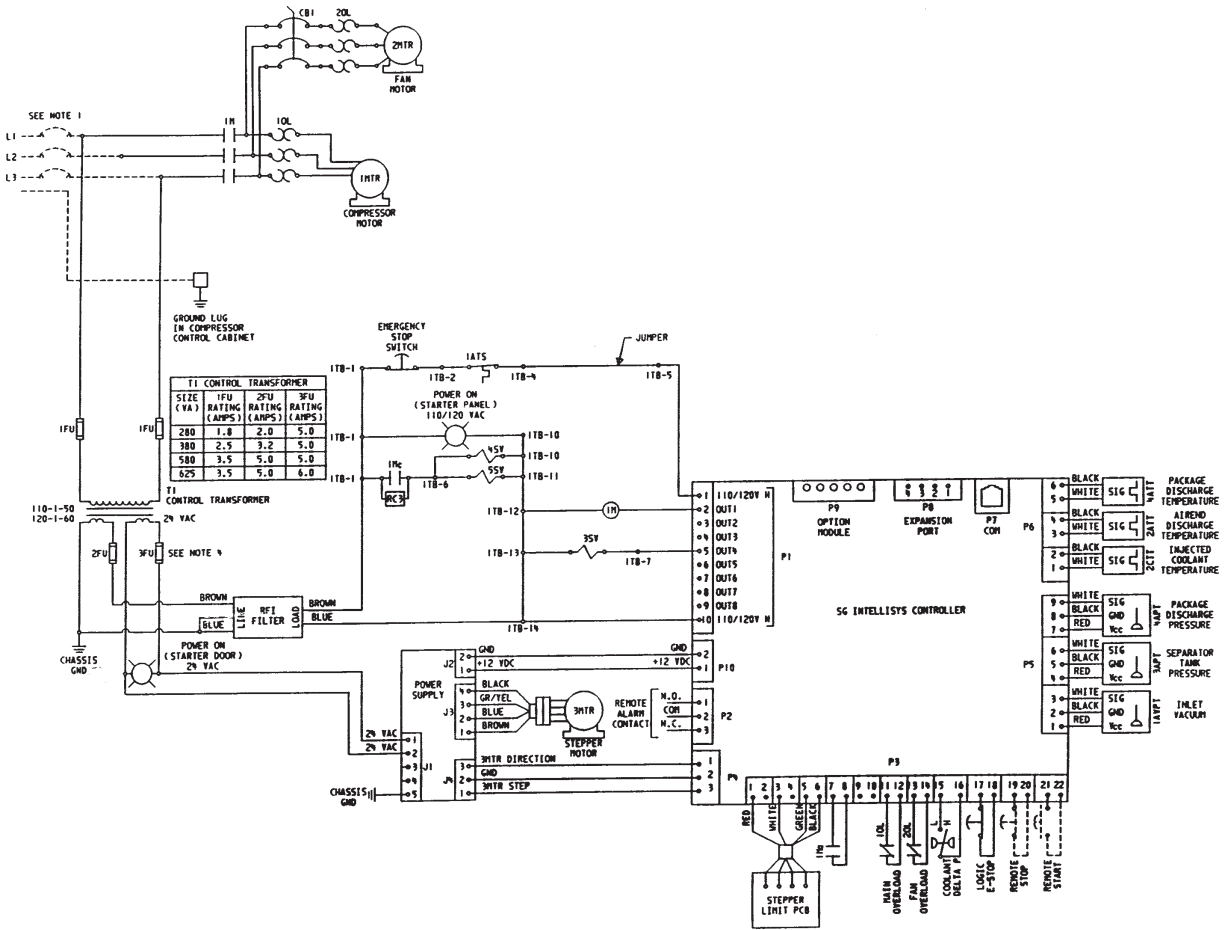
The "smart" position information remains in the Intellisys memory until either a pressure sensor is calibrated, the Intellisys is replaced or the EPROM is updated. At this time the Intellisys must collect the sump pressure and inlet vacuum information and reset the smart position of the inlet valve.

The process to get the Intellisys "smart" is as follows.

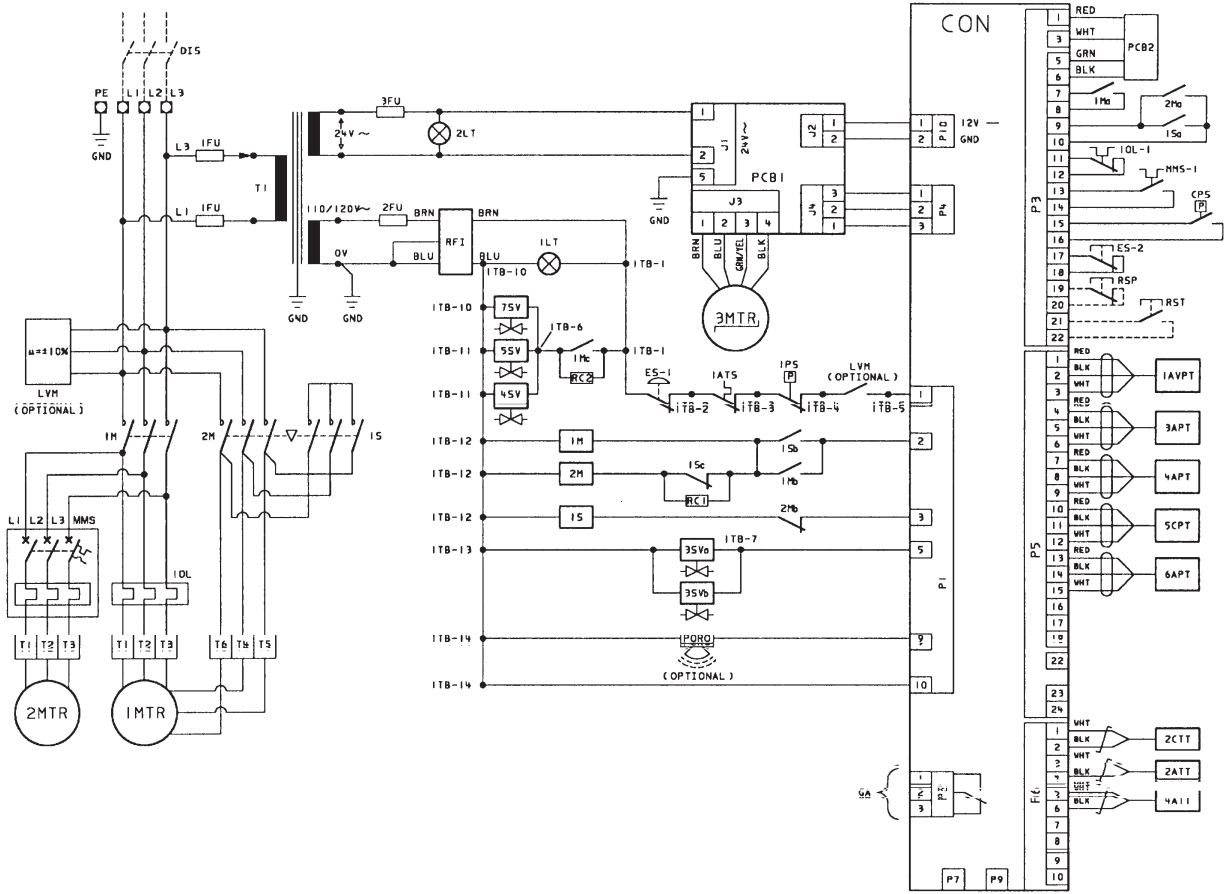
- A) Calibrate any of the pressure sensors as outlined in the Operator's Manual.
- B) Start the compressor and confirm the unit has loaded. Vent system air pressure if required. Confirm the injected oil temperature is above 120°F(4°C).
- C) Press the UNLOAD button. Select SUMP PRESSURE in the Current Status menu and observe until the sump pressure falls into the range of 24 to 33 psig and stabilizes.

