SCROLL LIQUID CHILLERS

Installation and Maintenance Manual

Model NWC and NCC
15 TO 70 Tons (60 Hz)
Water Cooled and Compressor
410A Chillers

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Unit Identification

When the unit arrives, compare all nameplate data with ordering and shipping information

Unit Inspection

When the unit is delivered, verify that it is the correct unit and that it is properly equipped. Compare the information, which appears on the unit nameplate with the ordering and submittal information

Inspection Checklist

To protect against loss due to damage incurred in transit, complete the following checklist upon receipt of the unit.

- Inspect the individual pieces of the shipment before accepting the unit. Check for obvious damage to the unit or packing material.
- Inspect the unit for concealed damage as soon as possible after delivery and before it is stored. Concealed damage must be reported within 15 days.
- If concealed damage is discovered, stop unpacking the shipment. Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.
- Notify the carrier's terminal of the damage immediately, by phone and by mail. Request an immediate, joint inspection of the damage with the carrier and the consignee.
- Notify the NAPPS sales representative and arrange for repair. Do not repair the unit, however, until damage is inspected by the carrier's representative.

Loose Parts Inventory

Check all items against the shipping list. Items, which are shipped loose, could be placed inside the unit control panel for shipment. If the optional neoprene or spring isolators (or other ship loose items) are ordered, they are secured in place on the shipping skid or inside the unit control panel.

Unit Description

NAPPS hermetic scroll condenserless chillers and water cooled chiller units are designed for installation on a prepared surface, in a suitable weatherproof location. The NCC condenserless chiller units and the NWC water cooled chiller units consist of two or four scroll compressors and an integral control panel mounted on a common base.

Each unit is completely assembled hermetic package that is factory-piped, wired, leak-tested, dehydrated, charged (NWC only, NCC units are charged by others after field assembly) and tested for proper control operation before shipment. Water inlet and outlet openings are covered before shipment. The NWC units contain an operating refrigerant charge. All units are factory charged with the proper amount of refrigerant oil.

All units feature manifolded compressor sets piped in parallel and utilize a passive oil management system to maintain the proper compressor oil level.

The unit wiring diagram and installation and maintenance manual have been shipped with the unit and can be found in the unit control panel. Be sure to read all of this literature before installing and operating the unit.

Warnings and Cautions

WARNINGS and **CAUTIONS** appear in **boldface** type at appropriate points in this manual. Your personal safety and reliable operation of this equipment depend upon strict observance of these precautions. NAPPS assumes no liability for installation or service procedures performed by unqualified personnel.

INSTALLATION

Important Environmental Concerns!

Scientific research has shown that certain man-made chemicals including refrigerants can affect the earth's ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Napps advocates the responsible handling of <u>all</u> refrigerant products.

Responsible Refrigerant Practices!

Government regulations dictate that all technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the rules for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, individual states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

WARNING!

Contains R410A Refrigerant!

System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate to verify refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives. Failure to follow proper procedures or the use of non-approved refrigerants, refrigerant substitutes, or refrigerant additives could result in death or serious injury or equipment damage.

<u>Unit Nameplate</u>

The unit nameplate is mounted on the inside of the control panel door. The nameplate provides, among other things, the following information:

— Unit model number
— Unit serial number
— Refrigerant type
— Refrigerant charge in pounds by circuit
— Maximum operating pressures
— Unit electrical requirements

Unit wiring diagrams and a panel layout can also been seen inside the control panel door.

Refer to "Model Number Description" for addtional data that can be found on the nameplate.

<u>Compressor Nameplate</u>

The nameplate for the hermetic scroll compressor is mounted on the compressor housing, near the motor terminal junction box.

<u>Evaporator Nameplate</u>

The evaporator ASME nameplate is mounted on evaporator under the insulation. To view the evaporator nameplate, remove the insulation over the area if covered and spread the insulation. The serial number information is also on record at the factory.

<u>Condenser Nameplate</u>

The condenser ASME nameplate is mounted on the side of the condenser.

<u>General Installation Information</u>

• Where specified, supply and install valves in the water piping upstream and downstream of the evaporator and condenser water boxes, to isolate the heat exchangers for maintenance and to balance/trim the system.

• Supply and install condenser water control valve(s). *Refer also to Trane publication RLC-EB-4 available from Trane Sales Officesfor additional technical assistance.*

Napps Technology offers a proportional, electronic valve on NWC15-30 ton models, and dual valves on NWC/NCC 40-70 ton models that are completely factory installed and set-up.

• Supply and install flow switch or equivalent devices in the chilled water piping. Interlock this switch with the controller to ensure that the unit can only operate when water flow is established. See wiring diagram for connection point. A switch may be ordered with the unit if desired. It will be shipped loose for field installation.

• Supply and install drain valves and vent cocks on each water box as appropriate.

• Where specified, supply and install strainers ahead of all pumps and automatic modulating valves. Note that Napps NWC models are supplied with a cleanable, factory selected Y strainer, already installed prior to shipment.

• Supply and install suitable refrigerant pressure relief piping from the pressure relief to the atmosphere if required. Follow ANSI/ASHRAE 15-2007 guidelines, relief manufactures' guidelines, and industry standards when working with relief piping.

• If necessary, supply enough refrigerant and dry nitrogen (150 psig) for pressure testing (NCC).

• Start the unit under supervision of a qualified service technician.

• Where specified, supply and insulate the chilled water piping as required, to prevent sweating under normal operating conditions. Napps provides factory insulation on evaporator and related components.

Storage

These units are designed for indoor installation only. Store the unit in a suitable weatherproof, vibration free, and secure area. Periodically check the pressure in each refrigerant circuit to verify that the refrigerant charge is intact. If it is not, contact a qualified service organization and the appropriate sales office. If the unit is still under factory warranty, you must follow warranty procedure prior to calling for service.

CAUTION:

Store these units in a protected area only. Do not store outdoors with a protective covering such as a plastic shroud. This can result in excessive water condensation that could damage controls and other components.

Noise Considerations

Locate the unit away from sound-sensitive areas. If necessary, install the optional isolators under the unit and/or the optional factory sound attenuation cabinet. Install vibration isolators in all piping and use flexible electrical conduit. Consult an acoustical engineer for critical applications.

Foundation

A base or foundation is recommended for most installations. Provide a level surface strong enough to support the unit. Refer to "Dimensional Data" for dimensions and weights. A flexible (isolated) concrete foundation or footings at each loading point will reduce transmission of vibration. Install anchor bolts in the concrete to secure the unit. If the floor is warped, uneven or in poor condition, make necessary repairs before positioning the unit. Once the unit is in place, it should be level, within ¼" over its entire length and width.

Clearances

Provide enough space around the unit to allow the installation and maintenance personnel unrestricted access to all service points. Unit dimensions are given in ""Dimensional Data". There should be adequate clearance for condenser and compressor servicing. A minimum of three feet is recommended for effective compressor service. A minimum clearance of 3'-6" is required to open the control panel doors. In all cases, local codes will take precedence over these recommendations.

INSTALLATION

Ventilation

Provisions must be made to remove heat generated by unit operation from the equipment room. Ventilation must be adequate to maintain an ambient temperature lower than 125°F.

The condenser relief valve on these units must be vented in accordance with all local and national codes. See also "Pressure Relief Valves."

Drainage

Locate the unit near a large capacity drain for condenser drain-down during shutdown or repair.

Handling

NCC and NWC units are shipped stretch wrapped and bolted to a shipping skid (unless other than standard shipping is selected).

WARNING!

Do not remove the unit from the shipping skid until it is at the installation location. Moving these units when not properly secured to the skid can result in personal injury or death, and can seriously damage the unit.

The skidded unit can be moved by using a fork truck of suitable capacity. Refer to "Dimensional Data" for unit weights.

WARNING!

Any on-site lifting equipment must be capable of handling the weight of the unit with an adequate safety factor. Use of under-capacity lifting equipment can result in personal injury or death, and can seriously damage the unit.

When moving the unit, the lifting forks must be positioned under the shipping skid as wide as possible where labeled. Lift the unit and move it to the desired location.

Once the unit is at the installation location, remove the stretch wrap. Inspect the unit for damage and report if damage is found.

The optional unit isolators (if ordered) are secured to the shipping skid or in the unit control panel. Other optional "ship loose" items may be attached to the skid or shipped separately depending on options selected.

Rigging

Two lifting eyes are provided on these models for rigging as integral components to the structural skid.

WARNING!

To prevent injury or death, and damage to the unit, the capacity of the lifting equipment must exceed the unit lifting weight by an adequate safety factor.

Lifting Procedure

1. Remove the stretch wrap from the unit as described above, leaving the unit mounted to the skid.
2. Install clevis connectors or equivalent in the 1 ¼" lifting holes provided on each of the lifting lugs
3. Attach lifting chains (cables) to these points. Each chain (cable) alone must be strong enough to lift the unit.
4. Attach chains (or cables) to a lifting beam. Position the chains (cables) so that they do not contact the unit piping or the unit control panel. Use a suitable spreader bar to insure proper weight distribution.

CAUTION:

To prevent damage to the unit, position the lifting beam and chains (cables) so that they do not contact the unit piping or the unit control panel.

5. Remove the bolts that secure the unit to the shipping skid.
6. Raise the unit just off the skid to make sure that the unit is level when lifted. Adjust chain (cable) lengths as required.
7. Lift the unit off of the skid and place in the installation location.

Alternate Moving Method

If it is not possible to lift the unit from above, as discussed previously, the unit can be raised off of the skid with jacks placed under the unit. Then position equipment dollies under each end of the unit frame, lower the unit onto the dollies, and roll the unit into position.

Access Restrictions

All NCC/NWC units are designed to pass through a standard 36 inch doorway. Refer to outline drawings for other important dimensions.

Direct Mounting

The unit can be installed directly on an isolated, rigid mounting surface as long as the surface is level and will support the weight of the unit. A mounting hole is provided at each of the unit mounting locations. A schematic of the mounting locations is shown in "Dimensional Data". Provide a means of securely anchoring the unit to the mounting surface. Level the unit carefully.

Isolator Mounting (Optional)

Install the optional mounting isolators at each mounting location. Refer to manufacturers recommendations for isolator selection, placement and loading information. Isolators are identified by color and by the isolator part number. Bolt the isolator to the mounting surface. Do not fully tighten the mount bolts. Mount the unit on the isolators and install a 1/2-inch (13 mm) nut on each isolator positioning pin or bolt. Maximum isolator deflection should be 1/4-inch. Level the unit carefully. Now fully tighten isolator mounting bolts. Refer also to "Unit Leveling."

Compressor Mounting

All compressors are rigidly bolted with compressor isolation mounts to the same compressor mounting frame (rails). No additional isolation or leveling is required. Inspect prior to start up to insure bolts are present and tight, and that no shipping damage has occurred.

Unit Leveling

Before tightening the mounting bolts, level the unit. Check unit level end-to-end by using a level, or by placing a level on the top surface of the unit frame. Unit should be level within 1/4-inch over the length. Place the level on the unit frame and check front to back level. Adjust to within1/4-inch of level front-to-back. Use shims as required to properly level the unit.

Unit Piping

CAUTION:

Excessive Water Pressure!

To prevent pressure vessel damage, do not exceed nameplate water side pressures.

Evaporator water pressure

Provide shutoff valves in the line(s) to the gauge(s) to isolate the gauges when not in use if field installed gauges are used. Use pipe unions to simplify disassembly for system service. Use vibration eliminators to prevent transmitting vibrations through the water lines. Install thermometers in the lines to monitor evaporator entering and leaving water temperatures. Install a balancing cock in the leaving water line. It may be used to establish a balanced water flow. Both the entering and leaving water lines should have shutoff valves installed to isolate the evaporator for service.

