YORK®	AIR-COOLED SCREW LIQUID CHILLERS	
SERVICE MANUAL	NEW RELEASE	Form 201.40-M1 (717)

MODEL YAGK0200/0700
AIR-COOLED SCREW LIQUID CHILLERS WITH VARIABLE SPEED DRIVE

200 TONS
700 KW
2 COMPRESSOR
50 AND 60 HZ

LD21813

HFC-134a

Issue Date:
July 14, 2017

IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

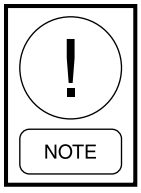
SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to specific situations:

Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.

Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions and are not followed.

Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.



Highlights additional information useful to the technician in completing the work being performed properly.

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual or product owner.

It is the responsibility of rigging, lifting, and operating/service personnel to verify the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the chiller.

CHANGE BARS

Revisions made to this document are indicated with a line along the left or right hand column in the area the revision was made. These revisions are to technical information and any other changes in spelling, grammar or formatting are not included.

The Control/VSD Cabinet contains lethal high AC and DC voltages. Before performing service inside the cabinet, remove the AC supply feeding the chiller and verify using a non-contact voltage sensor.

The DC voltage on the VSD DC Bus will take 5 minutes to bleed off, after AC power is removed. Always check the DC Bus Voltage with a Voltmeter to assure the capacitor charge has bled off before working on the system.

NEVER short out the DC Bus to discharge the filter capacitors.

NEVER place loose tools, debris, or any objects inside the Control Panel/VSD Cabinet.

NEVER allow the Control Panel VSD Cabinet doors to remain open if there is a potential for rain to enter the panel. Keep doors closed and assure all latches are engaged on each door unless the unit is being serviced.

ALWAYS lockout the disconnect supplying AC to the chiller.

The 1L Line Inductor will reach operating temperatures of over 150°C (300°F.) DO NOT open panel doors during operation. Assure the inductor is cool whenever working near the inductor with power OFF.

ASSOCIATED LITERATURE

MANUAL DESCRIPTION	FORM NUMBER
Equipment Pre-Startup and Startup Checklist	201.40-CL2
YAGK0200 2 Compressor 60 Hz (200 Ton) YAGK0700 2 Compressor 50 Hz (700 KW)	201.40-RP2.1
YAGK0200 2 Compressor 60 Hz (200 Ton) Operations Manual YAGK0700 2 Compressor 50 Hz (700 KW) Operations Manual	201.40-O1

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SECTION 1 - GENERAL CHILLER INFORMATION AND SAFETY

INTRODUCTION

YAGK chillers are manufactured to the highest design and construction standards to ensure high performance, reliability and adaptability to all types of air conditioning installations.

The unit is intended for cooling water or glycol solutions and is not suitable for purposes other than those specified in this manual.

Rigging and lifting should only be done by a professional rigger in accordance with a written rigging and lifting plan. The most appropriate rigging and lifting method will depend on job specific factors, such as the rigging equipment available and site needs. Therefore, a professional rigger must determine the rigging and lifting method to be used, and it is beyond the scope of this manual to specify rigging and lifting details.

This manual contains all the information required for correct installation and commissioning of the unit, together with operating and maintenance instructions. The manual should be read thoroughly before attempting to operate or service the unit.

All procedures detailed in the manual, including installation, commissioning and maintenance tasks must only be performed by suitably trained and qualified personnel.

The manufacturer will not be liable for any injury or damage caused by incorrect installation, commissioning, operation or maintenance resulting from a failure to follow the procedures and instructions detailed in the manual.

WARRANTY

The warranty is limited to parts only replacement and shipping of any faulty part, or sub-assembly, which has failed due to poor quality or manufacturing errors. All claims must be supported by evidence that the failure has occurred within the warranty period, and that the unit has been operated within the designed parameters specified.

All warranty claims must specify the unit model, serial number, order number and run hours/starts. Model and serial number information is printed on the unit identification plate.

The unit warranty will be void if any modification to the unit is carried out without prior written approval from Johnson Controls.

For warranty purposes, the following conditions must be satisfied:

- The initial start of the unit must be carried out by trained personnel from an authorized Johnson Controls Service Center. See *SECTION 6 - COMMISSIONING* for more information.
- Only genuine YORK approved spare parts, oils, coolants, and refrigerants must be used.
- All the scheduled maintenance operations detailed in this manual must be performed at the specified times by suitably trained and qualified personnel. See *SECTION 9 - MAINTENANCE* for more information.
- Failure to satisfy any of these conditions will automatically void the warranty. Refer to Form 50.05-NM2 for complete details.

QUALITY ASSURANCE AND SAFETY

YAGK chillers are designed within EN ISO 9001 and built within an EN ISO 9002 accredited manufacturing organization.

Units conform with the following European Directives:

YAGK units conform with the following European Directives:

- Machinery Directive (2006/42/EC)
- EMC Directive (2014/30/EU)
- Pressure Equipment Directive (2014/68/EU)
- ECO Design Directive (2009/125/EC)
- Safety Code for Mechanical Refrigeration EN 378-2 (2008)/A2(2012)
- Safety of machinery - Electrical Equipment of Machine EN 60204-1 & EN60335-2-40
- Generic emissions and immunity standards for industrial environment EN61000-6-4:2007 & 61000-6-2:2005
- ISO 9614 – Determination of sound power levels of noise sources using sound intensity
- Fan/motor efficiency EU 327/2011

- Chiller efficiency (medium temperature process) EU 2015/1095
- Manufactured in an EN ISO 9001 accredited organization
- Conform to CE Testing Services for construction of chillers and provide CE Listed Mark

ETL/ASME marked units conform to the following standards:

- UL1995 - Heating and Cooling Equipment.
- ANSI/ASHRAE 15 – Safety Code for Mechanical Refrigeration.
- ANSI/ASHRAE 34 – Number Designation and Safety Classification of Refrigerants.
- ANSI/NFPA 70 – National Electrical Code (N.E.C.).
- ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

FLUORINATED GREENHOUSE GASES

- This equipment contains fluorinated greenhouse gases covered by the Kyoto Protocol.
- The global warming potential of the refrigerant (RI34a) used in this unit is 1430.
- The refrigerant quantity is stated in the Physical
- Data table in Section 5 of this document.
- The fluorinated greenhouse gases in this equipment may not be vented to the atmosphere.
- This equipment should only be serviced by qualified technicians.

RESPONSIBILITY FOR SAFETY

Every care has been taken in the design and manufacture of the unit to ensure compliance with the safety requirements listed above. However, the individual rigging, lifting, maintaining, operating or working on any machinery is primarily responsible for:

- Personal safety, safety of other personnel, and the machinery.
- Correct utilization of the machinery in accordance with the procedures detailed in the manual.

ABOUT THIS MANUAL

The contents of this manual include suggested best working practices and procedures. These are issued for guidance only, and they do not take precedence over the previously stated individual responsibility and/or local safety regulations.

This manual and any other document supplied with the unit are the property of Johnson Controls which reserves all rights. They may not be reproduced, in whole or in part, without prior written authorization from an authorized Johnson Controls representative.

MISUSE OF EQUIPMENT

Suitability for Application

The unit is intended for cooling water or glycol solutions and is not suitable for purposes other than those specified in these instructions. Any use of the equipment other than its intended use, or operation of the equipment contrary to the relevant procedures may result in injury to the operator, or damage to the equipment.

The unit must not be operated outside the design parameters specified in this manual.

Structural Support

Structural support of the unit must be provided as indicated in these instructions. Failure to provide proper support may result in injury to the operator, or damage to the equipment and/or building.

Mechanical Strength

The unit is not designed to withstand loads or stresses from adjacent equipment, pipework or structures. Additional components must not be mounted on the unit. Any such extraneous loads may cause structural failure and may result in injury to the operator, or damage to the equipment.

General Access

There are a number of areas and features, which may be a hazard and potentially cause injury when working on the unit unless suitable safety precautions are taken. It is important to ensure access to the unit is restricted to suitably qualified persons who are familiar with the potential hazards and precautions necessary for safe operation and maintenance of equipment containing high temperatures, pressures and voltages.

Pressure Systems

The unit contains refrigerant vapor and liquid under pressure, release of this can be a danger and cause injury. The user should ensure that care is taken during installation, operation and maintenance to avoid damage to the pressure system. No attempt should be made to gain access to the component parts of the pressure system other than by suitably trained and qualified personnel.

Electrical

The unit must be grounded. No installation or maintenance work should be attempted on the electrical equipment without first switching power OFF, isolating and locking-off the power supply. Servicing and maintenance on live equipment must not be attempted. No attempt should be made to gain access to the control panel or electrical enclosures during normal operation of the unit.

Caution:

This equipment (Class A, Group 1) is designed and manufactured for use in an industrial environment, in accordance with EN 61000-6-2:2005 and EN 61000-6 4:2007 (with EN 55011:2016 limits). It is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference may occur if it is used on a low voltage public network.

This equipment equipped with VSD, may generate conducted and radiated disturbances, which may interfere with or damage susceptible connected apparatus.

Generally accepted engineering standards and practices should be followed to ensure trouble-free and EMC compliant electrical installation. Installations must be supervised or completed by a competent person in accordance with EN 13313.

Special considerations depending on the application:

- Industry standard grounding or “earthing” practices for the equipment and installation
- Use of shielded or special cables (power and/or control)
- Use of metallic conduit and/or cable trays for power and control cables connected to equipment
- Cable segregation (in order to avoid the risk of crosstalk or cross interference to signal cables, the power cables shall be segregated from signal cables)
- Dedicated isolation transformer
- Use of additional EMC filters

It is the responsibility of a designated System Integrator to take proper steps assuring the Electromagnetic Compatibility of both equipment and installation as a system.

Rotating Parts

Fan guards must be fitted at all times and not removed unless the power supply has been isolated. If ductwork is to be fitted, requiring the wire fan guards to be removed, alternative safety measures must be taken to protect against the risk of injury from rotating fans.

Sharp Edges

The fins on the air-cooled condenser coils have sharp metal edges. Reasonable care should be taken when working in contact with the coils to avoid the risk of minor abrasions and lacerations. The use of gloves is recommended.

Frame rails, brakes, and other components may also have sharp edges. Reasonable care should be taken when working in contact with any components to avoid risk of minor abrasions and lacerations.

Refrigerants and Oils

Refrigerants and oils used in the unit are generally non-toxic, non-flammable and non-corrosive, and pose no special safety hazards. Use of gloves and safety glasses is, however, recommended when working on the unit. The buildup of refrigerant vapor, from a leak for example, does pose a risk of asphyxiation in confined or enclosed spaces and attention should be given to good ventilation.

Use only the refrigerant specifically designated for the unit. Any other type of refrigerant may cause damage to the equipment and will void the warranty.

High Temperature and Pressure Cleaning

High temperature and pressure cleaning methods (e.g. steam cleaning) should not be used on any part of the pressure system as this may cause operation of the pressure relief device(s). Detergents and solvents, which may cause corrosion, should also be avoided.

Emergency Shutdown

In case of emergency , the control panel is fitted with an incoming supply circuit breaker with a red and yellow handle which can be used as the emergency stop device. When operated it removes the electrical supply to the inverter, fans, and control circuit thus shutting down the unit.

Safety Labels

The following labels may be attached to each unit to give instruction, or to indicate potential hazards that may exist.

White symbol on blue background.

For safe operation, read the Instructions first.

Black symbol on yellow background.

Warning: This machine may start automatically without prior warning.

Black symbol on yellow background.

Warning: Hot surface.

Black symbol on yellow background.

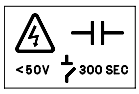
Warning: Safety relief valve may discharge gas or liquid without prior warning.

Black symbol on yellow background.

Warning: Isolate all electrical sources of supply before opening or removing the cover, as lethal voltages may exist.

Black symbol on yellow background.

General attention symbol.



Black symbol on yellow background.

Warning: On isolating the supply it may take up to 300 seconds for the capacitor voltage to fall below 50 volts.

TABLE 1 - MATERIAL SAFETY DATA

REFRIGERANT DATA	
Safety Data	**R-134a**
Toxicity	Low
In contact with skin	Liquid splashes or spray may cause freeze burns. Unlikely to be hazardous by skin absorption. R134a may be slightly irritant and liquid has a degreasing effect. Thaw affected areas with water. Remove contaminated clothing carefully — may adhere to skin in case of freeze burns. Wash affected areas with plenty of warm water. If symptoms occur (irritation or blistering) obtain medical attention.
In contact with eyes	Vapor has no effect. Liquid splashes or spray may cause freeze burns. Immediately irrigate with eyewash solution or clean water for at least 10 minutes. Obtain immediate medical attention.
Ingested	Highly unlikely to occur — but should this occur freeze burn will occur. Do not induce vomiting. Provided patient is conscious, wash mouth with water and give about 250 ml (0.5 pint) to drink. Obtain immediate medical attention.
Inhalation	High atmospheric concentrations may have an anaesthetic effect, including loss of consciousness. Very high exposures may cause an abnormal heart rhythm and prove suddenly fatal. At higher concentration there is a danger from asphyxiation due to reduced oxygen content of atmosphere. Remove patient to fresh air, keep warm and at rest. Administer oxygen if necessary. Apply artificial respiration if breathing has ceased or shows signs of failing. In event of cardiac arrest apply external cardiac massage. Obtain immediate medical attention.
Further medical advice	Symptomatic and supportive therapy is indicated. Cardiac sensitisation has been described which may, in the presence of circulating catecholamines such as adrenalin, give rise to cardiac arrhythmia's and subsequent arrest following exposure to high concentrations
Long term exposure	A lifetime inhalation study in rats has shown that exposure to 50,000 ppm resulted in benign tumors of the testis. This is not considered to be of relevance to humans exposed to concentrations at or below the occupational exposure limit.
Occupational exposure limits	Recommended limit: 1000 ppm v/v - 8 hr TWA.
Stability	Not specified.
Conditions to avoid	Use in presence of naked flames, red hot surfaces and high moisture levels.
Hazardous reactions	May react violently with sodium, potassium, barium and other alkali and alkaline earth metals. Incompatible materials: Magnesium and alloys containing more then 2% magnesium.
Hazardous Decomposition products	Halogen acids by thermal decomposition and hydrolysis.
General precautions	Avoid inhalation of high concentrations of vapors. Atmospheric concentrations should be minimized and kept as low as reasonably practicable below the occupational exposure limit. The vapor is heavier than air and collects at low level and in confined areas. Ventilate by extraction at lowest levels.
Respiratory protection	Where doubt exists on atmospheric concentration, HSE approved breathing apparatus should be worn. This should be self contained or of the long breather type.
Storage	Keep containers dry and in a cool place away from fire risk, direct sunlight, and all sources of heat such as radiators. Keep at temperatures not exceeding 45 °C.
Protective clothing	Wear overalls, impervious gloves and goggles/face protection.

TABLE 1 - MATERIAL SAFETY DATA (CONT'D)

REFRIGERANT DATA	
Safety Data	**R-134a**
Spill/leak procedure	Ensure suitable personal protective clothing and respiratory protection is worn. Provided it is safe to do so, isolate the source of the leak. Allow small spillage's to evaporate provided there is suitable ventilation. Large spillage's: Ventilate area. Contain spillage's with sand, earth or any suitable absorbent material. Prevent liquid from entering drains, sewers, basements and work pits since vapor may create a suffocating atmosphere.
Disposal	Best to recover and recycle. If this is not possible, destruction is to be in an approved facility which is equipped to absorb and neutralise acids and other toxic processing products.
Fire extinguishing data	Non-flammable at atmospheric conditions.
Containers	Fire exposed containers should be kept cool with water sprays. Containers may burst if overheated.
Fire fighting protective equipment	Self contained breathing apparatus and protective clothing must be worn in fire conditions.
REFRIGERANT OIL DATA	
Safety Data	**York "L" Oil**
Classification	Non-hazardous
In contact with skin	Minimally irritating. No first aid necessary. Exercise reasonable personal cleanliness including cleansing exposed skin areas several times daily with soap and water. Launder soiled work clothes at least weekly.
In contact with eyes	Flush eyes with eyewash solution or clean water for 15 minutes and consult a physician.
Ingested	May cause nausea and diarrhea. Obtain immediate medical attention.
Inhalation	If oil mist is inhaled, remove to fresh air and consult a physician.
Occupational exposure limits	Not determined.
Stability	Stable but hygroscopic - store in sealed containers.
Conditions to avoid	Strong oxidizers, caustic or acid solutions, excessive heat. May degrade some paints and rubber materials.
Hazardous decomposition products	Not fully, Analogous compounds evolve carbon monoxide, carbon dioxide and other unidentified fragments when burned. Burning may evolve irritating/noxious fumes.
Respiratory protection	Use in well ventilated areas - ventilate locally.
Protective clothing	Goggles or face shield should be worn. Gloves not necessary, but recommended, especially for prolonged exposure.
Spill / Leak procedure	Wear suitable protective equipment. Especially goggles. Stop source of spill. Use absorbent materials to soak up fluid (that is sand, sawdust and commercially available materials).
Disposal	Incinerate the oil and all associated wastes in an approved facility in accordance with local laws and regulations governing oily wastes.
Fire extinguishing data	Flash point over 300°C. Use dry chemical, carbon dioxide or foam. Spraying water on hot or burning liquid may cause frothing or splashing. If a leak or spill has not ignited use water spray to disperse the vapors and to provided protection for persons attempting to stop the leak.

TABLE 1 - MATERIAL SAFETY DATA (CONT'D)

Containers	Fire exposed containers should be kept cool with water sprays.
Fire fighting protective equipment	Self contained breathing apparatus should be worn in fire conditions.
THERMAL & ACOUSTIC MATERIALS DATA	
Health Hazard & First Aid	Toxicity Index <10 to NES713 Issue 3 (1991): Non-hazardous, non-toxic. No first aid necessary.
Stability / Reactivity	Stable.
Handling / Use / Disposal	No special handling precautions required. Dispose of according to local laws and regulations governing non-biodegradable non-hazardous solid wastes.
Fire & Explosion	Flammability rating Class 1 to BS 476 pt 7: Non-flammable. If forced to burn, combustion products are typically over 95% carbon dioxide and carbon monoxide.

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SECTION 2 - PRODUCT DESCRIPTION

YAGK HFC-134a chillers are designed for water or glycol cooling. All units are designed to be located outside on the roof of a building or at ground level.

The units are completely assembled with all interconnecting refrigerant piping and internal wiring, ready for field installation.

Prior to delivery, the unit is pressure tested, evacuated, and fully charged with refrigerant and oil in each of the two independent refrigerant circuits. After assembly, an operational test is performed with water flowing through the evaporator to ensure that each refrigerant circuit operates correctly.

The unit structure is manufactured from heavy gauge, galvanized steel. Many external structural parts are coated with "Aggreko Blue" baked-on powder paint.

All exposed power wiring is routed through liquid-tight, non-metallic conduit.

GENERAL SYSTEM DESCRIPTION

The YAGK Chiller combines the best of modern screw compressor design with the latest technology in variable speed drives. The result is superior control and efficiency in real world conditions. The VSD enables slowing the speed of the compressor to match the load on the system resulting in precise chilled liquid control, minimized sound, maximum energy efficiency, and reduced cost of ownership. The VSD also provides soft starts with no electrical inrush. The lack of heat build-up on start also enables required off time between starts to be reduced to a period of two minutes.

The YAGK Air-Cooled Screw Chiller utilizes many components, which are the same or nearly the same as a standard screw chiller of a similar size. This includes modular frame rails, condenser, fans, compressors and evaporator.

The chiller consists of two screw compressors in a corresponding number of separate refrigerant circuits, DX-evaporator, an air-cooled MCHX condenser, flash tanks, feed valves, oil separators and compressor mufflers. Oil separators utilize no moving parts. Oil return to compressor for lubrication without oil cooling.

FIGURE 1 - YAGK AIR-COOLED SCREW LIQUID CHILLER WITH VARIABLE SPEED DRIVE

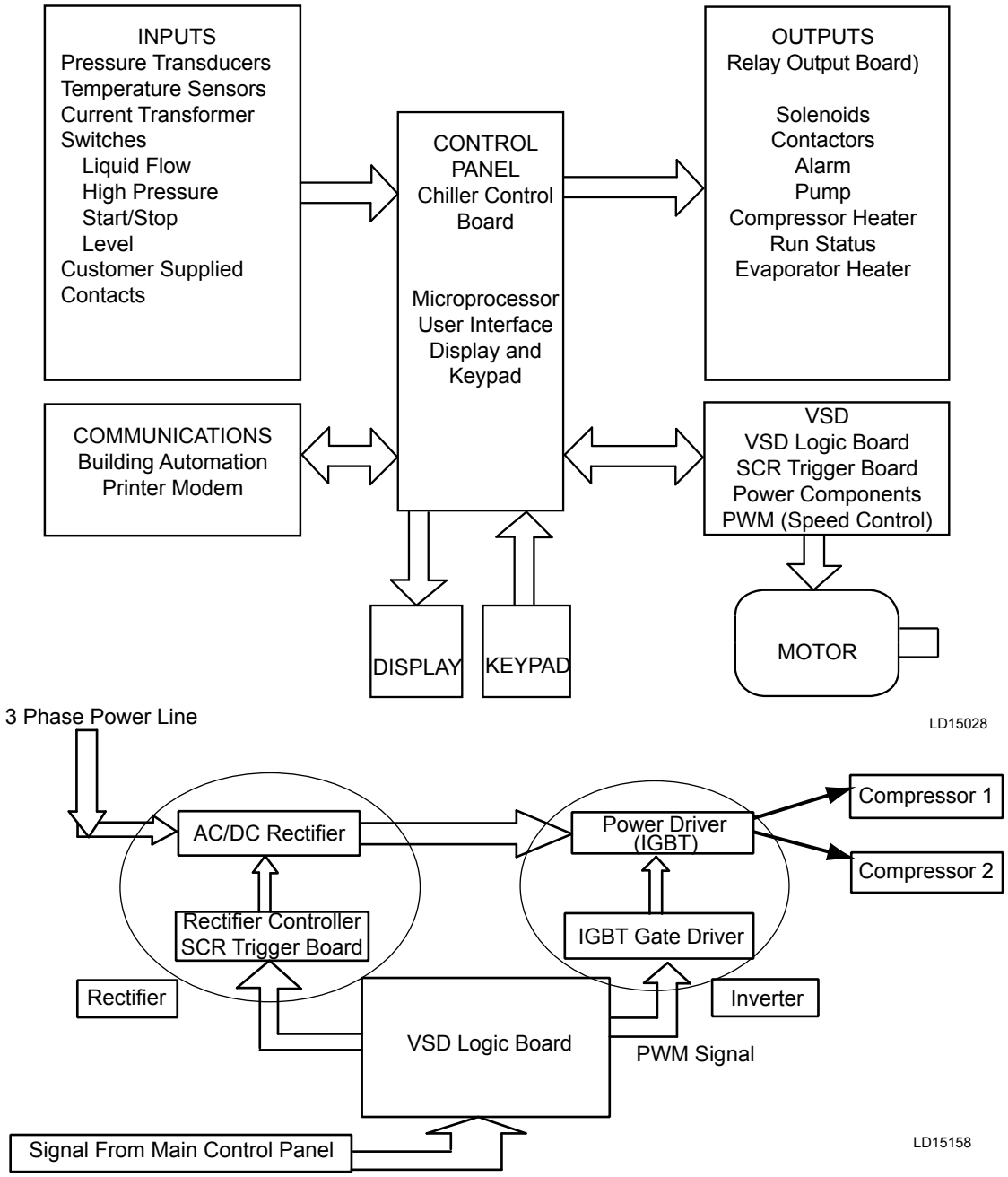


FIGURE 2 - CHILLER CONTROL SYSTEM

The chiller microprocessor communicates with the VSD Logic Board via a 3-wire RS-485 opto coupled data link. The VSD Logic Board runs the number of compressors required to meet the load and the compressors to the speed requested by the chiller microprocessor.

The basic system control and VSD system architecture is shown in Figure 2 above.

TABLE 2 - YAGK UNIT ASSEMBLY KEY

ITEM #	COMPONENT DESCRIPTION	ITEM #	COMPONENT DESCRIPTION
1	Evaporator	8	Compressor VSD Panel
2	Compressor	9	Auxiliary Panel
3	Oil Separator (OS)	10	Service Valve in Chilled Liquid Inlet
4	MCHX	11	Chilled Liquid Strainer
5	Flash Tank	12	Service Valve in Liquid Outlet
6	Fan	13	Fan VSD Keypads
7	Compressor Sound Enclosure		

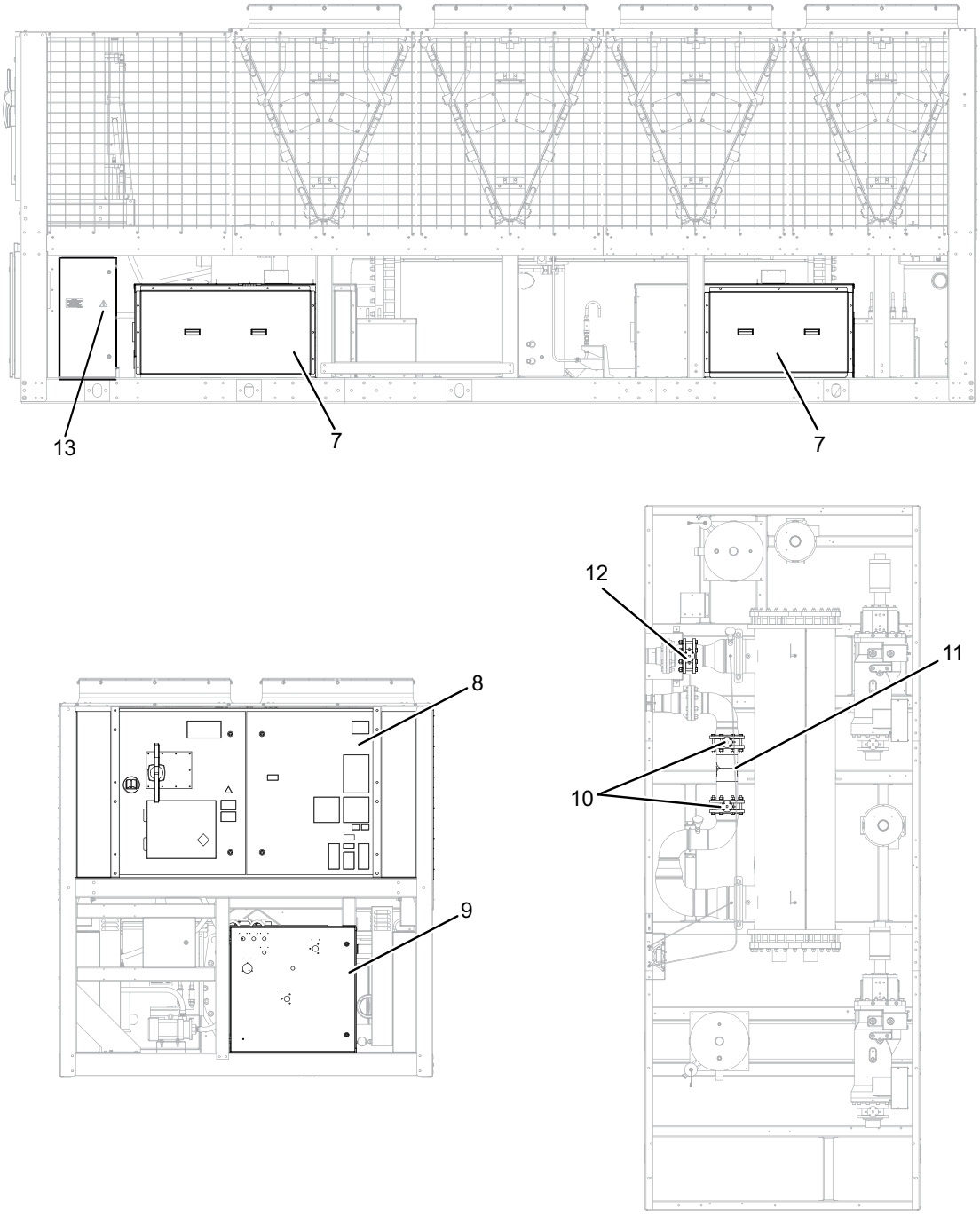
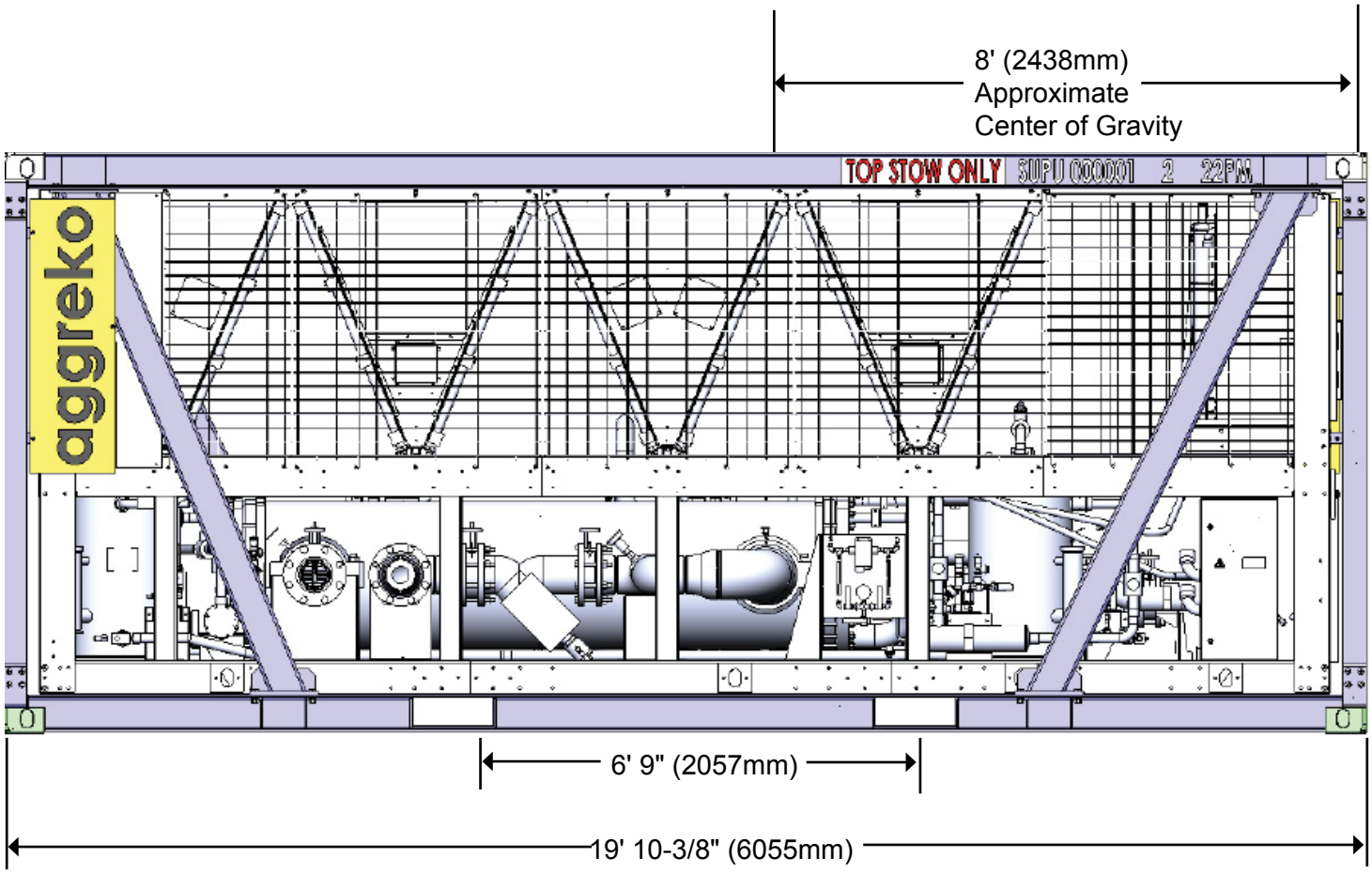
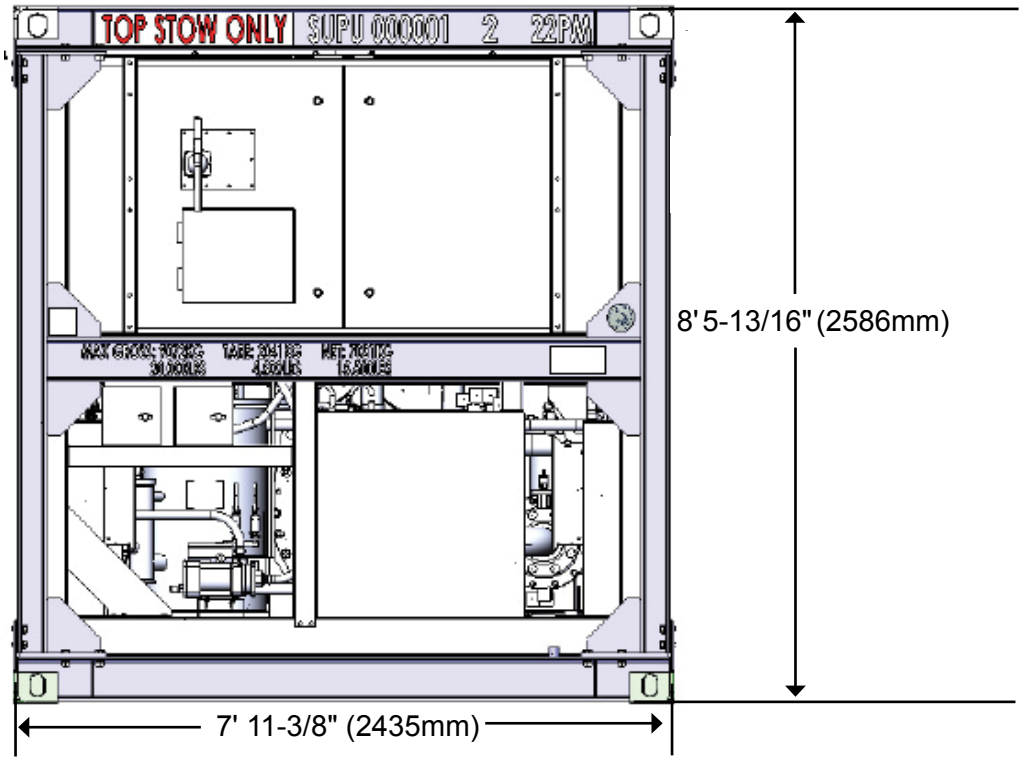


FIGURE 3 - YAGK0200 / 0700 UNIT ASSEMBLY


8' (2438mm)
Approximate
Center of Gravity
TOP STOW ONLY
SUPU 000001 2 22PM
aggreko
6' 9" (2057mm)
19' 10-3/8" (6055mm)


TOP STOW ONLY
SUPU 000001 2 22PM
8' 5-13/16" (2586mm)
7' 11-3/8" (2435mm)