This may take approximately 5 minutes. Do not reload the compressor while waiting or the procedure must be started again.
- D) After the sump pressure has entered the 24 to 33 psig range and stabilized, LOAD the compressor for a minute or two. Then press the UNLOAD button.
- E) Select SUMP PRESSURE in the Current Status menu and observe. The pressure should fall significantly faster than in Step C above. If the pressure does not fall faster, repeat the procedure.

DECAL, WIRING SCHEMATIC FULL VOLTAGE



DECAL, WIRING SCHEMATIC STAR DELTA



DECAL, WIRING SCHEMATIC STAR DELTA

LEGEND

ABBREV	DESCRIPTION
PE	EARTH LEAD, MAIN TERMINAL
GND	EARTH/GROUND
DIS	MAIN DISCONNECT (CUSTOMER SUPPLIED)
L1-L3	MAIN TERMINALS
1FU-3FU	CONTROL FUSE (3FU MUST BE A FAST ACTING TYPE BBS FUSE)
TI	TRANSFORMER, 110-1-50 OR 120-1-60, 24V TRANSFORMER/FUSE SIZE: T(KVA) 1FU(A) 2FU(A) 3FU(A)
	280 1.8 2.0 5.0
	380 2.5 3.2 5.0
	580 3.5 5.0 5.0
	625 3.5 5.0 6.0
IM	MAIN CONTACTOR
IMa-c	MAIN CONTACTOR AUXILIARY CONTACTS
2M	DELTA CONTACTOR
2Ma-d	DELTA CONTACTOR AUXILIARY CONTACTS
IS	STAR CONTACTOR
ISa-c	STAR CONTACTOR AUXILIARY CONTACTS
IMTR	MAIN DRIVE MOTOR
2MTR	FAN MOTOR
3MTR	STEPPER MOTOR
1OL	MAIN MOTOR OVERLOAD RELAY
MM5	FAN MANUAL MOTOR STARTER
RFI	RFI FILTER
1LT	LAMP, POWER ON - BACKPANEL
2LT	LAMP, POWER ON - INSTRUMENT PANEL
PCB1	PRINTED CIRCUIT BOARD, POWER SUPPLY
PCB2	PRINTED CIRCUIT BOARD, STEPPER, LIMIT
ES	EMERGENCY STOP
3SVa-b	SOLENOID VALVE, BLOWDOWN (3SVb REQUIRED ON 350-500HP UNIT ONLY)
4SV	SOLENOID VALVE, WATER SHUT OFF (WATER COOLED UNIT ONLY)
5SV	SOLENOID VALVE, COOLANT STOP (NOT REQUIRED ON UNITS WITH OIL PUMP)
7SV	SOLENOID VALVE, PRESSURE RELIEF (REMOTE COOLED UNIT ONLY)
IATS	SWITCH, HIGH AIR TEMPERATURE
RC1-2	ARC SUPPRESSORS
CON	INTELLISYS CONTROLLER
GA	REMOTE ALARM CONTACTS
RSP	REMOTE STOP
RST	REMOTE START
1AVPT	TRANSDUCER, PRESSURE - INLET VACUUM
3APT	TRANSDUCER, PRESSURE - SEPARATOR TANK WET SIDE
4APT	TRANSDUCER, PRESSURE - PACKAGE DISCHARGE
6APT	TRANSDUCER, PRESSURE - SEPARATOR TANK DRY SIDE
5CPT	TRANSDUCER, PRESSURE - INJECTED COOLANT (TWO STAGE ONLY)

LEGEND

ABBREV	DESCRIPTION
2ATT	SENSOR, TEMPERATURE - AIREND DISCHARGE
2CTT	SENSOR, TEMPERATURE - INJECTED COOLANT
4ATT	SENSOR, TEMPERATURE - PACKAGE DISCHARGE
IP5	SWITCH, INTERSTAGE PRESSURE (TWO STAGE UNIT ONLY)
CPS	SWITCH, COOLANT DELTA PRESSURE
ITB	TERMINALS
P7	COMMUNICATIONS PORT
P9	OPTIONS MODULE

LEGEND

ABBREV	DESCRIPTION
BLK	BLACK
BLU	BLUE
GRN	GREEN
RED	RED
WHT	WHITE
YEL	YELLOW
BRN	BROWN
GRN/YEL	GREEN/YELLOW

OPTIONS

ABBREV	DESCRIPTION
LVM	LINE VOLTAGE MONITOR
PORO	HORN, POWER OUTAGE RESTART

NOTES:

1. MAIN DISCONNECT AND BRANCH CIRCUIT PROTECTION TO BE PROVIDED BY CUSTOMER.
2. DASHED LINES REPRESENT WIRING BY CUSTOMER.
3. SIZING OF ELECTRICAL COMPONENTS, NOT SUPPLIED BY INGERSOLL-RAND, IS THE RESPONSIBILITY OF THE CUSTOMER AND SHOULD BE DONE IN ACCORDANCE WITH THE INFORMATION ON THE COMPRESSOR DATA PLATE, NATIONAL AND LOCAL ELECTRICAL CODES.
4. IP5 IS REPLACED WITH A JUMPER WIRE FROM ITB-3 TO ITB-4 ON UNITS NOT REQUIRING AN INTERSTAGE PRESSURE SWITCH.

IDENTIFICACION ESQUEMA ELECTRICO ESTRELLA DELTA

SPANISH

IDENTIFICACION	
ABBREV	DESCRIPCION
PE	CONEXION DE TIERRA, TERMINAL PRINCIPAL
GND	TIERRA
D15	DESCONEXION PRINCIPAL (SUMINISTRADA POR EL CLIENTE)
L1-L3	BORNES DE ALIMENTACION DE FUERZA
1FU-3FU	FUSIBLES DE CONTROL - 3FU DEBERA SER UN FUSIBLE BBS DE ACCION RAPIDA.
TI	TRANSFORMADOR, 110-1-50 OR 120-1-60, 24V CAPACIDADES DE TRANSFORMADOR/FUSIBLES: T(KVA) 1FUKA) 2FUKA) 3FUKA)
	280 1.8 2.0 5.0
	380 2.5 3.2 5.0
	580 3.5 5.0 5.0
	625 3.5 5.0 6.0
IM	CONTACTOR DE OPERACION/ARRANQUE
1Mo-c	CONTACTORS AUXILIARES DEL CONTACTOR DE OPERACION/ARRANQUE
2M	CONTACTOR DE OPERACION
2Mo-d	CONTACTORS AUXILIARES DEL CONTACTOR DE OPERACION
IS	CONTACTOR DE ARRANQUE
ISa-c	CONTACTORS AUXILIARES DEL CONTACTOR DE ARRANQUE
1MTR	MOTOR DEL COMPRESOR
2MTR	MOTOR DEL VENTILADOR
3MTR	MOTOR DEL PASO
1OL	RELE TERMICO DEL MOTOR
MMS	ARRANQUE MANUAL DEL MOTOR DEL VENTILADOR
RFI	FILTRO RFI
1LT	LAMPARA, CORRIENTE CONECTADA - PANEL POSTERIOR
2LT	LAMPARA, CORRIENTE CONECTADA - PANEL DE INSTRUMENTOS
PCB1	TARJETA DE CIRCUITOS IMPRESOS, ALIMENTACION DE CORRIENTE
PCB2	TARJETA DE CIRCUITOS IMPRESOS, LIMITADOR DE PASOS
ES	PARADA DE EMERGENCIA
35Vo-b	SOLENOIDES DE EVACUACION (REQUERIDOS SOLO EN UNIDADES DE 260-335KW)
4SV	SOLENOIDE DE CORTE DE AGUA (UNIDADES ENFRIADAS POR AGUA, UNICAMENTE)
5SV	SOLENOIDE DE CORTE DE REFRIGERANTE (NO SE REQUIERE EN UNIDADES CON BOMBA DE LUBRICACION)
7SV	SOLENOIDE DE ALIVIO DE PRESION (UNIDADES CON ENFRIADORES REMOTOS, UNICAMENTE)
1ATS	INTERRUPTOR POR ALTA TEMPERATURA DE AIRE
RC1-2	SUPRESORES DEL ARCO
CON	CONTROLADOR INTELLISYS
GA	CONTACTOS DE ALARMA REMOTA
RSP	PARADA REMOTA
RST	ARRANQUE REMOTO
1AVPT	TRANSDUCTOR DE PRESION - VACIO DE ADMISION
3APT	TRANSDUCTOR DE PRESION - TANQUE SEPARADOR LADO HUMEDO
4APT	TRANSDUCTOR DE PRESION - DESCARGA DE LA UNIDAD
6APT	TRANSDUCTOR DE PRESION - TANQUE SEPARADOR LADO SECO
5CPT	TRANSDUCTOR DE PRESION - LUBRICANTE DE IN Y ECCION (UNICAMENTE UNIDADES DE DOS ETAPAS)