Flow Sensing Devices

Chilled water flow switch, or other factory approved flow proving device is mandatory, field installation by contractor is required. Flow switch is to be installed and maintained per manufactures recommendations and interconnected to the Napps electrical control panel as described on the electrical diagram. Failure to provide this flow proving device voids unit warranty. To provide additional chiller protection, install and wire the flow switch in series with chilled water pump interlock for the chilled water circuits (refer to "Chilled Water Flow Interlock"). Specific connection and schematic wiring diagrams shipped with the unit.

General Water Piping Recommendations

Make water piping connections to the evaporator and condenser. Isolate and support piping to prevent stress on the unit. Use flanged ells or spool-pieces to facilitate service procedures. Construct piping according to local and national codes. Insulate and flush the piping before connecting the unit.

Caution:

To prevent equipment damage, bypass unit if using an acidic flushing agent.

Use a pipe sealant such as Teflon tape on all threaded water connections. Minimize heat gain and prevent condensation by insulating all chilled water piping.

Caution:

To prevent damage to water piping, do not over-tighten connections.

Water Flow Rates

Establish balanced water flow through both the evaporator and condenser. Flow rates should fall between the minimum and maximum values given in tables. Flow rates above or below these values can cause equipment damage or improper unit operation. Refer to submittal engineering data for minimum and maximum flow ranges.

Measure the evaporator water pressure drop at the pressure gauge(s) on the system water piping. Readings should approximate those shown by the pressure drop charts. Note: Evaporator pressure drop is an approximation and is to be used as a tool to estimate flow rate and as an aid to waterside system piping design. If an accurate measurement of flow rate is required, an accurate flow meter must be installed in the system.

Water System Volume

Napps requires minimum system volumes as indicated on then chart below. Special applications may deviate from these numbers as directed by Napps engineering. Operation below these volumes will cause unacceptable system control problems.

NxC15 - 108 gallons
NxC20 - 144 gallons
NxC26 - 188 gallons
NxC30 - 216 gallons
NxC40 - 288 gallons
NxC52 - 375 gallons
NxC60 - 432 gallons
NxC70 - 504 gallons

CAUTION:

Use Pipe Strainers!

To prevent evaporator or condenser damage, pipe strainers must be installed in the water supplies to protect components from water born debris. Napps is not responsible for equipment-only damage caused by water born debris. Removal of the factory installed Y strainer or screen will void the warranty on the brazed plate evaporator.

Condenser Water Piping (NWC only)

Condenser water inlet and outlet types, sizes and locations are given in "Unit Data". Condenser piping components and layout vary, depending on the water source and connection locations, but this system should include a water regulating valve. The optional water regulating valve maintains condensing pressure and temperature by throttling water flow leaving the condenser in response to compressor discharge pressure. Adjust the regulating valve for proper operation during unit start-up. Under full load standard conditions the water temperature rise should be 10° F, producing a flow rate in the range of 3 gpm per ton. Condenser piping must be in accordance with all local and national codes. Condenser piping components generally function identically to those in the evaporator piping system. Refer to "Evaporator Piping". In addition, cooling tower systems may include a manual or automatic bypass valve that can alter water flow rate to maintain condensing pressure. Well (city) water condensing systems should include a pressure reducing valve and water regulating valve. A pressure reducing valve should be installed to reduce water pressure entering the condenser. This is required only if water pressure exceeds nameplate maximums. This is also necessary to prevent damage to the disc and seat of the water regulating valve that can be caused by excessive pressure drop through the valve.

Water Treatment

Using untreated or improperly treated water in these units may result in inefficient operation and possible tube damage. Consult a qualified water treatment specialist to determine if treatment is needed.

Caution:

The use of untreated or improperly treated water in these units will result in scaling, erosion, corrosion, algae or slime. The services of a qualified water treatment specialist should be engaged to determine if treatment is needed. NAPPS warranty specifically excludes liability for corrosion, erosion or deterioration of NAPPS equipment.

NAPPS assumes no responsibilities for the results of the use of untreated or improperly treated water or saline/brackish water.

Napps NWC/NCC chillers are equipped with brazed plate evaporators made of stamped stainless steel plates, furnace brazed together with copper based joints. Because of the small complex geometry of the flow passages, it is imperative customers take all precautions to insure these evaporators are not fouled by large particles or mineral deposits. Chillers are factory selected and equipped with a Y strainer near the evaporator inlet. Screen may be removed for cleaning. Operation of chiller without screen in place will void warranty. Chemical treatment of the chilled water loop is required and must be performed by a qualified water treatment specialist.

Water Pressure Relief Valves

Install a water pressure relief valve in the condenser leaving water line. Water vessels with close-coupled shutoff valves have a high potential for hydrostatic pressure buildup on a water temperature increase. Refer to applicable codes for relief valve installation guidelines.

CAUTION:

Excessive Water Pressure!

To prevent condenser or regulating valve damage, do not exceed nameplate condenser water pressure.

Refrigerant Piping (NCC only)

Refer to the industry standards for refrigerant piping selection information; contact the factory if you do not have access to this data. Refrigerant pipe size selected must be within the velocity and pressure drop limitations required for proper system operation. It is essential that refrigerant piping be properly sized and applied since these factors have a significant effect on performance.

NOTE: Use Type K refrigerant grade copper tubing only. The use of a lower grade tubing can cause operating problems.

Refrigerant Piping: General Guidelines

Keep these general guidelines in mind as you review the recommendations specific to field piping refrigerant lines:

- Limit overall line length. Enough subcooling may be lost as refrigerant travels up the liquid riser to cause flashing. Review any questionable applications with the factory.
- Use Type L ACR copper tubing for R-22 or 407c systems, but Type K ACR should be used for R-410A
- Pipe sizing software such as Trane™ Engineering Toolbox can help to quickly determine proper sizes for refrigerant lines based on current engineering data.

Liquid Line

Sufficient subcooling must be maintained at the expansion valve. To provide proper operation throughout the range of operating conditions, the liquid-line pressure drop should not exceed the unit's minimum subcooling value less 5°F. To achieve this objective, keep these liquid-line considerations in mind:

1. Select the smallest, practical line size for the application. Limiting the refrigerant charge improves compressor reliability.
2. When designing the liquid line for a typical air-conditioning application (i.e. one with an operating range of 40°F to 115°F), remember that every 10 feet of vertical rise will reduce subcooling by 2.8°F, while every 10 feet of vertical drop will add 1.1°F of subcooling.
3. Provide a 1-inch pitch toward the evaporator for every 10 feet of run. Since this pitch equals that of the suction line, the two may be run together.
4. If the liquid line must be routed through an area warmer than outdoor air temperature, insulate the line to prevent the refrigerant from flashing.
5. Including a replaceable-core filter drier will permit easier proper system cleanup, moisture removal, and future maintenance. The core should be changed whenever the system is opened for service. Napps compressor-chillers do not include a filter-drier as standard, but one may be ordered if the installing contractor desires a factory type.
6. A moisture-indicating sight glass permits a visual check of the liquid column for bubbles. Sight glasses are included on the Napps compressor-chiller. However, **never use the sight glass to determine whether the system is properly charged!** Instead, either charge the system based on the required subcooling or calculate the amount of refrigerant needed and add it based on weight.

Discharge (Hot gas) Line

Limit the pressure drop in the discharge line to 6 psid whenever possible to minimize the adverse effect on unit capacity and efficiency. While a pressure drop of as much as 10 psid is usually permissible, note that a 6-psid pressure drop reduces unit capacity by 0.9 percent and efficiency by 3 percent.

Pitch discharge lines in the direction of hot gas flow at the rate of 1/2-inch per each 10 feet of horizontal run. Discharge line sizing is based on required velocity to provide good oil movement. Basic discharge line parameters are:

Max allowable pressure drop 6 psig (1F)
Maximum Velocity 3500 fpm
Minimum Velocity (at minimum load)
Horizontal lines 500 fpm
Vertical lines (up flow) 1000 fpm

To design the discharge line properly, follow the guidelines recommended below:

- Choose the shortest route from the compressor to the condenser.
- Use different pipe sizes for horizontal and vertical lines to make it easier to match line pressure drop and refrigerant velocity to discharge-line requirements.
- To assure proper oil entrainment **and** avoid annoying sound levels, size the discharge line so refrigerant velocity equals or exceeds the minimum velocity in Table 1 **and** remains below 3,500 fpm.
- Prevent oil and condensed refrigerant from flowing back into the compressor during "off" cycles by: (a) pitching the discharge line toward the condenser and (b) routing the discharge line so that it rises to the top of the condenser, then drops to the level of the condenser inlet, creating an inverted trap.
- Double risers are unnecessary. The scroll compressors in Napps units unload to the extent that a single, properly sized riser can transport oil at any load condition.

Table 1 - Minimum Discharge-Line Velocities for Oil Entrainment

	Refrigerant Velocity, fpm	
Nom. Pipe Size, in.	**Riser**	**Horizontal**
7/8	375	285
1-1/8	430	325
1-3/8	480	360
1-5/8	520	390
2-1/8	600	450

- Riser traps are also unnecessary. Avoid using riser traps. If the discharge riser is sized to maintain the proper refrigerant velocity, adding a trap will only increase the pressure drop.

Reliability determines the success of a split air-conditioning system. Interconnecting refrigerant lines play an instrumental role in that success. It's up to us to ensure that our system design practices evolve with equipment technologies.

This can be summarized as five fundamental "rules":

1. Choose the right system, i.e. don't specify split-system equipment when a packaged chiller is best suited for the job.
2. Size the interconnecting lines to avoid the use of traps and double risers.
3. Slope the suction and liquid lines toward the evaporator.
4. Minimize the length of the interconnecting tubing.
5. Keep the system clean.

Initial Leak Test

As shipped, Napps compressor-chillers contain a holding charge of Nitrogen only. Before connecting refrigerant piping, momentarily crack open a Schraeder valve on the liquid line to insure that the unit is still pressurized. If no gas escapes thru the valve, leak test the unit to determine the source of the refrigerant leak prior to installation and repair any leaks located.

Refrigerant Piping Sizes

Refer to the Trane guide TRG-TRC006-EN and/or ASHRAE publications to determine piping selection information. Refrigerant pipe sizes selected must be within the velocity and pressure drop limitations required for proper system operations. It is essential that refrigerant piping be properly sized and applied since these factors have a significant effect on system performance and reliability.

Final Leak Test

Once refrigerant piping is completed, thoroughly test the system for leaks.

System Evacuation

For field evacuation after leak checking, use a vacuum pump capable of pulling a vacuum of 100 microns or less. Follow the pump manufacturer's instructions for proper use of the pump. Insure that all sections of the system are properly evacuated before proceeding.

Warning!

Do not use oxygen, acetylene, or air for leak testing.

Caution:

Do not use a meghohm meter or apply power to compressor windings under vacuum: damage may occur.

Refrigerant Charging

Once the system is properly installed, leak tested and evacuated, refrigerant charging can begin. Liquid refrigerant must be charged into each circuit through the liquid line access with the compressor(s) off.

Caution:

Equipment Damage!