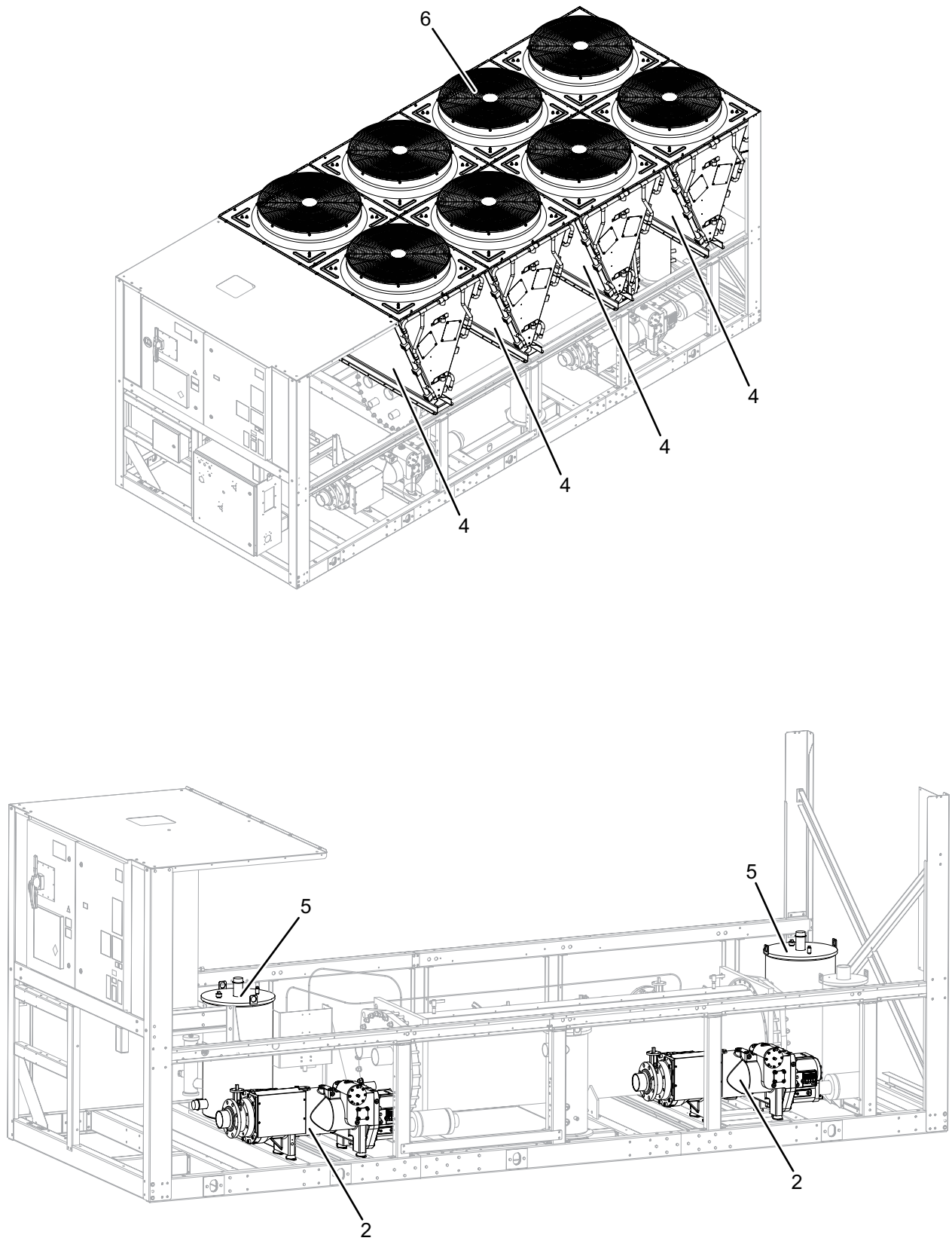


FIGURE 4 - YAGK0200 / 0700 FAN & COMPRESSOR DISPLAY

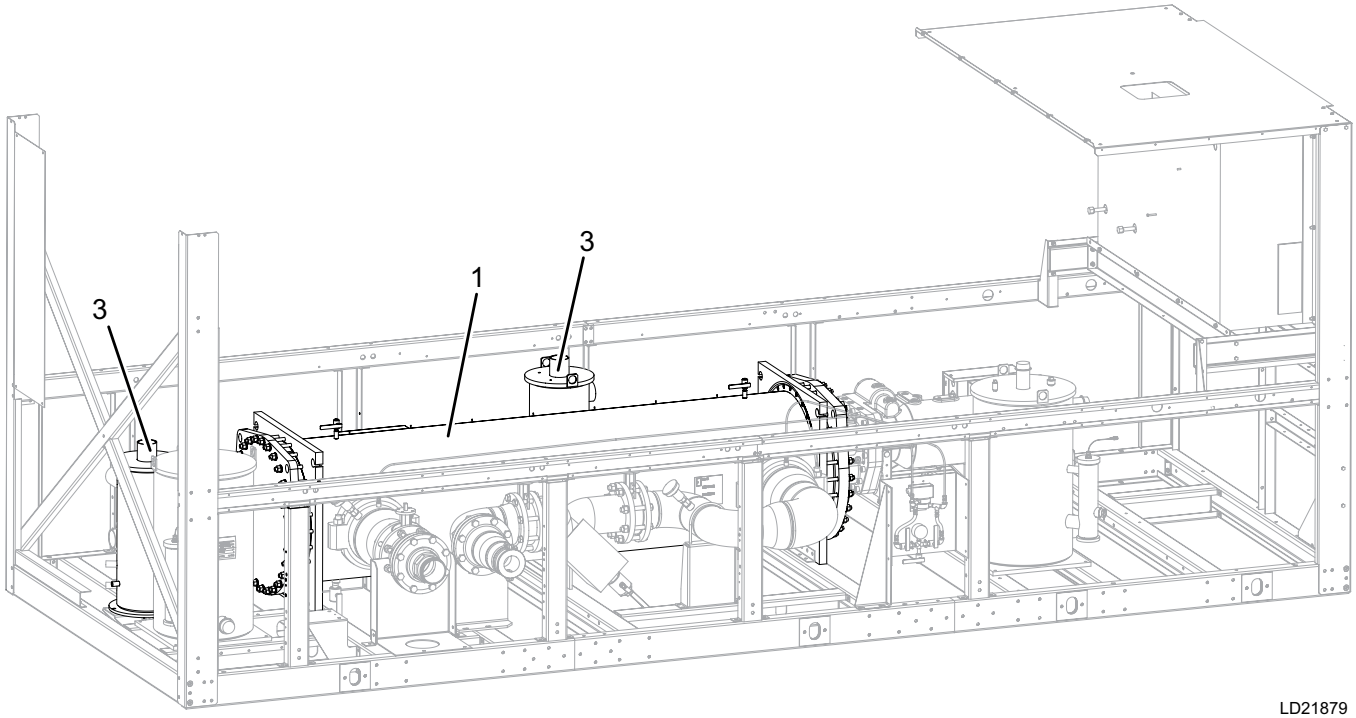


FIGURE 5 - YAGK0200 / 0700 CONDENSOR DISPLAY

SEMI-HERMETIC YAGK TWIN-SCREW COMPRESSORS

Compressors are direct drive, semi-hermetic, rotary twin-screw type, including: muffler, temperature actuated 'off-cycle' heater and precision machined cast iron housing.

Reliable suction gas cooled, high efficiency, hermetic compressor motor, full suction gas flow through mesh screen filter, with inherent internal thermal overload protection and external current overload on all three phases.

Continuous function, microprocessor controlled, Variable Speed Drive (VSD) shall provide valve-less, smooth capacity control .

EVAPORATOR

The system uses a high-efficiency shell and tube type Direct Expansion Evaporator. Each of the two refrigerant circuits consists of two (2) passes with the chilled liquid circulating back and forth across the tubes from one end to the other.

The design working pressure of the cooler on the shell side is 150 PSIG (10 bar), and 235 PSIG (16 bar) for the tube (refrigerant) side. The evaporator is constructed and tested in accordance with applicable sections of the ASME Pressure Vessel Code, Section VII, Division (1). Waterside exempt per paragraph U-1, C, (6).

The cooler is equipped with a thermostatically controlled heater for protection against low ambient and insulated with double 1-1/2" thick flexible closed-cell insulation.

Two compressor chillers utilize a typical 2-pass "E" type evaporator with refrigerant liquid inlets and suction outlets at the same end. Entering chilled liquid enters the refrigerant liquid inlet end of the cooler and leaving chilled liquid exits at the opposite end.

CONDENSER

The condenser uses aluminum micro-channel condenser coils protected by an electrostatically-applied coating.

Each condenser coil is a single piece all aluminum construction including headers, tubes and fins to avoid galvanic corrosion due to dissimilar metals. Coils and headers are brazed as one piece. Integral sub-cooling is included. The design working pressure is 375 PSIG (25.9 barg).

Multiple, standard low sound, high efficiency, TEAO motor driven fans move air through the coils. They are statically balanced, direct drive with corrosion-resistant glass fiber reinforced composite blades molded into low-noise, full airfoil cross sections, providing vertical air discharge from extended orifices for efficiency and low sound.

Fan motors are Totally Enclosed Air-Over (TEAO), squirrel-cage type and current protected. The direct drive motors feature double-sealed and permanently lubricated ball bearings.

REFRIGERANT CIRCUIT

An independent refrigerant circuit is provided per compressor. Each circuit uses copper refrigerant pipe formed on computer controlled bending machines to reduce the number of brazed joints resulting in a reliable and leak resistant system.

- Refrigerant circuit includes compressor suction and discharge isolation valves, filter-drier isolation valves, economizer shut-off valve, and expansion valve / evaporator isolation valves.
- The external oil separators, with no moving parts and designed for minimum oil carry-over, are mounted in the discharge line of the compressor.
- Liquid line components include: ball valves before and after filter drier, high absorption removable core filter-drier, sight glasses with moisture indicators, and electronic expansion valve.
- An economizer (flash) tank is located in each refrigerant circuit to increase the system efficiency.

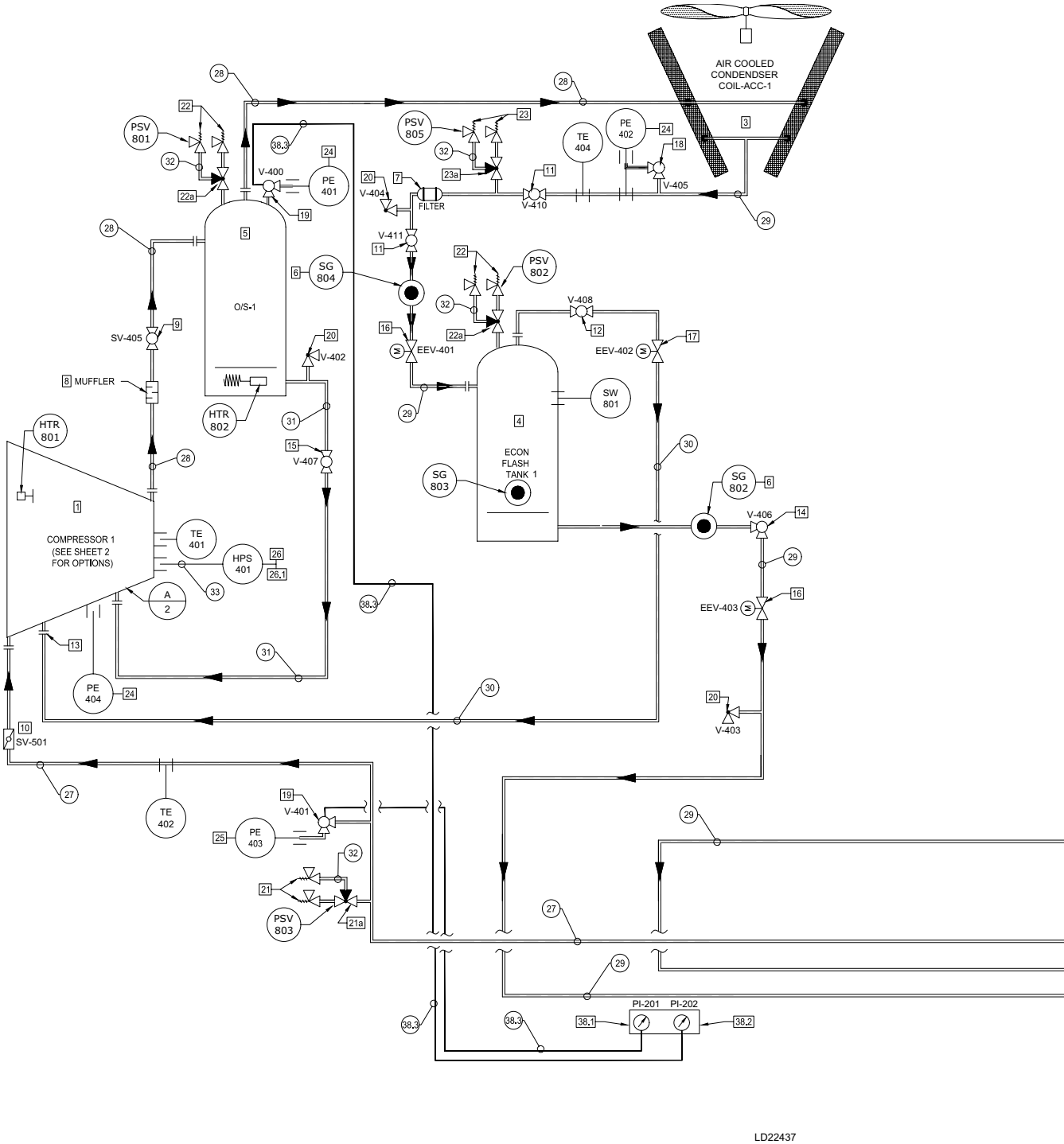


FIGURE 6 - YAGK PIPING & INSTRUMENTATION DIAGRAM - CE

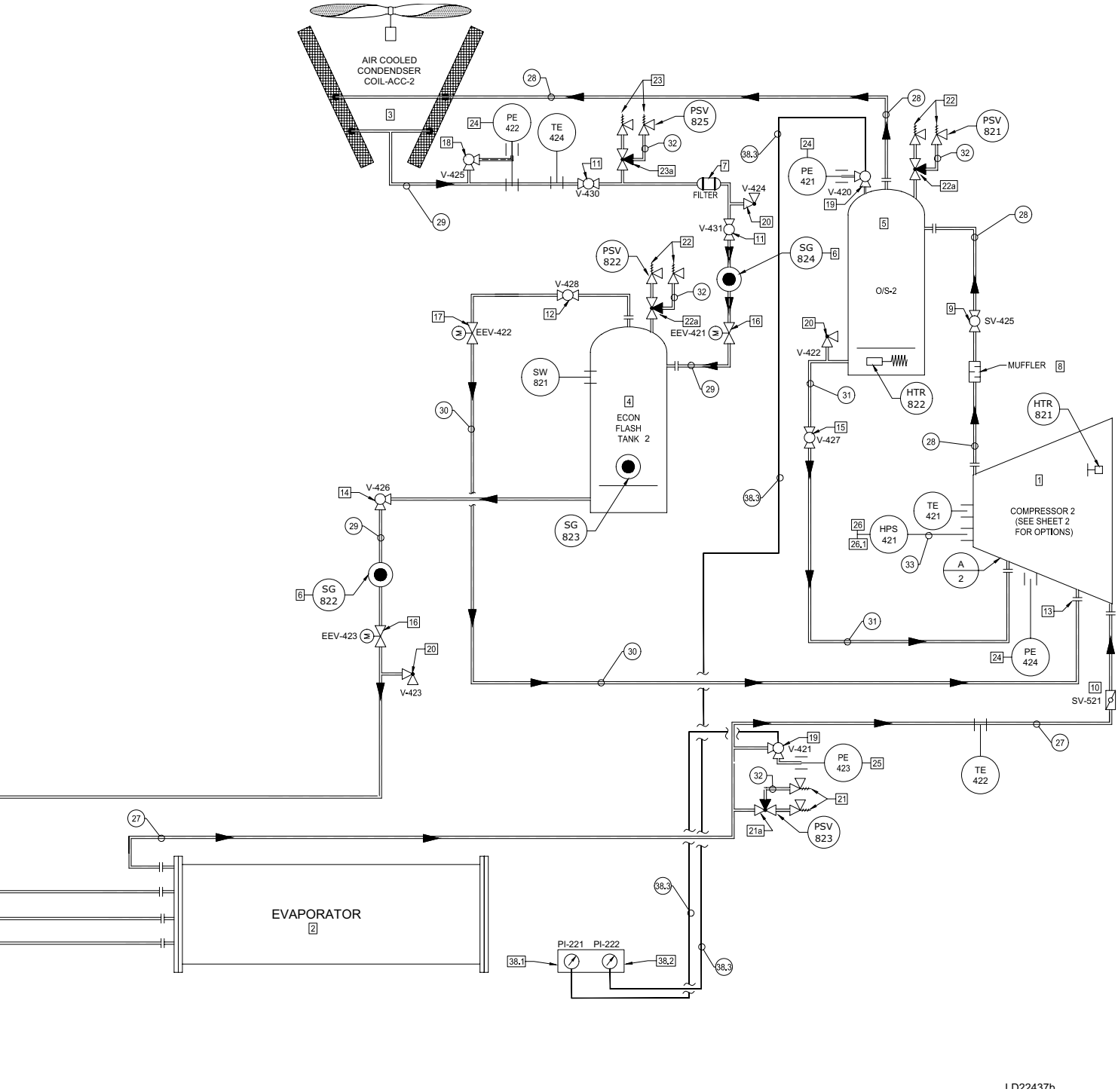


FIGURE 6 - YAGK PIPING & INSTRUMENTATION DIAGRAM - CE (CONT'D)

TABLE 3 - YAGK PIPING & INSTRUMENTATION KEY

DEVICE	DESCRIPTION
EEV-401	CONDENSER 1 DRAIN VALVE
EEV-402	ECONOMIZER 1 COMPRESSOR FEED VALVE
EEV-403	EVAPORATOR 1 ENTERING VALVE
EEV-421	CONDENSER 2 DRAIN VALVE
EEV-422	ECONOMIZER 2 COMPRESSOR FEED VALVE
EEV-423	EVAPORATOR 2 ENTERING VALVE
HPS-401	COMPRESSOR 1 HIGH PRESSURE CUT-OUT SWITCH
HPS-421	COMPRESSOR 2 HIGH-PRESSURE CUT-OUT SWITCH
HTR-801	COMPRESSOR 1 HEATER
HTR-802	OIL SEPARATOR 1 HEATER
HTR-821	COMPRESSOR 2 HEATER
HTR-822	OIL SEPARATOR 2 HEATER
PE-401	OIL SEPARATOR 1 DISCHARGE PRESSURE SENSOR
PE-402	CONDENSER 1 LEAVING PRESSURE SENSOR
PE-403	EVAPORATOR 1 PRESSURE SENSOR
PE-404	COMPRESSOR 1 OIL PRESSURE SENSOR
PE-421	OIL SEPARATOR 1 DISCHARGE PRESSURE SENSOR
PE-422	CONDENSOR 2 LEAVING PRESSURE SENSOR
PE-423	EVAPORATOR 2 PRESSURE SENSOR
PE-424	COMPRESSOR 2 OIL PRESSURE SENSOR
P I-201	SUCTION 1 PRESSURE GAUGE (PI-201 ONLY ON CE)
P I-202	DISCHARGE 1 PRESSURE GAUGE (PI-202 ONLY ON CE)
P I-221	SUCTION 2 PRESSURE GAUGE (PI-221 ONLY ON CE)
P I-222	DISCHARGE 2 PRESSURE GAUGE (PI-222 ONLY ON CE)
PSV-801	OIL SEPARATOR 1 SAFETY VALVE
PSV-802	ECONOMIZER FLASH TANK 1 SAFETY VALVE
PSV-803	EVAPORATOR 1 SAFETY VALVE
PSV-805	LIQUID LINE 1 SAFETY VALVE
PSV-821	OIL SEPARATOR 2 SAFETY VALVE
PSV-822	ECONOMIZER FLASH TANK 2 SAFETY VALVE
PSV-823	EVAPORATOR 2 SAFETY VALVE
PSV-825	LIQUID LINE 2 SAFETY VALVE
SG-802	EVAPORATOR 1 ENTERING LIQUID SIGHT GLASS
SG-803	ECONOMIZER FLASH TANK 1 SIGHT GLASS
SG-804	ECONOMIZER FLASH TANK 1 ENTERING LIQUID SIGHT GLASS
SG-822	EVAPORATOR 2 ENTERING LIQUID SIGHT GLASS
SG-823	ECONOMIZER FLASH TANK 2 SIGHT GLASS
SG-824	ECONOMIZER FLASH TANK 2 ENTERING LIQUID SIGHT GLASS

SYMBOL	DESCRIPTION
	BALL VALVE
	ANGLE BALL VALVE
	ANGLE GLOBE VALVE
	ELECTRIC MOTOR DRIVE
	RELIEF VALVE
	FILTER
	NOISE REDUCER
	SIGHT GLASS
	SENSOR
	DETAIL # SHEET #
	SERVICE VALVE
	CHANGEOVER VALVE
	PRWWBSSURE GAUGE
	HEATER

DETAIL 'A'

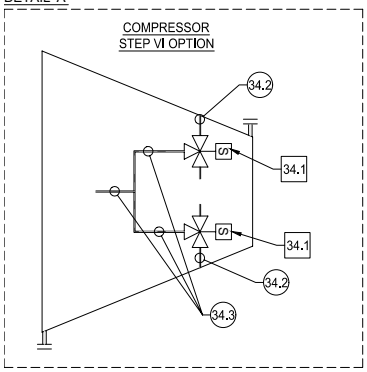


TABLE 3 - YAGK PIPING & INSTRUMENTATION KEY (CONT'D)

DEVICE	DESCRIPTION
SV-405	COMPRESSOR 1 DISCHARGE SERVICE VALVE
SV-425	COMPRESSOR 2 DISCHARGE SERVICE VALVE
SV-501	COMPRESSOR 1 ENTERING SERVICE VALVE
SV-521	COMPRESSOR 2 ENTERING SERVICE VALVE
SW-801	ECONOMIZER FLASH TANK LEVEL 1 SWITCH
SW-821	ECONOMIZER FLASH TANK 2 LEVEL SWITCH
TE-401	COMPRESSOR 1 DISCHARGE TEMPERATURE
TE-402	EVAPORATOR 1 TEMPERATURE SENSOR
TE-404	LEAVING CONDENSER1 LIQUID TEMPERATURE
TE-421	COMPRESSOR 2 DISCHARGE TEMPERATURE
TE-422	EVAPORATOR 2 TEMPERATURE SENSOR
TE-424	LEAVING CONDENSER 2 LIQUID TEMPERATURE
V-400	OIL SEPARATOR 1 PRESSURE SENSOR VALVE
V-401	EVAPORATOR 1 PRESSURE SENSOR VALVE
V-402	OIL SEPARATOR 1 ANGLE VALVE
V-403	EVAPORATOR 1 ANGLE ACCESS VALVE
V-404	LIQUID LINE 1 ANGLE ACCESS VALLE
V-405	CONDENSER 1 LEAVING PRESSURE SENSOR VALVE
V-406	ECONOMIZER FLASH TANK 1 ANGLE VALVE
V-407	LEAVING OIL SEPARATOR 1 BALL VALVE
V-408	ECONOMIZER FLASH TANK 1 BALL VALVE
V-410	LIQUID LINE 1 BALL VALVE
V-411	LIQUID LINE 1 BALL VALVE
V-420	OIL SEPARATOR 2 PRESSURE SENSOR VALVE
V-421	EVAPORATOR 2 PRESSURE SENSOR VALVE
V-422	OIL SEPARATOR 2 ANGLE VALVE
V-423	EVAPORATOR 2 ANGLE ACCESS VALVE
V-424	LIQUID LINE 2 ANGLE ACESS VALVE
V-425	CONDENSER 2 LEAVING PRESSURE SENSOR VALVE
V-426	ECONOMIZER FLASH TANK 2 ANGLE VALVE
V-427	LEAVING OIL SEPARATOR 2 BALL VALVE
V-428	ECONOMIZER FLASH TANK 2 BALL VALVE
V-430	LIQUID LINE 2 BALL VALVE
V-431	LIQUID LINE 2 BALL VALVE

SYMBOL	DESCRIPTION
	BALL VALVE
	ANGLE BALL VALVE
	ANGLE GLOBE VALVE
	ELECTRIC MOTOR DRIVE
	RELIEF VALVE
	FILTER
	NOISE REDUCER
	SIGHT GLASS
	SENSOR
	DETAIL # SHEET #
	SERVICE VALVE
	CHANGEOVER VALVE
	PRWWBSSURE GAUGE
	HEATER

SYMBOL	DESCRIPTION
	SERVICE VALVE
	REDUCER / COUPLING
	REMOVABLE CONNECTION
	VENT / BLEED VALVE
	DRAIN VALVE
	Y STRAINER
DP	DIFFERENTIAL PRESSURE SWITCH
	PRESSURE GAUGE
	ISOLATION VALVE
	SENSOR
	HEATER

DEVICE	DESCRIPTION
TC-101	ENTERING CHILLED WATER TEMPERATURE SENSOR
TC-201	LEAVING CHILLED WATER TEMPERATURE SENSOR
TI-101	ENTERING TEMPERATURE SENSOR - LCD DISPLAY
TI-201	LEAVING TEMPERATURE SENSOR - LCD DISPLAY
HTR-101	EVAPORATOR HEATER
STR-001	ENTERING WATER FILTER / STRAINER
PD-001	DIFFERENTIAL WATER PRESSURE SWITCH
PI-001	DIFFERENTIAL WATER PRESSURE GAUGE
V-001	SERVICE ISOLATION VALVE - ENTERING WATER
V-002	SERVICE ISOLATION VALVE - STRAINER / FILTER
V-003	SERVICE ISOLATION VALVE - LEAVING WATER
V-004	EVAPORATOR BLEED / VENT VALVE
V-005	EVAPORATOR DRAIN VALVE
V-006	STRAINER / FILTER DRAIN VALVE
V-007	ISOLATION VALVE - DIFFERENTIAL PRESSURE GAUGE
V-008	DIFFERENTIAL PRESSURE GAUGE DRAIN / BLEED VALVE

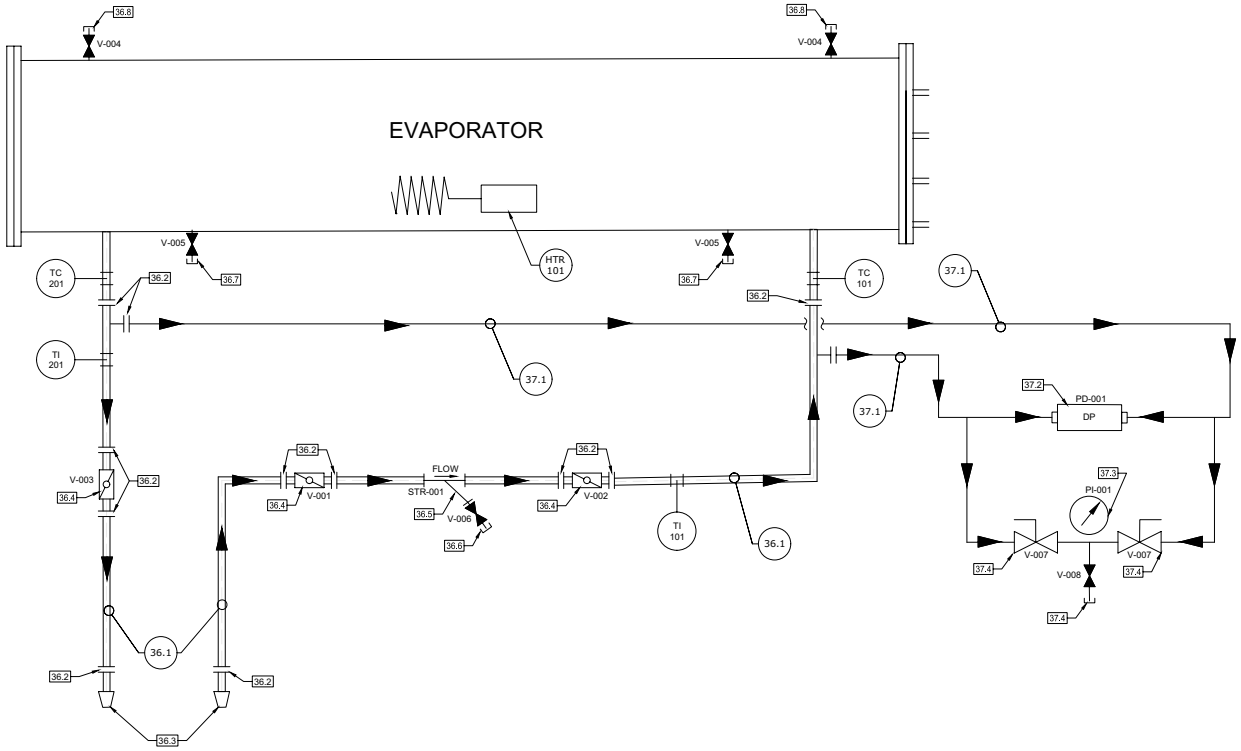


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FIGURE 7 - YAGK WATER PIPING (CE)

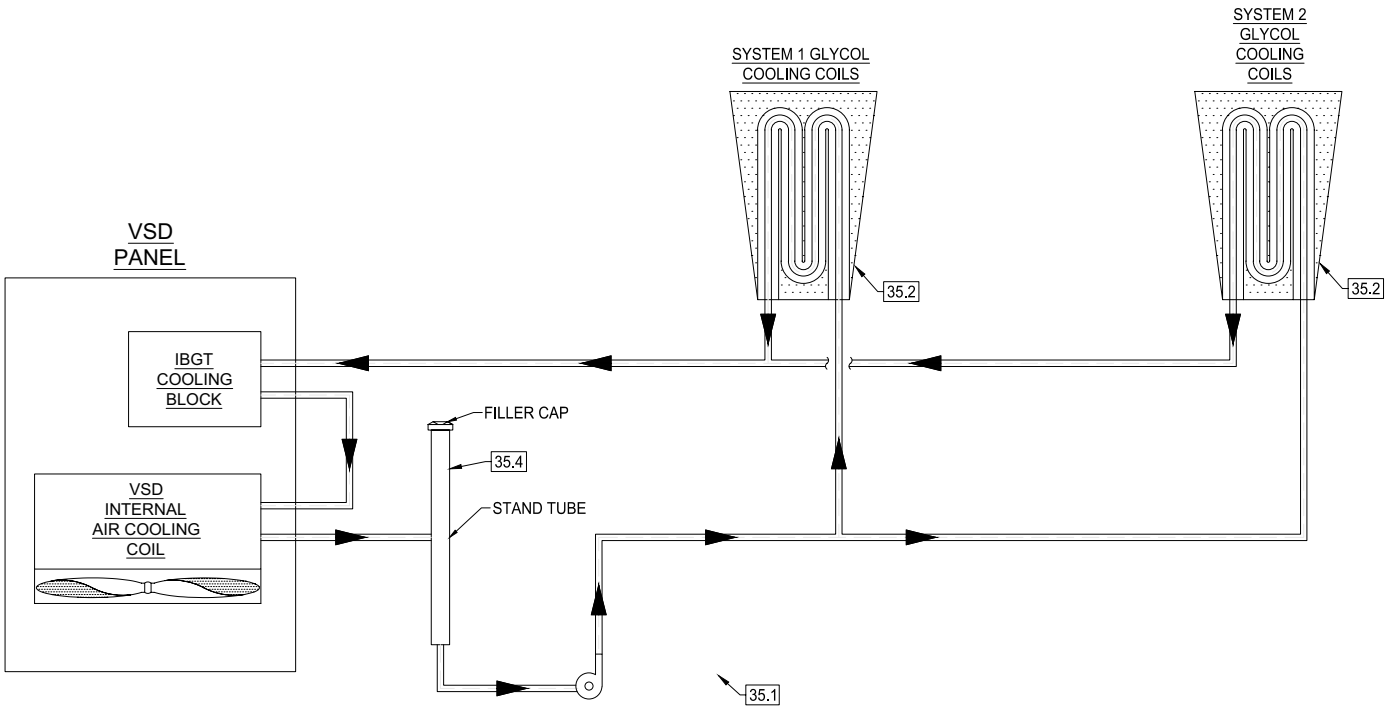


FIGURE 8 - YAGK PIPING AND INSTRUMENTATION DIAGRAM - GLYCOL CIRCUIT

ELECTRICAL

Johnson Controls has over 25 years of experience designing variable speed drives specifically for chiller applications. The result is an extremely reliable air-cooled chiller system that offers industry leading efficiency at real world operating conditions, valve-less compressor loading/unloading, excellent capacity control, high power factor and soft start.

Incoming single point power is standard utilizing a lockable circuit breaker, 115VAC control transformer, VSD, fan contactors, ON/OFF unit switch, microcomputer keypad and display, Chiller Control and VSD Logic boards, and relay boards.

Standard design includes IP55 rating, powder painted steel cabinet with hinged, latched, and gasket sealed outer doors equipped with wind struts for safer servicing. The panel includes a control display access door so that display and control features can be accessed without opening main cabinet doors.

All exposed power wiring is routed through liquid-tight, UV-stabilized, non-metallic conduit.

BUILDING AUTOMATION SYSTEM CAPABILITIES

The Johnson Controls® SC-EQ (Smart Chiller Equipment) Communication Card is an economical and versatile communications device that provides a communication connection between Johnson Controls® York equipment and standard open BAS protocols. It efficiently manages all of the communication protocols used by York equipment, exposing the data in a consistent, organized, and defined fashion.

The SC-EQ Communication Card is available as a card that can be fitted directly inside an Optiview or Latitude based equipment control panel, or supplied within a line voltage-enabled enclosure to be mounted externally from the control panel. The SC-EQ detects the chiller model and the BAS protocol and then automatically configures itself to communicate with both.

The installer typically only needs to set the MAC network address DIP switch.

MICROCOMPUTER CONTROL CENTER

The microcomputer control center provides automatic control of chiller operation including compressor start/stop and load/unload anti-recycle timers, condenser fans, evaporator pump, evaporator heater, unit alarm contacts and run signal contacts, The microcomputer control center comes online as soon as the main power switch on the unit is switched on; immediately, the microcomputer control center will begin to check all variables with a frequency ranging from 30 seconds to almost continuous monitoring.

The microprocessor controls the unit's capacity by matching the actual leaving chilled water temperature (LCWT) to the user-defined setpoint. Factors that may cause the system's actual LCWT to fluctuate are changes in ambient temperature, loop flow rate, load, and loop volume. The control system reacts to such changes by adjusting the number of compressors that are on and the loading of each compressor in order to keep the LCWT at the setpoint.

The control system logic monitors the rate at which the LCWT is approaching the setpoint to ramp up or down compressor capacity as required. The variable frequency drive allows the compressor capacity to match the load.

Display Data

- Leaving Chilled Liquid Temperature
- Returning Liquid Temperature
- Ambient Temperature
- Lead System
- Compressor Capacity (% of Full Load Amps)
- VSD Output Frequency / Compressor Speed
- Compressor Run Hours
- Compressor Number of Starts
- Oil Pressure and Temperature (per Compressor)
- Evaporator Pump Status
- Evaporator Heater Status
- History Data for Last Twenty Normal Shutdowns
- History Data for Last Ten Shutdown Faults

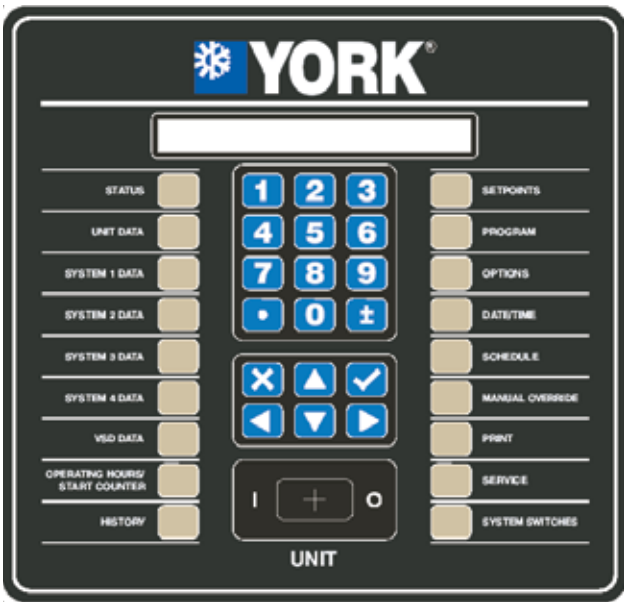


FIGURE 9 - VIEW OF YORK CONTROL CENTER USER INTERFACE

Programmable Setpoints

- Chiller On/Off
- Chilled Liquid (Water or Glycol)
- Local or Remote Control
- Units of Measure (Imperial or SI)
- System Lead / Lag
- Remote Temperature Reset
- Remote Current Limit
- Leaving Chilled Liquid Temperature Setpoint and Range

Johnson Controls' systems or another vendor's systems can incorporate these setpoints and data outputs to give the customer a complete understanding of how the system is running through a Building Automation System.