IDENTIFICACION	
ABBREV	DESCRIPCION
2ATT	SENSOR DE TEMPERATURA - DESCARGA DE UNIDAD DE AIRE
2CIT	SENSOR DE TEMPERATURA - LUBRICANTE DE INYECCION
4ATT	SENSOR DE TEMPERATURA - DESCARGA DEL PAQUETE
IP5	INTERRUPTOR DE PRESION ENTRE ETAPAS (UNICAMENTE UNIDADES DE DOS ETAPAS)
CP5	INTERRUPTOR, LUBRICANTE VARIACION DE PRESION
1TB	TERMINALES
P7	PUERTO DE COMUNICACIONES
P9	MODULO DE OPCIONES

IDENTIFICACION	
ABBREV	DESCRIPCION
BLK	NEGRO
BLU	AZUL
GRN	VERDE
RED	ROJO
WHT	BLANCO
YEL	AMARILLO
BRN	MARRON
GRN/YEL	VERDE/AMARILLO

OPCIONES	
ABBREV	DESCRIPCION
LVM	MONITOR DE VOLTAE
PORO	SIRENA DE ARRANQUE POR INTERRUPCION/FALLO DE POTENCIA

NOTAS:

1. EL INTERRUPTOR PRINCIPAL Y LA PROTECCION DEL CIRCUITO SERAN SUMINISTRADOS POR EL CLIENTE.
2. LINEAS DISCONTINUAS REPRESENTAN CABLEADO SUMINISTRADO POR EL CLIENTE.
3. LA SELECCION DE COMPONENTES ELECTRICOS NO SUMINISTRADOS POR INGERSOLL-RAND ES RESPONSABILIDAD DEL CLIENTE Y DEBERA SER HECHA DE ACUERDO CON DE PLACA DEL COMPRESOR, N.E.C. Y LOS CODIGOS ELECTRICOS LOCALES.
4. EL IP5 ES REEMPLAZADO POR UN ALAMBRE CONECTOR DESDE 1TB-3 A 1TB-4 LAS UNIDADES QUE NO REQUIEREN UN INTERRUPTOR DE PRESION ENTRE ETAPAS.

DECALQUE, LEGENDA DO ESQUEMA ELÉTRICO ESTRELA TRIÂNGULO

PORTUGUESE

LEGENDA	
ABBREV	DESCRIPTION
PE	CABO DE TERRA, TERMINAL DE REDE
GND	TERRA
D15	INTERRUPTOR PRINCIPAL (FORNECIDO PELO CLIENTE)
L1-L3	TERMINAIS PRINCIPAIS
1FU-3FU	FUSIVEL DE CONTROLE - O FUSIVEL 3FU DEVERA SER TIPO BBS DE AÇAO RAPIDA
TI	TRANSFORMADOR, 110-1-50 OR 120-1-60, 24V
	TAMANHO TRANSFORMADOR/FUSIVEL:
	1 (VA) 1FUKA) 2FUKA) 3FUKA)
	280 1.8 2.0 5.0
	380 2.5 3.2 5.0
	580 3.5 5.0 5.0
	625 3.5 5.0 6.0
IM	CONTATOR OPERAR/PARTIR
1Mo-c	CONTATOS AUXILIARES CONTATOR OPERAR/PARTIR
2M	CONTATOR OPERAR
2Mo-d	CONTATOS AUXILIARES CONTATOR OPERAR
1S	CONTATOR PARTIR
1So-c	CONTATOS AUXILIARES CONTATOR PARTIR
1MTR	MOTOR DO COMPRESSOR
2MTR	MOTOR DO VENTILADOR
3MTR	MOTOR DE PASSOS
1OL	TERMICO DE PROTECAO DO MOTOR
MMS	ARRANCADOR MANUAL DO MOTOR DE VENTILADOR
RFI	RELE DE RFI
1LT	LUZ, CORRENTE LIGADA - PAINEL TRASEIRO
2LT	LUZ, CORRENTE LIGADA - PAINEL DE INSTRUMENTOS
PCB1	PLACA DE CIRCUITO, ABASTECIMENTO DE CORRENTE
PCB2	PLACA DE CIRCUITO, CHAVE LIMITADORA
ES	PARADA DE EMERGENCIA
35Vo-b	SOLENOIDE DE ALIVIO (35Vb REQUERIDO SOMENTE NAS UNIDADES 260-335K
45V	SOLENOIDE BLOQUEIO AGUA (SOMENTE NAS UNIDADES REFRIGERADAS A AGUA)
55V	SOLENOIDE BLOQUEIO OLEO (NAO NECESSARIO NAS UNIDADES COM BOMBA DE OLEO)
75V	SOLENOIDE ALIVIO PRESSAO (SOMENTE NAS UNIDADES COM RESFRIADOR REMOTO)
IATS	CONTATO ALTA TEMPERATURA DO AR
RC1-2	SUPRESSORES DE ARCO
CON	CONTROLADOR INTELLISYS 5G
GA	CONTACTOS DE ALARME REMOTO
RSP	PARADA REMOTA
RST	PARTIDA REMOTA
1AVPT	TRANSDUTOR, PRESSAO - VACUO ADMISSAO
3APT	TRANSDUTOR, PRESSAO - PRESSAO TANQUE SEPARADOR UMIDO
4APT	TRANSDUTOR, PRESSAO - PRESSAO DESCARGA UNIDADE
6APT	TRANSDUTOR, PRESSAO - PRESSAO TANQUE SEPARADOR SECO
5CPT	TRANSDUTOR, PRESSAO - INJECAO LUBRIFICANTE (SOMENTE NAS UNIDADES DE DOIS ESTAGIOS)

LEGENDA	
ABBREV	DESCRIPTION
2ATT	SENSOR, TEMPERATURA - DESCARGA UNIDADE
2CTT	SENSOR, TEMPERATURA - INJECAO LUBRIFICANTE
4ATT	SENSOR, TEMPERATURA - DESCARGA COMPRESSOR
1PS	PRESSOSTATO INTERESTAGIAL (SOMENTE NAS UNIDADES DE DOIS ESTAGIOS)
CP5	INTERRUPTOR, DELTA-P LUBRIFICANTE
1TB	REGUA DE BORNES
P7	PORTA DE COMUNICACAO
P9	MODULO OPCIONAL