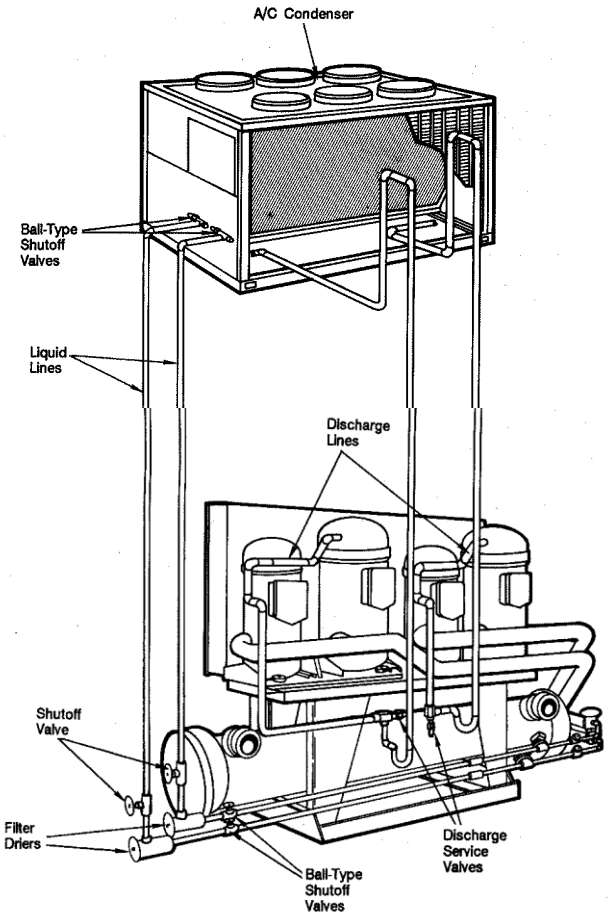
To prevent evaporator tube rupture, never charge liquid refrigerant into a water vessel when refrigerant temperature/pressure relationship of the vessel is below freezing.

Charge refrigerant into the system by weight. Use an accurate scale or charging cylinder to determine the exact charge entering the system. Failure to charge the system accurately can lead to under or over-charging and result in unreliable operation.

If system pressure equalize before the full charge enters the system, close the charging port and proceed to start-up procedure".

NOTE: Pitch horizontal runs of discharge (hot gas) line downward in the direction of flow @ ½" per each 10 ft. of run.

Figure 1 – Refrigerant Piping Diagram Configuration for typical dual circuit chiller



Liquid Line Components & Connections

Liquid line connections sizes and locations are shown in illustrations. Thermostatic expansion valves, refrigerant sight glass, solenoid valves and Schraeder valves are standard components on NCC liquid lines. A liquid line filter drier must be installed for each circuit. Install a liquid line service valve in the liquid line to isolate the drier for service.

Electrical Wiring

General Recommendations

The wiring procedures, as described in this portion of the manual, must be accomplished to obtain proper operation of the unit.

WARNING!

To prevent injury or death, disconnect electrical power source before completing connections to the unit.

All wiring must comply with National Electrical Code (NEC) and state and local requirements. Outside the United States, the national and/or local electrical requirements of other countries shall apply. The installer must provide properly sized system interconnecting and power supply wiring with appropriate fused disconnect switches. Type and locations of disconnects must comply with all applicable codes.

Caution:

To prevent corrosion and overheating at terminal connections, use copper conductors, sized per NEC and based on nameplate RLA.

Caution:

All wiring must comply with applicable local and national codes. Type and location of fused disconnect switches must comply with applicable local & national codes.

Minimum circuit ampacities, recommended fuse sizes and other unit electrical data are provided on the unit nameplate.

Power and Control Wiring

Unit Power Wiring

The installing contractor must connect appropriate power wiring (with fused disconnects) to the terminal block or non-fused, unit-mounted disconnect in the power section of the unit control panel. Electrical schematics and component location drawings are also mounted on the inside of the control panel door.

The unit power fused disconnect switch should be located in the general area of the unit, to comply with NEC or local codes. Some codes require line-of-sight disconnect locations. The optional unit unfused disconnect can be used as an emergency shutdown device.

Unit Control Wiring

Refer to controller section of IOM for additional details on field connections for controller and options.

Scroll Compressor Electrical Phasing

General

It is critical that proper rotation of the scroll compressors be established before the machine is started. Proper motor rotation requires confirmation of the electrical phase sequence of the power supply. The motor is internally connected for clockwise rotation with the inlet power supply phased “ABC” or “L1, L2, L3”.

The order in which the three voltages of a three-phase system succeed one another is called phase sequence or phase rotation.. When rotation is clockwise, phase sequence is usually called “ABC” and when counterclockwise, “CBA”.

This direction may be reversed by interchanging any two of the line wires. It is this possible interchange of wiring that makes a phase sequence indicator necessary, if the operator is to quickly determine the phase rotation of the motor.

Setting the Proper Electrical Phase Sequence

Proper compressor motor electrical phasing can be quickly determined and, if necessary, corrected before starting the unit. Use a quality instrument, such as an Associated Research Model 45 Phase Sequence indicator or equivalent and follow this procedure.

WARNING!

During installation, testing, servicing, and troubleshooting of this product, it may be necessary to work with live electrical components. To prevent injury or death due to electrocution, take extreme care when performing service procedures with electrical power energized. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all safety precautions when exposed to live electrical components could result in death or serious injury.

1. Verify that all operating controls for the unit are in the "Off" position.
2. Disconnect power to the power distribution block in the unit control panel
3. Connect the phase sequence indicator leads to the power distribution block as follows:

Phase Seq. Lead	Terminal ID
Black (Phase A)	L1
Red (Phase B)	L2
Yellow (Phase C)	L3

4. Turn power on by closing the unit supply power fused disconnect switch.
5. Read the phase sequence displayed on the indicator. The "ABC" LED on the face of the phase indicator will glow if phase sequence is ABC
6. If the "CBA" indicator glows instead, open the unit main power disconnect and switch two line leads on the power distribution block in the unit control panel. Close the main power disconnect and recheck phasing.
7. Open the unit disconnect and remove the phase indicator.

Unit Voltage

Electrical power to the unit must meet stringent requirements for the unit to operate properly. Total voltage supply and voltage imbalance between phases should be within the tolerances discussed below.

Voltage Supply

Measure each leg of supply voltage at the line voltage disconnect switches. Readings must fall within the range of 187-254 volts for units with a nameplate voltage of 208/230 volt and 414-508 volts for units with a nameplate voltage of 460 volts. If voltage on any leg does not fall within tolerance, notify the power company and request correction of this situation before operating the unit. Inadequate voltage to the unit will shorten the life of relay contacts and compressor motors.

Voltage Imbalance

Excessive voltage imbalance between phases in a three-phase system will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2 percent. Voltage imbalance is defined as 100 times the maximum deviation of the three voltages (three phases) subtracted from the average (without regard to sign), divided by the average voltage.

Maximum allowable imbalance is 2 percent. Voltage imbalance is defined as 100 times the maximum deviation of the three voltages (three phase) subtracted from the average (without regard to sign), divided by the average voltage.

Example:
If the three voltages measured at the line voltage fused disconnect are 221 volts, 230 volts and 227 volts, the average would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ volts}$$

The percentage of imbalance is then:

$$\frac{100\ (226-221)}{226} = 2.2\ \%$$

In the example above 221 is used because it is the farthest from the average. The 2.2 percent imbalance that exists exceeds maximum allowable imbalance by 0.2 percent. This much imbalance between phases can equal as much as 20 percent current imbalance with a resulting increase in winding temperature that will decrease compressor motor life.

Control Power Supply

A fused, panel-mounted control power transformer is standard on all units. Replacement fuses are listed on the "Fuse Schedule" decal located adjacent to the transformer inside the control box.

External Contacts

Modules Connections for Interconnecting

Napps chiller units can be interconnected, however, controller software may need to be updated to allow this type of operation. Please contact the factory for more information.

Chilled Water Flow Switch

The Magnum controller has an input that accepts a contact closure from a proof-of-flow device such as a flow switch or other factory approved flow proving device. When this input does not prove flow within a fixed time relative to transition from enabled to run modes of the chiller, or if the flow is lost while the chiller is in the running mode of operation, the chiller will be inhibited from running. The installer **must** provide and install this flow proving device. See also wiring diagrams attached to the inside of the control panel door. Failure to provide this flow proving device voids unit warranty.

Condenser Water Loss of Flow Protection

The controller logic will sense a loss of flow through the condenser. No flow switches are necessary with the standard Magnum configuration.

Condenser Water Pump Starter, Fan Staging or VFD controls

The controller has a condenser water pump or fan output relay that closes to indicate when the condenser water pump (or fans) should be started and opens to indicate when the pump (or fans) should stop. If condenser pumps are arranged in a bank with a common header, the output can be used to control an isolation valve and/or signal another device that an additional pump is required. Consult wiring diagram for connection point. NCC units may also use this same point as stage one of fan controls. A second output relay may also be provided as a stage two control. Water cooled NWC systems would tie this into cooling tower fan controls, while NCC units would use this as stage two fan control enable. Refer to "Wiring Diagram" located inside control box door. There is also an analog out that can be used to control a VFD, consult factory for how to enable this feature.

Equipment Grounds

Provide proper grounding at the connection point provided in the unit control panel**. Use copper conductors only.**

MCS-Magnum Controller

The Magnum is a rugged microprocessor based controller designed for the hostile environment of the HVAC/R industry. It is designed to be the primary manager of the NCC / NWC Product. The Magnum provides flexibility with setpoints and control options that can be selected prior to commissioning a system or when the unit is live and functioning. Displays, pressures, temps, alarms and other interfaces are accomplished in a clear and simple language that informs the user as to the status of the controller. Refer also to the "Wiring Diagram" attached to the inside of the control panel door.

A password is required to access MCS setpoints. Use password code **2112** to access many of these features. A factory code may be required to allow access to critical areas, and can only be entered by a factory representative.

A RS-485 port is provided for communication with other manufacturers systems. Additionally, a built-in RS-485 to RS-232 converter allows communication over the RS-485 port via the RS-232 port. Other features include the integration of BACnet, Johnson N2, and Modbus into the Magnum. Also available is a card that allows communication via LonWorks, and this should be ordered with the chiller if required. An Ethernet connection is also provided on each unit. While field changes can be made, please insure that the unit is ordered set up for required communications to insure that factory testing includes end user configuration.

A complete software support package is available for your PC allowing for system configuration, dynamic on-line display screens, remote communication, graphing and more. Downloads for the MCS-Connect software are available at www.mcscontrols.com at no charge. All information needed to run the unit is available from the unit display; however, a laptop computer is invaluable for ease of use of diagnosing or changing the unit setpoints. Note that not all setpoints can be changed with MCS-Connect. Some require a configuration change.

A serial cable is included in each shipment for the convenience of the field tech. If you do not have a laptop with a serial port, you will require a converter such as a Black Box item number #IC199A-R3 Serial-to-USB adaptor. A modem is also available to allow Napps personel to provide remote access to the Magnum controller if needed; call the factory for availability of free loaner modems if needed.

The standard configuration allows for unit to start at lowest stage possible (hot gas bypass if included as a capacity step), then add compressors as needed to meet demand.

All configuration changes need to be done by factory representatives to insure proper operation of the unit within design parameters. Refer to MCS Magnum manual for sequence of operation and additional details.

Installation Checklist

As the unit is installed, complete this checklist to verify that all recommended procedures are accomplished before the unit is started. This checklist does not replace the detailed instructions given in previous sections of this manual. Read the entire installation section carefully to become familiar with the procedures before installing the unit.

Unit Location

- —— Inspect installation location for adequate ventilation.
- —— Provide drain facilities for condenser (NWC).
- —— Remove and discard all shipping material (skid, etc.).
- —— Inspect to insure that all service access clearances are adequate.
- —— Install optional neoprene or spring isolators (if required).
- —— Secure the unit to the mounting surface.
- —— Level the unit.
- —— Isolate the compressor by removing the shipping bolts that hold the isolators down.