Extreme Conditions – During extreme or unusual conditions (that is, blocked condenser coils, ambient above scheduled maximum, and so on) the chiller control system will avoid shutdown by varying capacity. By monitoring motor current and suction and discharge pressures, the chiller can maintain maximum available cooling output without shutting down.

Unit Safeties are provided for the chiller to perform auto-reset shut down for the following conditions:

- Ambient temperature above or below allowable range
- Out of range leaving chilled liquid temperature
- Under voltage
- Flow switch operation

SOUND ATTENUATION

Low Noise Kits – The standard chiller configuration is equipped with acoustic treatments on the refrigerant lines and compressors.

SilentNight™ – Due to time of day based sound regulations in some locations it may be desirable to force the chiller to a lower sound level on demand. The SilentNight control option provides a control input to limit sound output of the chiller based on time of day. This feature is programmable at the chiller panel or can be controlled remotely via a signal (4-20mA or 0-10VDC) from a BAS system.

FAN

High Airflow Fans – The chiller is equipped with condenser fans with airfoil type blades and high power motors providing high airflow across coils.

CONDENSER COIL PROTECTION

The aluminum alloys used in the YAGK microchannel condenser with electrostatic coating have been carefully selected and tested for high corrosion resistance. However, all metals can corrode in harsh conditions. Consider protecting coils from corrosive environments such as coastal, marine, urban and industrial.

PROTECTIVE CHILLER PANELS

Wire Grills – UV stabilized black polyvinyl chloride coated, heavy gauge, welded wire mesh guards mounted on the exterior of the top section of unit. Protects condenser coil faces.

CONTROLS

Building Automation System Interface (Temperature) – Factory installed option to accept a 4 to 20mA or a 0 to 10VDC input to allow remote reset of the Leaving Chilled Liquid Temperature Setpoint. The setpoint can be positively offset upwards up to 22.2°C

(40°F). This option is useful for ice storage or process applications or for periods where higher chilled liquid temperatures are adequate for low loads.

Building Automation System Interface (Load Limit) – Factory installed option to accept a 4 to 20mA or a 0 to 10VDC input to allow remote reset of the Load Limit Setpoint. The setpoint can limit system demand from 30-100%.

SC-EQ - The SC-EQUIP (SC-EQ) Gateway provides BAS network connectivity for Johnson Controls and York mechanical equipment, such as chillers and rooftop units.

Thermal Storage – Provides special control logic and modifications to produce leaving chilled brine temperatures below 4.4°C (40°F) primarily at times of low ambient temperatures (night time). Option can be used to produce ice to supplement cooling and significantly decrease energy costs. The capability of the chiller is enhanced by using both ice and chilled water simultaneously during times of peak cooling needs.

MISCELLANEOUS ACCESSORIES

Flow Switch – Differential flow switch is furnished with each unit.

Service Isolation Valve – Service suction isolation valve for each refrigerant circuit.

Dual Pressure Relief Valve – Two safety relief valves are mounted in parallel; one is always operational to assist in valve replacement during maintenance.

Circuit Breaker – A unit-mounted circuit breaker with an external lockable handle is sized to provide motor branch circuit protection, short circuit protection and ground fault protection for the motor branch-circuit conductors, the motor control apparatus and the motors.

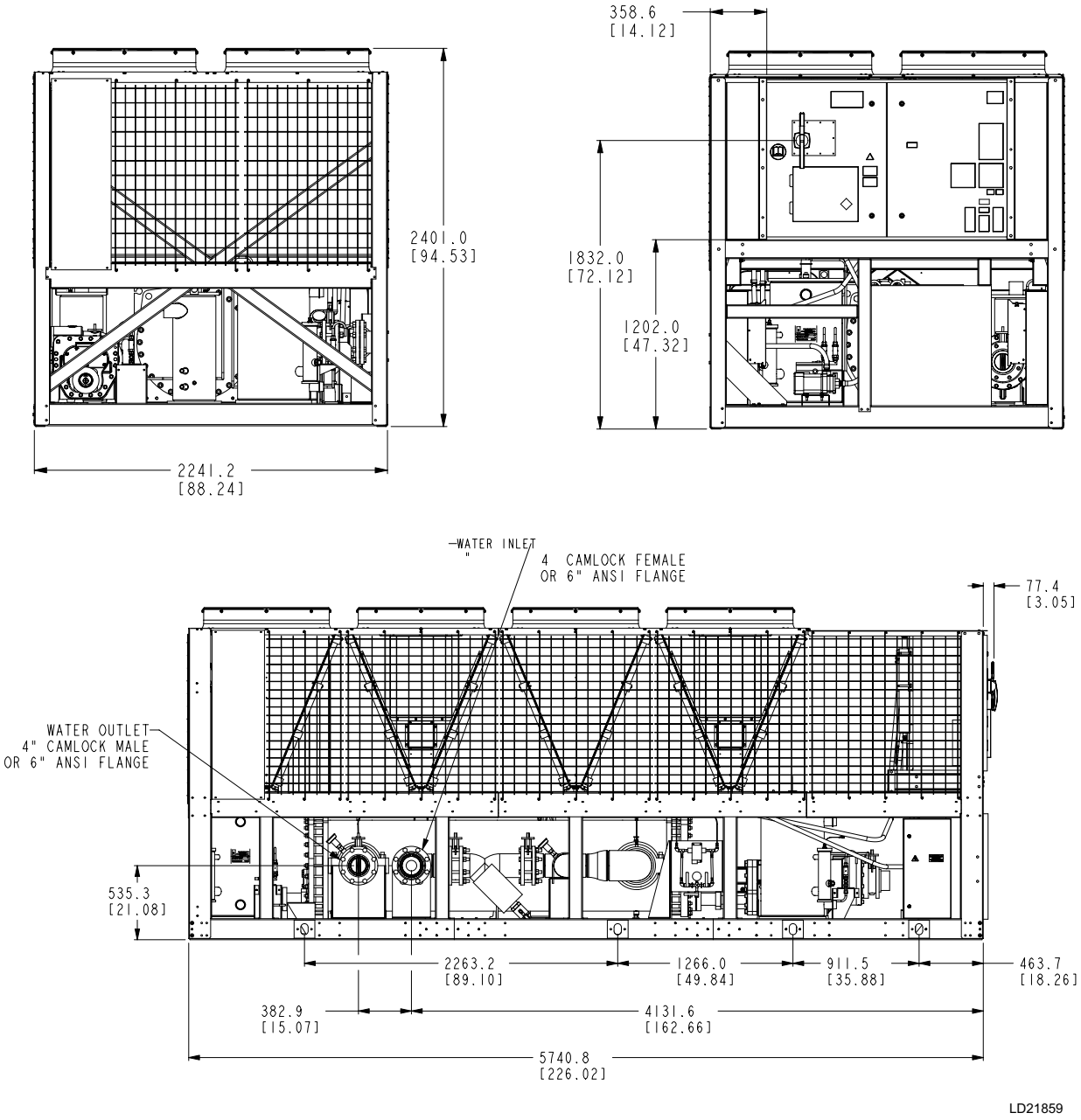
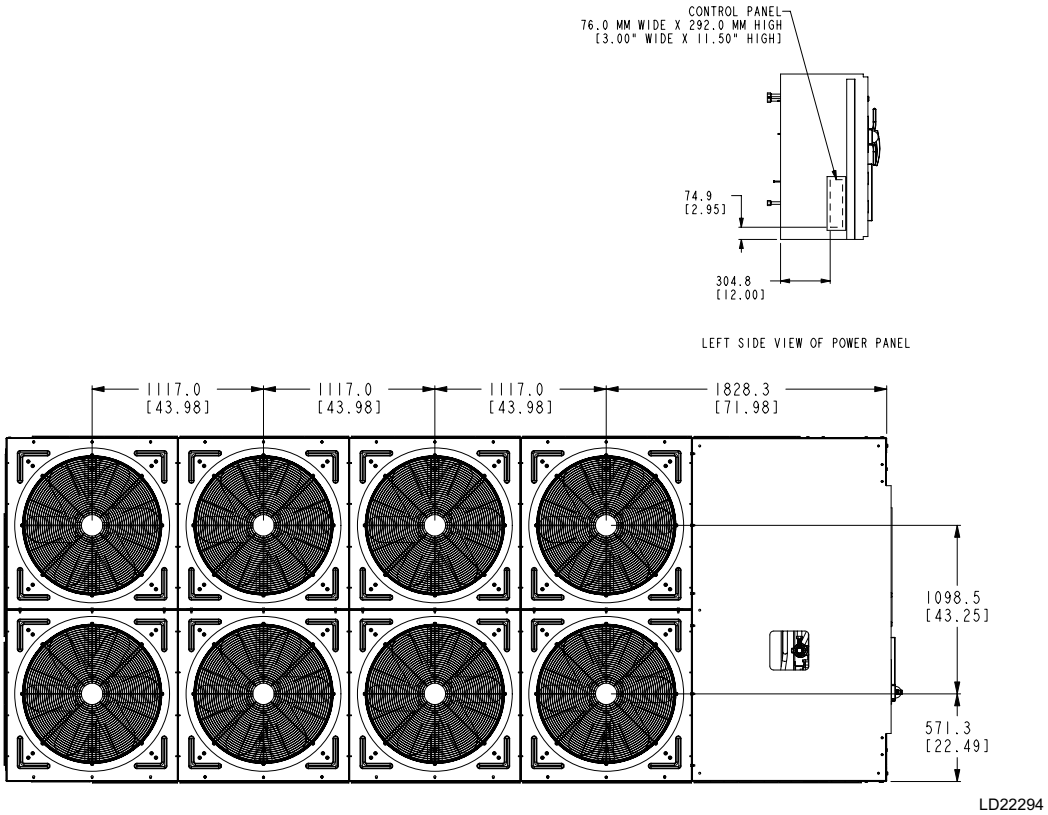


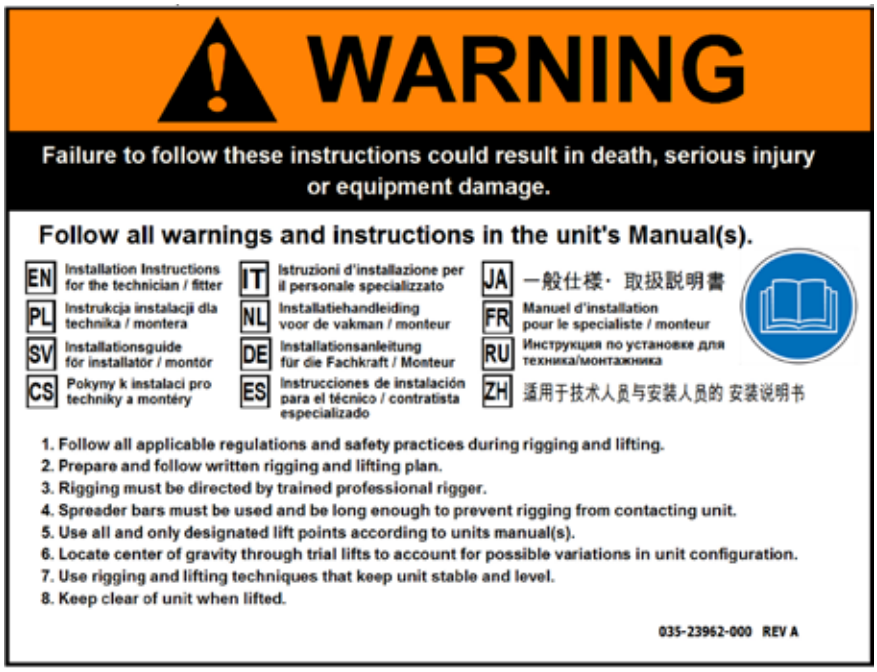
FIGURE 10 - YAGK0200 / 0700 DIMENSIONS



NOTE: "POWER ENTRY" is at the left side of the "Auxiliary Panel."

FIGURE 11 - YAGK0200 / 0700 DIMENSIONS (CONT'D)

SECTION 3 - RIGGING, HANDLING AND STORAGE



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Rigging and lifting should only be done by a professional rigger in accordance with a written rigging and lifting plan. The most appropriate rigging and lifting method will depend on job specific factors, such as the rigging equipment available and site needs. Therefore, a professional rigger must determine the rigging and lifting method to be used, and it is beyond the scope of this manual to specify rigging and lifting details.

LIFTING WEIGHTS

Refer to the unit nameplate for unit shipping weight. Note that weight may vary depending on unit configuration at the time of lifting. See *"Table 7 - Physical Data - Microchannel Coil" on page 59* for further information regarding shipping and operating weights.

DELIVERY AND STORAGE

To ensure consistent quality and maximum reliability, all units are tested and inspected before leaving the factory. Units are shipped completely assembled and containing refrigerant under pressure.

If the unit is to be put into storage, prior to installation, the following precautions should be observed:

- The chiller must be “blocked” so that the base is not permitted to sag or bow.
- Ensure that all openings, such as water connections, are securely capped.
- Do **NOT** store where exposed to high ambient air temperatures exceeding 125°F (51.6°C).
- The condensers should be covered to protect the coils and fins from potential damage and corrosion, particularly where building work is in progress.
- The unit should be stored in a location where there is minimal activity in order to limit the risk of accidental physical damage.
- To prevent inadvertent operation of the pressure relief devices the unit must not be steam cleaned.
- It is recommended that the unit is periodically inspected during storage.

INSPECTION

Remove any transit packing and inspect the unit to ensure that all components have been delivered and that no damage has occurred during transit. If any damage is evident, it should be noted on the carrier’s freight bill and a claim entered in accordance with the instructions given on the advice note.

Major damage must be reported immediately to your local Johnson Controls representative.

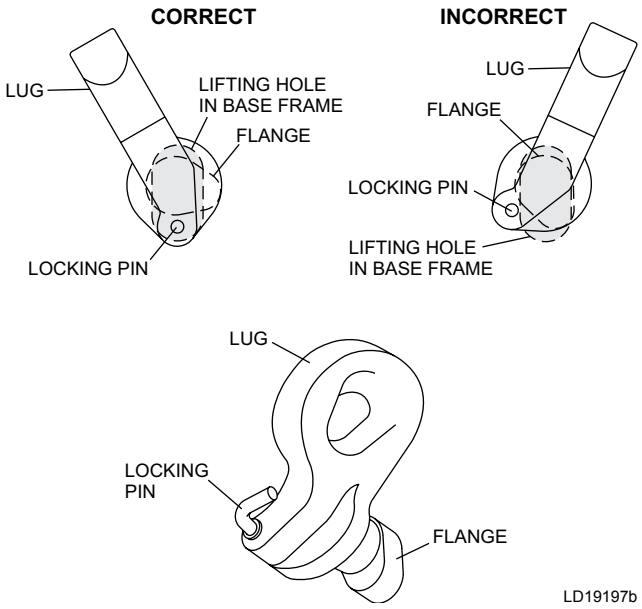
MOVING THE CHILLER

Prior to moving the unit, ensure that the installation site is suitable for installing the unit and is easily capable of supporting the weight of the unit and all associated services.

Care should be taken to avoid damaging the condenser cooling fins when moving the unit.

LIFTING LUGS

Units are provided with lifting holes in the base frame which accept standard lifting lugs set as shown in the figure below.



SECTION 4 - INSTALLATION

LOCATION REQUIREMENTS

For optimum performance and trouble-free service, it is essential that the installation site meet the location and space requirements for the model being installed.

It is important to ensure that the minimum service access space is maintained for cleaning and maintenance purposes.

OUTDOOR INSTALLATIONS

The units are designed for outdoor installation and can be installed at ground level on a suitable flat level foundation easily capable of supporting the weight of the unit, or on a suitable rooftop location. In both cases an adequate supply of air is required. Avoid locations where the sound output and air discharge from the unit may be objectionable.

The location should be selected for minimum sun exposure and away from boiler flues and other sources of airborne chemicals that could attack the condenser coils and steel parts of the unit.

If located in an area accessible to unauthorized persons, steps must be taken to prevent access to the unit by means of a protective fence. This will help to prevent the possibility of vandalism, accidental damage, or possible harm caused by unauthorized removal of protective guards or opening panels to expose rotating or high voltage components.

For ground level locations, the unit must be installed on a suitable flat and level concrete base that extends to fully support the two side channels of the unit base frame. A one-piece concrete slab, with footings extending below the frost line is recommended. To avoid noise and vibration transmission, the unit should not be secured to the building foundation.

On rooftop locations, choose a place with adequate structural strength to safely support the entire operating weight of the unit and service personnel. The unit can be mounted on a concrete slab, similar to ground floor locations, or on steel channels of suitable strength. The channels should be spaced with the same centers as the unit side and front base rails. This will allow vibration isolators to be fitted if required. Isolators are recommended for rooftop locations.

The condenser fans are propeller-type and are not recommended for use with ductwork, filters or other impediments to airflow in the condenser air stream.

On installations where winter operation is intended and snow accumulations are expected, additional elevation must be provided to insure normal condenser air flow.

Avoid locations near windows or structures where normal operating sounds may be objectionable.

LOCATION CLEARANCES

Adequate clearances around the unit(s) are required for the unrestricted airflow for the air-cooled condenser coils and to prevent re-circulation of warm discharge air back onto the coils. If clearances given are not maintained, airflow restriction or re-circulation will cause a loss of unit performance, an increase in power consumption, and may cause the unit to malfunction. Consideration should also be given to the possibility of down drafts, caused by adjacent buildings, which may cause re-circulation or uneven unit airflow.

For locations where significant cross winds are expected, such as exposed roof tops, an enclosure of solid or louver type is recommended to prevent wind turbulence interfering with the unit airflow.

When units are installed in an enclosure, the enclosure height should not exceed the height of the unit on more than one side. If the enclosure is of louvered construction, the same requirement of static pressure loss applies as for ducts and attenuators stated above.

Recommended Minimum Clearances

Recommended clearances for the YAGK units are:

- Side to wall – 6' (1.83m)
- Rear to wall – 6' (1.83m)
- Control panel end to wall – 4' (1.22m)
- Top – no obstructions whatsoever
- Distance between adjacent units – 10' (3.05m)

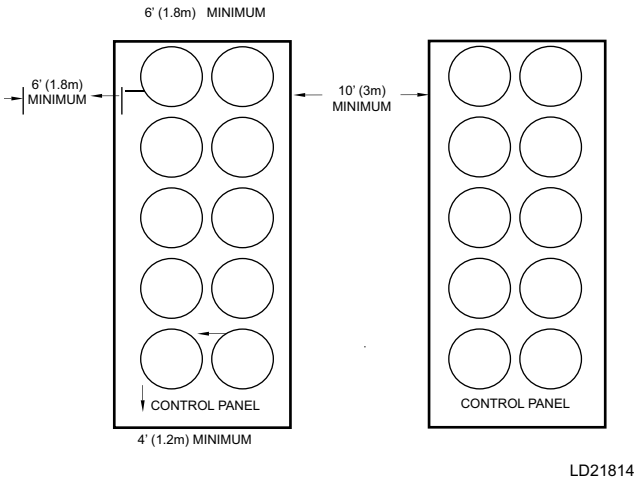


FIGURE 12 - ACCEPTABLE MINIMUM CLEARANCES AROUND / BETWEEN UNIT(S)

CAUTION

Clearance dimensions are necessary to maintain good airflow and ensure correct unit operation. It is also necessary to consider access requirements for safe operation and maintenance of the unit and power and control panels. Local health and safety regulations, or practical considerations for service replacement of large components, may require larger clearances than those recommended.

CHILLED LIQUID PIPING

General Requirements

The following piping recommendations are intended to ensure satisfactory operation of the unit(s). Failure to follow these recommendations could cause damage to the unit, or loss of performance, and may invalidate the warranty.

CAUTION

The maximum flow rate and pressure drop for the evaporator must not be exceeded at any time. *SECTION 5 - TECHNICAL DATA Pressure Drop Through Two Circuit YAGK Evaporators (SI Units) on Page 57* ***for details.***

NOTE

The liquid must enter the evaporator at the inlet connection.

The chilled liquid pump(s) installed in the piping system(s) should discharge directly into the unit evaporator section of the system. The pump(s) may be controlled by the chiller controls or external to the unit.

Pipework and fittings must be separately supported to prevent any loading on the evaporator. Flexible connections are recommended which will also minimize transmission of vibrations to the building. Flexible connections must be used if the unit is mounted on anti-vibration mounts, as some movement of the unit can be expected in normal operation.

The evaporator must not be exposed to flushing velocities or debris released during flushing. It is recommended that a suitably sized bypass and valve arrangement is installed to allow flushing of the piping system. The bypass can be used during maintenance to isolate the heat exchanger without disrupting flow to other units.

Drain and air vent connections should be provided at all low and high points in the piping to permit drainage of the system and to vent any air in the pipes.

Liquid system lines at risk of freezing, due to low ambient temperatures should be protected using insulation and heater tape and/or a suitable glycol solution. The liquid pump(s) may also be used to ensure liquid is circulated when the ambient temperature approaches freezing point.

Insulation should also be installed around the evaporator nozzles. Heater tape of 21 Watts per meter under the insulation is recommended, supplied independently and controlled by an ambient temperature thermostat set to switch ON at approximately 2.2°C (4°F), above the freezing temperature of the chilled liquid.

Evaporator heater mats are installed under the insulation, and are powered from the chiller's control panel. In sub-freezing conditions, unless the evaporator has been drained or an appropriate water-to-glycol concentration is maintained, high voltage power to the chiller must be kept on to ensure the heater mats assist in evaporator freeze protection. If there is a potential for power loss, Johnson Controls recommends that the evaporator is drained or that water in the chilled water circuit be replaced with an appropriate water-to-glycol concentration.

The installer/user must also ensure that the quality of the water in circulation is adequate, without any dissolved gases, which can cause oxidation of steel or copper parts within the evaporator.

WATER TREATMENT

Dirt, scale, grease and certain types of water treatment will adversely affect the heat exchanger surfaces and therefore the unit performance. Foreign matter in the water system(s) can increase the heat exchanger pressure drop, reducing the flow rate and causing potential damage to the heat exchanger tubes.

Aerated, brackish or salt water is not recommended for use in the water system(s). Johnson Controls recommends that a water treatment specialist be consulted to determine whether the proposed water composition will adversely affect the evaporator materials of carbon steel and copper. The pH value of the water flowing through the evaporator must be kept in a range between 7 and 8.5.

CONNECTION TYPES AND SIZES

For connection sizes relevant to individual models, see *SECTION 5 - TECHNICAL DATA*.

REFRIGERANT RELIEF VALVE PIPING

A pressure relief valve is mounted on each of the main refrigerant lines connecting the cooler to the compressor, the flashtanks, oil separators, and filter driers.

DUCTWORK CONNECTIONS

General Requirements

The following ductwork recommendations are intended to ensure satisfactory operation of the unit. Failure to follow these recommendations could cause damage to the unit, or loss of performance, and may invalidate the warranty.

When ducting is to be fitted to the fan discharge it is recommended that the duct should be the same cross-sectional area as the fan outlet and straight for at least three feet (1 meter) to obtain static regain from the fan. Ductwork should be suspended with flexible hangers to prevent noise and vibration being transmitted to the structure. A flexible joint is also recommended between the duct attached to the fan and the next section for the same reason. Flexible connectors should not be allowed to concertina.

The unit is not designed to take structural loading. No significant amount of weight should be allowed to rest on the fan outlet flange, deck assemblies or condenser coil module. No more than 3 feet (1 meter) of light construction ductwork should be supported by the unit. Where cross winds may occur, any ductwork must be supported to prevent side loading on the unit.

If the ducts from two or more fans are to be combined into a common duct, back-flow dampers should be fitted in the individual fan ducts. This will prevent recirculation of air when only one of the fans is running.

Units are supplied with outlet guards for safety and to prevent damage to the fan blades. If these guards are removed to fit ductwork, adequate alternative precautions must be taken to ensure persons cannot be harmed or put at risk from rotating fan blades.

ELECTRICAL CONNECTION

The following connection recommendations are intended to ensure safe and satisfactory operation of the unit. Failure to follow these recommendations could cause harm to persons, or damage to the unit, and may invalidate the warranty.

No additional controls (relays, and so on) should be mounted in the control panel. Power and control wiring not connected to the control panel should not be run through the control panel. If these precautions are not followed it could lead to a risk of electrocution. In addition, electrical noise could cause malfunctions or damage the unit and its controls.

After power wiring connection, do not switch on mains power to the unit. Some internal compenents are live when the mains are switched on and this must only be done by "Authorized" persons familiar with starting, operating and troubleshooting this type of equipment.

THERMAL STORAGE

Thermal storage is the practice of storing cooling energy during a period of little or no load and/or low energy costs for use during periods of high load and/or energy costs. Conventional cooling systems produce cooling when it is needed which is commonly during times of peak demand. Thermal storage allows generation of cooling capacity to occur during off-peak periods and store that capacity to meet future cooling requirements. Using thermal storage can result in smaller equipment sizes, thereby reducing capital cost, and also can result in significant energy cost savings

The YAGK has special control logic to be able to produce chilled leaving brine temperatures below 4.4°C (40°F) so as to supply a storage tank with chilled liquid during times of low demand. YAGK chillers selected for thermal storage operation can also be selected to efficiently provide chilled fluid at nominal cooling loads.

POWER WIRING

All electrical wiring should be carried out in accordance with local regulations. Route properly sized cables to cable entries on the unit.

In accordance with local codes, NEC codes, and U.L. standards, it is the responsibility of the user to install over current protection devices between the supply conductors and the power supply terminals on the unit.

To ensure that no eddy currents are set up in the power panel, the cables forming the 3-phase power supply must enter via the same cable entry.

All sources of supply to the unit must be taken via a common point of isolation (not supplied by Johnson Controls).

Copper power wiring only should be used for supplying power to the chiller. This is recommended to avoid safety and reliability issues resulting from connection failure at the power connections to the chiller. Aluminum wiring is not recommended due to thermal characteristics that may cause loose terminations resulting from the contraction and expansion of the wiring. Aluminum oxide may also build up at the termination causing hot spots and eventual failure. If aluminum wiring is used to supply power to the chiller, AL-CU compression fittings should be used to transition from aluminum to copper. This transition should be done in an external box separate to the power panel. Copper conductors can then be run from the box to the chiller.

POWER SUPPLY WIRING

Units require only one 3-phase supply, plus earth.

Connect the 3-phase supplies to the circuit breaker located in the panel, see *"Table 4 - Electrical Lug Data"* on page 50 for further information.

Connect a suitably sized earth wire to the PE terminal in the panel.

115VAC CONTROL SUPPLY TRANSFORMER

A 3-wire high voltage to 115VAC supply transformer is standard in the chiller. This transformer is mounted in the cabinet and steps down the high voltage supply to 115VAC to be used by the controls, VSD, Feed and Drain Valve Controller, valves, solenoids, heaters, and so on.

The high voltage for the transformer primary is taken from the chiller input. Fusing is provided for the transformer.

Removing high voltage power to the chiller will remove the 115VAC supply voltage to the control panel circuitry and the evaporator heater mat. In sub-freezing weather, this could cause serious damage to the chiller due to evaporator freeze-up. Do not remove power unless alternate means are taken to ensure operation of the control panel, evaporator shell heaters.

CONTROL PANEL WIRING

All control wiring utilizing contact closures to the control panel terminal block is nominal 115VAC and must be run in shielded cable, with the shield grounded at the panel end only, and run in water tight conduit. Run shielded cable separately from mains cable to avoid electrical noise pick-up. Use the control panel cable entry to avoid the power cables.

Voltage free contacts connected to the panel must be suitable for 115VAC10 ma (gold contacts recommended). If the voltage free contacts form part of a relay or contactor, the coil of the device must be suppressed using a standard R/C suppressor. The above precautions must be taken to avoid electrical noise, which could cause a malfunction or damage to the unit and its controls.

VOLTS FREE CONTACTS

Voltage free contacts are rated at 115VAC, 100VAC resistive load only. Inductive loads must be suppressed across the coil.

Chilled Liquid Pump Starter

Terminals 23 and 24 on 1TB close to start the chilled liquid pump. This contact can be used as a master start/stop for the pump in conjunction with the daily start/stop schedule. Cycle the pumps from the unit panel if the unit will be operational or shut-down during sub-freezing conditions. See *Evaporator Pump Control on Page 90* for more information on testing the pumps.

Run Contact

Terminals 21 and 22 on 1TB close to indicate that a system is running.

Alarm Contacts

Each system has a single voltage-free contact, which will operate to signal an alarm condition whenever any system locks out, or there is a power failure.

SYSTEM INPUTS

Remote Print

Closure of suitable contacts connected to Terminals 2 and 14 of 1TB will cause a hard copy printout of Operating Data/Fault History to be made if an optional printer is connected to the RS-232 port. The remote print circuitry is a 115VAC circuit. Contacts must be rated for low current (5mA). Gold contacts should be used.

Optional Remote Setpoint Offset – Temperature

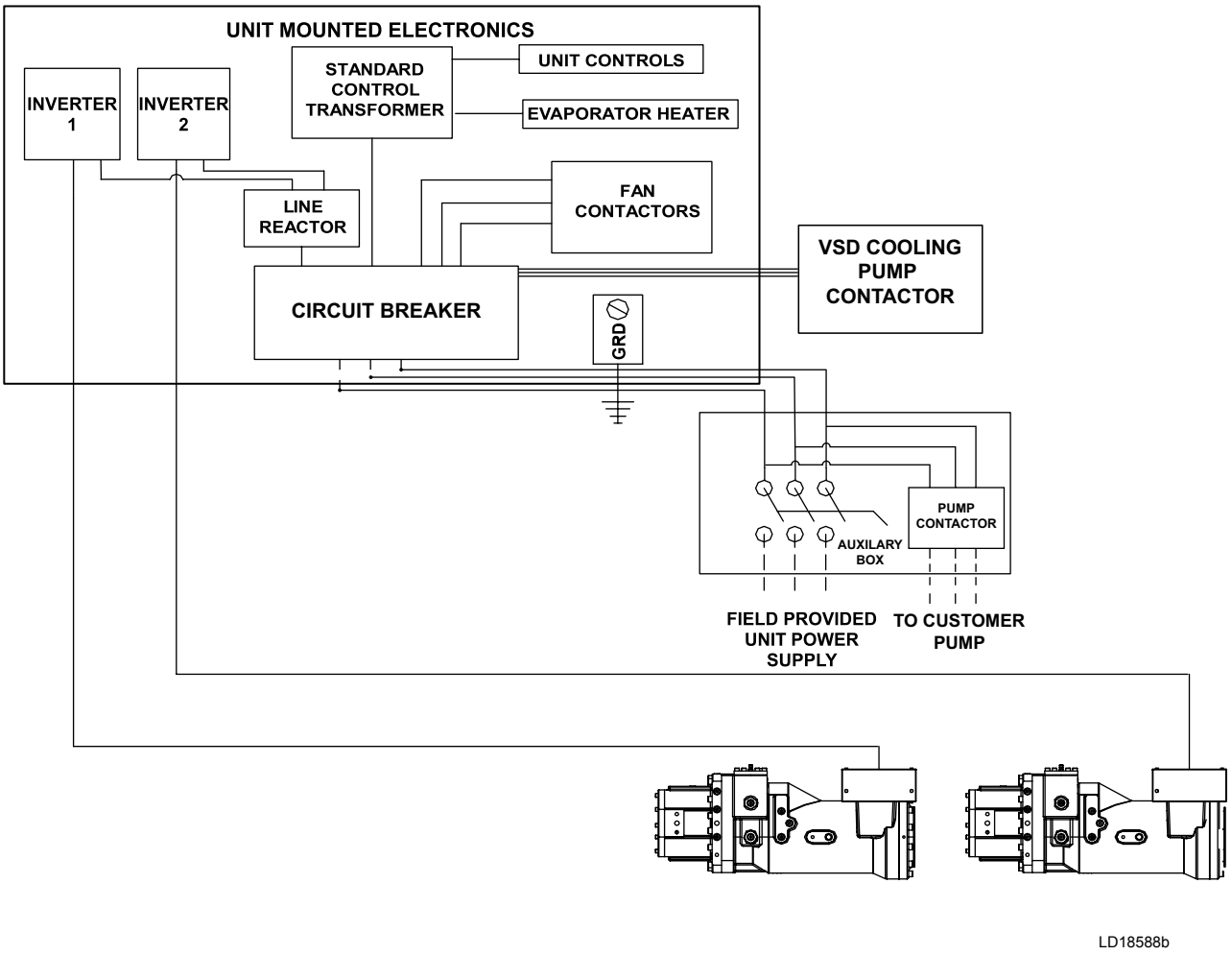
A voltage signal connected to Terminals 17 and 18 of "Auxiliary Panel" will provide a remote offset function of the chilled liquid setpoint, if required.

Optional Remote Setpoint Offset – Current

A voltage signal connected to Terminals 19 and 20 of "Auxiliary Panel" will provide a remote setting of current limit setpoint, if required.

Optional Remote Setpoint Offset – Sound Limiting

A voltage signal connected to Terminals 40 and 41 of "Auxiliary Panel"will provide remote setting of sound limit setpoint, if required.