LEGENDA	
ABBREV	DESCRIPTION
BLK	PRETO
BLU	AZUL
GRN	VERDE
RED	VERMELHO
WHT	BRANCO
YEL	AMARELO
BRN	MARRON
GRN/YEL	VERDE/AMARELO

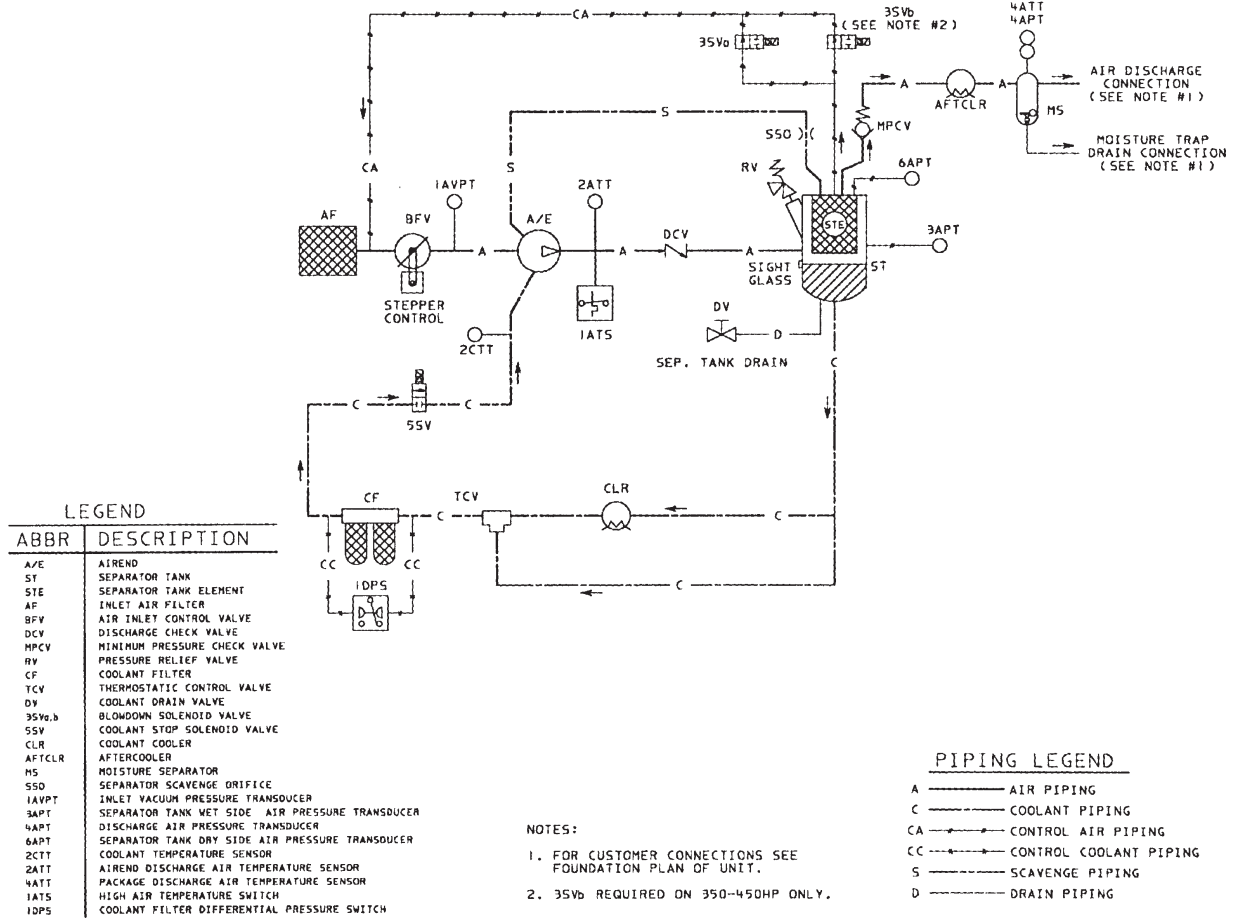
OPCOS

LVM	MONITOR LINHA DE VOLTAGEM
PORO	BUZINA, NOVA PARTIDA

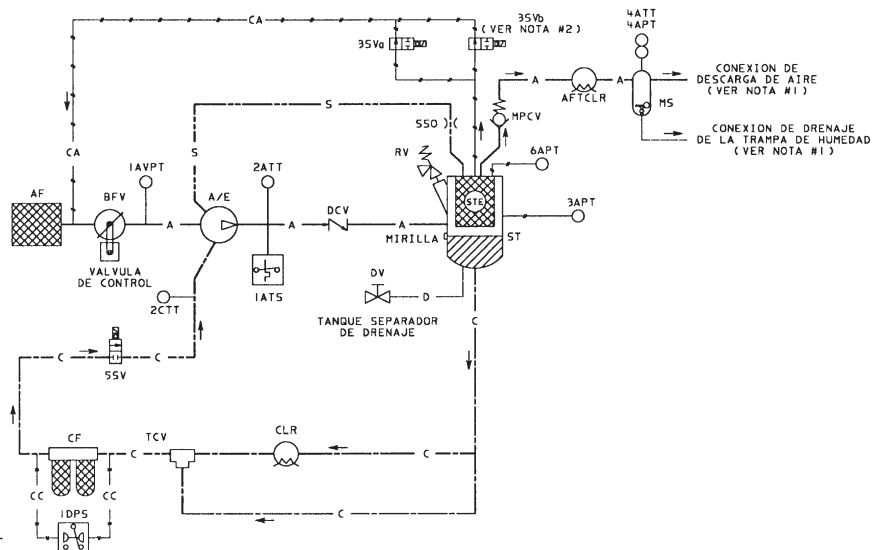
NOTAS:

1. CHAVE INTERRUPTORA PRINCIPAL E RAMAL DO CIRCUITO DE PROTECAO, A SEREM FORNECIDOS PELO CLIENTE.
2. LINHAS TRACEJADAS REPRESENTAM FIAÇAO ELETRICA DO CLIENTE.
3. DIMENSIONAMENTO DOS COMPONENTES ELETRICOS, NAO E FORNECIDO PELA INGERSOLL-RAND, E DE RESPONSABILIDADE DO CLIENTE E DEVE SER EXECUTADO DE ACORDO COM AS INFORMACOES DE PLACA DO COMPRESSOR E COM AS NORMAS ELETRICAS LOCAIS E NACIONAIS.
4. IPS E SUBSTITUIDO POR UM JUMPER ENTRE 1TB-3 E 1TB-4 NOS COMPRESSORES SEM PRESSOSTATO INTERESTAGIAL.

DIAGRAM, PROCESS AND INSTRUMENTATION AIRCOOLED WITH AFTERCOOLER



DIAGRAMA, PROCESO E INSTRUMENTACION ENFRIADO FOR AIRE CON POSTENFRIADOR



IDENTIFICACION DE COMPONENTES

ABBR	DESCRIPCION
A/E	UNIDAD DE AIRE
ST	TANQUE SEPARADOR
STE	ELEMENTO DE TANQUE SEPARADOR
AF	FILTRO DE ADMISION DE AIRE
BFV	VALVULA DE CONTROL DE ADMISION DE AIRE
DCV	VALVULA CHEQUE A LA DESCARGA
HPCV	VALVULA DE PRESION MINIMA
RV	VALVULA DE ALIVIO DE PRESION
CF	FILTRO DE REFRIGERANTE
TCV	VALVULA TERMOSTATICA
DV	VALVULA DE DRENAJE DE REFRIGERANTE
35Vb	VALVULA SOLENOIDE DE PARADA DE REFRIGERANTE
SSV	VALVULA SOLENOIDE DE PARADA DE REFRIGERANTE
CLR	ENFRIADOR DEL REFRIGERANTE
AFTCLR	POSTENFRIADOR
MS	SEPARADOR DE HUMEDAD
SSO	ORIFICIO DE BARRIDO DEL SEPARADOR
IAVPT	TRANSDUCTOR DE VACIO A LA ADMISION
3APT	TRANSDUCTOR DE PRESION DEL LADO HUMEDO DEL TANQUE SEPARADOR
6APT	TRANSDUCTOR DE PRESION DEL LADO SECO DEL TANQUE SEPARADOR
2CCT	SENSOR DE TEMPERATURA DE REFRIGERANTE
2ATT	SENSOR DE TEMPERATURA DE DESCARGA DE LA UNIDAD DE AIRE
WATT	SENSOR DE TEMPERATURA DE DESCARGA DEL COMPRESOR
IATS	INTERRUPTOR DE ALTA TEMPERATURA DE AIRE
IDPS	INTERRUPTOR DE PRESION DIFERENCIAL DEL FILTRO DE REFRIGERANTE