Condenser Connections (NWC)

- —— Make condenser water connections.
- —— Install a water regulating valve in the water outlet line, if required.
- —— Install shutoff valves, thermometers, plugged clean-out tees and pressure gauges in the water inlet and outlet lines as required.
- —— Install a water strainer and pressure reducing valve on the water inlet piping if applicable.
- —— Install drain piping with shutoff valves.
- —— Install a manual or automatic bypass valve in the cooling tower water supply (if used).
- —— Install refrigerant discharge piping for the condenser relief valve as applicable.
- —— Flush and clean all condensing water piping.

Refrigerant Piping

Perform the initial leak test (NCC). Napps is not responsible for system leaks on NCC units; perform leak test carefully.

- —— Connect a properly sized and constructed liquid line (with charging valve and filter drier) to the liquid line connection on the condenser (NCC).
- —— Connect a properly sized and constructed discharge line to the compressor discharge line connection (NCC).
- —— Leak test the unit and all piping connections. (NCC)
- —— Insulate any lengths of discharge or liquid line that are exposed to extremes in temperature.

Power Supply Wiring

- —— Connect proper power supply wiring, with fused disconnect, to the power distribution block (or optional unit mounted unfused disconnect) in the unit control panel.
- —— Connect proper power supply wiring, with fused disconnects, to the condenser water pump starter, to the cooling tower fan starter (if used), or to the air-cooled condenser control panel. Refer to wiring diagram for connection points.
- —— Connect flow switch to MCS Magnum where indicated on wiring diagram
- —— Connect to BAS if applicable

Evaporator Connections

- —— Make evaporator water connections. Support water piping.
- —— Install a flow sensing device as described above (mandatory).

System Interconnection Wiring

- —— Connect proper wiring to interlock the condenser water pump and the cooling tower (or air-cooled condenser) operation with unit start-up.

CAUTION:

The unit should be energized for 8 hours (min) to insure crankcase heaters have driven any trapped refrigerant out of the oil. Repeat this procedure any time a system has been without power long enough for refrigerant to migrate. Verify that the oil level is approx. center of the sight glass before starting.

Because scroll compressors are a uniquely different design from traditional reciprocating compressors, their operating characteristics and requirements are a departure from the reciprocating compressor technology.

Compressor Oil

The 410A scroll compressor uses POE oil as required by the manufacturer of the compressor. Refer to compressor manufacturer for exact type and amount of oil in the specific model in question.

Oil Level. While the compressor is running, the oil level may be below the sight glass but still visible through the sight glass. The oil level should never be above the sight glass!

Oil Appearance. If the oil is dark and smells burnt, it was overheated because of compressor operation at extremely high condensing temperatures, a compressor mechanical failure, or occurrence of a motor burnout. If the oil is black and contains metal flakes, a mechanical failure has occurred. This symptom is often accompanied by a high amperage draw at the compressor motor.

Note: If a motor burnout is suspected, use an acid test kit to check the condition of the oil. If a burnout has occurred, test results will indicate an acid level exceeding 0.05 mg KOH/g.

Note: The use of commercially available oil additives is not recommended. Liability for any detrimental effects that the use of non-approved products may have on equipment performance or longevity must be assumed by the equipment owner, equipment servicer, or the oil additive manufacturer.

Compressor Motor Winding Thermostat

Each motor winding thermostat is a pilot-duty control, designed to stop compressor operation if the motor windings become hot due to rapid cycling, loss of charge, abnormally low suction temperatures, or the compressor running backwards.

Compressor Electrical Phasing

Proper phasing of the electrical power is critical for proper operation and reliability of the scroll compressor. If the compressor electrical phasing is incorrect, the motor will draw low current, the suction and discharge pressures will change very little, and a rumble or rattle may be heard.

Note: The scroll compressor does not have suction or discharge valves. However, the symptoms for a phase reversal are similar to those for a valve failure.

Scroll Compressor Functional Test

Since the scroll compressor does not use discharge or suction valves, it is not necessary to perform a pump-down capability test, i.e. a test where the liquid line valve is closed and the compressor is pumped in a vacuum to see if it will pump-down and hold. If fact, this kind of test may actually damage the scroll compressor!

Caution:

Do not pump the scroll compressor into a vacuum. Scroll compressors can pull internal low vacuums when the suction side is closed or restricted. This, in turn, may cause the internal Fusite terminal to arc, resulting in compressor damage or failure. It may also trip the circuit breakers, blow fuses, or trip the discharge thermostat.

The proper procedure for checking scroll compressor operation is outlined below:

1. Verify that the compressor is receiving supply power of the proper voltage.
2. With the compressor running, measure the suction and discharge pressures to determine whether or not they fall within the normal operating ranges for the unit.

Normal operating pressures for the unit with a scroll compressor are the same as for a unit with a reciprocating compressor.

If the operating pressures do not seem correct, see "Scroll Compressor Electrical Phasing".

Compressor Operational Noises

Because the scroll compressor is designed to accommodate liquids (both oil and refrigerant) and solid particles without causing compressor damage, there are some characteristic sounds that differentiate it from those typically associated with a reciprocating compressor. These sounds, which are described below, are normal and no not indicate that the compressor is defective.

At Low Ambient Start-up: When the compressor starts up under low ambient conditions, the initial flow rate of the compressor is low, due to the low condensing pressure. This causes a low differential across the expansion valve that limits its capacity. Under these conditions, it is not unusual to hear the compressor rattle until the suction pressure climbs and the flow rate increases. These sounds are normal and do not affect the operation or reliability of the compressor.

Excess Amp Draw

Normally this condition occurs either because the compressor is operating at an abnormally high condensing temperature or because of low voltage at the compressor motor.

Motor amp draw may also be excessive if the compressor has internal mechanical damage. In this situation, vibration and discolored oil can also be observed.

Low Suctions

Low suctions *can be* caused by a plugged screen on the compressor suction inlet. If the screen is plugged, the pressure in the oil sump, as measured at the oil charging valve, will be lower than the suction pressure measured at the evaporator. Low suction pressures may be also caused by low evaporator load.

Other symptoms that may accompany low suctions include a rattling sound emitted from the compressor or an open motor winding thermostat or discharge thermostat.

Excessive Vibration

If the compressor vibrates and does not pump, check the compressor phasing as described in "Scroll Compressor Electrical Phasing" and check the oil level and the oil's appearance.

Periodic Maintenance

Perform all of the indicated maintenance procedures at the intervals scheduled. This will prolong the life of the unit and reduce the possibility of costly equipment failure.

Monthly

- Check compressor oil level.
- Check unit refrigerant charge by measuring sub-cooling or visually checking the sight glass for the presence of bubbles.
- Check refrigerant superheat at the compressor suction line. Superheat should be in the range of 10°-20°F. Note that a superheat calculated value is incorporated into the MCS-Magnum display.
- Check compressor phasing. (See "Scroll Compressor Electrical Phasing".)

Annually

- With the unit disconnect switch open, inspect the panel wiring. All electrical connections should be secure. Inspect the compressor contactors. If the contacts appear severely burned or pitted, replace the contactor. Do not clean the contacts.
- Verify flow switch operation as recommended by the device manufacturer.
- Remove any accumulation of dust and dirt from the unit.
- Check condenser water flow rate (NWC only)
- With unit operating, check refrigerant discharge and suction pressures.

DIMENSIONAL & ELECTRICAL DATA

Dimensional Data

The Napps application manual and/or project submittals contain dimensional data, application data, and electrical data as required.

Refer to name plate on control box door (inside) for specific unit electrical data.

These documents can be forwarded for specific jobs as part of a job submittal package upon request.

Electrical Schematic

Refer to name plate on control box door (inside) for electrical data and wiring diagram

Napps NWC/NCC Chillers

Sample: NWC 40SA TSC CD0S000 Ship With 40, 300

Digits 1, 2, 3 - Unit Series
NCC – 410A Scroll Compressor Chiller
NWC – 410A Scroll Water-cooled Chiller

Digit 4,5 – Unit Nominal Tonnage
15-70 = nominal tons

Digit 6 - Application
S – Standard Heat Exchangers/Efficiency
H – High Efficiency Brazed Plate Condenser
For Closed Loop Applications Only

Digit 7 – Build Sequence
A – 410A Platform

Digit 8,9,10 – Component Codes
Internal Component Code Data

- 8 - T, C, or O
- 9 – A, S, or O
- 10 – S or O

Digit 11 – Unit Voltage
A - 208 v 3 Ø 60 Hz
B - 230 v 3 Ø 60 Hz
C - 460 v 3 Ø 60 Hz
D - 575 v 3 Ø 60 Hz
E - 200v 3 Ø 50 Hz
E - 230v 3 Ø 50 Hz
G - 380-400v 3 Ø 50 Hz
H - 500v 3 Ø 50 Hz

Digit 12 – Power Connection
T = Standard terminal block
D = Non-fused disconnect

Digit 13 – Water Regulating Valves
0 = None
1 = Factory installed valve(s)

Digit 14 – Communication Options
S = Standard BACnet/Modbus/N2
L = LonTalk option

Digit 15 – Hot Gas Bypass
0 = No HGB function
1 = HGB on one circuit
2 = HGB on 2 ckts (optional for 40-60T units)

Digit 16 – Sound enclosure
0 = No Sound Enclosure Provided
1 = Factory Sound Enclosure

Digit 17 – Design Special
0 = No special Features
S = Special design features

Remaining Digits – Basic/Ship loose options
(Delineated with commas)
40 – 5 Yr Extended Comp. Warranty
70 – Flow Switche(s)
100 – Neoprene Seismic Isolators
200 – Spring-type Seismic Isolators
300 – Neoprene Non-seismic Isolators
400 – Spring-type Non-seismic Isolators
500 – Aux Controller Board(s)

See sales documents, final approved submittal sheets, or packing slips for detailed shipped-loose model information

APPENDIX: WARRANTY

I. LIMITED PRODUCT WARRANTY & SERVICE POLICY

Napps Technology, Inc. (NAPPS) warrants for a period of twelve (12) months from date of original shipment that all products, manufactured by NAPPS, with the exception of packaged refrigeration products, are free from defects of material and workmanship when used within the service, range, and purpose for which they were manufactured. Packaged refrigeration products shall be so warranted for a period of twelve (12) months from date of start-up or eighteen (18) months from date of original shipment, whichever may first occur. Service Parts shall be so warranted for a period of ninety (90) days from date of installation, or twelve (12) months from date of original shipment, whichever may first occur.

In case material is rejected on inspection by the buyer as defective, NAPPS shall be notified in writing within ten (10) days from receipt of said material. NAPPS will then have the option of re-inspection at the buyer's plant or its own plant before allowing or rejecting the buyer's claim. Expenses incurred in connection with claims for which NAPPS is not liable may be charged back to the buyer. No claim for correction will be allowed for work done in the field except with the written consent of NAPPS. Defects that do not impair service shall not be cause for rejection. NAPPS assumes no liability in any event for consequential damages. No claim will be allowed for material damaged by the buyer or in transit. Defective equipment or parts shall be returned to NAPPS freight prepaid.

NAPPS will, at its option, repair, replace or refund the purchase price of products found by NAPPS to be defective in material or workmanship provided that written notice of such defect requesting instruction for repair, replacement or refund is received by NAPPS within ten (10) days of determination of said defect, but not more than one (1) year after the date of shipment, and provided that any instructions given thereafter by NAPPS are complied with.

Any products covered by this order found to NAPPS' satisfaction to be defective upon examination at NAPPS' factory will, at NAPPS' option, be repaired or replaced and returned to Buyer via lowest cost common carrier, or NAPPS may, at its option, grant Buyer a credit for the purchase price of the defective article.