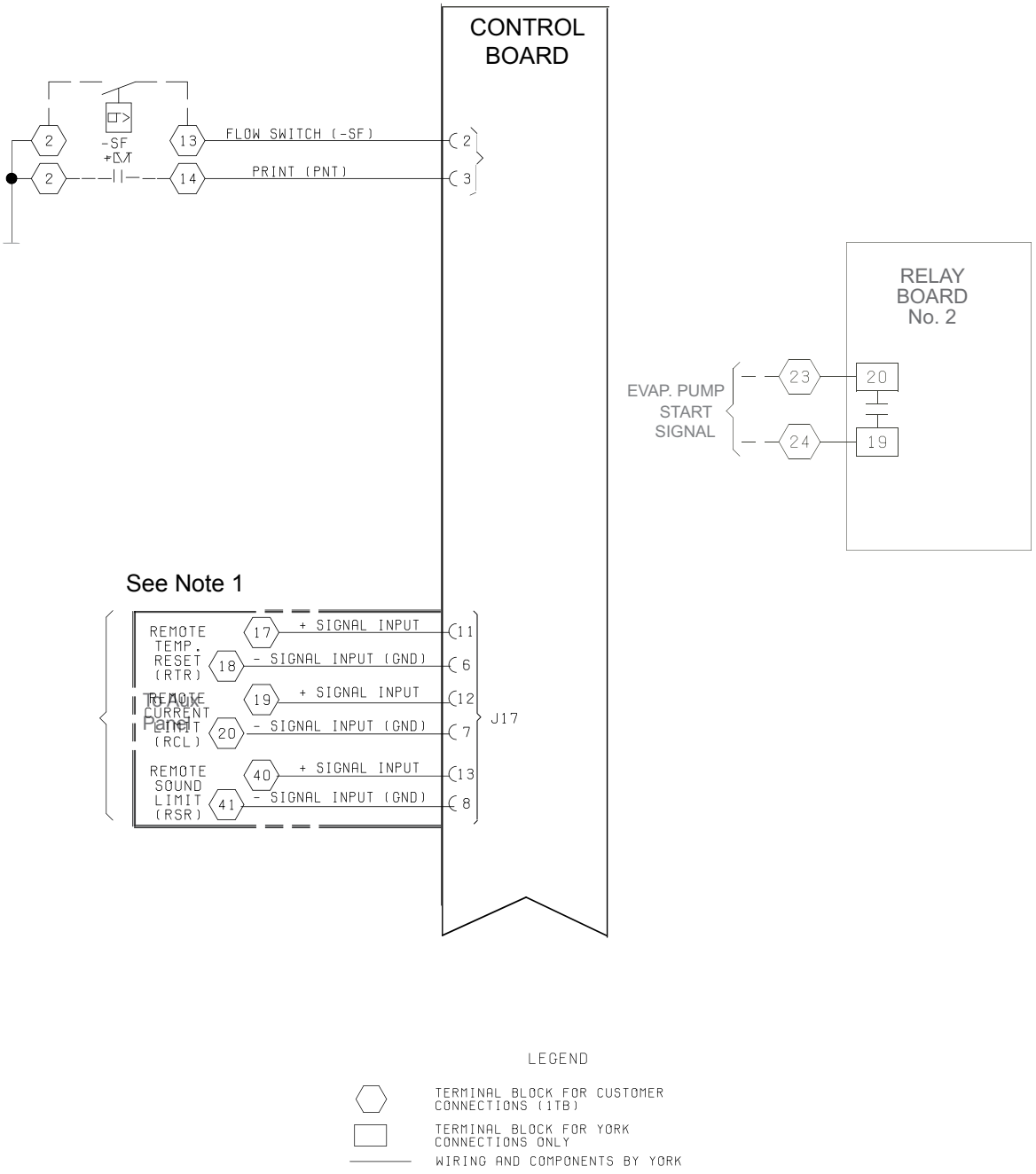
NOTE

Minimum Circuit Ampacity (MCA), Minimum/Maximum Fuse Size and Minimum/Maximum Circuit Breaker size varies on chillers based upon model and options ordered. Consult YorkWorks or the chiller data plate for electrical data on a specific chiller.

Voltage Utilization Range

RATED VOLTAGE	UTILIZATION RANGE
380/3/60	342-402
400/3/60	360-440
400/3/50	360-440
460/3/60	414-508

FIGURE 13 - SINGLE POINT POWER WIRING



Note:

1. Customer connections referenced are located in the Auxiallary Power panel.

FIGURE 14 - CUSTOMER CONTROL CONNECTIONS

TABLE 4 - ELECTRICAL LUG DATA

FIELD WIRING LUGS				SINGLE POINT WIRING	
				CIRCUIT BREAKER	
YAGK MODEL		INPUT VOLTS	INPUT FREQ	WIRES PER PHASE	LUG WIRE RANGE
60HZ	50HZ				
YAGK0200	YAGK0700	380	60	2	SEE BUS BAR IN FIGURES 15 AND 16.
		400	50/60	2	SEE BUS BAR IN FIGURES 15 AND 16.
		400	50	2	SEE BUS BAR IN FIGURES 15 AND 16.
		460	60	3	#2 - 4/0

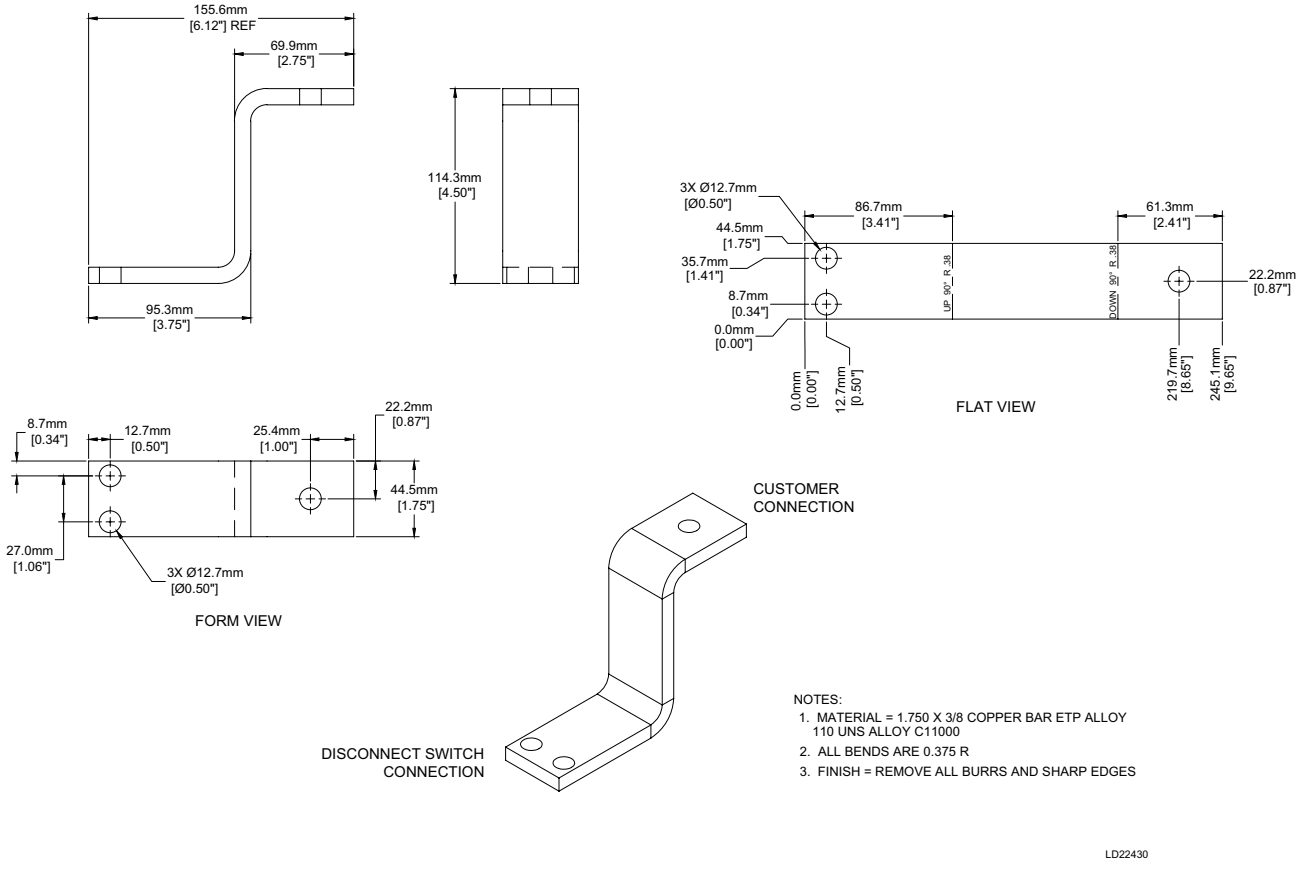


FIGURE 15 - BUS BAR, MIDDLE PHASE AGGREKO AUX PANEL

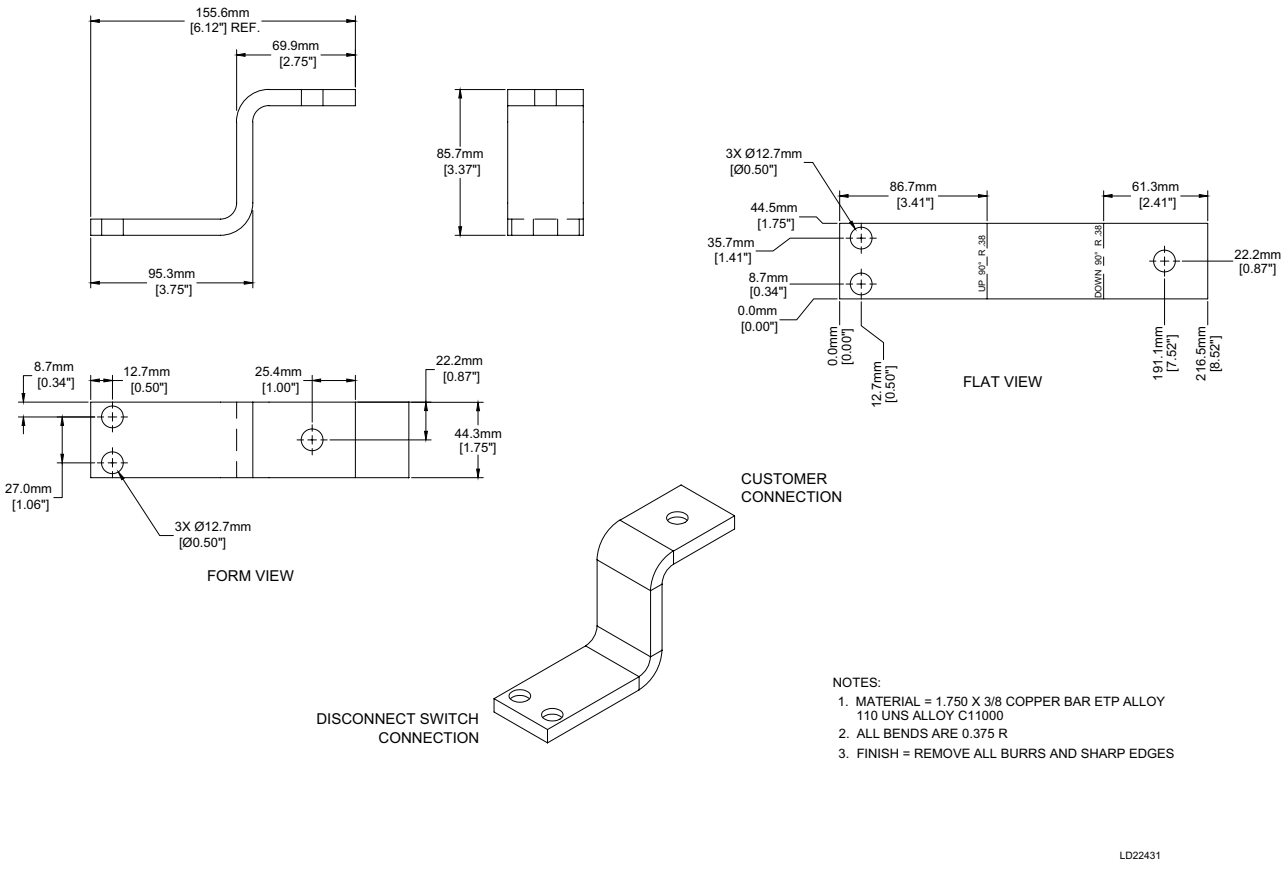


FIGURE 16 - BUS BAR OUTER PHASE AGGREKO AUX PANEL

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SECTION 5 - TECHNICAL DATA

TABLE 5 - COMPLETE PIN NUMBER DESCRIPTION

FEATURE	PIN	OPTION	OPTION DESCRIPTION
CONTRACT	Contract	NUM	Contract Number = {num}
ORDER	Order Quantity	QTY	Order Quantity {ord_qty}
USA	USA Origin	N	USA Origin not required
SHIPWT	Shipping Weight	LBS	USA Origin required
		KGS	
MODEL	Model 1 (PIN 1)	Y	York
COMPRTYP	Compressor Type (PIN 2)	A	Aggreko
CHILLERTYP	Ciller Type (PIN 3)	G	Air-cooled
DESIGNER	Design Series (PIN 4)	K	Design Series
UNTDSG	Unit Designator (PIN 5-8)	0200	The first 3 bits refer to capacity, the number is capacity in RT (IP) or kW (SI)
		0700	
PLOADEFF	Full Load Efficiency (PIN 9)	For Marketing Purposes Only	
PLOADEFF	Parl Load Efficiency (PIN 10)	For Marketing Purposes Only	
SOUND	Sound (PIN 11)	For Marketing Purposes Only	
VOLTAGE		40	380/3/60
		46	460/3/60
		50	380-415/3/50
		56	400/3/50/60
MODLVL	Modification Level (PIN 14)	A	Modification Level
REF	Refrigerant (PIN 15)	A	R-134a Refrigerant
STARTERTYP	Starter Type (PIN 16)	X	No Selection
		Q	Special Quote
POWERFLD	Power Field (PIN 17)	B	SP Circuit Breaker with Lockable Handle
		Q	Special Quote
PIN18	PIN18	X	No Selection
		Q	Special Quote
PANELOPT	Panel Options (PIN 19)	X	No Selection
		Q	Special Quote
AMB	Ambient Kits (PIN 21)	X	No Selection
		Q	Special Quote
BAS	BAS Reset/Offset (PIN 21)	X	No Selection
		L	E-Link Kit (factory mounted, field commissioned) LON Output
		S	SC-Equip Board
		Q	Special Quote
LANGDESP	Language Display (Pin 22)	A	English
		C	English LCD with Chinese keypad overlay
		E	Chinese LCD
		F	French
		G	German
		H	Hungarian
		I	Italian

TABLE 6 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	PIN	OPTION	OPTION DESCRIPTION
LANGDESP (CONT'D)	Language Display (PiIN22)	J	Japanese
		K	Korean
		L	Polish
		N	Dutch
		P	Portuguese
		R	Russian
		S	Spanish
		W	Swedish
		Z	Czech
		Q	Special Quote
SYSPARM	System Parameter (PIN 23)	X	No Selection
		K	Quick Start
		M	Quick Start and Silent Night /Load Limiting Control Option
		N	Silent Night Sound/Load Limiting Control Option
		Q	Special Quote
SAFETYCDE	Safety Code (PIN 24)	C	European Safety Code (CE)
		L	N. American Safety Code (cUL/cETL)
		Q	Special Quote
SENSOR	Sensor (PIN 25)	X	No Selection
		Q	Special Quote
PUMPCTRL	Punp Control (PIN 26)	X	No Selection
		Q	Special Quote
REMOTEPNL	Remote Panel (PIN 27)	X	No Selection
		Q	Special Quote
SEQCTRL	Sequence Control (PIN 28)	X	No Selection
		Q	Special Quote
FANFQ	Maximum Fan Frequency (PIN 29, 30)		
LWT	Leaving Water Temp (PIN 31, 32)		
PIPECODE	Piping Code (PIN 33)	X	No Selection
		Q	Special Quote
METERDEV	Metering Device (PIN 34)	X	No Selection
		Q	Special Quote
VALVEOPT	Valve Options (PIN 35)	X	No Selection
		Q	Special Quote
PIN36	PIN 36	X	No Selection
		Q	Special Quote
PIN37	PIN 37	X	No Selection
		Q	Special Quote
CPRVAR	Compressor Variation (PIN 38)	S	Standard Compressor - CTS
		W	Standard Compressor - WTS
		C	Optimized Compressor - WTS
		Q	Special Quote

TABLE 6 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	PIN	OPTION	OPTION DESCRIPTION
HTR	Heaters (PIN 42)	X	No Selection
		Q	Special Quote
DWP	PIN	1	150 psig DWP Waterside
		Q	Special Quote
INS	Insulation (PIN 44)	X	No Selection
		Q	Special Quote
SHPLOSFLG	Ship Loose Flange Kit (PIN 45)	X	No Selection
FLOW	Flow Switch (PIN 46)	Q	Special Quote
VESSEL	Vessel Codes (PIN 47)	X	No Selection
		Q	Special Quote
CLR	Cooler (PIN 48)	X	No Selection
		Q	Special Quote
EVAPCONN	Evaporator Connection Location (PIN 49)	X	No Selection
		Q	Special Quote
COILS	Refrigerant / Glycol System Coils (PIN 50)	X	No Selection
		Q	Special Quote
BRANDING	Branding Kit (PIN 51)	X	No Selection
		Q	Special Quote
FANTYP	Fan Type (PIN 52)	X	No Selection
		Q	Special Quote
ENCLPNL	Enclosure Panels (PIN 53)	X	No Selection
		Q	Special Quote
NOISERDCT	Noise Reduction (PIN 54)	X	Low Noise Kit (level 0 reduction) (factory)
		R	Low Noise Kit (level 1 reduction) (factory)
		Q	Special Quote
ISOL	Vibration Isolators (PIN 55)	X	No Selection
		Q	Special Quote
STRMOD	Structural Modification (PIN 56)	A	Skid
		B	ISO Frame
		Q	Special Quote
PIN57	PIN 57	X	No Selection
		Q	Special Quote
SPAPP	Special Applications (PIN 58)	X	No Selection
		Q	Special Quote
PMPPKG	Pump Package (PIN 59)	X	No Selection
		Q	Special Quote
PMPPKGOPT	Pump Package Options (PIN 60)	X	No Selection
		Q	Special Quote

TABLE 6 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	PIN	OPTION	OPTION DESCRIPTION
SRDOCS	Spec Req Documents (PIN 61)	X	No Selection
		Q	Special Quote
EXWTY	Extended Warranty (PIN 62)	X	No Selection
		Q	Special Quote
REFWTY	Refrigerant Warranty (PIN 63)	X	No Selection
		Q	Special Quote
SHIPINS	Ship Instructions (PIN 64)	X	No Selection
		Q	Special Quote
STKPGRM	Stock Program (PIN 65)	X	No Selection
		Q	Special Quote
LOC	Manufacturing Location	MTY	Monterey, Mexico
YW	YorkWorks Config Version	CV	
	YorkWorks Upload Version	UV	
SQ	Special Quote	Q	Special Quote

EVAPORATOR PRESSURE DROP

The flow rate must not exceed the maximum GP. Make sure that the liquid flow rate is between minimum GPM and maximum GPM.

The minimum and maximum flow rate for YAGK chiller models see *Table 7 on Page 59 for Physical Data.*

NOTE

Excessive flow above the Maximum GPM may damage the Evaporator.

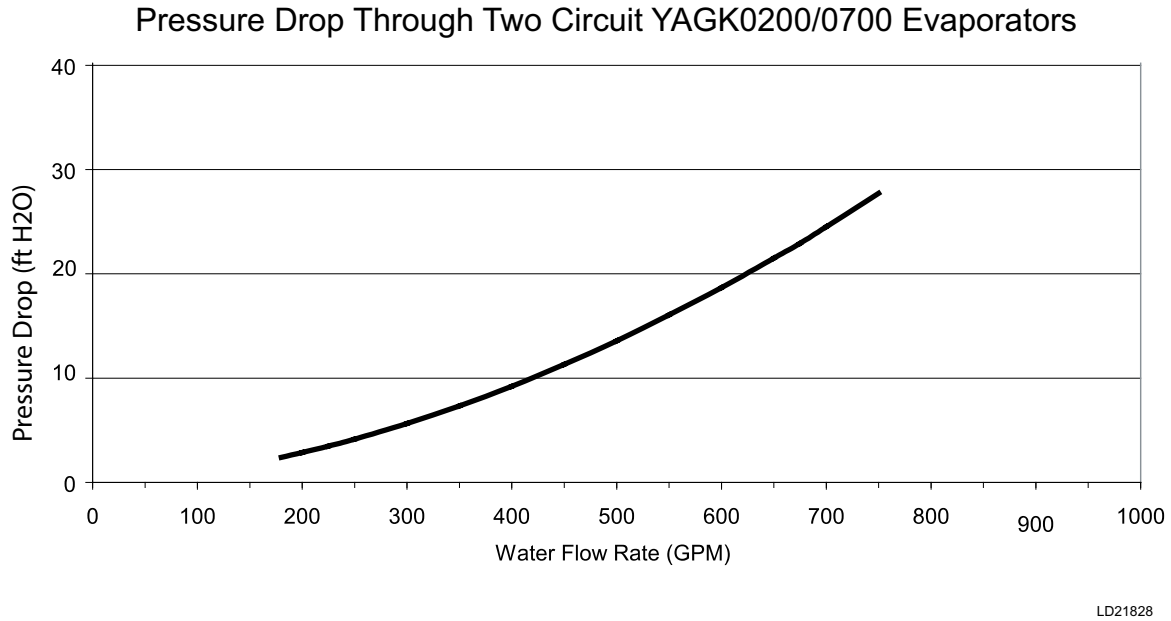

FIGURE 17 - PRESSURE DROP THROUGH TWO CIRCUIT YAGK EVAPORATORS (ENGLISH UNITS)

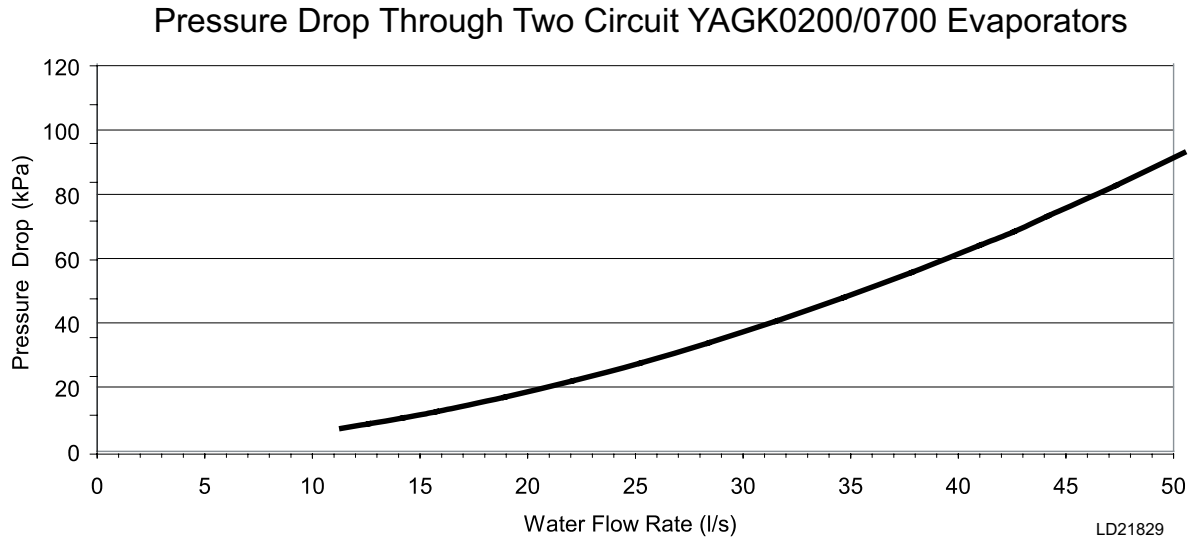

FIGURE 18 - PRESSURE DROP THROUGH TWO CIRCUIT YAGK EVAPORATORS (SI UNITS)

Waterside Pressure Drop in Evaporator

The waterside pressure drop is calculated with fresh water.

GLYCOL CORRECTION FACTORS

When using glycol solutions, pressure drops are higher than with water (see correction factors to be applied when using glycol solutions). Special care must be taken not to exceed the maximum flow rate allowed.

A. = Correction Factor

B. = Mean Temperature through Evaporator

C. = Concentration WIW

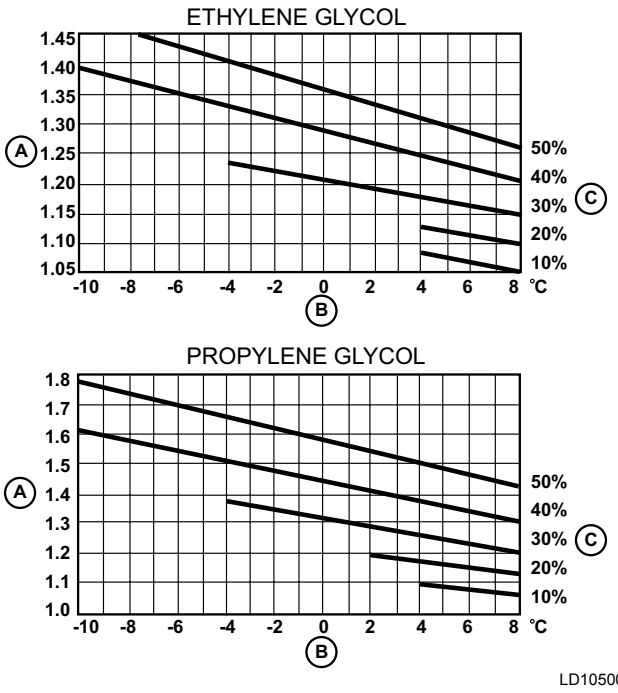

FIGURE 19 - GLYCOL CORRECTION FACTORS

TABLE 6 - OPERATIONAL LIMIT

UNIT	LEAVING LIQUID TEMP		AIR ON CONDENSER	
	MIN	MAX[1]	MIN[2]	MAX[3]
°F	5	70	0	122 (131)
°C	-15	21.1	-17.8	50 (55)

NOTES:
1. For leaving water temperature higher than 70°F (21.1°C), contact the nearest Johnson Controls office for application guidelines.
2. Compressor will stop working when ambient to be below 0°F (-17.8°C).
3. Compressor may unload at this ambient. For Middle East region, max ambient can be up to 131°F (55 °C).

If glycol is installed in the evaporator, the glycol concentration must assure that the freeze point is below either the lowest expected ambient temperature at the chiller location or the lowest expected refrigerant temperature, whichever is lower, to avoid evaporator damage.

REMOVING WATER/GLYCOL FROM THE EVAPORATOR

If the chiller is equipped with a -20°F evaporator freeze protection option, which incorporates immersion heaters, power must be removed from the chiller before the evaporator is drained to assure the heaters are not damaged. Failure to remove power will cause the evaporator immersion heaters to fail.

The data shown in this table is applicable to selected typical configurations. Other configurations are available through our configuration/selection software. Johnson Controls Sales Office for the chiller configuration that best matches your specific needs.

TABLE 7 - PHYSICAL DATA - MICROCHANNEL COIL

YAGK MODEL # 0200 / 0700	
EVAPORATOR	
Min flow rate, gpm (L/s)	300 (18.93)
Max flow rate glycol, gpm (L/s)	800 (50.47)
Inlet/Outlet diameter in (mm)	4 Camlock Male / 6 ANSI Flange (100 / 150)
COMPRESSORS	
Type	Semi-Hermetic Screw
Circuit #	2
Compressor #	2
Refrigerant type	R-134a
Refrigerant charge, lbs (kg)	175 / 0175 (79.38 / 79.38)
Oil Charge, Ckt-1/Ckt-2, gal (liters)	2 / 2 (7.57 / 7.57)
CONDENSER FANS	
Fan Number Ckt-1/Ckt-2	4/4
Fan RPM 60Hz (50Hz)	1150 (950)
Fan Motor Power, hp (50 / 60Hz)	3
SHIPPING DATA	
Shipping weight with ISO frame, lbs (kg)	20,000 (9091)
Unit Length in (mm)	226.02 (5740.8)
Unit Width in (mm)	94.6 (2403)
Unit Height in (mm)	88.24 (2241.2)
Operation weight, lbs (kg)	21167 (9621)

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2 COMPRESSOR POWER WIRING CONNECTIONS FOR SINGLE POINT CONNECTION

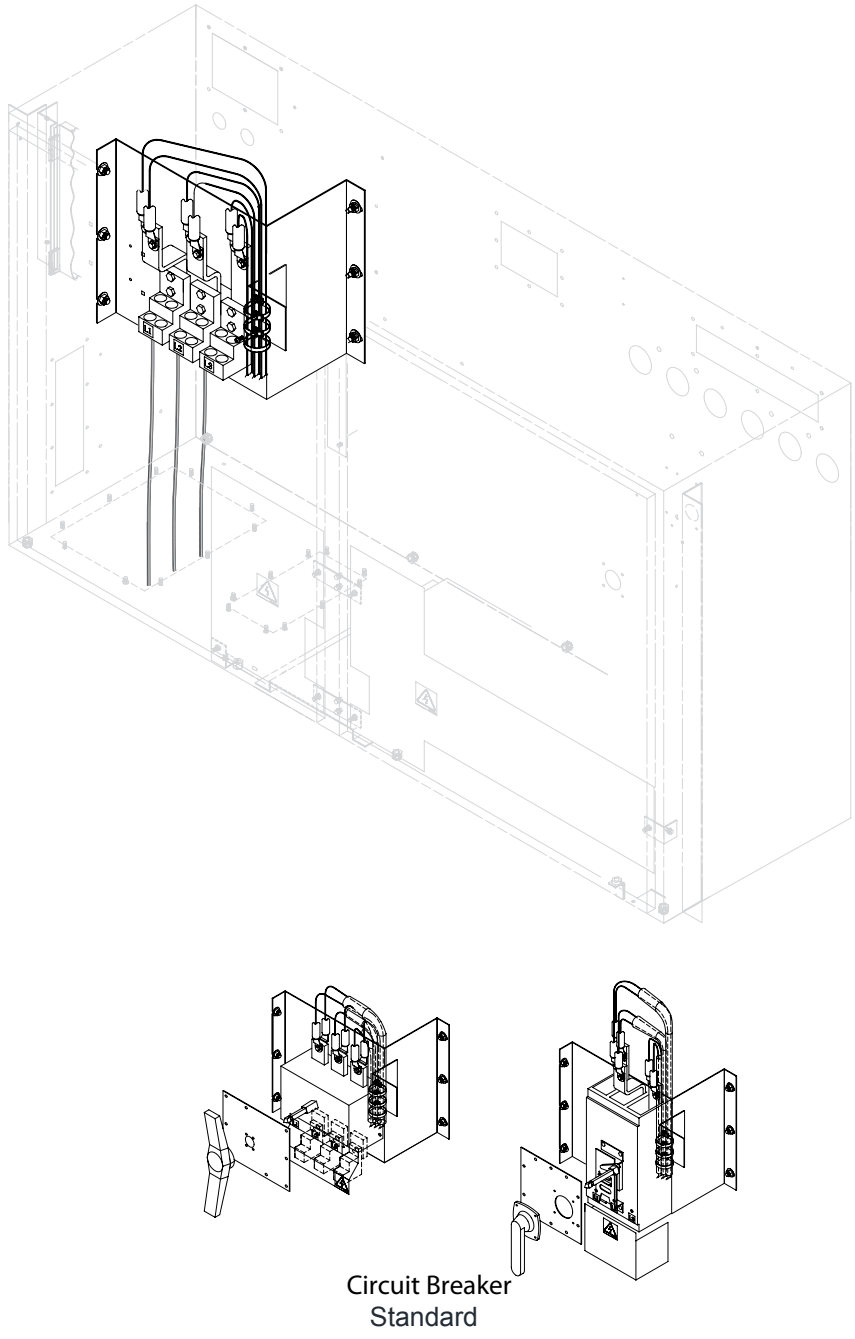

FIGURE 20 - 2 COMPRESSOR POWER WIRING - SINGLE POINT CONNECTION

NOTE

Minimum Circuit Ampacity (MCA), Minimum/Maximum Fuse Size and Minimum/Maximum Circuit Breaker size varies on chillers based upon model and options ordered. Consult YorkWorks or the chiller data plate for electrical data on a specific chiller.

Voltage Utilization Range

RATE VOLTAGE	UTILIZATION RANGE
380/60/3	360-440
460/60/3	414-508
400/50/3	360-440
400/60/3	360-440

SINGLE POINT CONNECTIONS
VSD CONTROL PANEL

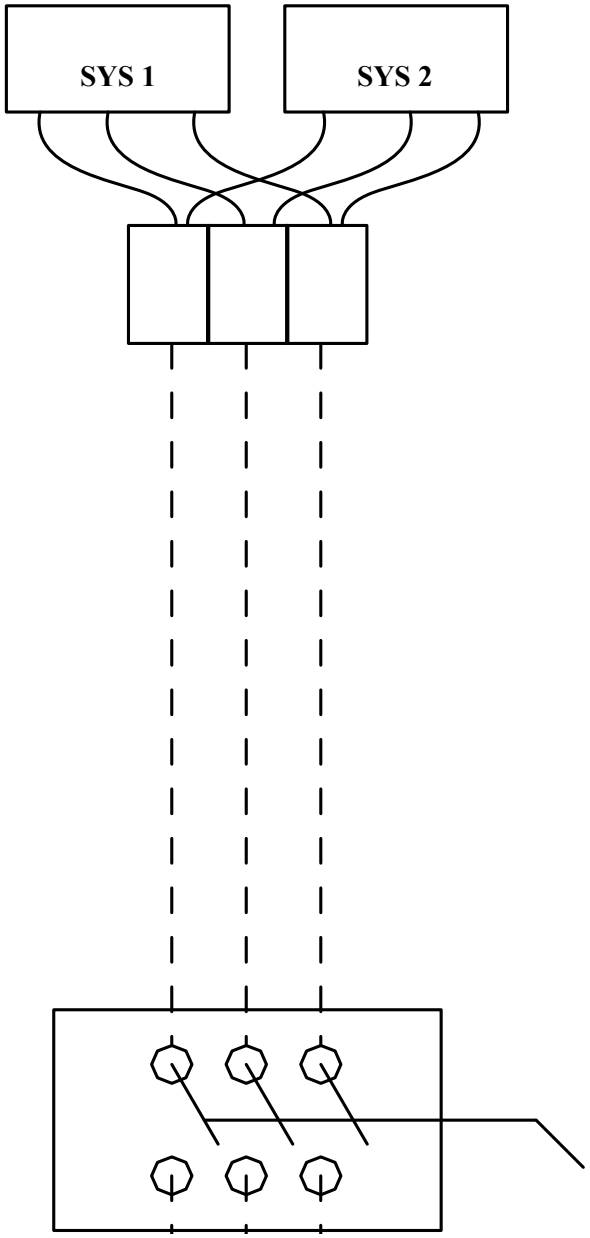

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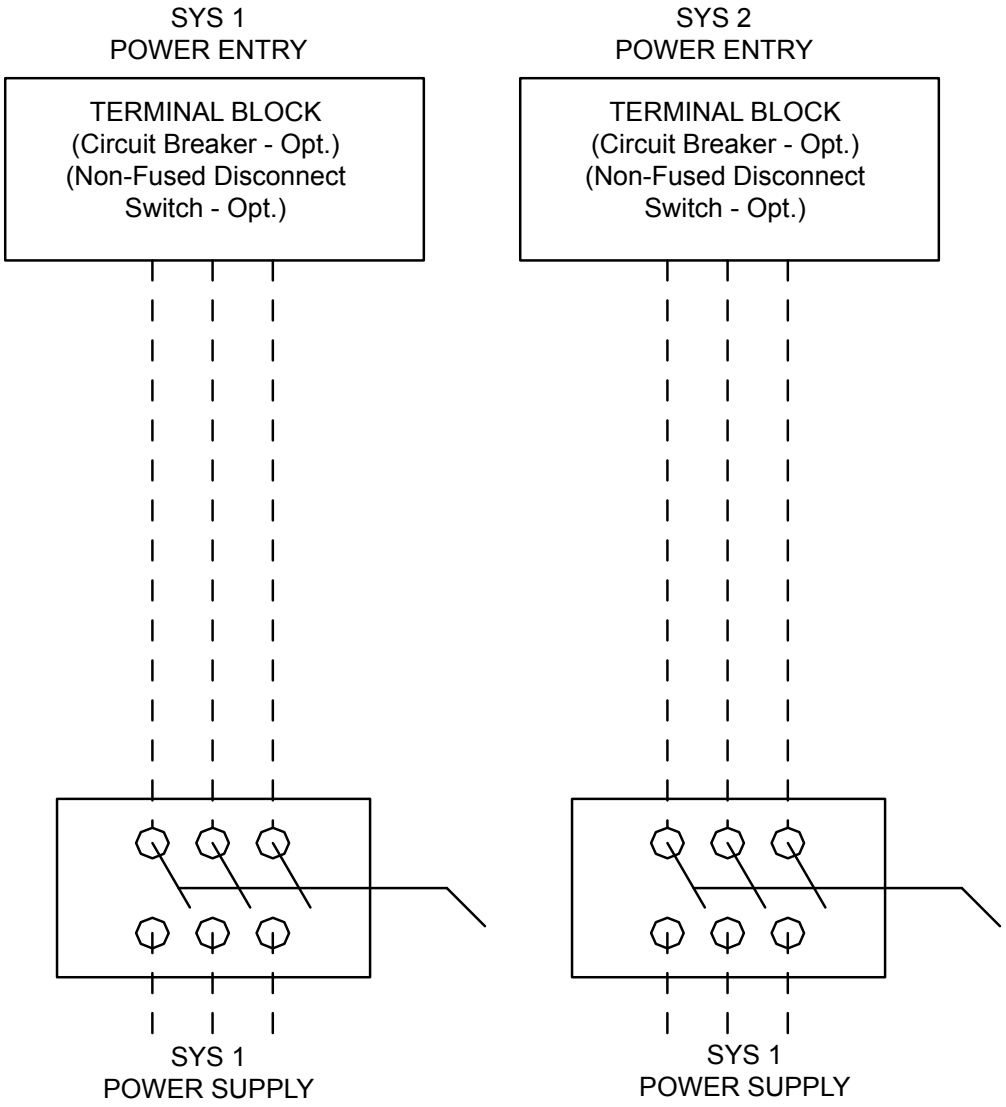
FIGURE 21 - SINGLE POINT CONNECTION - VSD CONTROL PANEL

MULTI POINT CONNECTIONS
VSD CONTROL PANEL



NOTE: Sys #1 and Sys #2 Power Connections located on left side mid panel.