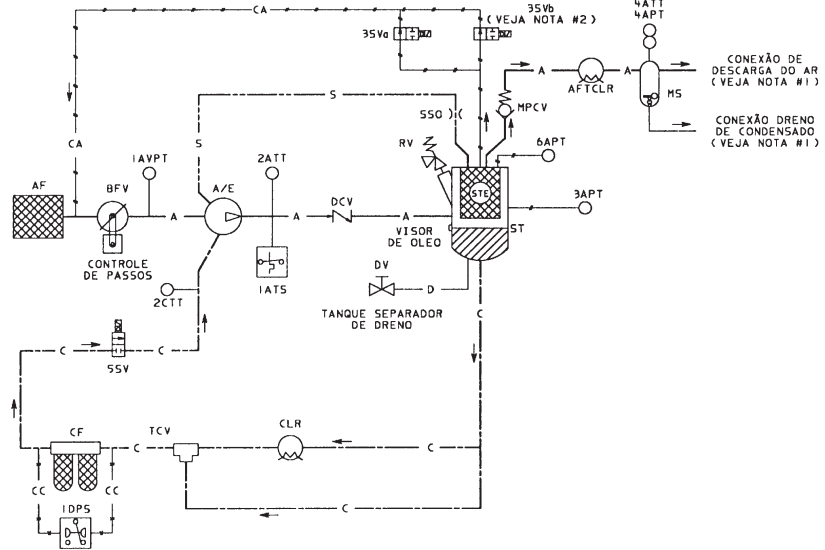
NOTAS:

1. PARA LAS CONEXIONES DEL CLIENTE, VER PLAN DE CIMENTACION DE LA UNIDAD
2. 35Vb REQUERIDA EN LAS UNIDADES DE 350-450 HP SOLAMENTE

DESCRIPCION DE TUBERIA

- A ————— TUBERIA DE AIRE
- C ————— TUBERIA DE REFRIGERANTE
- CA ————— TUBERIA DE AIRE DE CONTROL
- CC ————— TUBERIA DE CONTROL DE REFRIGERANTE
- S ————— TUBERIA DE BARRIDO
- D ————— TUBERIA DE DRENAJE

DIAGRAMA DE PROCESSO E INSTRUMENTAÇÃO, REFRIGERADOS A AR COM PÓS RESFRIADOR



LEGENDA

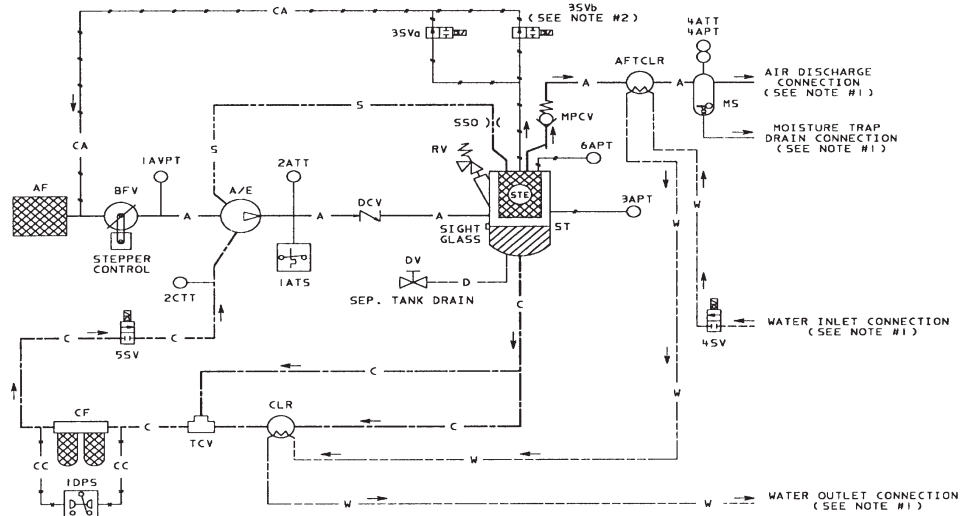
ABREV	DESCRICAO
A/E	UNIDADE COMPRESSORA
ST	TANQUE SEPARADOR
STE	ELEMENTO TANQUE SEPARADOR
AF	FILTRO DE ADMISSAO
BFV	VALVULA DE CONTROLE DE ADMISSAO DO AR
DCV	VALVULA DE RETENCAO NA DESCARGA
MPCV	VALVULA DE PRESSAO MINIMA
RV	VALVULA DE ALIVIO
CF	FILTRO DO LUBRIFICANTE
TCV	VALVULA TERMOSTATICA
DV	VALVULA DRENO DO LUBRIFICANTE
35Vb,3	VALVULA SOLENOIDE DE ALIVIO BLOWDOWN
55V	VALVULA SOLENOIDE DE RETENCAO DO LUBRIFICANTE
CLR	RESFRIADOR DO LUBRIFICANTE
AFTCLR	RESFRIADOR POSTERIOR
MS	SEPARADOR DE UNIDADE
550	ORIFICIO LINHA DO PESCADOR
1AVPT	TRANSUTOR DO VACIO NA ADMISSAO
3APT	TRANSUTOR DE PRESSAO DE MOLHADO FACE NA TANQUE SEPARADOR
4APT	TRANSUTOR DE PRESSAO NA DESCARGA DO CONJUNTO
6APT	TRANSUTOR DE PRESSAO DE SECO FACE NA TANQUE SEPARADOR
2CTT	SENSOR TEMPERATURA DO LUBRIFICANTE
2ATT	SENSOR TEMPERATURA DO AR NA DESCARGA DA UNIDADE
4ATT	SENSOR TEMPERATURA DE DESCARGA DO CONJUNTO
1ATS	CONTATO ALTA TEMPERATURA DO AR
1DPS	CONTATO DELTA P DO FILTRO DO LUBRIFICANTE

- NOTAS:
1. PARA CONEXAO DO CLIENTE VEJA DESENHO GERAL DO CONJUNTO
 2. 35Vb REQUERIDA SOMENTE NOS MODELOS 350-450 HP

LEGENDA DA TUBULACAO

- A ————— TUBULACAO DO AR
- C ————— TUBULACAO DO LUBRIFICANTE
- CA ————— TUBULACAO AR DE CONTROLE
- CC ————— TUBULACAO CONTROLE DO LUBRIFICANTE
- S ————— TUBULACAO DO PESCADOR
- D ————— TUBULACAO DE DRENO