Without limitation of the foregoing, this warranty shall not apply to (i) deterioration by corrosion or erosion of material or any cause or failure other than defect of material or workmanship; (ii) the performance of any system of which NAPPS' products are a component part; or (iii) any of NAPPS' products or parts thereof which have been subjected to alteration or repair by anyone other than NAPPS or someone authorized by NAPPS, or subjected to misuse, neglect, free chemicals in system, corrosive atmosphere, abuse or improper use or misapplication such as breakage by negligence, accident, vandalism, the elements, shock, vibration or exposure to any other service, range or environment of greater severity than that for which the products were designed, or if operation is contrary to NAPPS' or manufacturer's recommendation, or if the serial number has been altered, defaced or removed.

Hermetic motor/compressors furnished by NAPPS are subject to the standard warranty terms set forth above, except that the hermetic motor/compressor replacements or exchanges shall be made through the nearest authorized wholesaler of the hermetic motor/compressor manufacturer (**not** NAPPS' factory) and no freight shall be allowed for transportation of the hermetic motor/compressor to and from the wholesaler. For TRANE hermetic motor/compressors, the nearest wholesaler referred to herein shall be the nearest TRANE PARTS CENTER. The replacement hermetic motor/compressor shall be identical to the model of the hermetic motor/compressor being replaced. Additional charges, which may be incurred through the substitution of other than identical replacements, are not covered by this warranty. Evaporator failure due to fluid freezing that is the result of low fluid flow or inadequate fluid freeze protection, for applications with leaving fluid temperatures below 40° F, is not covered by this warranty.

THE WARRANTY PROVIDED ABOVE IS THE ONLY WARRANTY MADE BY NAPPS WITH RESPECT TO ITS PRODUCTS OR ANY PARTS THEREFORE AND IS MADE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, BY COURSE OF DEALING, USAGES OF TRADE OR OTHERWISE, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE OR OF MERCHANTABILITY UNDER THE UNIFORM COMMERCIAL CODE. IT IS AGREED THAT THIS WARRANTY IS IN LIEU OF AND BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTEES OR LIABILITIES ARISING BY LAW OR OTHERWISE. NAPPS SHALL NOT INCUR ANY OTHER, OBLIGATIONS OR LIABILITIES OR BE LIABLE TO BUYER OR ANY CUSTOMER OF BUYER FOR ANY ANTICIPATED OR LOST PROFITS, INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR ANY OTHER LOSSES OR EXPENSES INCURRED BY REASON OF THE PURCHASE, INSTALLATION, REPAIR, USE OR MISUSE BY BUYER OR THIRD PARTIES OF ITS PRODUCTS (INCLUDING ANY PARTS REPAIRED OR REPLACED); AND NAPPS DOES NOT AUTHORIZE ANY PERSON TO ASSUME FOR NAPPS ANY OTHER LIABILITY IN CONNECTION WITH THE PRODUCTS OR PARTS THEREFORE. NAPPS SHALL NOT BE RESPONSIBLE FOR THE LOSS OR REPLACEMENT OF OR THE ADDITION OF COMPRESSOR OIL, OR REFRIGERANT. THIS WARRANTY CANNOT BE EXTENDED, ALTERED OR VARIED EXCEPT BY A WRITTEN INSTRUMENT SIGNED BY NAPPS AND BUYER.

II. LIMITATION OF LIABILITY

NAPPS shall not be liable, in contract or in tort, for any special, indirect, incidental or consequential damages, such as, but not limited to, loss of profits, or injury or damage caused to property, products, or persons by reason of the installation, modification, use, repair, maintenance or mechanical failure of any NAPPS product.

APPENDIX: VENDOR DATA SHEETS

The following vendor data sheets are attached:

1. MSC-CT300 Current Transducer Data Sheet
2. MCS-667F Pressure Transducer Data Sheet
3. MCS-T100 Temperature Sensor Data Sheet
4. Sporlan SD278 IB Interface Board Installation Manual & Troubleshooting
5. Sporlan 100-50-2 IB Interface Board Data Sheets
6. Copeland Compressors – Refrigeration Oils
7. NAPPS MCS Digital Controller – MCS CONNECT Software Installation & Setup

MSC-CT300 Current Transducer Data Sheet

Micro Control Systems
5877 Enterprise Parkway, Fort Myers, FL 33905
Office: 239-694-0089 Fax: 239-694-0031
www.mcscontrols.com

The MCS-CT300 Specifications & Description

Part # MCS-CT300

Physical Characteristics

Dimensions:
- Height .....4.00"
- Width.....2.38"
- Depth .....1.56"
- Wire Hole.....1.00"

Amperage Rating .....0-300A ±2% FS
Sensor Output Voltage.....0-5vdc
Supply Voltage .....Induced

Operating Temperature.....-40°F to +158°F (-40°C to +70°C)
Storage Temperature.....-40°F to +158°F (-40°C to +70°C)

Product Description

The MCS-CT300 current sensor monitors current flowing to electrical equipment. The magnitude of the current is converted to a linear (0-5vdc) output signal which can be read as a standard analog input signal. The signal is used by MCS micro controllers for the following:

1. For slide valve positioning on screw machines
2. For high amp motor overload protection
3. For verification of device on / off

The MCS-CT300 is a solid-core version, where the conductor runs through the sensor. No cutting, taping or rerouting is required. It is accurate, reliable, easy to install and requires no service.

The MCS-CT300 has an accuracy of ±2% over the range 10% to full scale in the frequency range from 50-60Hz. The sensor outputs a 0-5vdc signal. The sensor power is induced from the current being monitored.

On the printed circuit board a resistor is mounted across the CT terminals which eliminates danger from induced current. A removable three-position terminal block is provided for easy wiring.

Two-conductor shielded cable must be used. The shield must be cut at the MCS-CT300 end and tied to ground at the MCS micro controller terminal block.

Volts dc	Amps
0.08	5
0.17	10
0.33	20
0.50	30
0.67	40
0.83	50
1.00	60
1.17	70
1.33	80
1.50	90
1.67	100
1.83	110
2.00	120
2.16	130
2.33	140
2.50	150

Volts dc	Amps
2.66	160
2.83	170
3.00	180
3.16	190
3.33	200
3.50	210
3.66	220
3.83	230
4.00	240
4.16	250
4.33	260
4.50	270
4.66	280
4.83	290
5.00	300

MCS-667F Pressure Transducer Data Sheet

MICRO CONTROL SYSTEMS
5877 Enterprise Parkway, Fort Myers, FL 33905
Office: 239-694-0089 Fax: 239-694-0031
www.mcscontrols.com

The MCS-667F-T-xx Specifications & Description

Physical Characteristics

Pressure Range	0 to 667 psi (Gauge)
Accuracy	± 0.25% of span
Housing	Stainless steel
Operating Temperature	-40°F to +221°F (-40°C to +105°C)
Proof Pressure	2 x FS
Burst Pressure	20 x FS
Random Vibration	40 G p-p
Input Voltage	5vdc
Output Voltage	0.5 to 4.5vdc
Connection	1/4" SAE female flare

Cable:

Connector	Packard with Neoprene seal
Length	20', 40' or 60' feet.
Type	3-conductor, 20 awg stranded
Shield	Foil shield with 25% overlap
Drain	Stranded tinned copper drain

Part number description when ordering (MCS-667F-T-xx)

xx	20' 40' or 60' wire length

Part # MCS-667F-T-xx

Product Description

The MCS-667F-T-xx pressure transducer is a proven performer at a low cost. Its design is ideal for demanding HVAC and refrigeration applications where long-term reliability is a requirement. Internal components are packaged in a stainless steel housing with a 1/4" SAE female flare fitting.

The cable is available in either 20', 40' or 60' lengths with a removable Packard connector to provide easy serviceability. The wire is sealed and crimped to the Packard connector providing a liquid tight environment and strain relief. Media compatibility: Refrigerants (freons) and ammonia.

The table at the bottom left provides a cross reference between psi and vdc at a sensor input pin (SI) of the MCS micro controller.

Product Specifications

PSI	SI (vdc)	PSI	SI (vdc)	PSI	SI (vdc)	PSI	SI (vdc)	PSI	SI (vdc)	PSI	SI (vdc)	PSI	SI (vdc)
0	0.50	100	1.10	200	1.70	300	2.30	400	2.90	500	3.50	600	4.10
10	0.56	110	1.16	210	1.76	310	2.36	410	2.96	510	3.56	610	4.16
20	0.62	120	1.22	220	1.82	320	2.42	420	3.02	520	3.62	620	4.22
30	0.68	130	1.28	230	1.88	330	2.48	430	3.08	530	3.68	630	4.28
40	0.74	140	1.34	240	1.94	340	2.54	440	3.14	540	3.74	640	4.34
50	0.80	150	1.40	250	2.00	350	2.60	450	3.20	550	3.80	650	4.40
60	0.86	160	1.46	260	2.06	360	2.66	460	3.26	560	3.86	660	4.46
70	0.92	170	1.52	270	2.12	370	2.72	470	3.32	570	3.92	667	4.50
80	0.98	180	1.58	280	2.18	380	2.78	480	3.38	580	3.98		
90	1.04	190	1.64	290	2.24	390	2.84	490	3.44	590	4.04		

Revised 2011-03-17

Note: The MCS-667F is a drop in replacement for the TI-667A used in some Napps NxC models

MCS-T100 Temperature Sensor

Micro Control Systems
5877 Enterprise Parkway, Fort Myers, FL 33905
Office: 239-694-0089 Fax: 239-694-0031
www.mcscontrols.com

The MCS-T100 Specifications & Description

Physical Characteristics

Standard Temperature Range	+32°F to +158°F (0°C to +70°C)
Standard Temperature Accuracy	±0.36° F (±0.2°C)
Extended Temperature Range	-25°F to +230° F (-30°C to 110°C)
Extended Temperature Accuracy	±1.5°F (±0.8°C)
Resistance Range	2 Meg to 286 ohms
Response Time (32 to 212°F)	22 sec (in liquid)
Response Time (212 to 32°F)	30 sec (in liquid)
Input Voltage	5vdc
Sensor Resistance	100,000 ohms @ 77°F (25°C)
Housing Specifications:	
Dimensions	0.187"OD x 1.5"L
Material	Stainless Steel
Environmental rating	Waterproof to IP68
Testing	10,000 freeze/thaw thermal cycles
Cable:	
Length	20', 40' or 60'
Wire	2 conductor 22 awg stranded
Shield	Foil shield with 25% overlap
Drain	Stranded tinned copper drain
Part number description when ordering (MCS-T100-xx)	
xx	20', 40' or 60' wire length

Part # MCS-T100

Product Description

The MCS-T100 is an extremely fast acting temperature sensor built for demanding environments. It is ideal for high moisture locations with continuous freeze and thaw cycles. The sensor is potted with a thermally conductive adhesive to guarantee durability and response. Its high accuracy allows for interchangeability in the field.

The large resistance range allows the use of over 1000' of cable with no noticeable effect. By placing a 100,000 ohm resistor between signal and ground the sensor may be used in a three wire input mode. The table below provides a cross reference between °F, ohms and vdc at a sensor input pin (S1) of a MCS micro controller.