LD17317

FIGURE 22 - MULTI POINT CONNECTIONS - MULTI POINT CONTROL PANEL

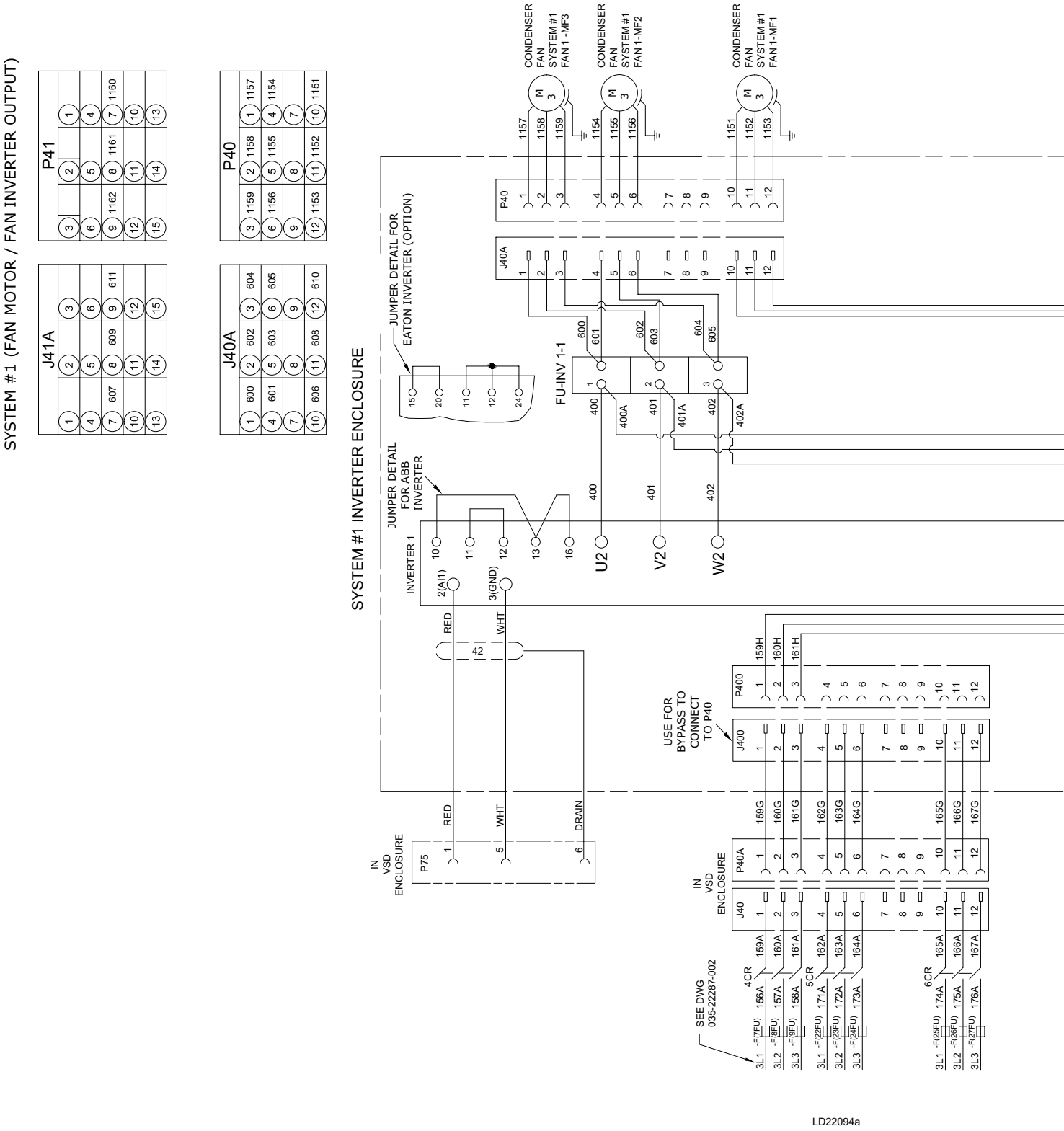


FIGURE 23 - YAGK SYSTEM 1 FAN MOTOR / FAN INVERTER

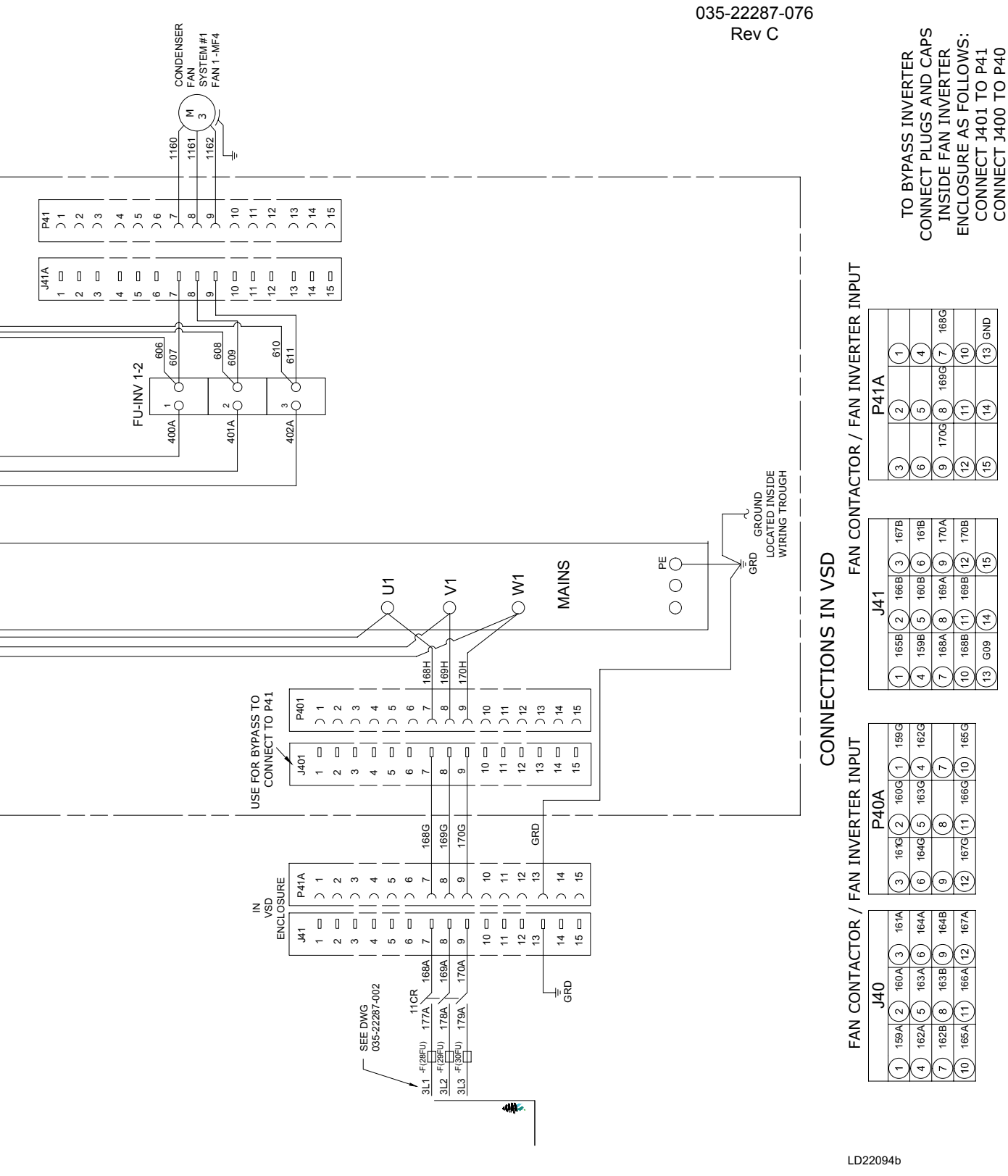


FIGURE 23 - YAGK SYSTEM 1 FAN MOTOR / FAN INVERTER (CONT'D)

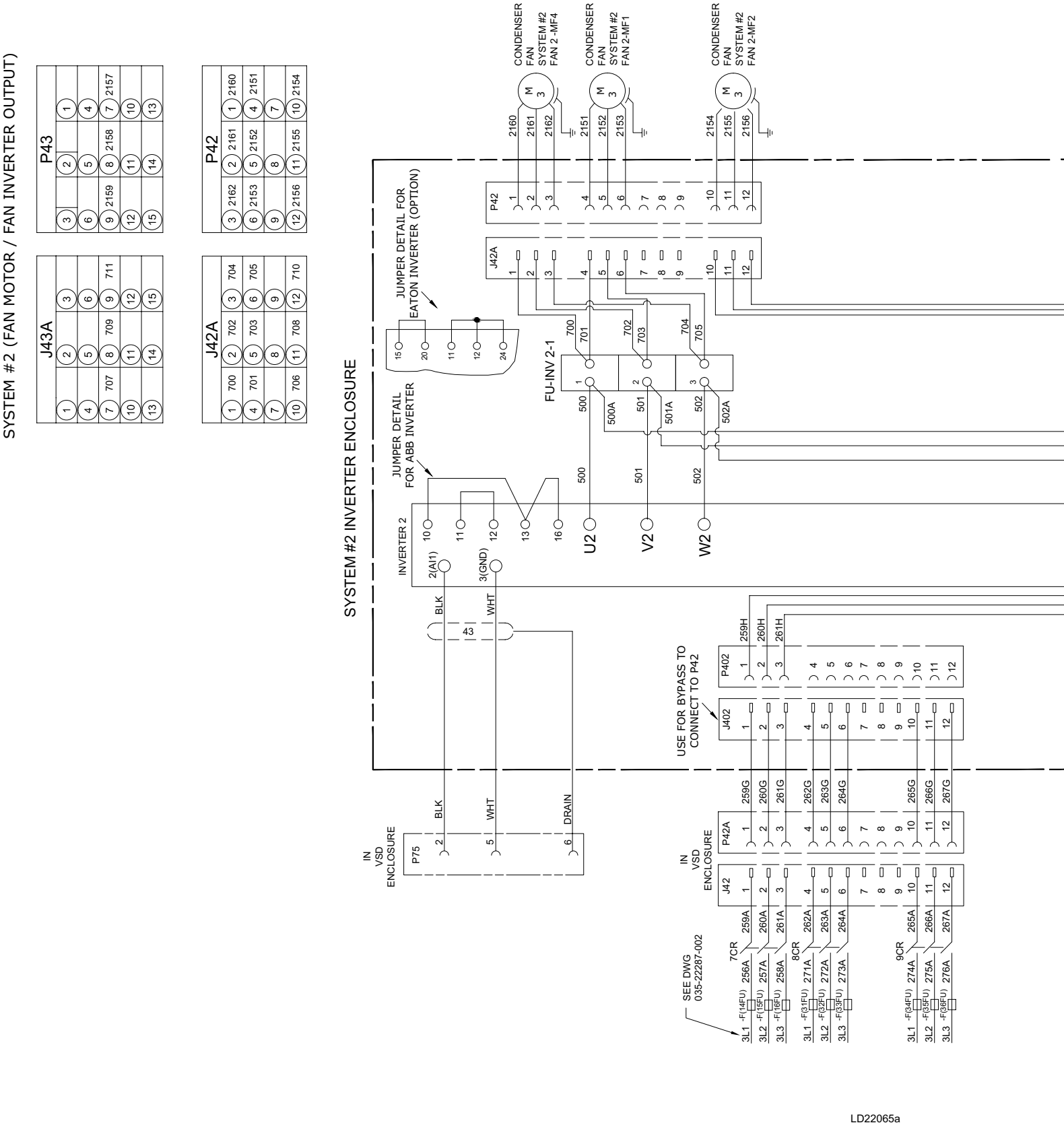


FIGURE 24 - YAGK SYSTEM 2 FAN MOTOR / FAN INVERTER

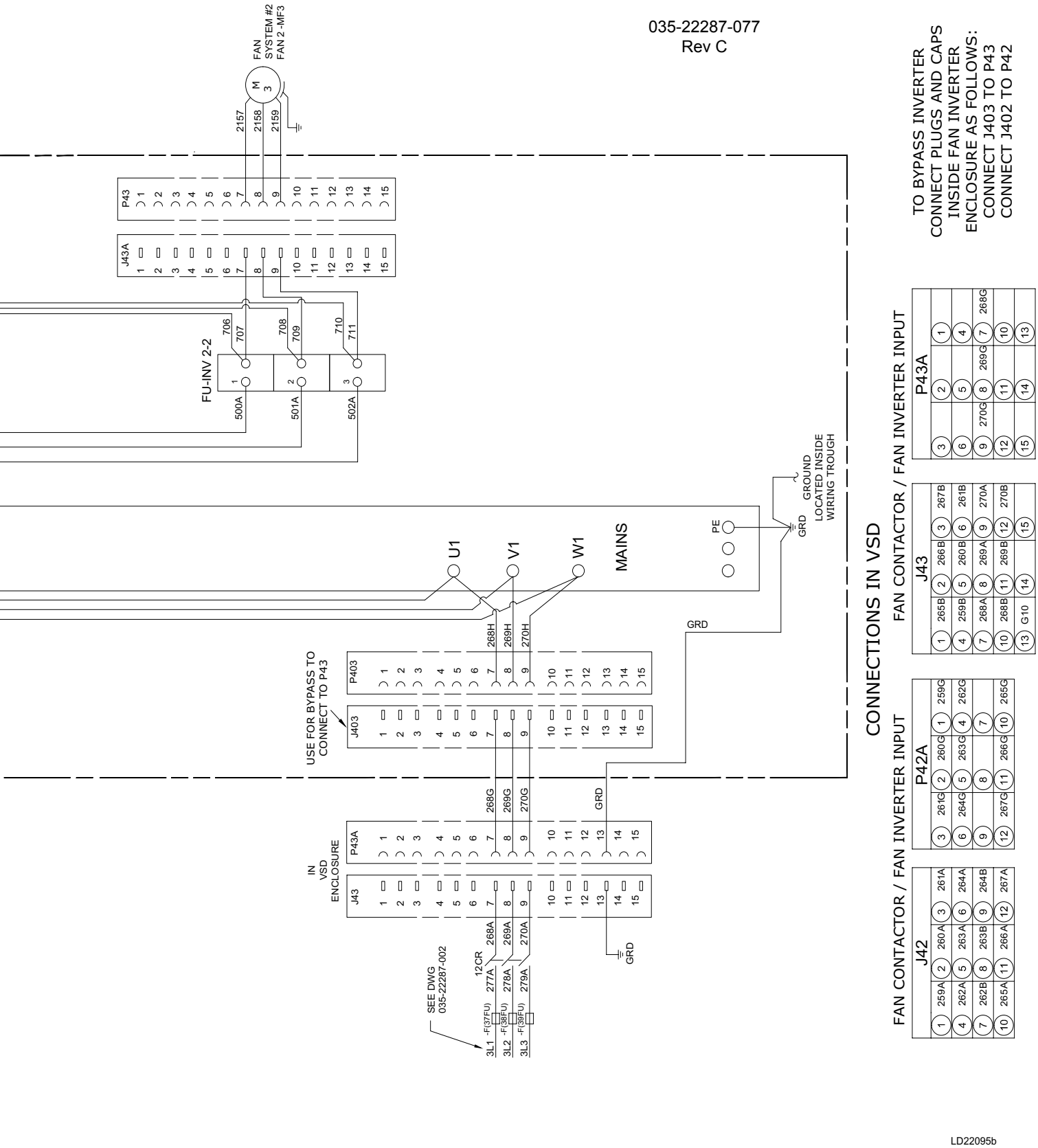


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FIGURE 24 - YAGK SYSTEM 2 FAN MOTOR / FAN INVERTER (CONT'D)

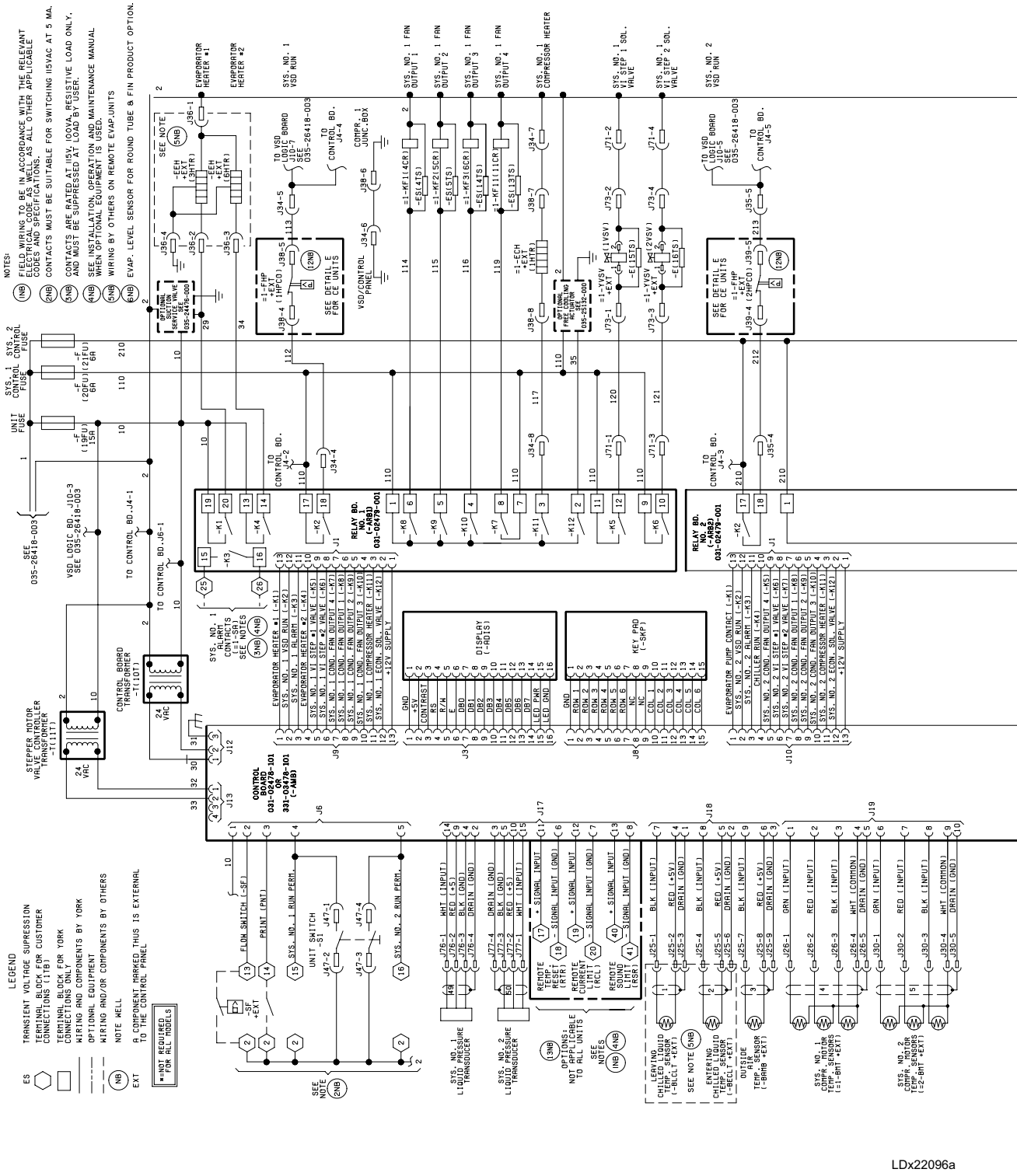

FIGURE 25 - YAGK0200 / 0700 WIRING DIAGRAM

035-26418-001
Rev A

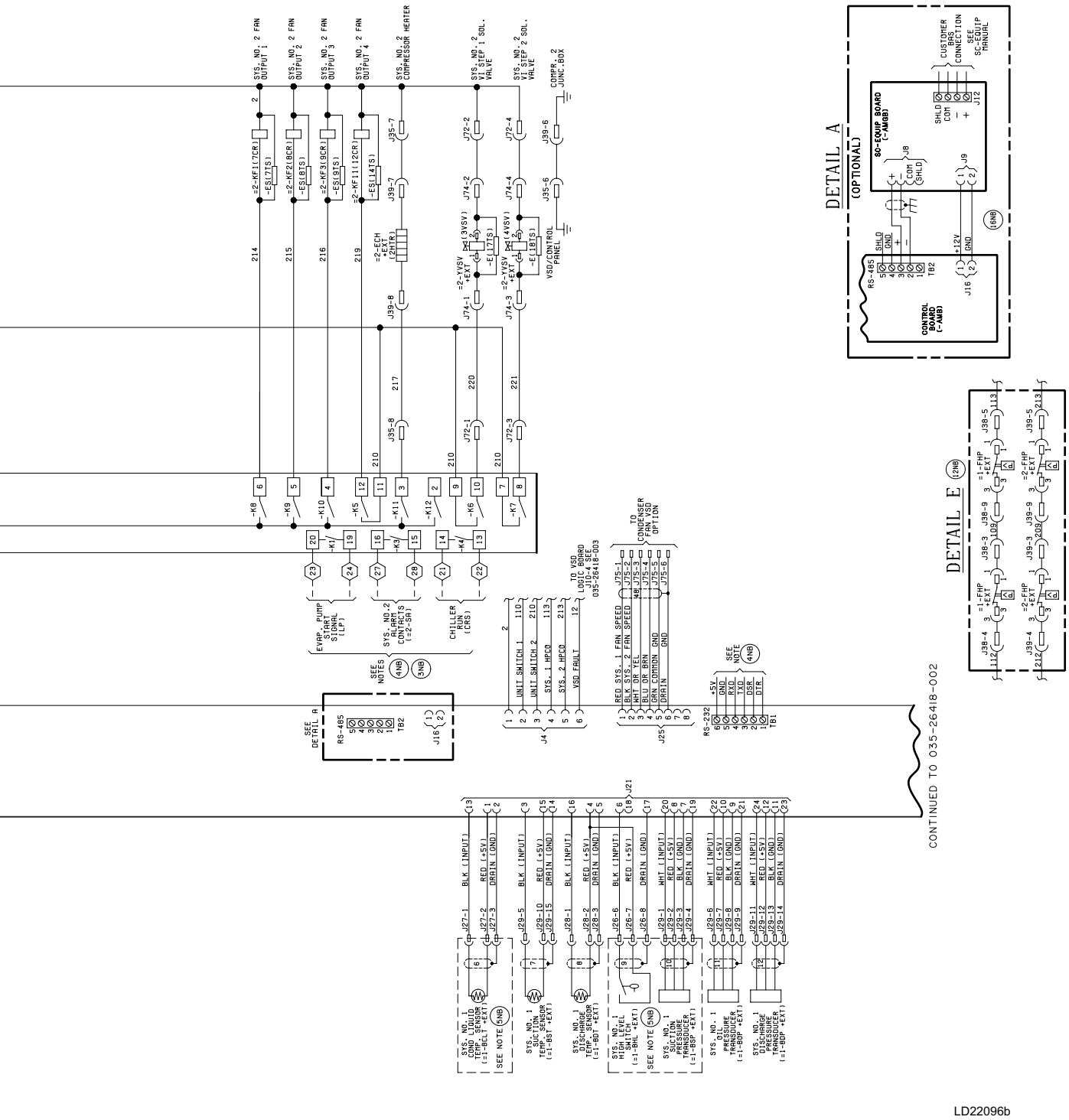

FIGURE 25- YAGK0200 / 0700 WIRING DIAGRAM (CONT'D)

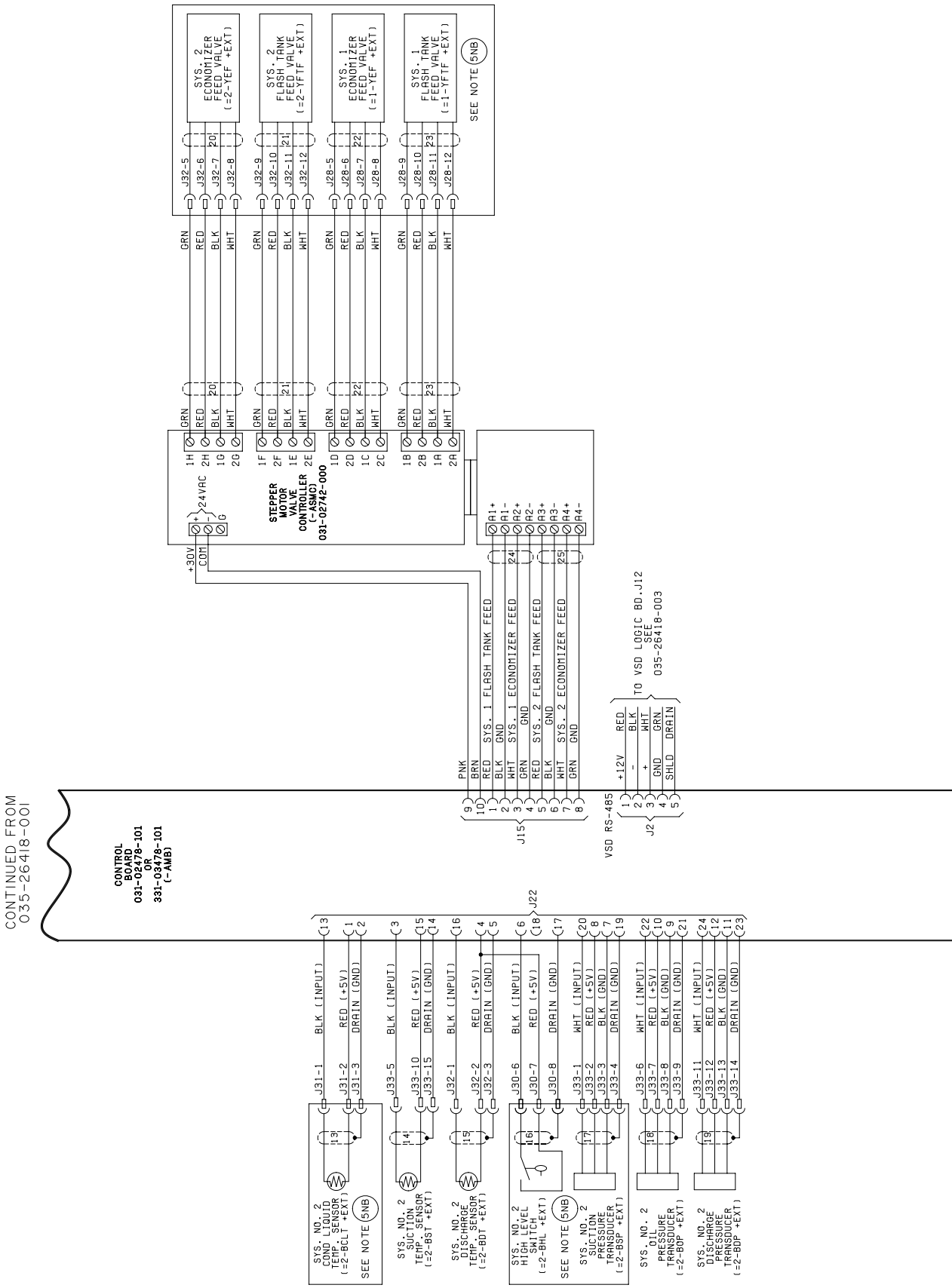

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FIGURE 26 - YAGK CONTROL ELEMENTARY DIAGRAM 2 COMPRESSOR

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Rev A

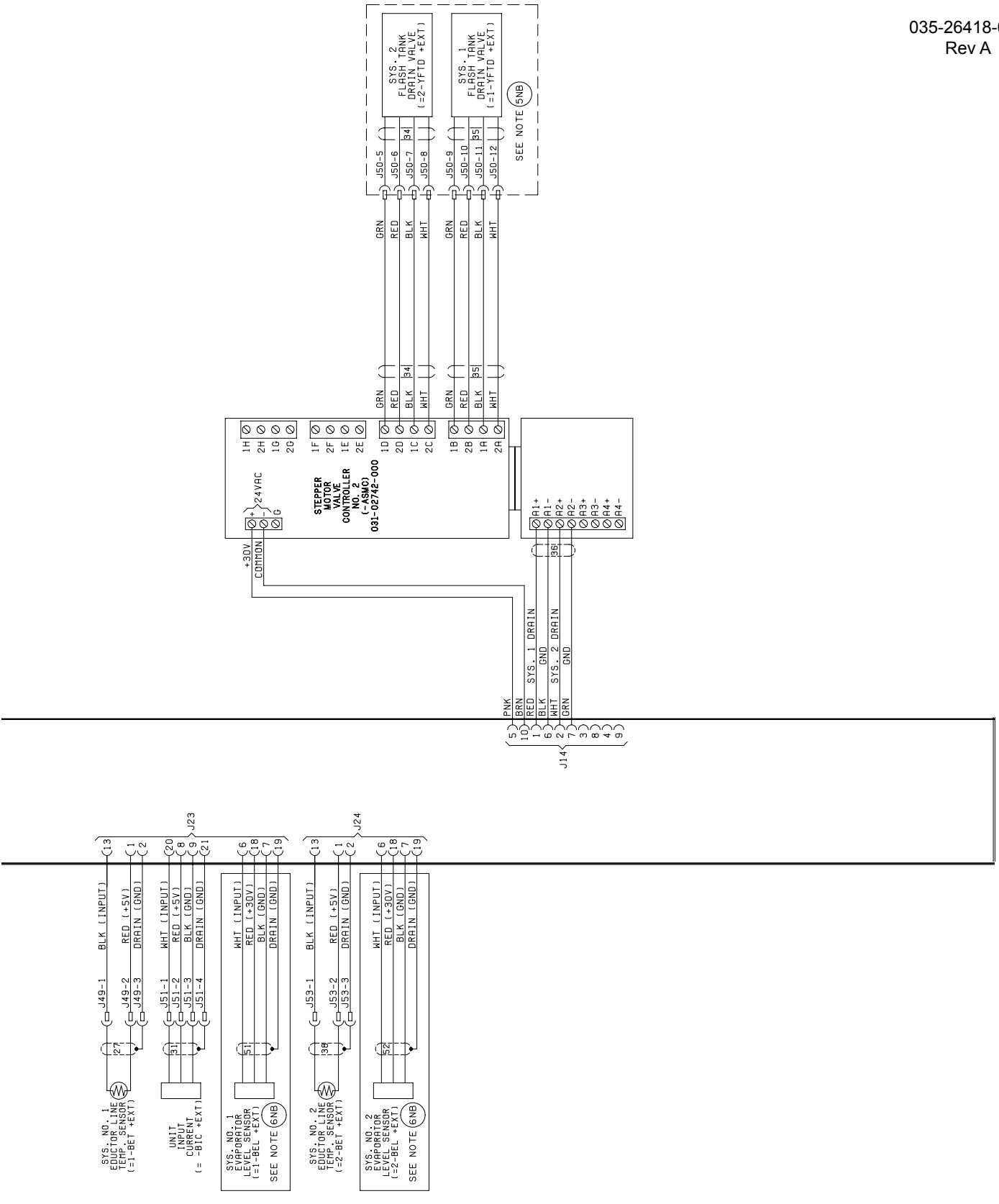
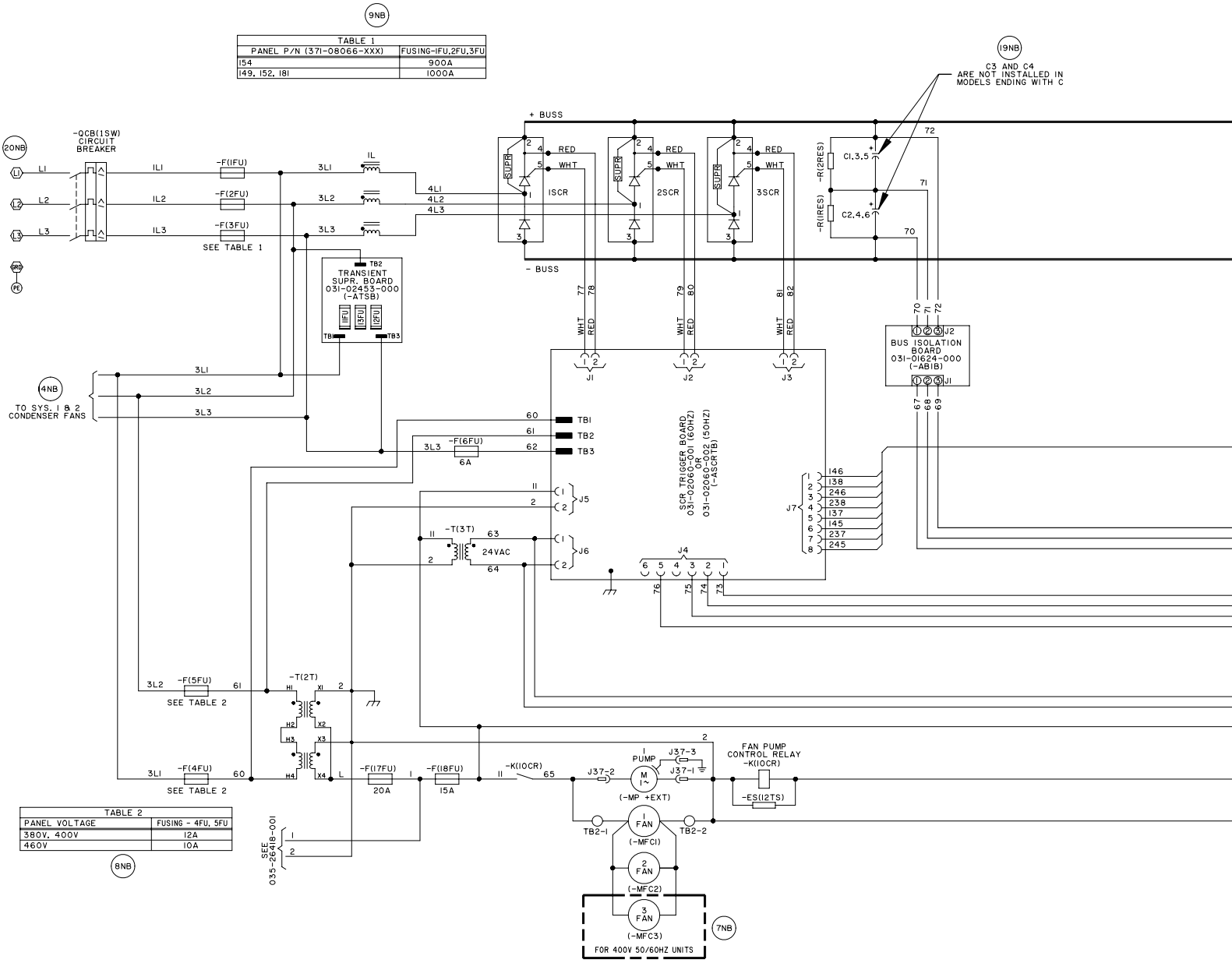