DIAGRAM, PROCESS AND INSTRUMENTATION WATERCOOLED AFTERCOOLER - 90°

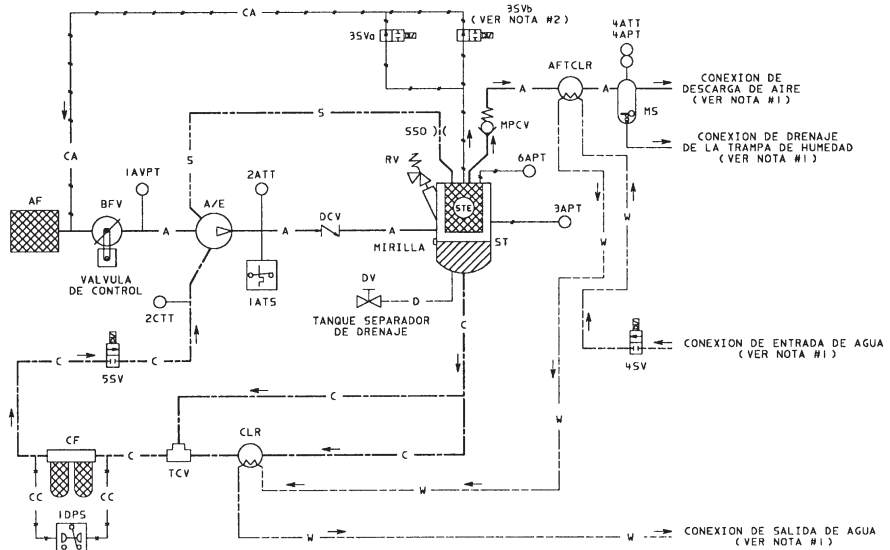


LEGEND	
ABBR	DESCRIPTION
A/E	AIREND
ST	SEPARATOR TANK
STE	SEPARATOR TANK ELEMENT
AF	INLET AIR FILTER
BFV	AIR INLET CONTROL VALVE
DCV	DISCHARGE CHECK VALVE
MPCV	MINIMUM PRESSURE CHECK VALVE
RV	PRESSURE RELIEF VALVE
CF	COOLANT FILTER
TCV	THERMOSTATIC CONTROL VALVE
DV	COOLANT DRAIN VALVE
35Vo/b	BLOWDOWN SOLENOID VALVE
4SV	WATER SHUT-OFF SOLENOID VALVE
5SV	COOLANT STOP SOLENOID VALVE
CLR	COOLANT COOLER
AFTCLR	AFTERCOOLER
MS	MOISTURE SEPARATOR
SSO	SEPARATOR SCAVENGE ORIFICE
IAVPT	INLET VACUUM PRESSURE TRANSDUCER
3APT	SEPARATOR TANK WET SIDE AIR PRESSURE TRANSDUCER
6APT	SEPARATOR TANK DRY SIDE AIR PRESSURE TRANSDUCER
2CTT	COOLANT TEMPERATURE SENSOR
2ATT	AIREND DISCHARGE AIR TEMPERATURE SENSOR
4ATT	PACKAGE DISCHARGE AIR TEMPERATURE SENSOR
IATS	HIGH AIR TEMPERATURE SWITCH
IDPS	COOLANT FILTER DIFFERENTIAL PRESSURE SWITCH

- NOTES:
1. FOR CUSTOMER CONNECTIONS SEE FOUNDATION PLAN OF UNIT.
 2. 35Vb REQUIRED ON 350-450HP ONLY.

PIPING LEGEND	
A	AIR PIPING
C	COOLANT PIPING
W	WATER PIPING
CA	CONTROL AIR PIPING
CC	CONTROL COOLANT PIPING
S	SCAVENGE PIPING
D	DRAIN PIPING

DIAGRAMA, PROCESO E INSTRUMENTACION POSTENFRIADOR ENFRIADO POR AGUA - 90°



IDENTIFICACION DE COMPONENTES

ABBR	DESCRIPCION
A/E	UNIDAD DE AIRE
ST	TANQUE SEPARADOR
STE	ELEMENTO DE TANQUE SEPARADOR
AF	FILTRO DE ADMISION DE AIRE
BFV	VALVULA DE CONTROL DE ADMISION DE AIRE
DCV	VALVULA CHEQUE A LA DESCARGA
MPCV	VALVULA DE PRESION MINIMA
RV	VALVULA DE ALIVIO DE PRESION
CF	FILTRO DE REFRIGERANTE
TCV	VALVULA TERMOSTATICA
DV	VALVULA DE DRENAJE DE REFRIGERANTE
35Vb	VALVULA SOLENOIDE DE PARADA DE REFRIGERANTE
45V	VALVULA SOLENOIDE DE CORTE DE AGUA
55V	VALVULA SOLENOIDE DE PARADA DE REFRIGERANTE
CLR	ENFRIADOR DEL REFRIGERANTE
AFTCLR	POSTENFRIADOR
MS	SEPARADOR DE HUMEDAD
SSO	ORIFICIO DE BARRIDO DEL SEPARADOR
1AVPT	TRANSDUCTOR DE VACIO A LA ADMISION
3APT	TRANSDUCTOR DE PRESION DEL LADO HUMEDO DEL TANQUE SEPARADOR
4APT	TRANSDUCTOR DE PRESION DE AIRE DE DESCARGA
6APT	TRANSDUCTOR DE PRESION DEL LADO SECO DEL TANQUE SEPARADOR
2CTT	SENSOR DE TEMPERATURA DE REFRIGERANTE
2ATT	SENSOR DE TEMPERATURA DE DESCARGA DE LA UNIDAD DE AIRE
4ATT	SENSOR DE TEMPERATURA DE DESCARGA DEL COMPRESOR
IATS	INTERRUPTOR DE ALTA TEMPERATURA DE AIRE
1DPS	INTERRUPTOR DE PRESION DIFERENCIAL DEL FILTRO DE REFRIGERANTE

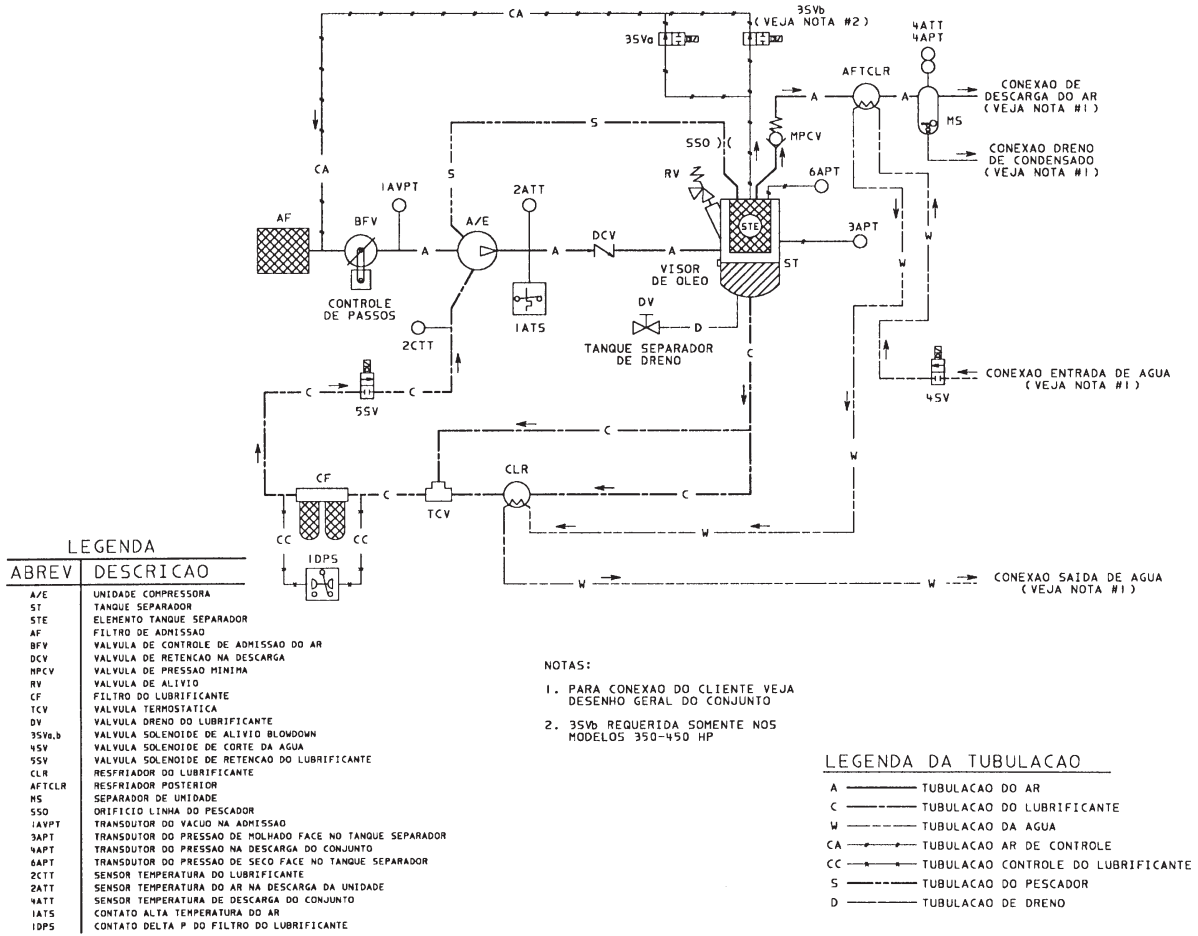
NOTAS:

1. PARA LAS CONEXIONES DEL CLIENTE, VER PLAN DE CIMENTACION DE LA UNIDAD
2. 35Vb REQUERIDA EN LAS UNIDADES DE 350-450 HP SOLAMENTE

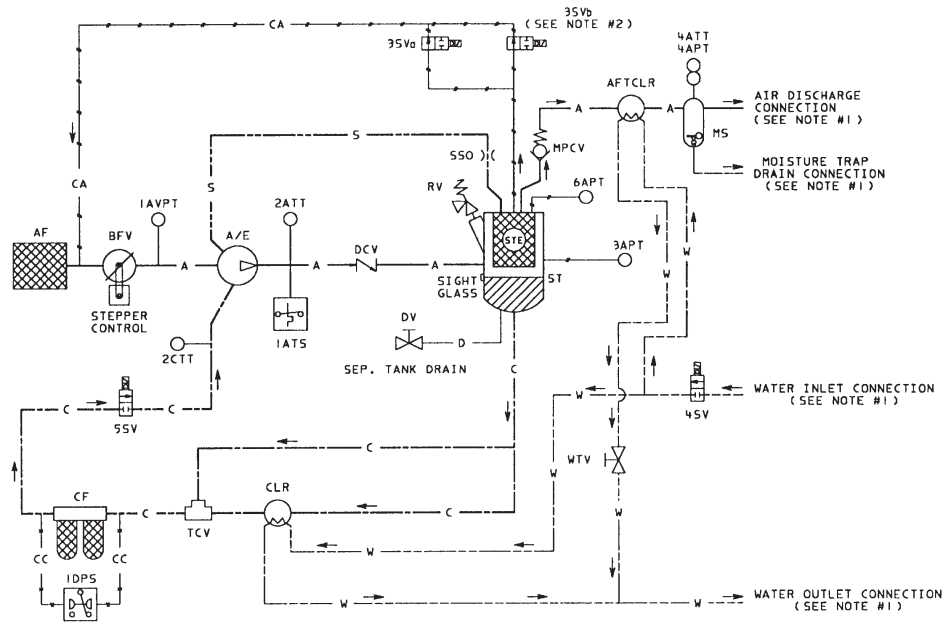
DESCRIPCION DE TUBERIA

A	TUBERIA DE AIRE
C	TUBERIA DE REFRIGERANTE
W	TUBULACAO DE AGUA
CA	TUBERIA DE AIRE DE CONTROL
CC	TUBERIA DE CONTROL DE REFRIGERANTE
S	TUBERIA DE BARRIDO
D	TUBERIA DE DRENAJE

DIAGRAMA DE PROCESSO E INSTRUMENTAÇÃO, REFRIGERADOS A ÁGUA COM PÓS RESFRIADOR - 90°



DIAGRAM, PROCESS AND INSTRUMENTATION WATERCOOLED AFTERCOOLER - 115°



LEGEND

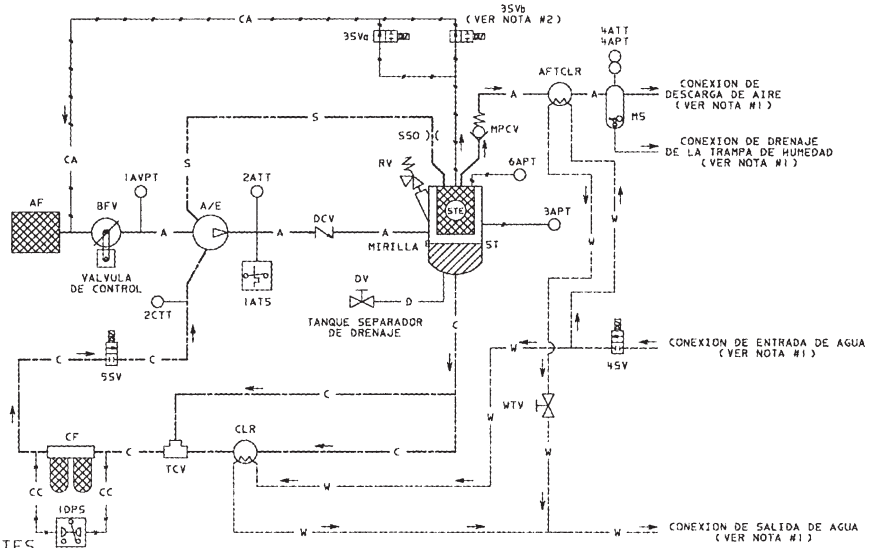
ABBR	DESCRIPTION
A/E	AIREND
ST	SEPARATOR TANK
STE	SEPARATOR TANK ELEMENT
AF	INLET AIR FILTER
BFV	AIR INLET CONTROL VALVE
DCV	DISCHARGE CHECK VALVE
MPCV	MINIMUM PRESSURE CHECK VALVE
RV	PRESSURE RELIEF VALVE
CF	COOLANT FILTER
TCV	THEMOSTATIC CONTROL VALVE
DV	COOLANT DRAIN VALVE
35Vb,b	BLOWDOWN SOLENOID VALVE
4SV	WATER SHUT-OFF SOLENOID VALVE
5SV	COOLANT STOP SOLENOID VALVE
CLR	COOLANT COOLER
AFTCLR	AFTERCOOLER
MS	MOISTURE SEPARATOR
SSO	SEPARATOR SCAVENGE ORIFICE
1AVPT	INLET VACUUM PRESSURE TRANSDUCER
3APT	SEPARATOR TANK WET SIDE AIR PRESSURE TRANSDUCER
4APT	DISCHARGE AIR PRESSURE TRANSDUCER
6APT	SEPARATOR TANK DRY SIDE AIR PRESSURE TRANSDUCER
2CTT	COOLANT TEMPERATURE SENSOR
2ATT	AIREND DISCHARGE AIR TEMPERATURE SENSOR
4ATT	PACKAGE DISCHARGE AIR TEMPERATURE SENSOR
IATS	HIGH AIR TEMPERATURE SWITCH
IDPS	COOLANT FILTER DIFFERENTIAL PRESSURE SWITCH
WTV	WATER TRIM VALVE

- NOTES:**
1. FOR CUSTOMER CONNECTIONS SEE FOUNDATION PLAN OF UNIT.
 2. 35Vb REQUIRED ON 350-450HP ONLY.