Product Specifications

Temp (°F)	Resist (ohms)	S1 (vdc)	Temp (°F)	Resist (ohms)	S1 (vdc)	Temp (°F)	Resist (ohms)	S1 (vdc)	Temp (°F)	Resist (ohms)	S1 (vdc)	Temp (°F)	Resist (ohms)	S1 (vdc)
21	491,039	0.846	37	302,535	1.242	53	191,021	1.718	69	123,406	2.238	85	81,454	2.756
22	476,042	0.868	38	293,758	1.270	54	185,753	1.750	70	120,169	2.271	86	79,420	2.787
23	461,550	0.890	39	285,263	1.298	55	180,647	1.782	71	117,027	2.304	87	77,444	2.818
24	447,544	0.913	40	277,040	1.326	56	175,696	1.814	72	113,977	2.337	88	75,522	2.849
25	434,007	0.936	41	269,080	1.355	57	170,897	1.846	73	111,015	2.369	89	73,654	2.879
26	420,922	0.960	42	261,373	1.384	58	166,243	1.878	74	108,139	2.402	90	71,838	2.910
27	408,271	0.984	43	253,910	1.413	59	161,730	1.910	75	105,347	2.435	91	70,072	2.940
28	396,041	1.008	44	246,684	1.442	60	157,353	1.943	76	102,634	2.467	92	68,355	2.970
29	384,214	1.033	45	239,686	1.472	61	153,109	1.975	77	100,000	2.500	93	66,685	3.000
30	372,778	1.058	46	232,908	1.502	62	148,991	2.008	78	97,441	2.532	94	65,060	3.029
31	361,718	1.083	47	226,342	1.532	63	144,997	2.041	79	94,955	2.565	95	63,480	3.058
32	351,020	1.109	48	219,982	1.563	64	141,123	2.074	80	92,541	2.597	96	61,943	3.088
33	340,672	1.135	49	213,820	1.593	65	137,363	2.106	81	90,194	2.629	97	60,448	3.116
34	330,661	1.161	50	207,850	1.624	66	133,715	2.139	82	87,915	2.661	98	58,993	3.145
35	320,976	1.188	51	202,063	1.655	67	130,175	2.172	83	85,699	2.693	99	57,577	3.173
36	311,604	1.215	52	196,456	1.687	68	126,740	2.205	84	83,546	2.724	100	56,200	3.201

Revised 2009-10-01

Sporlan SD278 IB Interface Board Installation Manual & Troubleshooting

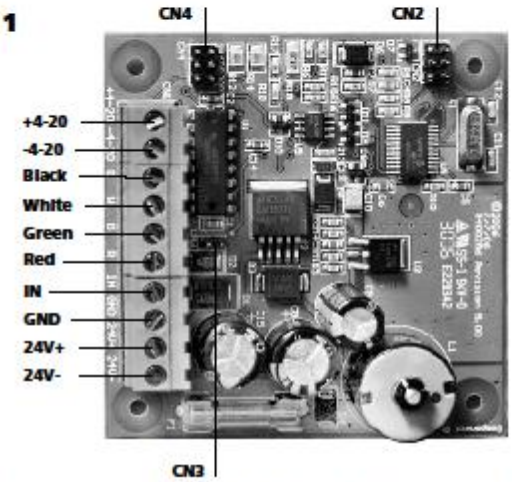
November 2008 / **SD-278**

IB SERIES

INTERFACE BOARDS

The **IB Series** interface boards have been developed as economical compliments to the TCB temperature control boards. The **IB Series** is available in four basic models, IB1, IB2, IB3 and IB6, and each can accept 4-20 milliamp or 0-10 volt DC analog input signals. All are designed to allow externally supplied control signals to control one or two Sporlan step motor valves including CDS evaporator control valves, SDR electric discharge bypass valves and SEI/SER/SEH electric expansion valves.

Figure 1



The IB1 is programmed to control any Sporlan step motor valve having 1596 steps of resolution, the IB2 is used with valves having 2500 steps, the IB3 is used with valves having 3193 steps and the IB6 is used on valves with 6386 steps. "Q" denotes quick response for special applications. Please contact Sporlan for more information.

CONFIGURE the BOARD

When used with a 0-10 volt input signal, a jumper should be placed on the pins labeled CN3 as shown in the Figure 1. This is the default jumper position. The impedance for this input is 40 k ohms.

When used with a 4-20 milliamp input, the board must be matched to the impedance of the external controller. Refer to the manufacturer's literature and choose the jumper position on CN4 as shown Figure 1. Possible impedance selections on CN4 are 1,000 ohms (1k), 600 ohms, and 300 ohms. Note: Jumpers should never be on both CN3 and CN4.

Choose "Open on Rise" or "Close on Rise" operation using the middle two pins on jumper CN2. The jumper is stored on one pin only and will cause the valve to open as input signal rises, i.e. valve is closed at 0 volts or 4 milliamps and fully open at 10 volts or 20 milliamp input. By placing the jumper on both pins, the operation is reversed so that the valve will be fully open at 0 volts or 4 milliamps. Other pins on CN2 have been clipped at the factory and are not used for operation of the valve.

FOR USE ON REFRIGERATION and/or AIR CONDITIONING SYSTEMS ONLY

SPORLAN

WIRING CONNECTIONS

From left to right when the board is oriented with the terminal strip across the bottom.

+4-20	connection for the positive leg of a 4-20 milliamp or 0-10 volt signal
-4-20	connection for negative leg of a 4-20 milliamp or 0-10 volt signal
B	black wire from valve, or both valves when two valves are used
W	white wire from valve, or both valves when two valves are used
G	green wire from valve, or both valves when two valves are used
R	red wire from valve, or both valves when two valves are used
IN	from external pumpdown switch or relay. See wiring instructions.
GND	to external pumpdown switch or relay. See wiring instructions.
24V+	from 24 volt, 40 VA transformer. See wiring instructions.
24V-	from 24 volt, 40 VA transformer. See wiring instructions.

Note: Power supplied may be 24 volts AC or DC

MOUNT the BOARD

The **IB Series** is based on a 3.0" x 3.0" circuit card with 0.125" mounting holes, 0.25" from each corner as shown in Figure 2. If desired, these mounting holes may be used with customer supplied non-metallic standoffs. The **IB Series** does, however, come supplied with a length of snap-in plastic track. The track should be mounted in the desired location and one side of the IB engaged in the upper groove in the track. The IB is then pushed down so that the opposite side of the board snaps into the uppermost groove in the opposite side of the track. The board may be mounted in the orientation most convenient for wiring. Location should be dry, protected and close to the 24 volt power supply and external controller.

WIRING INSTRUCTIONS and CAUTIONS

Use the chart above as a guide for wire connections. Certain precautions must be taken in wiring and operation of the **IB Series**.

1. The 24 volts must be supplied by a transformer not used for any other purpose. In addition, the secondary winding of the transformer must not be connected to chassis ground. A single transformer may be used to power multiple IB boards if wiring recommendations shown in Figure 3 are followed. A transformer that can supply a load of 30VA per board should be used. For example, a transformer of 90VA or more should be used if powering three IB Boards.
2. The primary input of the transformer should be protected by Metal Oxide Varister (MOV) surge suppressors, supplied with the IB. For protection from electrical transients, connect one MOV between one leg of the input voltage (high side) of the 24 VAC transformer and earth ground. Connect a second MOV between the other leg of the input voltage of the 24 VAC transformer and earth ground. Note: The supplied MOVs may only be used with up to 240V supply voltage.
3. The pumpdown terminals, labeled IN and GND, must be supplied with a "dry" contact from a switch or relay. No external power should be applied to these terminals.

OPERATION and TROUBLESHOOTING

When properly configured and installed the **IB Series** requires no maintenance. They incorporate a number of operational features to assure trouble free service. On power-up the board will initialize by giving the valve a large number of steps to assure that the valve is fully shut. The routine will require approximately 8 seconds for the IB1, 16 seconds for the IB2 and IB3 and 32 seconds for the IB6. The valve will not respond to input signals during this time.

The IB is supplied with an onboard fuse and one spare fuse. If a replacement fuse is not available, a 1 amp 250 volts delay fuse type GMC1 or equivalent may be used. The fuse is designed to prevent board damage from miswiring. If the fuse fails, correct wiring in accordance to all recommendations before restoring power.

If the valve is required to shut during operation, the pumpdown terminals should be used. When given a pumpdown signal, the board will shut the valve immediately and overdrive by 250 steps to reset valve position. On removal of the pumpdown signal the valve will resume position as dictated by the external control signal.

If power is lost to the IB or wire to the valve is severed, the valve will remain in its last position. On critical applications solenoid valves may be desired up stream of the step motor valve.

To force the valve shut during operation for test purposes, simply remove the jumper from CN4 or CN3, depending on configuration. To resume normal operation, replace the jumper. To allow for component tolerances, the IB will shut the valve when the input signal reaches 4.05 milliamps or 0.05 volts depending on the configuration.

The IB can power one or two valves. The valves will operate simultaneously and will open and close by the same number of steps. Both valve wires must be connected in the proper color sequence.

If a step motor is suspected to have failed, a simple resistance check may be made of the motor windings, however, actual winding failures are rare. Therefore Sporlan developed a diagnostic instrument, the SMA-12, to test step motors. The SMA-12 is a step motor actuator that will operate all 12 volt DC bipolar step motor valves, as well as test the continuity of the valve wiring and motor. The step rate can be selected at 1, 50, 100 or 200 steps-per-second. At the one step-per-second rate the SMA-12 LED's will indicate the continuity of the valve wiring and motor by lighting in turn. The SMA-12 can also be used to manually open, position, or shut the valve should the controller fail. If contaminants are suspected, the SMA-12 can be used to drive the valve fully open to purge the foreign material.

ORDERING INFORMATION

MODEL	PART#	STEPS	USED on VALVES
IB1	952955	1596	SEI or SER for discharge bypass
IB2	983188	2500	CDS-4, CDS-7
IB3	952956	3193	SDR-3, SDR-3X
IB6	952957	6386	CDS-9, CDS-16, CDS-17, SDR-4
IB10	952958	1596	SEI-.5 to SEI-11, SER-1.5 to SER-20
IB20	983189	2500	SERI-G, SERI-J, SERI-K
IB30	952959	3193	SEI-30
IB60	952960	6386	SEI-50, SEH

When a system component does fail, it is important to first determine whether the failure is the valve, the IB, or the external controller.

TEST THE VALVE

The resistance of the motor winding may be tested without opening the system.

1. Remove power from the external controller and/or IB.
2. Remove the valve leads from IB.
3. Measure the resistance between the black and white leads of the valve. For the SEI, SDR, SEH, CDS-9, CDS-16, and CDS-17 valves, the resistance should be 75 ohms with the valve at room temperature or approximately 65 ohms if the valve is at -40°F. For the SERI-G, SERI-J, SERI-K, CDS-4, and CDS-7 valves, the resistance should be 100 ohms at room temperature and approximately 76 ohms if the valve is at -40°F.
4. Measure the resistance between the green and red leads. This value should be within ± 5% of the resistance between the black and white leads.
5. Measure the resistance from any lead to valve body. Resistance should be infinite, that is to say, open.

TEST THE IB

The flow charts on the following page are designed to assist in diagnosing a possible IB failure. All measurements should be made with a **Digital Multimeter**.