FIGURE 26 - YAGK CONTROL ELEMENTARY DIAGRAM 2 COMPRESSOR (CONT'D)



LD22098a

FIGURE 27 - YAGK POWER ELEMENTARY DIAGRAM 2 COMPRESSOR

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Rev A

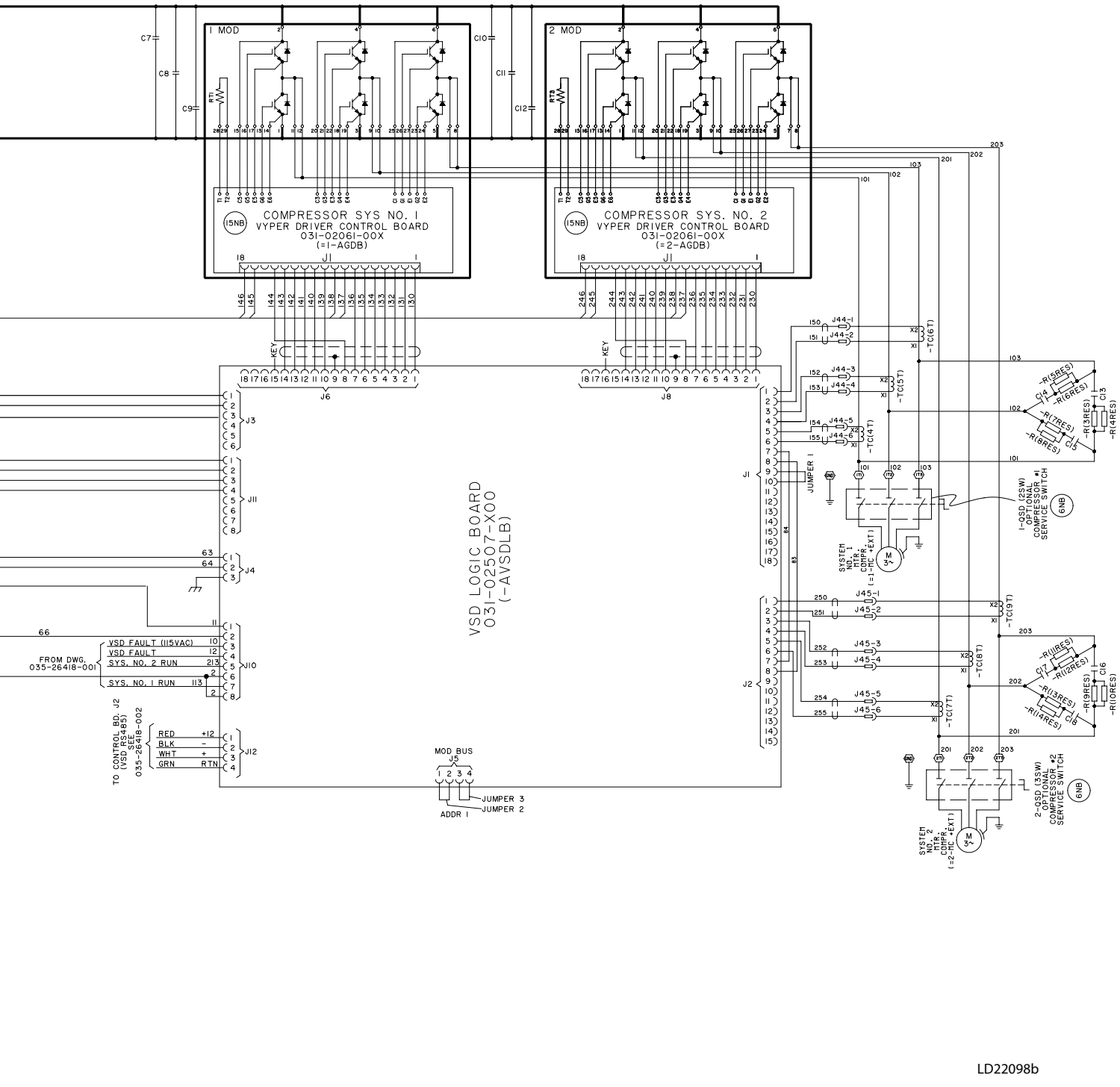

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FIGURE 27 - YAGK POWER ELEMENTARY DIAGRAM 2 COMPRESSOR (CONT'D)

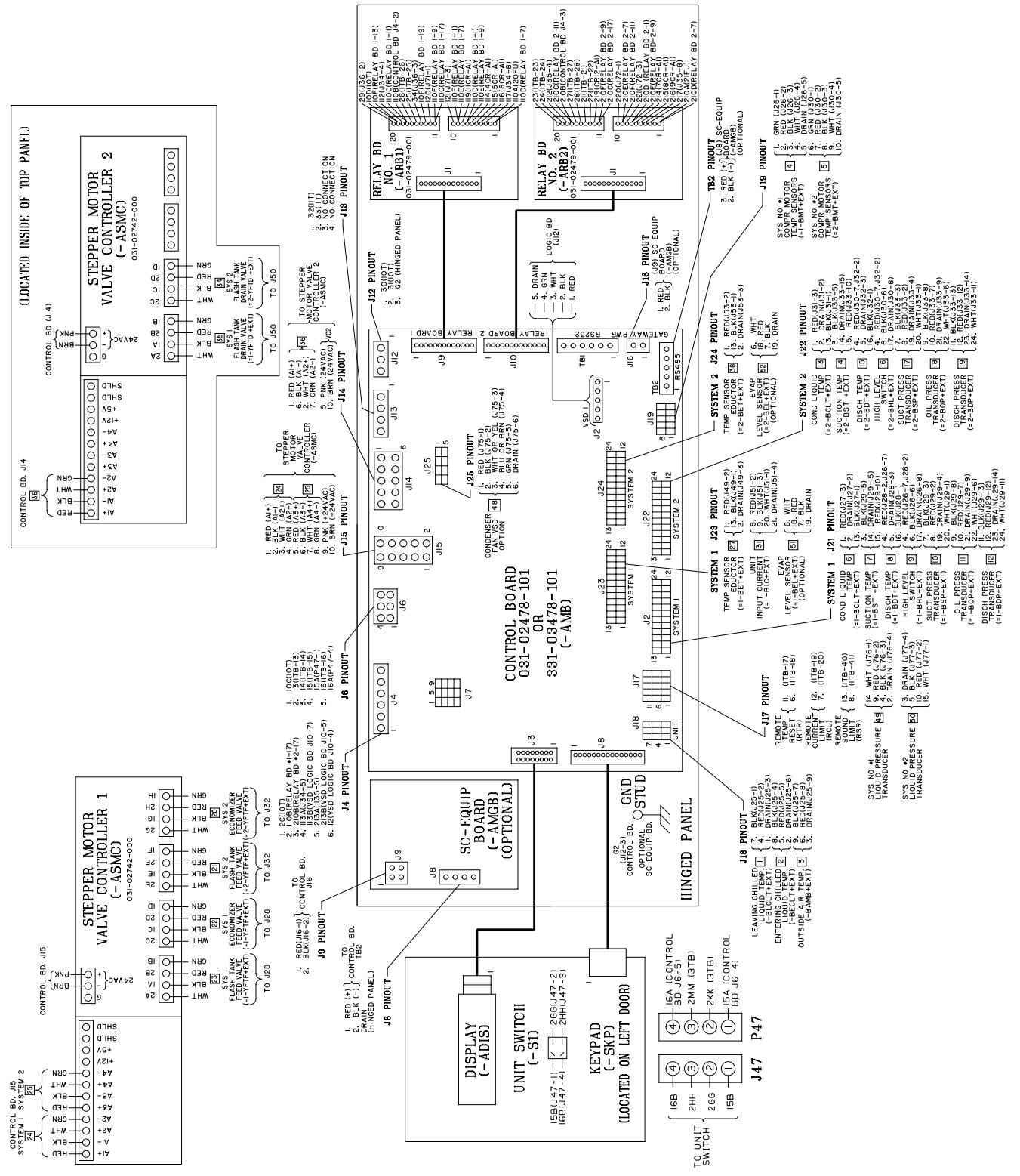

FIGURE 28 - YAGK CONTROL WIRING CONNECTION DIAGRAM 2 COMPRESSOR

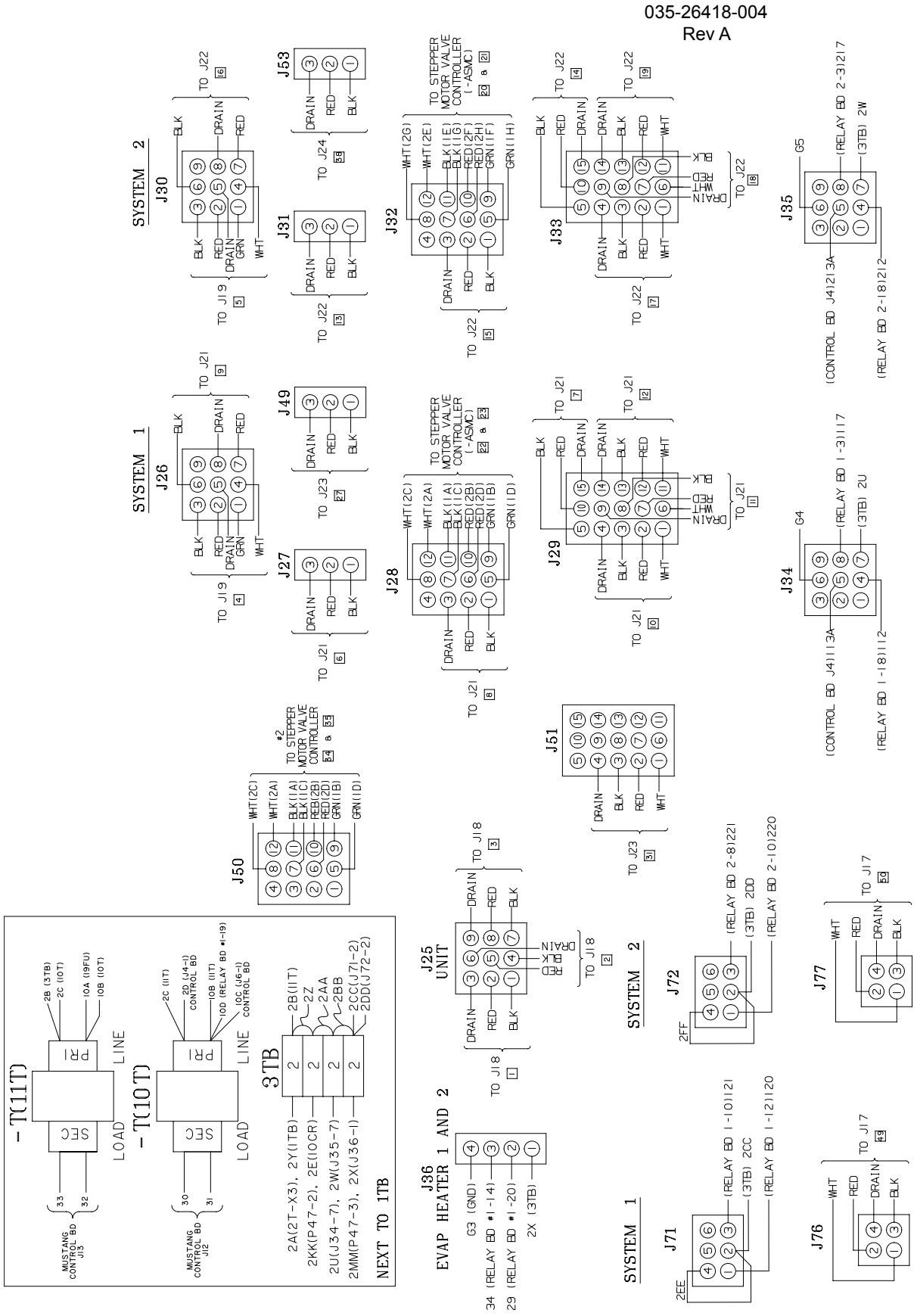

FIGURE 28 - YAGK CONTROL WIRING -CONNECTION DIAGRAM 2 COMPRESSOR (CONT'D)

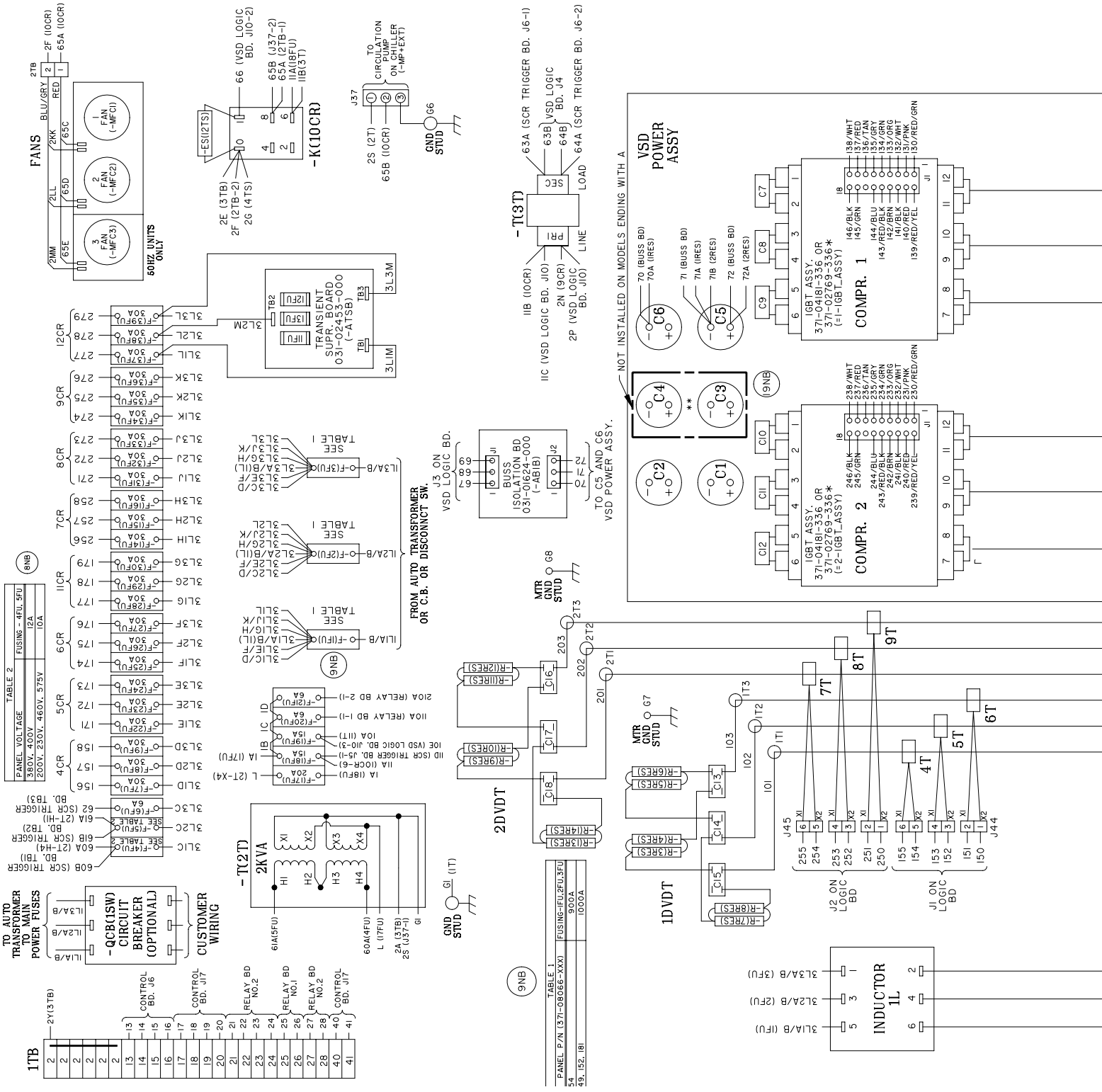

FIGURE 29 - YAGK POWER WIRING CONNECTION DIAGRAM 2 COMPRESSOR

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Rev A

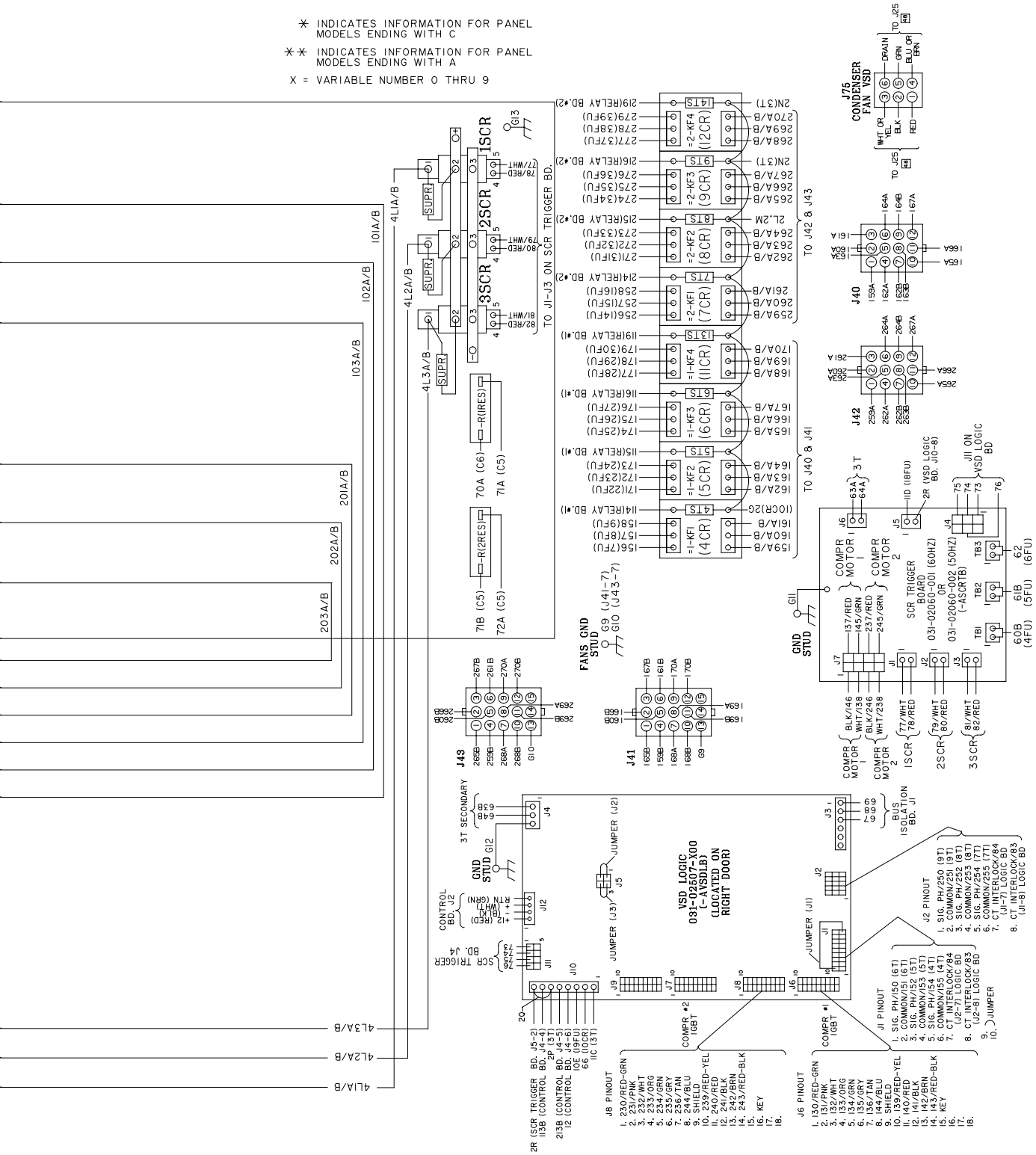

FIGURE 29 - YAGK POWER WIRING CONNECTION DIAGRAM 2 COMPRESSOR (CONT'D)

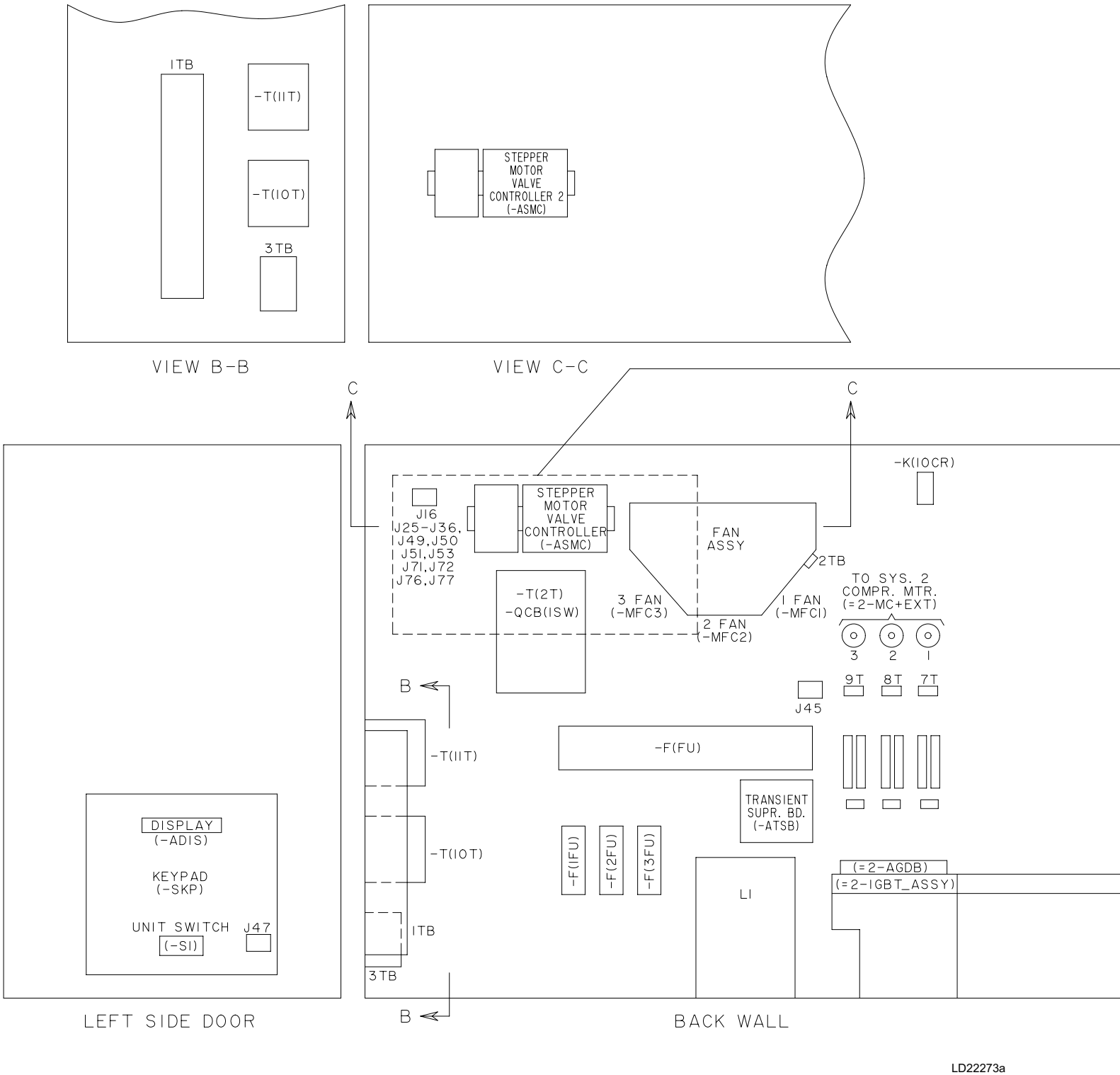

FIGURE 30 - YAGK 2 COMPRESSOR PANEL LAYOUT

035-26418-006
Rev

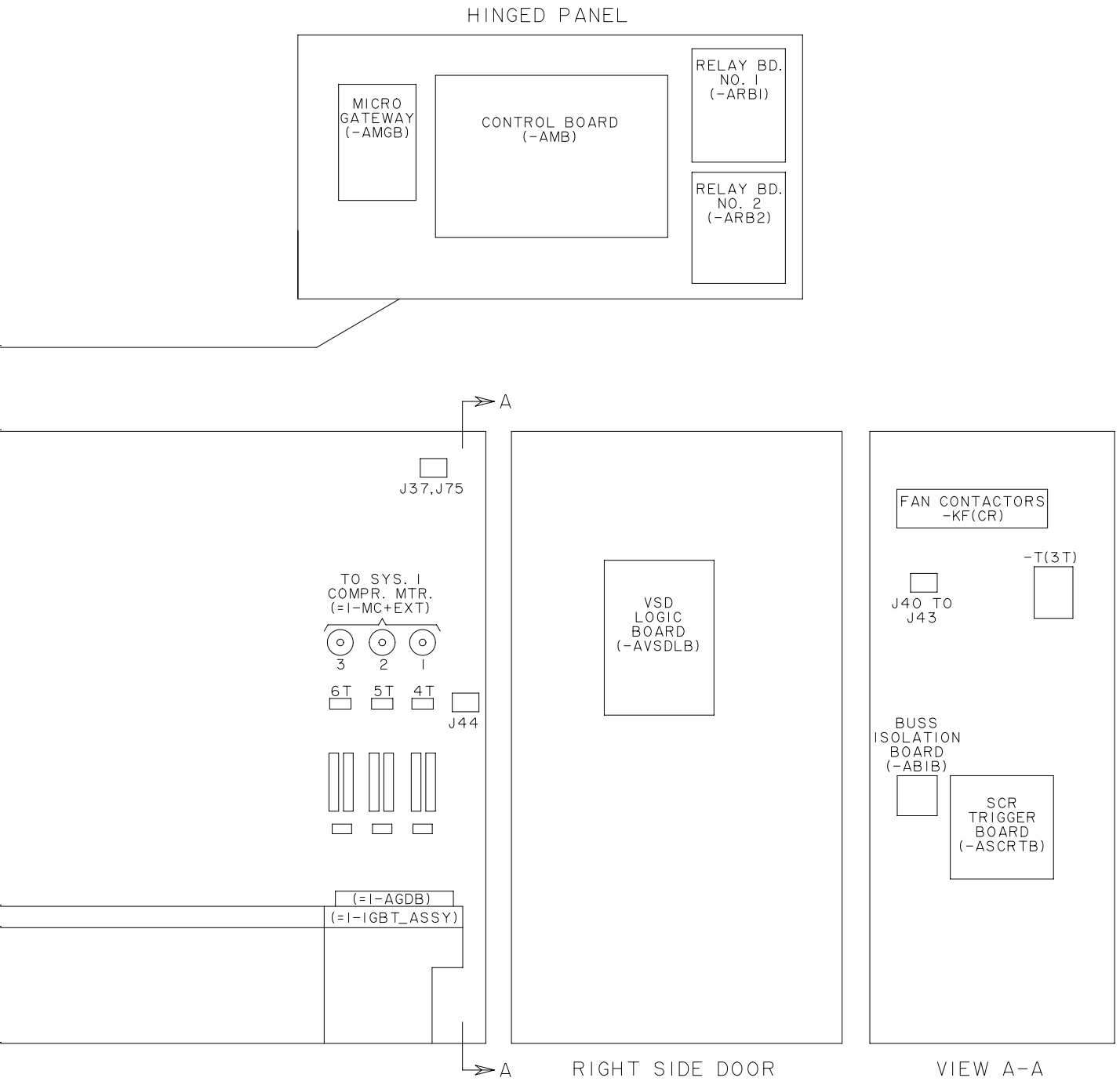

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FIGURE 30 - YAGK 2 COMPRESSOR PANEL LAYOUT (CONT'D)

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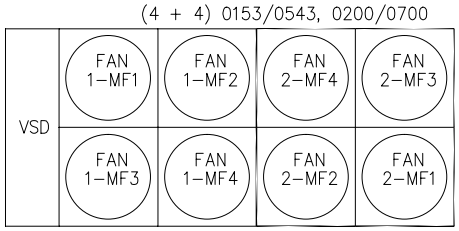
Rev G



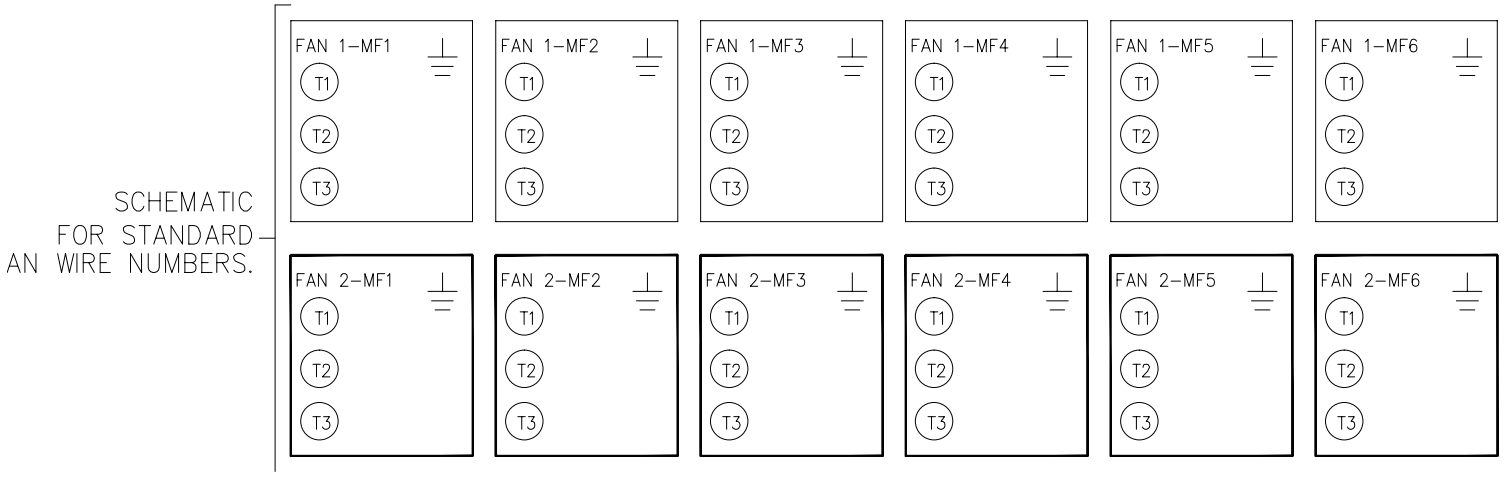


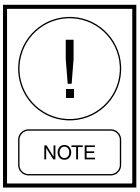
FIGURE 31 - SCHEMATIC FOR STANDARD WIRE NUMBERS

SECTION 6 - COMMISSIONING

PREPARATION

Commissioning of this unit should only be carried out by Johnson Controls Authorized personnel.

Commissioning personnel should be thoroughly familiar with the information contained in this document before starting the unit.



Commission the unit using the detailed checks outlined in the Equipment Pre - Startup Checklist and Startup Checklist found at the end of this section.

The following basic checks should be made with the customer power to the unit switched OFF.

Proper electrical lock out and tag out procedures must be followed.

Inspection

Inspect unit for installation damage. If found, take action and/or repair as appropriate.

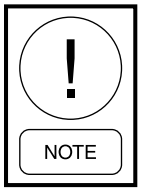
Refrigerant Charge

Packaged units are normally shipped as standard with a full refrigerant operating charge. Check that refrigerant pressure is present in both systems and that no leaks are apparent. If no pressure is present, a leak test must be undertaken, the leak(s) located and repaired.

Do not evacuate or liquid charge with static water in the evaporator. Turn the pump on. Take care to liquid charge slowly to avoid excessive thermal stress at the charging point and to assure the refrigerant temperature in the evaporator does not go below the freezing point with liquid refrigerant in the evaporator. Once the vacuum is broken, charge into the evaporator or flash tank with the Condenser Drain Valve (Flash Tank Feed) open and the chilled liquid pump ON to the full operating charge, as detailed in *SECTION 5 - TECHNICAL DATA*.

Correct System Refrigerant Charge

The charge on a system should always be checked when operating for several minutes at full speed with the system stable. Stable conditions are defined as operation without fan cycling, economizer cycling, VI solenoid cycling, or any other system transient conditions. Ideal refrigerant charge will be reached when both suction superheat and liquid subcooling can meet the requirements.



It is not necessary to weigh charge unless the entire charge has been lost. The ease of charging is possible since the microchannel coils hold only a small amount of refrigerant charge.

Service and Oil Line Valves

Open each compressor oil, economizer, suction, liquid, and discharge ball or service valves. If valves are of the back-seat type, open them fully (counterclockwise) then close one turn of the stem to ensure operating pressure is fed to pressure transducers.

Compressor Oil

To add oil to a circuit - connect a YORK hand oil pump (Part No. 470-10654-000) to the 1/4 (6.35mm) oil charging valve on the oil separator piping with a length of clean hose or copper line, but do not tighten the flare nut. Using clean oil of the correct type (L oil), pump oil until all air has been purged from the hose then tighten the nut. Stroke the oil pump to add oil to the oil system. While the compressor is running at full speed, the oil level should be visible in the sight glass of the oil separator. Avoid levels above the sight glass. This may cause excessive oil carryover in the system. High oil concentration in the system may cause nuisance trips resulting from incorrect readings on the level sensor and temperature sensors. Temperature sensor errors may result in poor liquid control which will result in liquid overfeed and subsequently damage the compressor. High oil carryover may also cause liquid to be returned to the compressor, which can damage the compressor.

Fans

Check that all fans are free to rotate and are not damaged. Ensure blades are at the same height when rotated. Ensure fan guards are securely fixed.

Isolation / Protection

Verify all sources of electrical supply to the unit are taken from a single point of isolation. Check that the maximum recommended fuse sizes given in the Technical Data section has not been exceeded.

Control Panel

Check the panel to see that it is free of foreign materials (wire, metal chips, and so on) and clean out if required.

Power Connections

Check that the customer power cables are connected correctly to the terminal blocks or optional circuit breaker. Ensure that connections of power cables within the panels to the circuit breaker or terminal blocks are tight.

Grounding

Verify that the unit's protective ground terminal(s) are properly connected to a suitable grounding point. Ensure that all unit internal ground connections are tight.

Liquid System

Flow rates and pressure drops must be within the limits given in *SECTION 5 - TECHNICAL DATA*. Operation outside of these limits is undesirable and could cause damage.

If main power must be switched OFF for maintenance or shutdown, precautions must be taken. If there is a possibility of liquid freezing due to low ambient temperatures, the evaporator should be drained or power should be applied to the chiller. This will allow the evaporator heater to protect the evaporator from freezing down to 0°F (-17.7°C). If power is removed for more than 8 hours, before placing the unit back in service, valves should be opened and power must be switched on for at least 8 hours (24 hours if ambient temperature is below 86°F [30°C]) before the unit is restarted.