PIPING LEGEND

A	AIR PIPING
C	COOLANT PIPING
W	WATER PIPING
CA	CONTROL AIR PIPING
CC	CONTROL COOLANT PIPING
S	SCAVENGE PIPING
D	DRAIN PIPING

DIAGRAMA, PROCESO E INSTRUMENTACION POSTENFRIADOR ENFRIADO POR AGUA - 115°



IDENTIFICACION DE COMPONENTES

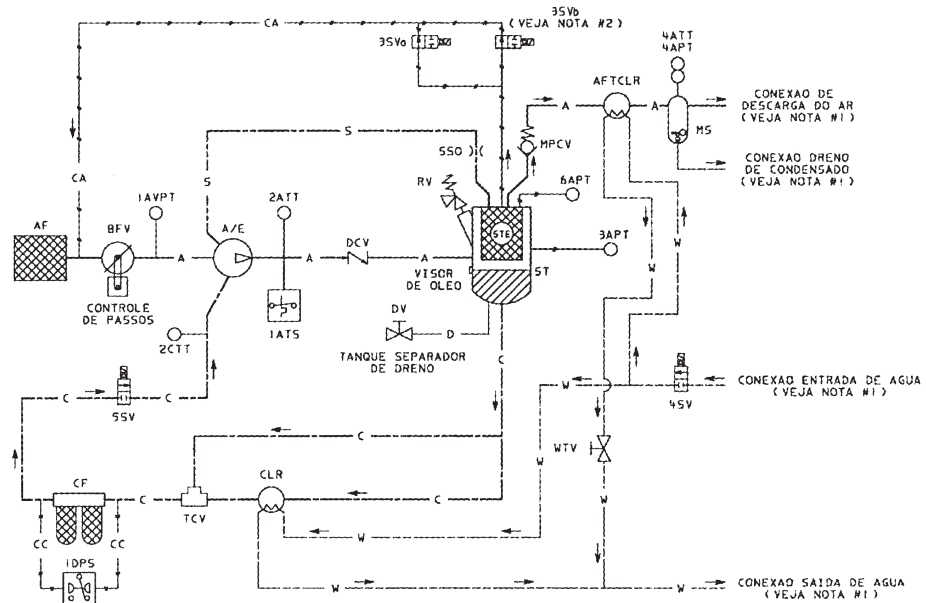
ABBR	DESCRIPCION
A/E	UNIDAD DE AIRE
ST	TANQUE SEPARADOR
STE	ELEMENTO DE TANQUE SEPARADOR
AF	FILTRO DE ADMISION DE AIRE
BFV	VALVULA DE CONTROL DE ADMISION DE AIRE
DCV	VALVULA CHEQUE A LA DESCARGA
MPCV	VALVULA DE PRESION MINIMA
RV	VALVULA DE ALIVIO DE PRESION
CF	FILTRO DE REFRIGERANTE
TCV	VALVULA TERMOSTATICA
DV	VALVULA DE DRENAJE DE REFRIGERANTE
35Vb	VALVULA SOLENOIDE DE PARADA DE REFRIGERANTE
45V	VALVULA SOLENOIDE DE PARADA DE REFRIGERANTE
55V	VALVULA SOLENOIDE DE PARADA DE REFRIGERANTE
CLR	ENFRIADOR DEL REFRIGERANTE
AFTCLR	POSTENFRIADOR
MS	SEPARADOR DE HUMEDAD
550	ORIFICIO DE BARRIDO DEL SEPARADOR
1AVPT	TRANSDUCTOR DE YACIO A LA ADMISION
3APT	TRANSDUCTOR DE PRESION DEL LADO HUMEDO DEL TANQUE SEPARADOR
4APT	TRANSDUCTOR DE PRESION DE AIRE DE DESCARGA
6APT	TRANSDUCTOR DE PRESION DEL LADO SECO DEL TANQUE SEPARADOR
2CTT	SENSOR DE TEMPERATURA DE REFRIGERANTE
2ATT	SENSOR DE TEMPERATURA DE DESCARGA DE LA UNIDAD DE AIRE
4ATT	SENSOR DE TEMPERATURA DE DESCARGA DEL COMPRESOR
1ATS	INTERRUPTOR DE ALTA TEMPERATURA DE AIRE
IDPS	INTERRUPTOR DE PRESION DIFERENCIAL DEL FILTRO DE REFRIGERANTE
WTV	VALVULA DE AJUSTE DE AGUA

- NOTAS:
1. PARA LAS CONEXIONES DEL CLIENTE, VER PLAN DE CIMENTACION DE LA UNIDAD
 2. 35Vb REQUERIDA EN LAS UNIDADES DE 350-450 HP SOLAMENTE

DESCRIPCION DE TUBERIA

A	TUBERIA DE AIRE
C	TUBERIA DE REFRIGERANTE
W	TUBULACION DE AGUA
CA	TUBERIA DE AIRE DE CONTROL
CC	TUBERIA DE CONTROL DE REFRIGERANTE
S	TUBERIA DE BARRIDO
D	TUBERIA DE DRENAJE

DIAGRAMA DE PROCESSO E INSTRUMENTAÇÃO, REFRIGERADOS A ÁGUA COM PÓS RESFRIADOR - 115°



LEGENDA	
ABREV	DESCRICAO
A/E	UNIDADE COMPRESSORA
ST	TANQUE SEPARADOR
STC	ELEMENTO TANQUE SEPARADOR
AF	FILTRO DE ADMISSAO
BFV	VALVULA DE CONTROLE DE ADMISSAO DO AR
DCV	VALVULA DE RETENCAO NA DESCARGA
MPCV	VALVULA DE PRESSAO MINIMA
RV	VALVULA DE ALIVIO
CF	FILTRO DO LUBRIFICANTE
TCV	VALVULA TERMOSTATICA
DV	VALVULA DRENO DO LUBRIFICANTE
35Vb	VALVULA SOLENOIDE DE ALIVIO BLOWDOWN
4SV	VALVULA SOLENOIDE DE CORTE DA AGUA
5SV	VALVULA SOLENOIDE DE RETENCAO DO LUBRIFICANTE
CLR	RESFRIADOR DO LUBRIFICANTE
AFTCLR	RESFRIADOR POSTERIOR
MS	SEPARADOR DE UNIDADE
550	ORIFICIO LEMBA DO PESCADOR
1AVPT	TRANSDUTOR DO VACUO NA ADMISSAO
3APT	TRANSDUTOR DO PRESSAO DE MOLHADO VACE NO TANQUE SEPARADOR
6APT	TRANSDUTOR DO PRESSAO NA DESCARGA DO CONJUNTO
8APT	TRANSDUTOR DO PRESSAO DE SECO FACE NO TANQUE SEPARADOR
2CTT	SENSOR TEMPERATURA DO LUBRIFICANTE
2ATT	SENSOR TEMPERATURA DO AR NA DESCARGA DA UNIDADE
4ATT	SENSOR TEMPERATURA DE DESCARGA DO CONJUNTO
1AT5	CONTATO ALTA TEMPERATURA DO AR
1DPS	CONTATO DELTA P DO FILTRO DO LUBRIFICANTE
WTV	VALVULA DE CONTROLE DA AGUA

- NOTAS:
1. PARA CONEXAO DO CLIENTE VEJA DESENHO GERAL DO CONJUNTO
 2. 35Vb REQUERIDA SOMENTE NOS MODELOS 350-450 HP

LEGENDA DA TUBULACAO	
A	TUBULACAO DO AR
C	TUBULACAO DO LUBRIFICANTE
W	TUBULACAO DA AGUA
CA	TUBULACAO AR DE CONTROLE
CC	TUBULACAO CONTROLE DO LUBRIFICANTE
S	TUBULACAO DO PESCADOR
D	TUBULACAO DE DRENO

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