Figure 3

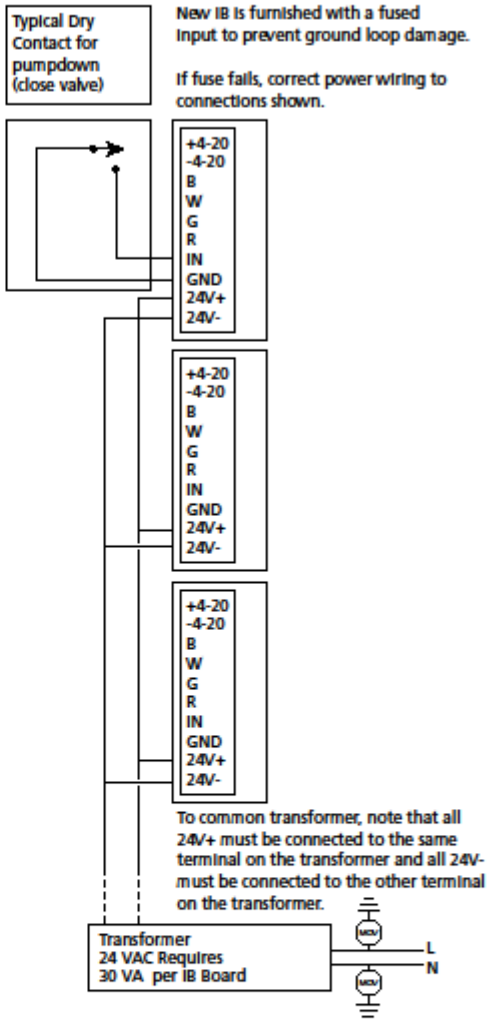
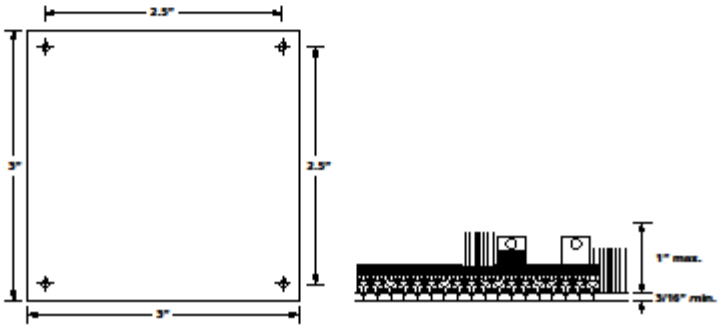


Figure 2



TROUBLE SHOOTING GUIDE – IB Operating on External Signal (4-20 ma or 0-10 VDC)

Note: Before testing the IB, make certain the valve is operating. See "Test the Valve" instructions.

1. Is there 24 V AC at terminals 24V+ & 24V-?	NO	Repair or replace power supply or power supply wiring.
YES		
2. Is the fuse installed and intact?	NO	Check wiring for polarity. Transformer should NOT be a grounded secondary type. Replace if necessary.
YES		
3. Is the 24V transformer of the isolated secondary type?	NO	Replace the transformer with an isolated secondary type.
YES		
4. Is the valve connected to terminals (black, white, green, red) with wire colors correct?	NO	Shut off power to IB and correct wiring.
YES		
5. Connect voltmeter on AC scale to the Black and White valve terminals. Interrupt and restore power to the IB. Does the meter read 12-14 volts AC?	NO	Using an SMA-12 test instrument, test the step motor. If operational, replace the IB.
YES		
6. Repeat above test using Red and Green terminals. Does the meter read 12-14 volts AC?	NO	Using an SMA-12 test instrument, test the step motor. If operational, replace the IB.
YES		
7. Are wires for external signal connected to terminals +4-20 & -4-20?	NO	Shut off power to IB and external controller. Correct input signal observing polarity.
YES		
8. Is external signal present? Signal should be 4-20 MA at 12 volts DC or 0-10 VDC.	NO	Test or replace external controller.
YES		
9. Is polarity of signal correct? (+) to term +4-20 and (-) to term -4-20.	NO	Shut off power to IB and external controller and correct wiring.
YES		
10. Is pin jumper for input signal selection (CN4 or CN2) on the correct pins? See Figure 1*.	NO	Shut off power to IB and external controller and move pin jumper to correct location.
YES		
11. If present, remove wires from pumpdown terminals IN & GND. Did the valve open?	NO	First make sure input at terminal +4-20 & -4-20 is greater than 4 ma. If so, repair wiring or replace pumpdown relay.
YES		
12. Put a jumper across terminals IN & GND. Did the valve close?	NO	Using an SMA-12 test instrument, test the step motor. If operational, replace the IB.
YES		
13. Remove the jumper from terminals IN & GND and reconnect the wires.		
YES		
14. Remove the pin jumper from CN4 or CN2. Did the valve close?	NO	IB is defective, Replace IB
YES		
IB is functional, test external controller.		

***Note: CN4 provides 3 levels of input impedence to match external controller outputs. Be sure controller output and IB inputs are matched. Refer to controller manufacturer literature for more information.**

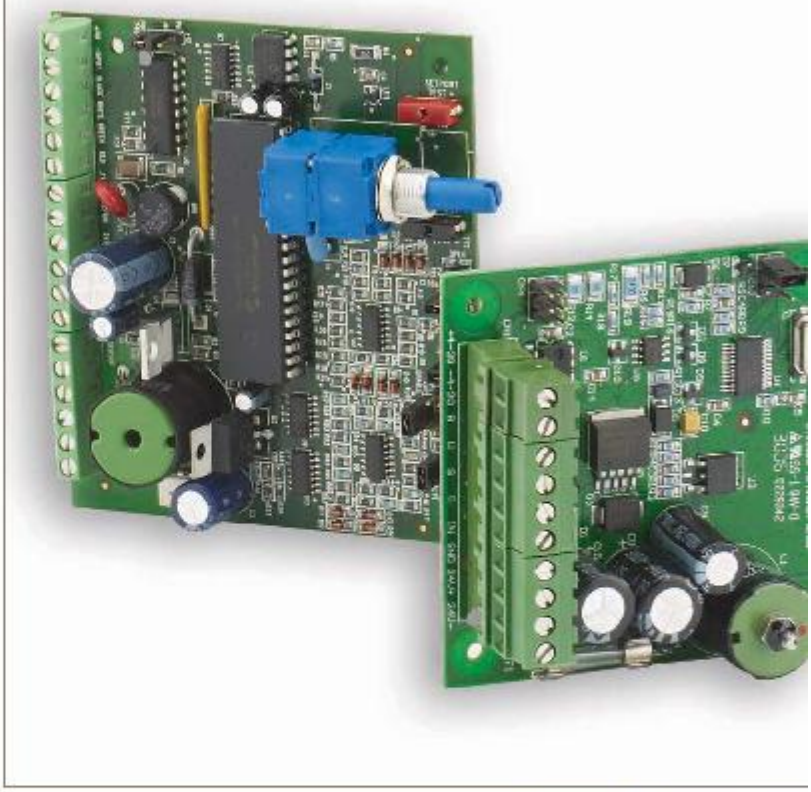
SPORLAN

Printed in the U. S. of A.

1108

Sporlan 100-50-2 IB Interface Board Data Sheets

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



Sporlan IB Series Interface Boards

IB1, IB2, IB3, IB6

Bulletin 100-50-2, January 2009

Parker SPORLAN

ENGINEERING YOUR SUCCESS.

The **IB Series** interface boards have been developed as economical compliments to the TCB temperature control boards. The **IB Series** is available in four basic models, IB1, IB2, IB3 and IB6, and each can accept 4-20 milliamp or 0-10 volt DC analog input signals. All are designed to allow externally supplied control signals to control one or two Sporlan step motor valves including CDS evaporator control valves, SDR electric discharge bypass valves and SEI/SER/SEH electric expansion valves.

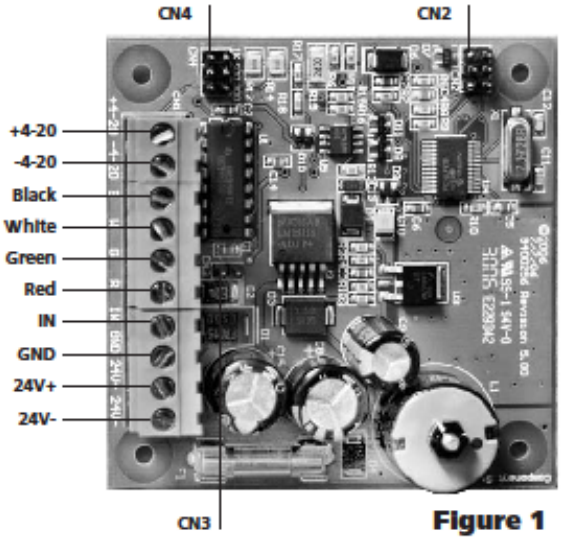


Figure 1

The IB1 is programmed to control any Sporlan step motor valve having 1596 steps of resolution, the IB2 is used with valves having 2500 steps, the IB3 is used with valves having 3193 steps and the IB6 is used on valves with 6386 steps. "Q" denotes quick response for special applications. Please contact Sporlan Valve Company. Refer to Ordering Information, page 3.

CONFIGURE the BOARD

When used with a 0-10 volt input signal, a jumper should be placed on the pins labeled CN3 as shown in the Figure 1. This is the default jumper position. The impedance for this input is 40 k ohms.

When used with a 4-20 milliamp input, the board must be matched to the impedance of the external controller. Refer to the manufacturer's literature and choose the jumper position on CN4 as shown Figure 1. Possible impedance selections on CN4 are 1,000 ohms (1k), 600 ohms, and 300 ohms.

Choose "Open on Rise" or "Close on Rise" operation using the middle two pins on jumper CN2. The jumper is stored on one pin only and will cause the valve to open as input signal rises, i.e. valve is closed at 0 volts or 4 milliamps and fully open at 10 volts or 20 milliamp input. By placing the jumper on both pins, the operation is reversed so that the valve will be fully open at 0 volts or 4 milliamps. Other pins on CN2 have been clipped at the factory and are not used for operation of the valve.

MOUNT the BOARD

The **IB Series** is based on a 3.0" x 3.0" circuit card with 0.125" mounting holes, 0.25" from each corner. If desired, these mounting holes may be used with customer supplied non-metallic standoffs. The **IB Series** does, however, come supplied witha length of snap-in plastic track. The track should be mounted in the desired location and one side of the IB engaged in the upper groove in the track. The IB is then pushed down so that the opposite side of the board snaps into the uppermost groove in the opposite side of the track. The board may be mounted in the orientation most convenient for wiring. Location should be dry, protected and close to the 24 volt power supply and external controller.

WIRING INSTRUCTIONS & CAUTIONS

Use the chart above as a guide for wire connections. Certain precautions must be taken in wiring and operation of the **IB Series**.

1. The 24 volts must be supplied by a 30 VA or 40 VA transformer not used for any other purpose. In addition, the secondary winding of the transformer must not be connected to chassis ground. A single transformer may be used for multiple IB boards. If this feature is used, one leg of the 24 volt supply must be connected to all of the IB boards at the 24+ terminal. The other leg of the 24 volt supply must be connected to all of the IBs at the 24- terminal. Please refer to Figure 2.

   Incorrect wiring will cause the fuse to fail, a spare fuse is included and may be replaced with any 1 amp 250 volts delay fuse type GMC1 or equivalent. Wiring should be corrected before replacing the fuse.

2. The primary input of the transformer should be protected by Metal Oxide Varister (MOV) surge suppressors, supplied with the IB. For protection from electrical transients, connect

WIRING CONNECTIONS

From left to right when the board is oriented with the terminal strip across the bottom.

- **+4-20** - connection for the positive leg of a 4-20 milliamp or 0-10 volt signal
- **-4-20** - connection for negative leg of a 4-20 milliamp or 0-10 volt signal
- **B** - black wire from valve, or both valves when two valves are used
- **W** - white wire from valve, or both valves when two valves are used
- **G** - green wire from valve, or both valves when two valves are used
- **R** - red wire from valve, or both valves when two valves are used
- **IN** - from external pumpdown switch or relay. See wiring instructions.
- **GND** - to external pumpdown switch or relay. See wiring instructions.
- **24V-1** - from 24 volt, 20 VA transformer. See wiring instructions.
- **24V-2** - from 24 volt, 20 VA transformer. See wiring instructions.

NOTE: Power supplied may be 24 volts AC or DC.

one MOV between one leg of the input voltage (high side) of the 24 VAC transformer and earth ground. Connect a second MOV between the other leg of the input voltage of the 24 VAC transformer and earth ground. See Figure 2.

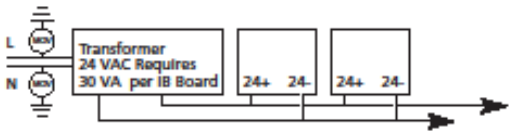


Figure 2

3. The pumpdown terminals must be supplied with a "dry" contact from a switch or relay. No external power should be applied to these terminals.