Temperature Sensor(s)

Ensure the leaving liquid temperature sensor is coated with heat conductive compound (Part No. 013-00890-000) and is inserted to the bottom of the water outlet sensor well in the evaporator. This sensor is part of the pump control freeze protection operation. It provides some freeze protection and must always be fully inserted in the water outlet sensor well.

- Leaving Liquid Temperature Sensor
- Entering Liquid Temperature Sensor

Programmed Options

Verify that the options factory-programmed into the Micro Panel are in accordance with the customer's order requirements by pressing the OPTIONS key on the keypad and reading the settings from the display.

Programmed Settings

Ensure the system cutout and operational settings are in accordance with the operating requirements by pressing the PROGRAM key.

Date and Time

Program the date and time by first ensuring that the CLK jumper JP2 on the Chiller Control Board is in the ON position. Then press the DATE/TIME key and set the date and time. See *SECTION 8 - MICROPANEL, Date/Time Key Operation on page 145.*

Start/Stop Schedule

Program the daily and holiday start/stop by pressing the SCHEDULE key. See *SECTION 8 - MICROPANEL, "Schedule Key Operation" on page 146.*

Setpoint and Remote Offset

Set the required leaving chilled liquid temperature setpoint and Control Range under the SETPOINTS key. The chilled liquid temperature control settings need to be set according to the required operating conditions.

If remote temperature reset (offset) is to be used, the maximum reset required must be programmed by pressing the SETPOINTS key. See *SECTION 8 - MICROPANEL, "Setpoints Key Operation" on page 129.*

FIRST TIME START-UP

During the commissioning period there should be sufficient heat load to run the unit under stable full load operation to enable the unit controls, and system operation to be set up correctly, and a commissioning log taken. Be sure that the chiller is properly programmed and the Equipment Pre Startup and Startup Checklist (located at the end of this section) are completed.

Interlocks

Verify that liquid is flowing through the evaporator and that heat load is present. Ensure that any remote run interlocks are in the run position and that the Daily Schedule requires the unit to run or is overridden.

Unit Switch

Place the UNIT switch on the keypad to the ON position.

Startup

Press the SYSTEM SWITCHES key and place the system switch for System 1 to the ON position. There may be a few seconds delay before the first compressor starts because of the anti-recycle timer. When each compressor starts, immediately push the "Emergency Bottom" on the "Auxiliary Panel" if any unusual noises or other adverse conditions develop.

When a compressor is running, the controller monitors oil pressure, motor current, and various other system parameters such as discharge pressure, chilled liquid temperature, and so on. Should any problems occur; the control system will immediately take appropriate action and display the nature of the fault.

Oil Pressure

When a compressor starts, press the relevant System Pressures key and verify that oil differential pressure (oil pressure-suction pressure) develops immediately. If oil pressure does not develop, the automatic controls will shut down the compressor. Under no circumstances should a restart attempt be made on a compressor, which does not develop oil pressure immediately. Switch the UNIT switch to the OFF position.

Loading

Once the unit has been started, all operations are fully automatic. After an initial period at minimum capacity, the control system will adjust the unit load depending on the chilled liquid temperature and rate of temperature change. If a high heat load is present, the controller will increase the speed of the compressor(s).

Condenser and Fan Rotation

Once a compressor is running, discharge pressure rises as refrigerant is pumped into the air-cooled condenser coils. This pressure is controlled by VSD fans to ensure maximum unit efficiency while maintaining sufficient pressure for correct operation of the condensers and the lubrication system.

As discharge pressure rises, the condenser fans operate in stages or ramp up in speed to control the pressure. Verify that the fans operate in the correct direction of rotation and operation is correct for the type of unit.

Suction Superheat

Check suction superheat at steady full compressor load only. Measure suction temperature with a thermocouple on the copper line about 6" (150 mm) before the compressor suction service valve. Measure suction pressure at the suction transducer access valve or the compressor suction service valve. Superheat should be 10°F to 12°F (5.55 to 6.67°C) and should be reasonably close to the panel display. Superheat setting is programmable on the control panel, but is not mechanically adjustable. The Flash Tank Drain Valve controller modulates the 2 phase Drain Valve Stepper Motor to control system superheat. Superheat control is a function of suction pressure and suction temperature measurements from the sensors that are routed to the Chiller Control Board which in turn sends control signals to the Flash Tank Drain and Fill Valve Controller located in the left, back wall of the Chiller Controls Cabinet.

Subcooling

Check liquid subcooling at steady full compressor load only. It is important that all fans are running for the system. Measure liquid line temperature on the copper line at the main liquid line service valve. Measure liquid pressure at the liquid line service valve. Under full load standard conditions, subcooling should be 5 to 7°F (2.77 to 3.88°C), no bubbles should show in the sight glass. If subcooling is out of range, add or remove refrigerant as required to clear the sight glass. Do not overcharge the unit.

YORK®	MODEL YAGK	
CHECKLIST	New Release	Form 201.40-CL2 (317)

EQUIPMENT PRE-STARTUP AND STARTUP CHECKLIST

CUSTOMER: _____ JOB NAME: _____

ADDRESS: _____ LOCATION: _____

PHONE: _____ CUSTOMER ORDER NO: _____

JCI TEL NO: _____ JCI ORDER NO: _____ JCI CONTRACT NO: _____

CHILLER MODEL NO: _____ **UNIT SERIAL NO**: _____

The work (as checked below) is in process and will be completed by: _____ / _____ / _____
Month Day Year

The following work must be completed in accordance with installation instructions:

PRE-STARTUP

UNIT CHECKS (NO POWER)

The following basic checks should be made with the customer power to the unit switched OFF.

WARNING: Proper electrical lock out and tag procedures must be followed.

Check the system 24 hours prior to initial start:

1. Inspect the unit for shipping or installation damage. ..... ☐
2. Ensure that all piping has been completed. ..... ☐
3. Assure the unit is properly charged and there are no piping leaks. ..... ☐
4. Open each system suction service valve, discharge service valve, economizer service valve, liquid line stop valve, and oil line ball valve. ..... ☐
5. The oil separator oil level(s) should be maintained so that an oil level is visible in either of the oil separator sight glasses when a compressor is running at high speeds for 10 to 15 minutes. An oil level may not be visible in the sight glasses when the compressor is off and it may be necessary to run the compressor to obtain a level. In shutdown situations and at some load points, much of the oil may be in the condenser and the level in the separators may fall below the bottom sight glass. ..... ☐

   On systems with dual oil separators per compressor, one separator may show a lower level or no level, while the other separator shows a level between the 2 sight glasses. This is normal and a level is only required in one separator. Do not add oil to raise the level in the other oil separator.

   Oil levels in single separator systems should not go above the top of the upper sight glass. Dual separator systems should also not show oil levels above the top of one of the sight glasses. In the rare situation where oil levels are high, drain enough oil to lower the level to the bottom of the top sight glass.

   Sight glasses will vary in type depending upon the manufacturer of the separator. One type will have balls that float in the sight glasses to indicate level. Another type will have a bulls' eye glass. The bulls' eye glass will tend to appear to lose the lines in the bulls' eye when the level is above the glass. Oil level should not be above the top sight glass. In the rare situation where oil levels are high, drain oil to lower the level to the bottom of the top sight glass.

   Oil levels in the oil separators above the top sight glass in either oil separator should be avoided and may cause excessive oil carryover in the system. High oil concentration in the system may cause nuisance trips resulting from incorrect readings on the level sensor and temperature sensors. Temperature sensor errors may result in poor refrigerant control and liquid overfeed to the compressor.

   In the unlikely event it is necessary to add oil, connect a YORK oil pump to the charging valve on the oil separator, but do not tighten the flare nut on the delivery tubing. With the bottom (suction end) of the pump submerged in oil to avoid entrance of air, operate the pump until oil drips from the flare nut joint, allowing the air to be expelled, and tighten the flare nut. Open the compressor oil charging valve and pump in oil until it reaches the proper level as described above.

   CAUTION: When oil levels are high, adding oil may not visibly increase the level in the separators during operation. This may be an indication the level is already too high and the oil is being pumped out into the system where it will cause heat transfer and control problems.

6. Ensure water pumps are on. Check and adjust water pump flow rate and pressure drop across the cooler. ..... ☐

   CAUTION: Excessive flow may cause catastrophic damage to the evaporator.

7. Check the control panel to ensure it is free of foreign material (wires, metal chips, tools, documents, etc.). ..... ☐

8. Visually inspect wiring (power and control). Wiring MUST meet N.E.C. and local codes. ..... ☐

9. Check tightness of the incoming power wiring inside the power panel and inside the motor terminal boxes. ..... ☐

10. Check for proper size fuses in control circuits. ..... ☐

11. Verify that field wiring matches the 3-phase power requirements of the chiller. (See chiller nameplate) ..... ☐

12. Be certain all water temperature sensors are inserted completely in their respective wells and are coated with heat conductive compound. ..... ☐

13. Ensure the suction line temperature sensors are strapped onto the suction lines at 4 or 8 O'clock positions. ..... ☐

14. Assure the glycol level in the VSD cooling system is 9 to 15 inches (23 to 28 cm) from the top of the fill tube. This check should be performed prior to running the pump. ..... ☐

    CAUTION: Never run the glycol pump without coolant! Running the glycol pump without coolant may damage the pump seals.

    Always fill the system with approved YORK coolant (P/N 013-03344-000) to avoid damage to the pump, cooling system and the chiller.

15. Check to assure the remote start/stop for Sys #1 on Terminals 2 to 15 and Sys #2 on Terminals 2 to 16 are closed on the User Terminal Block 1TB to allow the systems to run. If remote cycling devices are not utilized, place a wire jumper between these terminals. ..... ☐

16. Assure a flow switch is connected between Terminals 2 and 13 on the User Terminal Block 1TB in the panel. Throttle back flow to assure the flow switch opens with a loss of flow. It is recommended that auxiliary pump contacts be placed in series with the flow switch for additional protection, if the pump is turned off during chiller operation. Whenever the pump contacts are used, the coil of the pump starter should be suppressed with an RC suppressor (031-00808-000). ..... ☐

A. START-UP

Panel Checks
(Power ON – Both System Switches OFF)

WARNING: You are about to turn power on to this machine. SAFETY IS NUMBER ONE! Only qualified individuals are permitted to service this product. The qualified individual furthermore is to be knowledgeable of, and adhere to, all safe work practices as required by NEC, OSHA, and NFPA 70E. Proper personal protection is to be utilized where and when required.

1. Assure the chiller OFF/ON UNIT switch at the bottom of the keypad is OFF. ..... ☐

2. Apply 3-phase power to the chiller. Turn on the optional panel circuit breaker if supplied. The customer's disconnection devices can now be set to ON. ..... ☐

3. Verify the control panel display is illuminated. ..... ☐

4. To prevent the compressors from starting, assure that the system switches under the SYSTEM SWITCHES key are in the OFF position. ..... ☐

5. Verify that the voltage supply corresponds to the unit requirement and is within the limits given in the "Technical Data" section. ..... ☐

6. Ensure the heaters on each compressor are ON using a clamp-on ammeter. Heater current draw is approx. 3A. ..... ☐

7. Verify the "Factory Set" overload potentiometers on the VSD Logic Board are set correctly. Press the VSD DATA key and using the arrow keys, scroll to the compressor overload settings. Verify the "Factory Set" overload potentiometer(s) on the VSD Logic Board are set correctly. In the unlikely event that they are not set correctly, adjust the potentiometers until the desired values are achieved. ☐

WARNING: The VSD is powered up and live. High voltage exists in the area of the circuit board on the bus bars, VSD Pole Assemblies, and wiring to the input inductor.

Adjust the potentiometers, if needed. The potentiometers are Sys 1=R19, Sys 2=R64, Sys 3=R42, and Sys 4=R86.

CAUTION: Incorrect settings of the potentiometers may cause damage to the equipment.

Record the Overload Potentiometer settings below:

Compressor Overload Setting:

System 1 = _____ Amps

System 2 = _____ Amps

System 3 = _____ Amps

System 4 = _____ Amps

8. Press the STATUS key. If the following message appears, immediately contact Johnson Controls Product Technical Support. The appearance of this message may mean the chiller has lost important factory programmed information. The serial number and other important data may need to be reprogrammed. ..... ☐

UNIT WARNING: INVALID SERIAL NUMBER
ENTER UNIT SERIAL NUMBER

NOTE: Changing the programming of this feature requires the date and time to be set on the chiller prior to programming. Additional information regarding this message and how to enter the serial number with the factory provided password is outlined in the "Serial Number Programming".

If the following message appears when the STATUS key is pressed, immediately contact Johnson Controls Product Technical Support. The appearance of this message indicates the chiller is a High IPLV chiller operating in Standard IPLV control.

UNIT WARNING: OPTIMIZED EFFICIENCY
DISABLED – CONTACT YORK REPRESENTATIVE

NOTE: Changing the programming of this feature requires the date and time to be set on the chiller prior to programming. Additional information regarding this message is provided in the "Enabling Optimized High IPLV Mode".

9. Program the required options into the Panel for the desired operating requirements. Record the values below:

Display Language = _____

Chilled Liquid Mode = _____

Local/Remote Mode = _____

Display Units = _____

Lead/Lag Control = _____

Remote Temperature Reset = _____

Remote Current Reset = _____

Remote Sound Limit = _____

Low Ambient Cutout = _____

CAUTION: Damage to the chiller could result if the options are improperly programmed.

B. PROGRAMMED VALUES

Program the required operating values into the microprocessor for cutouts, safeties, etc. and record them in the chart below.

Suction Pressure Cutout = _____ PSIG (kPa)

Low Ambient Cutout = _____ °F (°C)

Leaving Chilled Liquid Temperature Cutout = _____ °F (°C)

Motor Current Limit = _____% FLA

Pulldown Current Limit Time = _____MIN

Suction Superheat Setpoint = _____°F (°C)

Remote Unit ID # = _____

Sound Limit Setpoint = _____%

C. CHILLED LIQUID SETPOINT

Program the Chilled Liquid Setpoint/Range and record:

Local Cooling Setpoint = _____ °F (°C)

Local Cooling Range = _____ to _____ °F (°C)

Maximum Remote Temperature Reset = _____ to _____ °F (°C)

D. DATE/TIME, DAILY SCHEDULE, AND CLOCK JUMPER

1. Set the date and time. ..... ☐
2. Program the Daily Schedule start and stop times. ..... ☐
3. Place the panel in Service Mode and turn on each fan stage one by one. Ensure the fans rotate in the correct direction, so air flow exits the top of the chiller ..... ☐
4. Remove the cap on the fill tube and run the glycol pump to verify the level in the fill tube. Ensure the glycol level in the VSD cooling system is 9 to15 inches (23 to 28 cm) from the top of the fill tube while running. The pump can be run by placing the chiller in the Service Mode. Be sure to re-install the cap before stopping the glycol pump to avoid overflowing the fill tube when the glycol pump is turned off. The glycol system holds about 3.5 gallons of coolant (P/N 013-03344-000) on the largest chiller model. ..... ☐

E. INITIAL START-UP

After the control panel has been programmed and the compressor heaters have been energized for at least 8 hours (ambient temperature more than 96ºF (36ºC)) or 24 hours (ambient temperature less than 86ºF (30ºC)), the chiller may be placed in operation.

1. Turn on the UNIT switch and program the system switches on the keypad to the "ON" position. ..... ☐
2. If cooling demand permits, the compressor(s) will start and a flow of refrigerant will be noted in the sight glass, after the anti recycle timer times out and the precharge of the DC Bus is completed. After several minutes of operation, the bubbles in the sight glass will disappear and there will be a solid column of liquid when the Drain and Feed Valves stabilize the flash tank level. ..... ☐
3. Allow the compressor to run a short time, being ready to stop it immediately if any unusual noise or adverse conditions develop. Immediately at start-up, the compressor may make sounds different from its normal high-pitched sound. This is due to the compressor coming up to speed and the initial lack of an oil film sealing the clearances in the rotors. This should be of no concern and lasts for only a short time. ..... ☐
4. Check the system operating parameters. Do this by selecting various displays such as pressures and temperatures. Compare these to test gauge readings. ..... ☐

F. CHECKING SUBCOOLING AND SUPERHEAT

The subcooling should always be checked when charging the system with refrigerant and/or before checking the superheat. The subcooling measurement should always be taken with the system loaded, the economizer solenoid energized, and the level in the flash tank reasonably stable with a level of approximately 35%.

Note: It may be desirable to check subcooling with one compressor running to allow the compressor to operate at full speed for a period of time to stabilize system temperatures and pressures.

When the refrigerant charge is correct, there will be no bubbles in the liquid sight glass with the system operating under full load conditions, and there will be 5 to 7°F (2.77 to 3.78°C) subcooled liquid leaving the condenser. Subcooling should be set at 10°F (5.56°C). An overcharged system should be guarded against. Evidence of overcharge is as follows:

a. If a system is overcharged, the discharge pressure will be higher than normal. Normal discharge/condensing pressure can be found in the refrigerant temperature/pressure chart; use entering air temperature plus 30°F (17°C) for normal condensing temperature.
b. The temperature of the liquid refrigerant out of the condenser should be about 5 to 7°F (2.77 to 3.78°C) less than the condensing temperature (The temperature corresponding to the condensing pressure from the refrigerant temperature/pressure chart).

The subcooling temperature of each system should be calculated by recording the temperature of the liquid line at the outlet of the condenser and subtracting it from the recorded liquid line pressure at the liquid stop valve, converted to temperature from the temperature/pressure chart.

Subcooling

Example:

Liquid line pressure =	
110 PSIG converted to	93°F (33.9°C)
Minus liquid line temp.	-87°F (30.6°C)
Subcooling =	6°F (3.3°C)

The subcooling should be adjusted between 5 and 7 °F (2.77 and 3.78°C)

NOTE: This may be difficult to measure, due to test instrument error and the difficulty generally encountered when measuring subcooling on systems operating with very low condenser subcooling.

Record the liquid line pressure and it's corresponding temperature, liquid line temperature, and subcooling below:

	SYS 1	SYS 2	
Liq Line Press =	_____	_____	PSIG (kPa)
Temp =	_____	_____	°F (°C)
Liq Line Temp =	_____	_____	°F (°C)
Subcooling =	_____	_____	°F (°C)

Add or remove charge as necessary to obtain a full sight glass fully loaded while keeping subcooling to about 5 to 7°F (2.77 to 3.78°C). After an adjustment is made to the charge, the flash tank level may rise or drop from the approx. 35% point. Before another measurement is made, allow the level to stabilize.

After the subcooling is set, the suction superheat should be checked. The superheat should be checked only after steady state operation of the chiller has been established, and the system is running in a fully loaded, stable condition. Correct superheat for a system is between 8 and 12°F (4.45 and 6.67°C) and should be reasonably close to the system superheat on the chiller display.

The superheat is calculated as the difference between the actual temperature of the returned refrigerant gas in the suction line entering the compressor and the temperature corresponding to the suction pressure as shown in a standard pressure/temperature chart.

Superheat

Example:

Suction Temp =	46°F (8°C)
minus Suction Press	
30 PSIG converted to Temp	- 35°F (1°C)
	11°F (6°C)

The suction temperature should be taken 6" (13 mm) before the compressor suction service valve, and the suction pressure is taken at the compressor suction service valve.

No superheat adjustments are necessary and the electronically controlled Drain Valve need not be adjusted in the field. Ensure that superheat is controlling at 8 to 12°F (4.45 to 6.67°C). The purpose of this check is primarily to verify the transducer and suction temperature sensors in a system are providing reasonably accurate outputs to the chiller controls. It also checks the operation of the Feed and Drain Valves.

Record the suction temperature, suction pressure, suction pressure converted to temperature, and superheat of each system below:

	SYS 1	SYS 2	
Suction Press =	_____	_____	PSIG (kPa)
SP to Temp =	_____	_____	°F (°C)
Suction Temp =	_____	_____	°F (°C)
Superheat =	_____	_____	°F (°C)

Discharge superheat will typically run approx. 28 to 30°F. This can be checked on the micropanel display. If the suction superheat drops very low or the economizer feeds liquid into the compressor, the superheat will drop sharply to approx. 2 to 3°F.

Leak Checking

Leak check compressors, fittings, and piping to ensure no leaks.

If the chiller is functioning satisfactorily during the initial operating period, no safeties trip and the chiller controls chilled liquid temperature; it is now ready to be placed into service.

JOB NAME: _____

SALES ORDER #: _____

LOCATION: _____

SOLD BY: _____

INSTALLING CONTRACTOR: _____

START-UP TECHNICIAN/ COMPANY: _____

START-UP DATE: _____

CHILLER MODEL #: _____

SERIAL #: _____

COMPRESSOR #1
MODEL#: _____

SERIAL #: _____

COMPRESSOR #2
MODEL#: _____

SERIAL #: _____

SECTION 7 - OPERATION

OPERATING CONTROLS

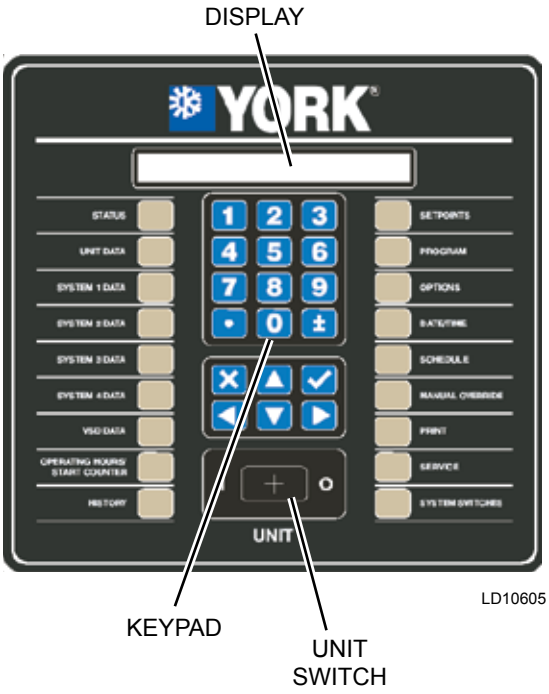


FIGURE 32 - KEYBOARD AND DISPLAY

Unit Switch

A double pole single throw ON/OFF rocker switch on the front of the control panel is used to turn the entire chiller ON and OFF. When the switch is placed in the OFF position, the entire unit slowly ramps to a controlled stop. The unit switch is wired in series with run permissives and provides the necessary input to enable the chiller to run. When both inputs are high, the entire chiller will be enabled to run. When both inputs are low, the chiller will be disabled as a UNIT switch OFF Shutdown.

Keypad

An operator keypad allows complete control of the system from a central location. The keypad offers a multitude of command keys on the left and right side of the keypad to access displays, program setpoints, history data, and initiate system commands. Most keys have multiple displays that can be accessed by repetitively pressing the key or by pressing the ▲,▼,◄, and ► (ARROW) keys. The keypad utilizes an overlay to convert the keypad to various languages.

The keypad also contains keys in the center section for data entry in the various program modes. These keys are listed below:

- 0-9 Keys NUMERIC KEYPAD
- PERIOD/DECIMAL
- +/- PLUS/MINUS
- ✓ ENTER
- × CANCEL
- ▲ UP ARROW
- ▼ DOWN ARROW
- ◄ LEFT ARROW
- ► RIGHT ARROW

The numeric keys allow keying numeric values into memory.

The • (PERIOD/DECIMAL) key allows keying a decimal point into numeric values.

The +/- (PLUS/MINUS) key allows making numeric values negative.

The ✓ (ENTER) key stores program changes into memory.

The X (CANCEL) key is used to cancel the data entry operation and returns the programmed value to the original value, before any programming changes were made, when an error is made.

The ▲ (UP ARROW) and ▼ (DOWN ARROW) keys allow scrolling backward (▲) and forward (▼) through items to be programmed under keys such as the PROGRAM or OPTIONS key.

The ▲ (UP ARROW) and ▼ (DOWN ARROW) keys also allow scrolling forward (▼) or backwards (▲) through data display keys that have multiple displays under keys such as UNIT DATA, SYSTEM DATA, HISTORY, PROGRAM, OPTIONS, and so on. The arrow keys can be used instead of repeatedly pressing the data key to see the multiple displays under a key. Once the ▲ ▼ (ARROW) keys are pressed and used for scrolling, pressing the original data key will return to the first display message displayed under the data (UNIT DATA, SYSTEM DATA, and so on) keys.

The ◄ ► (LEFT and RIGHT ARROW) keys allow scrolling between non-numeric program choices under the OPTION, DATE/TIME, and SCHEDULE keys.

The ◄ (LEFT ARROW) key allows programming the default value when programming numeric values. For changing numeric values, the ► (RIGHT ARROW) key has no function.

The ◄ ► (ARROW) keys also allow scrolling sideways between the same displays on different systems. For example, pressing the ► (RIGHT ARROW) key while viewing the system #1 suction pressure moves the display to system #2 suction pressure.

Pressing the ◄ (LEFT ARROW) key moves the opposite direction. The arrow keys also allow fast scrolling through data under keys such as HISTORY by enabling the operator to move between subgroups of data such as Unit, System, and VSD data.

Keypad Data Entry Mode

For numeric programmable items, the data entry mode is entered by pressing any of the number keys, the decimal point key, or the +/- key. When the data entry mode is entered, the data from the key press will be entered and the cursor will appear under the position where the data is being entered.

For non-numeric programmable items, data entry mode is entered by pressing the ◄ or ► (ARROW) keys. When the data entry mode is entered, the cursor will appear under the first position of the non-numeric string. The programmable choice may be changed by pressing the ◄ or ► (ARROW) keys.

To exit the data entry mode and store the programmed value, the ✓ (ENTER) key must be pressed. When the ✓ (ENTER) key is pressed, the cursor will disappear.

The data entry mode may also be exited by pressing the X (CANCEL) key. The programmed data will be returned to its original value when the X (CANCEL) key is pressed.

When the data entry mode is exited, the cursor will disappear. If any other key is pressed while in the Data Entry Mode, the following display will appear for 2 seconds indicating the user must choose between accepting or canceling the change:

```
XXXXXXXXXX PRESS ✓  TO ACCEPT VALUE OR
        X TO CANCEL DATA ENTRY
```

If the ✓ (ENTER) key was pressed from the data entry mode and the numeric value entered was out of range, the following message will appear for 2 seconds followed by the original data display.

```
XXXXXXXXXX OUT OF RANGE  TRY AGAIN!
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

Display

The 80 character (2 lines of 40 characters per line) display is a Liquid Crystal Display (LCD) used for displaying unit parameters, system parameters, and operator messages. The display has an LED backlight background for night viewing and is viewable in direct sunlight.

Anti-recycle Timer

On power-up of the control panel, the anti-recycle timer for each system will be set to 120 seconds and must time out before a compressor is allowed to start.

Whenever a system starts, the anti-recycle timer for all systems will be set to 120 seconds and will count down from the time the motor starts. The timer must time out before another compressor is allowed to start.

Whenever a system shuts down, the anti-recycle timer for that system will be set to 120 seconds. The timer must time out before the system is allowed to restart.

Evaporator Pump Control

The evaporator pump dry contacts are energized when any of the following conditions are true:

- If a Low Leaving Chilled Liquid Fault occurs.
- Whenever a compressor is running.
- The Daily Schedule is ON and the UNIT switch is ON.

Even if one of above is true, the pump will not run if the panel has been powered up for less than 30 seconds or if the pump has run in the last 30 seconds to prevent pump motor overheating.

Evaporator Heater Control

The evaporator heater is controlled by ambient air temperature. If no systems are running and the ambient temperature drops below 4.4 °C (40°F), the heater is turned ON. If no systems are running and the temperature rises above 7.2°C (45°F) the heater is turned OFF. Whenever a system is running, the evaporator heater is turned OFF. Both evaporator heater outputs will always be turned ON and OFF together. An under voltage condition will keep the heater OFF until full voltage is restored to the system.

Compressor and Oil Separator Heater Control

Each compressor and oil separator has its own heater. The purpose of the heaters is to assure refrigerant does not condense in the compressor and oil separator. The heaters will be OFF whenever the respective compressor is running. As soon as the compressor shuts OFF, the heaters will turn ON as long as all motor temperature sensors in the compressor read less than 70°C (158°F). The heater s will turn OFF, if any internal compressor motor temperature sensor reads more than 71.1°C (160°F).

Alarms

Each system has its own alarm. The Alarm output is ON (dry contact closed) when no fault condition is present and OFF (dry contact open) to indicate an alarm situation. The Alarm will be activated (contacts open), if any of the following are true.

- A system is faulted or inhibited from starting for more than 5 seconds.
- The unit is faulted or inhibited from starting for more than 5 seconds.
- A system is locked out.
- The unit is locked out.
- Power is removed from the chiller.

Chiller Run Contact

The Chiller Run dry contact is closed whenever any system is running. It is open when all systems are shut OFF.

Flow Switch Control

The chilled liquid flow switch of provided MUST be connected between Terminals 2 and 13 of 1TB to provide protection against loss of liquid flow, which will cause evaporator freeze-up if the chiller is permitted to run.

Remote Run / Stop

A Remote Run/Stop input is available for each system.

BASIC OPERATING SEQUENCE

Start Sequence and Loading

To initiate the start sequence of the chiller, the following conditions must be satisfied before the pre charge of the DC Bus will take place:

- UNIT SWITCH must be ON.
- At least one System Switch is ON.
- Run permissive inputs (Remote Cycling Contacts) must be closed.
- No unit faults exist.
- No unit start inhibits exist.
- At least one system not faulted or inhibited.
- The Daily Schedule is calling for the chiller to run.
- The Flow Switch is closed.
- Leaving Chilled Liquid Setpoint is above the Setpoint plus CR (Setpoint High Limit).

Once the pre charge takes place, if the anti-recycle timer is timed out the chiller control system on the Chiller Control Board will select the number of compressors to start and begin operation of the compressors. The compressor(s) speed will be ramped to the minimum start frequency and increase speed as needed in an effort to regulate the leaving chilled liquid temperature to meet the desired Setpoint.

UNIT WARNING

Unit Warning Operation

Unit warnings are caused when a condition is present requiring operator intervention to restart the unit. All setpoints, program values, and options should be checked before operating the unit. Warnings are not logged to the history buffer. If a unit warning is in effect, the message will be displayed to the operator when the STATUS key is pressed.

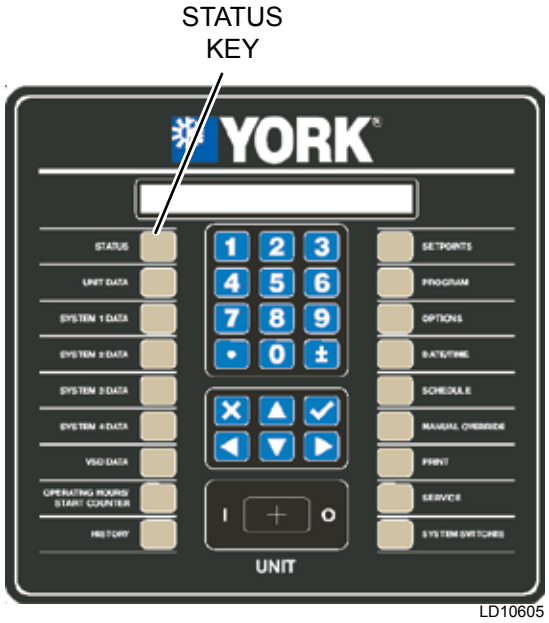


FIGURE 33 - STATUS KEY DISPLAY

Low Battery Warning

The LOW BATTERY WARNING can only occur at unit power-up. On micropanel power-up, the RTC battery is checked to see if it is still operational. If it is, normal unit operation is allowed. If the battery voltage is determined to be low, the following warning message is displayed indefinitely.

UNIT WARNING: !! LOW BATTERY !!
CHECK SETPOINTS/PROGRAM/OPTIONS/TIME

If a low battery condition exists, all programmed setpoints, program values, time, schedule, and history buffers will be lost. These values will all be reset to their default values, which may not be the desired operating values. Once a bad battery is detected, the unit will be prevented from running until the MANUAL OVERRIDE key is pressed. Once the MANUAL OVERRIDE key is pressed, the anti recycle timers will be set to the programmed default anti recycle time to allow the operator sufficient time to check setpoints, program values, and so on.

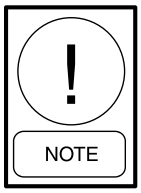
If a low battery is detected, it should be replaced as soon as possible. The programmed values will all be lost and the unit will be prevented from running on the next power interruption.

Invalid Number of Compressors Warning

The INVALID NUMBER OF COMPRESSORS SELECTED Warning will occur after the VSD has been initialized, if no Number of Compressors Select jumpers are installed or if more than 1 jumper is installed. The following warning message will be displayed indefinitely.

UNIT WARNING:
INVALID NUMBER OF COMPRESSORS SELECTED

To clear this warning, both the control panel and VSD control voltage must be turned OFF and the jumpers properly installed in the VSD wiring harness.



These jumpers are factory installed in the wire harness plug and should not require changes.

Invalid Serial Number Warning

If the INVALID SERIAL NUMBER message appears, immediately contact Johnson Controls Product Technical Support. The appearance of this message may mean the chiller has lost important factory programmed information. The serial number can be entered using the SERVICE key.

UNIT WARNING: INVALID SERIAL NUMBER
ENTER UNIT SERIAL NUMBER

This status message can be bypassed to view additional messages under the STATUS key by pressing the STATUS key repeatedly to scroll through as many as three STATUS messages that could possibly be displayed at any time.

UNIT SAFETIES

Unit Safety Operation

Unit faults are safeties that cause all running compressors to be shut down, if a safety threshold is exceeded for 3 seconds. Unit faults are recorded in the history buffer along with all data on the unit and system operating conditions. Unit faults are auto reset faults where the unit will be allowed to restart automatically after the fault condition is no longer present. The only exception is any of the VSD related unit faults. If any 3 VSD unit faults occur within 90 minutes, the unit will be locked out on the last fault. A VSD lockout condi-

tion requires a manual reset using the system switches. Both system switches must be cycled OFF and ON to clear a VSD unit lockout fault. If a unit safety is in effect, the message will be displayed to the operator when the STATUS key is pressed.

In the descriptions of the fault displays that follow, the fault message will show a YYYYYYY to indicate that a system is in a FAULT condition and will restart when the fault clears or LOCKOUT and will not restart until the operator clears the fault using the keypad.

If a control panel safety occurs after the VSD fault, but before the fault is reset, the control panel fault is an ALL FAULT of the VSD fault, meaning it will be registered as such in the History because it occurred while the VSD was shutting down or while the systems were shut down. All faults do not store operating data at the time of the fault.

If a VSD fault occurs during the fault ramp down or while the systems are shut down, the VSD fault will be registered as a new fault. The reason for this is the belief any VSD fault should be registered with a full account of the systems data at the time of the fault.

High Ambient Temp Fault

If the ambient temperature rises above 54°C (130°F), the chiller will shut down with a controlled ramped shutdown. Restart will automatically occur, if demand allows, when temperature falls 1.1°C (2°F) below the cutout (52.9°C [128°F]). This fault cannot cause a lockout. The fault display message will be present only during the time when the ambient temperature is causing a fault condition. A sample display is shown below:

```
UNIT YYYYYYY
HIGH AMBIENT TEMP
```

The unit will also be inhibited from starting any time the temperature is above 52.9°C (128°F).

Low Ambient Temp Fault

If the ambient temperature falls below the programmable Low Ambient Temp Cutout the chiller will shut down with a controlled ramped shutdown. This fault will only occur if the Low Ambient Cutout is ENABLED under the OPTIONS key. Restart can occur, if demand allows, when temperature rises 1.1°C (2°F) above the cutout. This fault cannot cause a lockout. The fault display message will be present only during the time when the ambient temperature is causing a fault condition. A sample display is shown below:

```
UNIT YYYYYYY
LOW AMBIENT TEMP
```

The unit is also inhibited from starting any time the temperature is below the cutout plus 1.1°C (2°F).

Low Leaving Chilled Liquid Temp Fault

The Low Leaving Chilled Liquid Temp Cutout helps to protect the chiller from an evaporator freeze-up should the chilled liquid temp drop below the freeze point. This situation could occur under low flow conditions or if the Micro Panel setpoint values are improperly programmed. Any time the leaving chilled liquid temperature (water or brine) drops below the programmable cutout point, the chiller will fault and shutdown with a controlled ramped shutdown. Restart can occur, if demand allows, when chilled liquid temperature rises 2.2°C (4°F) above the cutout. This fault cannot cause a lockout. A sample shutdown message is shown below:

```
UNIT YYYYYYY
LOW LEAVING CHILLED LIQUID TEMP
```

The unit is inhibited from starting any time the chilled liquid temperature is below the cutout plus 2.2°C (4°F).

VSD Communications Failure Fault

The VSD Communications Failure is to prevent the unit from trying to run, if the Chiller Control Board never initializes communications with the VSD Logic Board. The unit will also shut down with a controlled ramped shutdown if the Chiller Control Board loses communications with the VSD Logic Board while the chiller is operating.

On power-up, the Chiller Microprocessor Board will attempt to initialize communications with the VSD Logic Board. The control panel will request data from the VSD, which includes the number of compressors and the VSD software version. Once these data points have been received by the Chiller Control Board, and have been successfully initialized, the Chiller Control Board will not request them again. If the comms connection fails to occur and a reply from the VSD Logic Board does take place in 8 seconds, the Chiller Control Board will prevent the chiller from operating and a fault message will be displayed.

During normal operation, if the control panel Chiller Control Board receives no valid response to messages for 8 seconds, the unit will shut down all compressors on a Comms fault. The Chiller Control Board will continue to send messages to the VSD while faulted.

The unit will be inhibited from starting until communications is established. The fault will automatically reset when the Chiller Control Board receives a valid response from the VSD for a data request. Below is an example of a Comms Failure fault message:

```
UNIT YYYYYYYY
VSD COMMUNICATIONS FAILURE
```

SYSTEM SAFETIES (FAULTS)

System Safety (Fault) Operation

System safeties are faults that cause individual systems to be shut down if a safety threshold is exceeded for 3 seconds. System faults are auto reset faults in that the system will be allowed to restart automatically after the 120 second anti-recycle timer times out. The only exception is after any 3 faults on the same system occur within 90 minutes, that system will be locked out on the last fault. The lockout condition requires a manual reset using the system switch. The respective system switch must be cycled OFF and ON to clear the lockout fault.

When multiple systems are operating and a system fault occurs, the running systems will ramp down and the faulted system will be shut OFF and the previously operating will restart if required after the fault clears and/or the 120 second anti-recycle timer times out.

In the descriptions of the fault displays that follow, the fault message will show a YYYYYYYY to indicate that a system is in a FAULT condition and will restart when the fault clears, or LOCKOUT and will not restart until the operator clears the fault using the keypad. If a system safety is in effect, the message will be displayed to the operator when the STATUS key is pressed.

In some cases, a control panel fault will occur after a VSD fault, possibly during system shutdown or at some later time. This is known as an ALL FAULT and these faults will be recorded as such under the HISTORY information stored at the instant of the primary fault. In some cases, this information may be valuable in troubleshooting the primary fault. See an example of the ALL FAULT history message "*All Fault Data on Page 123* under the HISTORY key. When an ALL FAULT occurs, associated history information will not be stored. If an additional fault does not occur, the ALL FAULTS display will indicate NONE.

In cases where a VSD fault occurs during the ramp down of a control panel fault (that is, low suction pressure, low water temp, and so on), the VSD fault will be stored as a new fault with the associated fault information stored at the instant the VSD fault occurred (that is: IGBT Gate Drive, Single Phase Input, VSD CT Plug, and so on). The control panel fault that occurred prior to the VSD fault will be stored with the associated complete data related to the fault as a numerically lower numbered history in the history buffers.

High Discharge Pressure Cutout (Software) Fault

The High Discharge Pressure Cutout is a software fault. A system will fault and shut down with a controlled ramped shutdown on high discharge pressure when the discharger pressure rises above the programmed discharge pressure cutout for 0.5 seconds. The system will be allowed to restart when the discharge pressure falls to the programmed pressure cutout-30 PSIG. The system will also be inhibited from starting if the discharge pressure is above The programmed pressure cutout-30 PSIG. The fault message for this safety is shown below.