OPERATION and TROUBLESHOOTING

When properly configured and installed the **IB Series** requires no maintenance. They incorporate a number of operational features to assure trouble free service. On power-up the board will initialize by giving the valve a large number of steps to assure that the valve is fully shut. The routine will require approximately 8 seconds for the IB1, 16 seconds for the IB2 and IB3, and 32 seconds for the IB6. The valve will not respond to input signals during this time.

If the valve is required to shut during operation, the pumpdown terminals should be used. When given a pumpdown signal, the board will shut the valve immediately and overdrive by 250 steps to reset valve position. On removal of the pumpdown signal the valve will resume position as dictated by the external control signal.

If power is lost to the IB or wire to the valve severed, the valve will remain in its last position. Solenoid valves may be desired before the step motor valve on critical applications.

To force the valve shut during operation for test purposes, simply remove the jumper from CN4 or CN3, depending on configuration. To resume normal operation, replace the jumper.

To allow for component tolerances, the IB will shut the valve when the input signal reaches 4.05 milliamps or 0.05 volts depending on the configuration.

The IB can power one or two valves. The valves will operate simultaneously and will open and close by the same number of steps. Valve wires must be connected exactly the same for both valves.

ORDERING INFORMATION

MODEL	PART#	STEPS	USED on VALVES
IB1	952955	1596	SEI .5 -11, SER-1.5, SER-20 for discharge
IB2	983188	2500	CDS-4, CDS-7
IB3	952956	3193	SDR-3, SDR-3X
IB6	952957	6386	CDS-9, CDS-16, CDS-17
IB1Ω	952958	1596	SEI .5, SEI-11, SER
IB2Ω	983189	2500	SERI-G, SERI-J, SERI-K
IB3Ω	952959	3193	SEI-30
IB6Ω	952960	6386	SEI-50, SEH

Copeland Compressors – Refrigeration Oils

Copeland 17-1248

17-1248

Application Engineering Bulletin
AE-1248-R7

Revised January, 2000

REFRIGERATION OILS

As a result of the changes taking place in our industry due to the CFC issue, Copeland has evaluated numerous compressor lubricants to ensure compatibility with new HFC refrigerants and HCFC interim blends offered by several chemical producers. In addition to compatibility with these new refrigerants, it is also desirable that any new lubricant be compatible with the traditional refrigerants such as R-12, R-22 or R-502. However, this has not been achieved in all cases.

The following table summarizes which oils/lubricants are approved for use in Copeland compressors with the various refrigerants:

Use this data for Napps Copeland equipped products

COPELAND APPROVED LUBRICANTS

	Lubricant Type	Traditional Refrigerants R-12	Traditional Refrigerants R-22, R-502	Interims R-401A, R-401B, R-402A, R-408A, R-409A (MP-39, MP-66, HP-80, FX-10, FX-56)	HFC's R-134a, R-404A, R-507 R-407C, R-410A
POE's	Copeland Ultra 22CC		A	A	P
	Copeland 3MA		A	A	P (1,3)
	Mobil EAL ARCTIC 22CC	NOT ACCEPTABLE	A	A	P
	ICI (Virginia KMP) Emkarate RL 32CF		A	A	P
	Thermal Zone 22CC		A	A	P
MINERAL OILS	Witco Suniso 3GS	P	P	PM	NOT ACCEPTABLE
	Texaco Capella WF32	P	P	PM	
	Calumet RO15	P	P	PM	
	Witco (2,3) LP-200	P	P		
	Penreco (2,3) Sontex 200-LT Shrltene	P	P		
AB	Copeland Ultra 200	A	A	PM	NOT ACCEPTABLE
	Shreve Zerol 200 TD	A	A	PM	
	Soltex AB200A	A	A	PM	
	Thermal Zone 200	A	A	PM	
AB MO MIX	Shell 22-12	A	A	P	NOT ACCEPTABLE
	Witco R-195-0	A	A	P	

Legend:
P = Preferred Lubricant Choice
A= Acceptable Alternative
M= Mixture of Mineral Oil and Alkyl Benzene (AB) with minimum 50% AB

(1) ZP Scroll A/C applications
(2) BR, QR and Scroll A/C applications
(3) Not available in field

Copeland 17-1248

Napthenic Mineral Oils

The BR, QR, and Scroll compressors used in HCFC R-22 applications use Witco LP-200 or Sontex 200-LT, both "white oils". Since these oils are not available through normal refrigeration wholesalers, for field "top-off" the use of any approved mineral oil (MO) or alkyl benzene (AB) is permissible.

Suniso 3GS, Capella WF32 and Calumet RO15 (pale yellow oils) are available through refrigeration wholesalers. These oils are compatible if mixed and can be used on both high and low temperature systems.

Polyol Ester Lubricants

Copeland has tested and approved the following polyol ester lubricants for use in our compressors:

Copeland Ultra 22CC

Mobil EAL Arctic 22CC

ICI Emkarate RL 32CF

Thermal Zone 22CC

These lubricants have been specifically formulated to meet our stringent demands and have been found to be equivalent in performance. These POE's **must** be used if HFC refrigerants are used in the system. They are also acceptable for use with any of the traditional refrigerants or interim blends and are compatible with mineral oils. They can therefore be mixed with mineral oils when used in systems with CFC or HCFC refrigerants. These lubricants are compatible with one another and can be mixed.

The ZP scroll compressors used in HFC R-410A applications use a POE oil not available through wholesalers. Any of the POE oils listed above may be used to replace up to 50% of the original oil if necessary.

One caution the users of POE's must be aware of is the hygroscopic nature of these lubricants. Care must be taken to avoid moisture absorption during handling.

Alkyl Benzene's

Copeland Ultra 200, Zerol 200TD, Soltex AB 200A and Thermal Zone 200 are alkyl benzene (AB) lubricants. Copeland recommends these lubricants for use as mixtures with mineral oil (MO) when using the Interim Blends such as R-401A, R-401B, R-402A, R-408A, and R-409A (MP-39, MP-66, HP80, FX-10 and FX-56). A minimum of 50% AB is required with these mixtures to assure proper oil return to the compressor.

Shell 22-12 and Witco R-195-0 are mixtures of AB/MO. If these lubricants are used in a retrofit situation, virtually all of the existing MO must be drained prior to re-filling with these products to assure a minimum 50% AB content.

Additional Literature

Additional information regarding HFC's and retrofits can be obtained from the following Copeland literature:

AE Bulletin 4-1295	HFC 134a Refrigerant Guidelines
Form 93-11	Copeland Accepted Refrigerants/Lubricants
Form 93-02	R-12 to R-401A Refrigerant Changeover Guidelines
Form 93-03	R-12 to R-401B Refrigerant Changeover Guidelines
Form 93-04	R-12 to R-134a Refrigerant Changeover Guidelines
Form 93-05	R-502 to R-402A or R-408A Refrigerant Changeover Guidelines
Form 94-15	R-502 to R-404A or R-507 Refrigerant Changeover Guidelines
Form 95-14	R-22 to R-407C Refrigerant Changeover Guidelines

Copeland Corporation
Sidney, OH 45365-0669

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NAPPS MCS Digital Controller – MCS CONNECT Software Installation & Setup

Downloading and Installing MCS CONNECT Software

Go to WWW.MCSCONTROLS.com. Go to software page and select MCS CONNECT. Select SAVE. After downloading, open and select RUN. Follow prompts and software will be installed on your computer.

If your computer does not have a serial port, you will need to purchase a USB to Serial adapter. (Computer stores or Radio Shack should have this.) Install the software for the adapter. If your computer has a serial port, you will not need an adapter.

You will need to know which Port your computer uses as the COM PORT. In Vista, go to the CONTROL PANEL and select DEVICE MANAGER. Look for PORTS (COM & LPT), expand and you should see a COM PORT number. Windows 7 is similar.

Start the MCS CONNECT program. Select SETUP>COMMUNICATIONS then change LOCAL COM PORT to match your computer. Select SAVE and then OK.

Connecting to the Chiller

Connect the supplied NULL MODEM cable between your USB adapter or serial port to the chiller. A standard serial cable will not work. Start the MCS CONNECT software and select LOCAL SERIAL. You should see the site info page. The software should scan and find the chiller. (If you see a *Failed to open com port* error, or it scans and does not find the chiller, your com port settings are not correct.) Click on the tab 1-NCC/NWC. You will now have a screen full of real time data.

Set Point Changes

Click on the button VIEW ONLY. Enter the password code 2112. Select OK. Button should now say SERVICE. Go to set points and double click on a value. Change and select OK.

Viewing and Troubleshooting ALARMS

The NAPPS MCS Digital Controller will record and store 30 second sensor input data prior to and up to any LOCKOUT ALARM. Select ALARM tab, then INFO next to the alarm you want to analyze. This will pop up a screen that shows operating conditions just prior to the trip. You can easily determine if the fault was caused by a sudden or gradual change. For instance, a sudden increase in discharge pressure might suggest a condenser pump or fan failure etc. (This data can also be viewed from the chiller LCD screen. Select LOCKOUT ALARMS.)

Downloading and Viewing Graphs

The NAPPS MCS Digital Controller continuously records and stores sensor input and relay/analog output data. This data is collected in 10 second (default) intervals. The controller stores 1008 packets of data replacing the oldest with the newest. With the time interval set at 10 seconds you can download graph data with a time span of 168 minutes. The time interval is adjustable.

In the MCS CONNECT program, select GRAPH. Data will be downloaded and then a graph setup page will appear. Select the input and output data you want to look at. Type in Y axis parameters and select OK. Use the scroll bar at the bottom of the graph to view. You can go back to the setup page at any time to change selections. You may save the graph to view later. You don't have to be connected to view a saved graph file. Your saved graph will be located in a folder called GRAPH inside another folder called MCS on your C: Drive.

To change the default 10 second interval, make changes and select SAVE and then OK on the setup page. The controller will now record data at this new interval.

To view a saved graph, select LOAD A GRAPH FILE. These files can be emailed to us for analysis if needed.

Updating Chiller Software and Configuration Files

NAPPS chillers are programmed, set up, and tested prior to shipment. Sometimes after a unit arrives at the jobsite, the customer may want to enable an option such as 0-5VDC Target reset or chilled water pump control etc. These options require a configuration change. We will either have you download the configuration file from the chiller and email it to us where we will modify it and return it to you, or we will modify a default configuration file we have here at the factory and send it to you. Modifying a configuration file you send us will save any setpoint changes that have been made on site. Otherwise, the controller will be set back to default factory settings.

To email us a copy of your chiller's configuration file, in the MCS CONNECT program, establish communication with the chiller and select RECEIVE CFG. Name it something and email it to engineering@nappsac.com.

To load a configuration file, turn off circuit enable switches and select TRANSMIT CFG. Locate the new file and press OPEN. The file will be uploaded to the controller. The controller will reboot itself.

Routine software (HEX FILE) updates are not necessary. However, if we think a software update is necessary to resolve an operating issue you may be having, we will email the hex file in a zipped folder. Save the zipped folder to your desktop. Right click folder and select EXTRACT ALL. This will create another folder by the same name on your desktop. Inside this folder you'll find the hex file. It should be about 2300kb large.

In the MCS CONNECT program, select TRANSMIT SW. Locate the *extracted* hex file and select Transmit. Watch the chiller LCD screen. After the file is uploaded the NAPPS MCS Digital Controller will verify that it's a valid file and then erase the flash memory. Next, it will write the new hex to memory. When completed, the controller will reboot itself. This process may take 15 or 20 minutes. After the reboot is completed, close and restart the MCS CONNECT program to reestablish communication with the chiller.

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For more information, contact your local Trane sales Office or e-mail us at pmkrug@nappsac.com

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