```
SYS X YYYYYYYY HIGH DISCHARGE PRESSURE
```

The X indicates the system and YYYYYYYY indicates the system is in a FAULT condition and will restart when the 120 second anti-recycle timer times out, or LOCKOUT and will not restart until the operator clears the fault using the keypad.

High Discharge Pressure Cutout (HPCO) (Hardware) Fault

The mechanical High Pressure Cutout protects the system from experiencing dangerously high discharge pressure. A system will fault and shut down immediately when the mechanical high pressure cutout contacts open. The fault will occur immediately and not wait 3 seconds, which is typical of most system faults. The HPCO is wired in series with the VSD Run Signal and will only be checked by the Chiller Control Board when the system is running. The mechanical cutout opens at 23.2 barg ± 0.55 barg (337 PSIG ± 8 PSIG) and closes at 17.4 barg ± 0.69 barg (252 PSIG ± 10 PSIG). The Status display fault message for this system is shown below:

```
SYS X YYYYYYYY HPCO FAULT
```

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the 120 second anti-recycle timer times out or LOCKOUT and will not restart until the operator clears the fault using the keypad.

Low Suction Pressure Cutout (Software) Fault

The programmable Low Suction Pressure Cutout is a secondary back-up for the flow switch and protects against operation with low refrigerant charge, which helps protect the chiller from an evaporator freeze-up, should the system attempt to run with a low refrigerant charge. The Status display fault message for this cutout is shown below:

SYS X YYYYYYYY LOW SUCTION PRESSURE

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the 120 second anti-recycle timer times out or LOCKOUT and will not restart until the operator clears the fault using the keypad. Typically, the cutout will be set at 1.65 barg (24 PSIG) for chilled water applications.

The cutout is ignored for the first 30 seconds of system run time. During the next 3 minutes of run time the cutout point is linearly ramped from 10% of the cutout value up to the programmed cutout point. If at any time during the first 3 minutes of operation the suction pressure falls below the ramped cutout point, the system will shut down with a controlled ramped shutdown.

The cutout pressure during operating periods of 30 seconds to 210 seconds is ramped and can be calculated by:

After the first 3 minutes and 30 seconds of run time, if the suction pressure falls below the cutout as a result of a transient in the system, a transient timer is set at 30 seconds and a linearly ramped cutout is set starting at 10% of the programmed cutout. If over the next 30 seconds, the suction pressure does not stay above the ramped cutout, which ramps between 10% of the cutout and the programmed cutout over the 30 second period, the system will fault on low suction pressure.

Low Motor Current Cutout Fault

The Motor Current Cutout shuts the system down with a controlled ramped shutdown when the microprocessor detects the absence of motor current (less than 10% FLA), usually indicating that a compressor is not running. This safety is ignored for the first 10 seconds of operation.

The status display fault message for this safety is shown below:

SYS X YYYYYYY LOW MOTOR CURRENT

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the 120 second anti-recycle timer times out or LOCKOUT and will not restart until the operator clears the fault using the keypad.

High Differential Oil Pressure Cutout Fault

The High Differential Oil Pressure Cutout protects the compressor from low oil flow and insufficient lubrication, possibly from a dirty oil filter. A system will fault and shut down with a controlled ramped shutdown when its Discharge to Oil Differential Pressure rises above the cutout of 4.48 bard (65 PSID). This safety is ignored for the first 90 seconds of run time. This safety measures the pressure differential between discharge and oil pressure, which is the pressure drop across the oil filter. The Status display fault message for this safety is shown in the next column.

SYS X YYYYYYY HIGH DIFF OIL PRESSURE

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the 120 second anti-recycle timer times out or LOCKOUT and will not restart until the operator clears the fault using the keypad.

Low Differential Oil Pressure Cutout Fault

The Low Differential Oil Pressure Cutout protects the compressor from low oil flow and insufficient lubrication. A system will fault and shut down with a controlled ramped shutdown when it's differential between oil and suction pressure falls below the cutout. This safety assures that the compressor is pumping sufficiently to push oil through the oil cooling circuit and through the internal compressor lubrication system. The Status display fault message for this safety is shown below:

SYS X YYYYYYY LOW DIFF OIL PRESSURE

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart

when the 120 second anti-recycle timer times out or LOCKOUT and will not restart until the operator clears the fault using the keypad.

The safety is ignored for the first 60 seconds of run time. After the first 60 seconds of operation, the cutout is linearly ramped from 0 bard to 2.09 bard (0 PSID to 30 PSID) in 5 to 10 minutes based on ambient temperature. See *"Table 2 - Low Differential Oil Pressure Cutout" on page 23* for ramp times for the given ambient temperatures.

TABLE 8 - LOW DIFFERENTIAL OIL PRESSURE CUTOUT

AMBIENT TEMPERATURE	RAMP TIME
more than 10°C (50ºF)	5 Minutes
more than 7.2°C (45ºF)	6 Minutes
more than 4.4°C (40ºF)	7 Minutes
more than 1.6°C (35ºF)	8 Minutes
more than 1.1°C (30ºF)	9 Minutes
more than or equal to 1.1°C (30ºF)	10 Minutes

A 30 second safety bypass below 50 Hertz is employed during ramp down. The bypass is primarily needed under conditions where another compressor is being brought on and the running compressor is being ramped down to 5 Hertz to add the additional compressor due to load requirements. Under these conditions, the slow speed of the running compressor(s) causes the oil differential to become very low, especially if the water temperature is high and the suction pressure is high. The bypass assures the compressor(s) will not trip on a nuisance low oil differential fault.

High Discharge Temperature Cutout Fault

The High Discharge Temperature Cutout protects the motor and compressor from overheating. A system will fault and shut down with a controlled ramped shutdown when its Discharge Temperature rises above 121°C (250°F). A system will also be inhibited from starting if the discharge temperature is above 93°C (200°F). The Status display fault message for this safety is shown below:

SYS X YYYYYYY HIGH DISCHARGE TEMP

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the 120 second anti-recycle timer times out or LOCKOUT and will not restart until the operator clears the fault using the keypad.

Low Discharge Superheat Cutout Fault

The Low Discharge Superheat safety helps protect the compressor from liquid floodback through the economizer line due to a high flashtank level. It also helps protect the compressor from excessive oil in circulation due to excess oil charge in the system. Excessive oil in circulation brings back liquid refrigerant which is entrained in the oil. The liquid then drops out once it enters the compressor.

The safety is ignored for the first 10 minutes of operation if the system economizer feed valve is closed (0%) and for 5 minutes of operation if the economizer feed valve is open greater than 0%. If the discharge superheat falls below 2.8°C (5.0°F) for 5 minutes under either condition, the system will shut down.

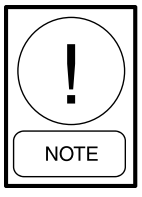
The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the 120 second anti-recycle timer times out or LOCKOUT and will not restart until the operator clears the fault using the keypad.

Sensor Failure Cutout Fault

The Sensor Failure Cutout prevents the system from running when a critical sensor (transducer, level sensor, or motor winding temp sensor) is not functioning properly and reading out of range. This safety is checked at startup and will prevent the system from running if one of the sensors has failed.

The sensor failure safety will also fault and shutdown a system while in operation, if a safety threshold is exceeded or a sensor reads out of range (high or low). Following is the Status display fault message.

SYS X YYYYYYY SENSOR FAILURE: *ZZZZZZZZZZZ*



The X indicates the specific system. YYYYYYY will either indicate the system is in a FAULT condition and will restart when the fault clears, or LOCKOUT after 3 faults and will not restart until the operator clears the fault using the keypad.

ZZZZZZZZZZZ indicates the failed sensor below:

- SUCT PRESS
- OIL PRESS
- DSCH PRESS
- MOTOR TEMP X *

*The Unit Setup Mode allows a specific motor temperature sensor to be ignored, if it fails.

The start inhibit thresholds for each sensor are shown in the following table.

TABLE 9 - START INHIBIT SENSOR THRESHOLDS

SENSOR	LOW THRESHOLD	HIGH THRESHOLD
Suction Transducer	0.3VDC	4.7VDC
Oil Transducer	0.3VDC	4.7VDC
Discharge Transducer	0.3VDC	4.7VDC
Motor Temp. Sensor	0°C (0ºF)	116°C (240ºF)

High Motor Temperature Cutout Fault

The High Motor Temperature Cutout prevents a compressor from running when its motor temperature is too high. A system will fault and shut down when any compressor motor temperature sensor rises above 121°C (250°F). The system will be inhibited from starting if its motor temperatures sensors indicate temperatures above 116°C (240°F). If any single temperature sensor is being ignored under the Unit Set-up Mode, that sensor will not be utilized when evaluating motor temperature.

Below is a sample Status display fault message:

```
SYS X YYYYYYY HIGH MOTOR TEMP
```

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the fault clears or LOCKOUT and will not restart until the operator clears the fault using the keypad.

System Control Voltage Cutout Fault

The System Control Voltage Cutout alerts the operator the 115VAC Control voltage to one of the systems is missing. This could be due to a system fuse that has been removed or is blown. The affected system will fault and shut down immediately when the 115VAC supply is lost.

The safety will not shut down a system if the UNIT switch is OFF, which electrically removes the 115VAC to all systems. The safety is only used to indicate a situation where a single system is missing the 115VAC. The safety will not cause a lockout and the system fault will reset when power is returned. A sample message is shown below:

```
SYS X YYYYYYY CONTROL VOLTAGE
```

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the fault clears or LOCKOUT and will not restart until the operator clears the fault using the keypad.

VSD OPERATION AND CONTROLS

VSD Logic Board

The VSD Logic Board communicates with the Chiller Control Board via comms and controls the VSD functions. It converts the frequency and run commands from the Chiller Control Board into the necessary voltage and frequency commands to operate the inverter section. It also controls the converter section of the drive (AC Line to DC Bus conversion) by controlling the pre-charge function.

The VSD Logic Board contains a 2nd microprocessor (motor controller) that generates the PWM signals that control the IGBT outputs in the inverter section of the VSD.

An FPGA handles the hardware safeties that can shut down the VSD much faster than the software safeties. The VSD Logic Board handles all of the VSD related safeties, which includes motor current, BUS voltage, and other safeties.

The VSD Logic Board reports shutdown information back to the Chiller Control Board via the RS-485 communication link.

VSD Start/Run Initiation

Following a successful pre charge of the DC Bus and a run command from the Chiller Control Board, the VSD Logic Board microprocessor will determine the motor output voltage (% modulation) and the output frequency required based on the operating frequency command from the Chiller Control Board. This information will then be sent to the PWM generator located on the VSD Logic Board.

On startup, the output frequency from the VSD to the motor(s) will be increased from 0 Hz to the operating frequency commanded by the Chiller Control Board.

The rate of change of the frequency will also be controlled by the VSD Logic Board.

The rate of change of the output frequency at startup, during acceleration is 10 Hz/sec between 0 and 50 Hz and 30.4 Hz/sec above 50 hertz. The maximum rate of change of the output frequency during deceleration between 200 and 100 Hz is 30.4 Hz/sec, and 100 and 0 Hz is 10 Hz/sec.

The VSD Logic Board and its PWM generator will receive operating frequency and voltage commands from the Chiller Control Board based on the load.

When a frequency (speed) change is requested from the Chiller Control Board, the chiller microprocessor will send the change to the VSD Logic Board and the VSD Logic Board will acknowledge it accepted the change. Loading and unloading will take place at the rate of 0.1 to 1Hz every 2 seconds.

PWM Generator Type and Carrier Frequency

The PWM generator is responsible for providing asymmetrical uniform sampled PWM waveforms to the compressor motor by turning ON an OFF the inverter IGBT's. The waveform generated is equivalent to a specific V/F ratio at a given speed based on the voltage and frequency commands from the Chiller Control Board. The PWM Generator receives operating frequency and voltage commands from the VSD Logic Board control processor.

Short Circuit Protection Minimum Output Pulse Width and Interlock Delay

The PWM generator is programmed to drop all ON pulses in less than 10 microseconds (and all matching OFF pulses in the mirrored waveform) to permit time for the IGBT gate drivers to detect and self extinguish an inverter short circuit condition.

Modulating Frequency

The modulating frequency range will range from 0 to 200 Hz. The modulating frequency waveform consists of a sinusoidal waveform summed together with 16.66% of the third harmonic component of the sinusoidal waveform. Utilization of this waveform as the modulating waveform will permit the drive to generate a fundamental line to line voltage equal to the DC Bus voltage divided by 1.414.

VSD % Modulation

The voltage and frequency commands issued by the VSD Logic Board microprocessor are determined by the frequency command from the Chiller Control Board. The VSD output is a PWM signal which has effects on the motor comparable to an AC voltage sinusoidal waveform. To change the speed of an AC motor, the frequency of the AC voltage must be changed. Whenever frequency is changed, the voltage is changed in a linear ratio.

The PWM generator provides an output that simulates a true AC waveform by repetitively turning ON and OFF the voltage to the motor to create an average voltage that is equal to a lower AC voltage at lower frequencies and a higher voltage at higher frequencies. The PWM generator also changes the % modulation of the waveform to simulate the frequency change to maintain the V/F ratio with motor speed changes.

The complex control algorithm modifies the voltage command to boost the voltage of the V/F ration at lower speeds to provide additional torque.

VSD Cooling and Cooling Loop

The VSD generates heat in the IGBT power modules and the SCR/Diode assemblies, which must be removed. The heat not only heats the modules but also the Micro/VSD cabinet.

The VSD is cooled by a glycol loop and circulating pump. The glycol cooling loop feeds a liquid cooled heatsink called a chill plate that cools the IGBT's and SCR/Diode modules. The coolant is pumped by a circulator pump through the heatsink. Here it absorbs heat in several passes of tubes on the lower rows of the inside condenser coils, where the condenser fans remove the heat picked up from the modules. The coolant is then pumped back to the modules. The glycol loop also provides cooling for the Micro/VSD cabinet. The baseplates of the power components are mounted to the glycol cooled heatsinks in the cooling loop. The cooling loop also circulates the glycol through a cooling coil in the cabinet. A fan blows air from the cabinet across the cooling coil to cool the electronics in the cabinet.

CAUTION

Never run the glycol pump without coolant! Running the glycol pump without coolant may damage the pump seals

Always fill the system with approved coolant to avoid damage to the pump seals and other components.

Heat transfer characteristics of the coolant are very critical. Substituting coolant or adding water will result in cooling loop performance loss and chiller shutdown.

The glycol coolant level in the VSD cooling system should be maintained between 9 and 15 inches (23 and 38 cm) from the top of the fill tube. This check should be performed prior to running the pump. The pump can be test run by placing the chiller in Service Mode. It is advisable to fill the tube to the required level before starting the glycol pump because it may empty when the pump starts. The level should be topped off as needed while running. Be sure to re-install the cap before stopping the glycol pump to avoid overflowing the fill tube when the glycol pump is turned OFF.

Glycol coolant has a defined operating life. System coolant should be changed 5 years from date of shipment of the equipment. Mixing other coolants or water with the special glycol will reduce the life of the coolant, and cause VSD overheating and damage.

LD15134

FIGURE 34 - VSD GLYCOL PUMP

The VSD fan and glycol pump will run if any of the following conditions listed below are true, provided the VSD has been powered up for less than 30 seconds and the pump has not run in the last 30 seconds. The 30 second limitations prevent pump motor overheating.

- Compressor Baseplate temp is more than Cutout (218°F) minus 10°F.
- Pre-charge Enable 1 from the Chiller Logic Board is ON.
- VSD Internal Ambient Temp more than Cutout minus 10°F.
- Any compressor is running.
- Service Mode Fan/Pump Run is enabled.

The VSD fan/glycol pump will turn OFF when ALL of the following conditions are true:

- Compressor 1 IGBT Baseplate temp is less than Cutout minus 15°F.
- Compressor 2 IGBT Baseplate temp is less than Cutout minus 15°F.
- Pre-charge Enable 1 from the Chiller Logic Board is OFF.
- VSD Internal Ambient Temp less than Cutout minus 15°F.
- No compressors are running.
- Service Mode Fan/Pump is disabled.

NOTE

In some cases, when no compressors are running, the condenser fans may be turned on by the microprocessor, to keep the power components and Control/VSD Cabinet from overheating.

IGBT Module Baseplate Temperature Sensing

Each IGBT module has an internal 5Kohm thermistor built in to measure the temperature of the module. Up to 4 thermistors are connected to the VSD Logic Board (one per compressor). The highest module temperature of compressors 1 and 2 are sent to the logic board. If the temperature exceeds the software trip point, the unit will shut down on a safety. See *High Baseplate Temperature (Software) Fault on page 104 for details.*

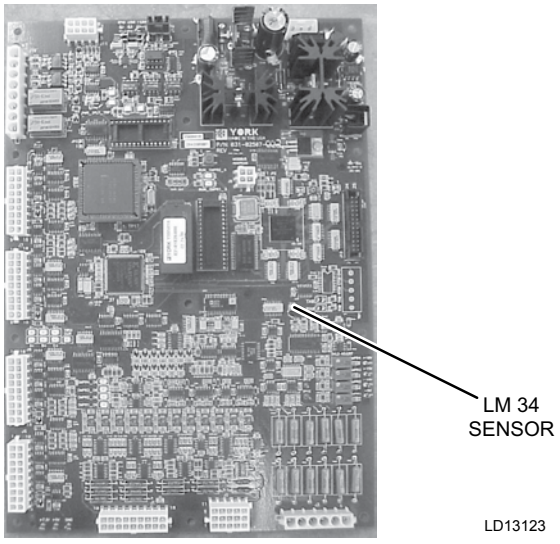


FIGURE 35 - NEW BOARD - P/N 031-02507-XXX

VSD Internal Ambient Temperature Sensing

A National LM34 temperature sensor located on the VSD Logic Board is used to measure the internal ambient temperature of the Control Panel/VSD enclosure. It has an output voltage that is linearly proportional to the temperature in degrees Fahrenheit. If the temperature exceeds the software trip point, the unit will shut down on a safety. See *High VSD Internal Ambient Temperature (Software) Fault on Page 105* for details.

Pre-charge

When cooling is required (LCWT is more than SPHL), leaving chilled liquid temp is greater than the setpoint high limit, the chiller Control Board will send a Pre-Charge Enable via comms to the VSD Logic Board. The VSD's DC Bus voltage(s) across the Bus Filter Capacitors will slowly be increased to the proper level (more than 500VDC) through firing of the SCR Trigger Board(s) and the associated pre-charge enable control signal(s). The pre-charge time interval is fixed at 20 seconds. The purpose of the pre charge is to limit current when charging an uncharged capacitor bank. When uncharged, the capacitor bank looks like an electrical short. The bus is brought up slowly by only turning ON the SCR's during the trailing half of the + and – portion of the incoming AC sine wave. Following is the status message displayed while the pre charge is taking place.

• S YS X VSD DC BUS PRECHARGE

Following successful completion of the pre-charge interval, the SCR's on the AC to DC semi-converter (SCR/Diode Modules) will be gated fully ON by the SCR Trigger Board, and the DC Bus will be brought up to its full potential. After pre-charge has been successfully completed, the SCR's will stay fully ON until the Chiller Control Board turns off the Pre-Charge Enable via comms.

The pre-charge will only take place when all of the following conditions are true, otherwise it is disabled:

- Daily Schedule is ON.
- UNIT switch is ON.
- System Switch(es) are ON.
- Run Permissive(s) are Enabled.
- Flow Switch indicates flow.
- LCHLT more than Setpoint High Limit.
- Unit not faulted / locked out.
- Any system not faulted, locked out.

Run Mode / Unit Restart

In order to initiate a system run, two conditions must be met. At least 1 of the 2 systems run signals from the control panel must be present and at least 1 of the 4 possible Compressor RUN bits must be set in the serial communications link between the VSD Logic Board and the Chiller Control Board. Following successful completion of pre-charge and receipt of the system run signals, the motor output voltage (% modulation) and output frequency commands will be determined by the VSD microprocessor located on the VSD Logic Board. These two parameters will be sent to the PWM generator located on the VSD Logic Board for waveform processing at a rate of once every 10 msec.

The voltage and frequency commands issued by the VSD microprocessor are determined by the operating frequency command received on the communications link from the Chiller Control Board, and by the present operating frequency of the drive. Upon receipt of a legitimate run command communication, the VSD's output frequency will be increased from 0 Hz to the operating frequency command from the communications link.

DC Bus Voltage Sensing and Scaling

Full DC Bus voltage and ½ DC Bus voltages are sensed for up to 2 DC Buses. The 2 compressor chillers share a common DC Bus. The DC Bus is wired to the DC Bus Isolation Board, the voltage is divided down through a resistance voltage divider, and the reduced voltage is fed to the VSD Logic Board for safety monitoring.

Current Sensing and Scaling

Individual current transformers on each leg sense three phases of output current on each compressor. These signals are buffered, divided by 2, and filtered by an RMS to DC converter. The highest of the currents in the three phases of each compressor leaving the RMS converters is then sent to an A-D converter, scaled, monitored by the VSD Logic Board overload and high current protection circuitry, and sent to the Chiller Control Board for display as the compressor current.

In order to set the motor overload level (determined by the setting of the overload ADJUST potentiometer on the VSD Logic Board), the voltage level on the wipers of the four overload ADJUST potentiometers is continuously sensed by the VSD Logic Board for current protection and sent to the Chiller Control Board for both display purposes and for current limiting control. This parameter is the 105% FLA value.

VSD Transmitted Operating Parameters

VSD operating parameters will be transmitted to the Chiller Control Board over the RS-485 communications link between the 2 boards. These values will be displayed on the control panel display. The data and display format are outlined in*"Table 10 - VSD Operating Display Parameters" on page 102*.

VSD SAFETIES (FAULTS)

VSD operating conditions are monitored by both software algorithms and hardware circuitry. Both types exist as a result of the need for both extremely fast protection requirements such as a short circuit condition or a slow reacting trip such as a slow rising overload condition. To eliminate nuisance unit trips, the sensor inputs for the VSD's operating parameters are averaged four times before Software generated unit/system fault trips from the VSD Logic Board are initiated. These faults cause single compressor or total unit controlled ramped shutdown. Other parameters that are not fed to the VSD Logic Board microprocessor are protected by Hardware generated fault trips. Hardware trips involve electronic circuitry that measures voltages or currents and activate level sensitive comparators connected to programmable gate arrays on the VSD Logic Board FPGA (Field Programmable Gate Array). These safeties operate extremely fast and provide immediate shutdown, because they are not dependent upon software program loops that operate in seconds or fractions of a second. Outputs from the gate arrays provide a digital signal to indicate whether a safety threshold has been reached.

Immediate Fault shutdowns are often accompanied by audible motor backspin due to equalizing of the differential between discharge and suction when the compressor is turned OFF while rotating at high speeds. This should not cause concern and will not damage the chiller.

Each fault outlined in the descriptions that follow will indicate whether it is a hardware or software generated fault.

It will be noted the ramped shutdown results in minimal compressor backspin and noise associated with backspin. Immediate shutdowns will result in compressor backspin and a higher noise level based upon the differential pressure between discharge and suction.

When a VSD fault occurs, the VSD Logic Board captures VSD data in the onboard battery backed RAM. At the same time, the VSD Board Fault Relay will open, signaling the Chiller Control Board microprocessor to save a snapshot of system data. The VSD Logic Board then transmits the fault data to the Chiller Control Board microprocessor on the next comms between the two boards. If the Chiller Control Board receives the comms fault indication before the Fault Relay signal, it will immediately save a snapshot of system data when the comms fault is recognized. This also enables the microprocessor to capture fault data if the Fault relay fails. Both the system and VSD fault data are then stored in the Chiller Control Board history buffers. Any additional faults that may occur during shutdown on the first fault or between the first fault and the next comms will also be stored and transmitted to the Chiller Control Board, along with the original fault data. This data will be stored as ALL FAULT data.

When the control panel acknowledges a fault (via the fault acknowledge bit in comms) the fault relay will be reset (closed) by the VSD Logic Board and the fault indication flag (in comms) will be reset.

The fault relay will not open when a non-running fault occurs. In this case, the system will be inhibited from running until the fault condition is corrected. An inhibit message will be displayed on the panel display indicating the system is not allowed to run. Examples of this type of fault would be the High Internal Ambient fault and the VSD CT Plug Fault. When the chiller receives the transmitted fault data via comms, it will save a snapshot of system data in the history buffer even though the chiller is not running.

Some faults will be unit faults; other faults will be system (specific compressor or compressor pairs) faults, depending upon the number of compressors in the chiller. Most faults will shut down the unit/ system and allow restart once the fault clears and the 120 sec anti-recycle timer times out. These faults will allow up to 3 faults within 90 minutes before locking out the unit/ system. Other faults lock out the unit/system after only a single fault. Details on individual faults are provided in the following explanations

A start inhibit will take place if a VSD fault condition exists and a compressor that is not running is called to start. The start inhibit will be cleared when the fault condition goes away and the compressor will be permitted to start.

Pre-charge Low DC Bus Voltage (Software) Fault

On standard 200V, 230V, 460V and 575V chillers the

TABLE 10 - VSD OPERATING DISPLAY PARAMETERS

DATA	DISPLAY FORMAT
Highest Phase of Compressor Motor Current in Amperes RMS (per Compressor)	XXX Amps
VSD Output Frequency	XXX.X Hz
Motor Overload Setting (105% FLA potentiometer setting) in amperes RMS (per Compressor)	XXX Amps
DC Bus Voltage in DC Volts (maximum of 2)	XXX Volts
VSD Internal Ambient Temperature	XXX.XºF (or ºC)
IBGT Power Assembly Power Module Highest Baseplate Temperature (maximum of 2)	XXX.XºF (or ºC)
Pre-Charge Enable Signal (maximum of 2)	On or OFF
VSD cooling Fan/Pump	On or OFF
Compressor Run Status (maximum of 4)	On or OFF

DC Bus voltage must reach at least 41VDC within four seconds and 500VDC within 19 seconds after the pre-charge signal has been asserted. If not, the unit/system will shut down on a fault. On 380-400VAC chillers the voltage must reach 41VDC in 4 seconds and 414VDC in 19 seconds.

This auto-restart safety will lock out on the third fault within 90 minutes. The fault will be a unit fault. The Status display fault message is shown below:

```
UNIT YYYYYYYY
 PRECHARGE - LOW DC BUS VOLTAGE
```

Pre-charge DC Bus Voltage Imbalance (Software) Fault

The 1/2 DC Bus voltage magnitude must remain within plus or minus 100VDC of the total DC Bus voltage divided by two during the pre-charge interval. If not, the unit/system shall shut down on a fault.

This safety will lock out on the 1st fault. The fault will be a unit fault. The Status display fault message is shown below:

```
UNIT YYYYYYYY
 PRECHARGE - DC BUS VOLTAGE IMBALANCE
```

High DC Bus Voltage (Hardware) Fault

The high DC Bus voltage trip level is determined by hardware on the VSD Logic Board and is designed to trip the unit at 766 plus or minus 30VDC. If the DC Bus exceeds this level, the unit/system will fault and shut down immediately.

This safety is an auto-restart safety that will lock out on the 3rd fault in 90 minutes. The fault will be a unit fault. Two key presses of the STATUS KEY are required to show the fault on both systems. Below is the control panel Status display fault message:

```
UNIT YYYYYYYY
 HIGH DC BUS VOLTAGE
```

Low DC Bus Voltage (Software) Fault

The low DC Bus voltage trip level is set at 500VDC on 200V, 230V, 460V and 575V chillers. If the DC Bus drops below this level the unit/system will fault and immediately shut down. On 380V and 400V chillers the trip point will be 414VDC.

The low DC Bus voltage cutout is an auto-restart safety that will lock out on the 3rd fault in 90 minutes. The fault is a unit fault. Below is an example of the Status display fault message:

```
UNIT YYYYYYYY
 LOW DC BUS VOLTAGE
```

DC Bus Voltage Imbalance (Software) Fault

The 1/2 DC Bus voltage magnitude must remain within plus or minus 100VDC of the total DC Bus voltage divided by two. If the 1/2 DC Bus magnitude exceeds the plus or minus 100VDC tolerances, the unit/system will fault and immediately shut down.

This safety will lock out on the first fault. The fault will be a unit fault. Below is the Status display fault message:

```
UNIT YYYYYYYY
 DC BUS VOLTAGE IMBALANCE
```

High Motor Current (Hardware) Fault

The three output lines to each phase of the compressor motor are monitored via three current transformers within the VSD. The unit's three phases of instantaneous output current will be compared to a predetermined limit, which is contained in hardware.

The nominal peak current trip level is:

- 575.5 Amps (554 Amps minimum, 597 Amps maximum).
- 380VAC, 60Hz and 400VAC, 50Hz nominal peak current trip level is 649.5 Amps (626 Amps minimum, 674 Amps maximum).
- VAC units, nominal peak current load is 863.3 Amps (831 Amps minimum, 896 Amps maximum).

The variation in trip point is the result of component tolerances on the VSD Logic Board. If the peak current limit is exceeded, the unit will fault and shutdown immediately.

This fault is an auto-restart safety that will lock out the system on the 3rd fault in 90 minutes. The fault will be an individual system/compressor fault for all units. Following is a sample Status display fault message:

```
SYS X YYYYYYYY HIGH MOTOR CURRENT
```

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart or LOCKOUT and will not restart until the operator clears the fault using the keypad.

Motor Current Overload (Software) Fault

The Motor Current Overload will compare the highest of the 3 phases of motor current per compressor to the compressor's 105 % FLA ADJUST (overload) potentiometer setting on the VSD Logic Board. If the current exceeds the setting continuously for 20 seconds, the compressor will trip.

This safety will lock out a system on the 1st fault and shut down with a controlled ramped shutdown. The fault will be an individual system/compressor fault for all systems. A sample Status display fault is shown below:

```
SYS X YYYYYYY MOTOR CURRENT OVERLOAD
```

The X indicates the system and YYYYYYY indicates the system is in a LOCKOUT condition and will not restart until the operator clears the fault using the keypad.

Motor Current Overload (Hardware) Fault

The Motor Current Overload will compare the highest of the 3 phases of motor current per compressor to the compressor's overload ADJUST potentiometer setting. If the current exceeds the setting continuously for 30 seconds, all compressors will fault and shut down immediately.

The fault will be a unit fault and will lock out all systems on the first fault. A sample Status display fault is shown below:

```
UNIT YYYYYYY
 MOTOR CURRENT OVERLOAD
```

YYYYYYY indicates the unit is in a Lockout condition and will not restart until the operator clears the fault using the keypad.

IGBT Gate Driver (Hardware) Fault

The unit's phase bank assembly(s) contains one IGBT gate driver control board per compressor. These boards monitor the saturation voltage drop across each of the six IGBT's while gated ON. If the IGBT's saturation voltage exceeds the prescribed limit, the gate driver will make the determination that a short circuit is present. This in turn will cause the system to trip. During normal operation, the voltage drop across a saturated IGBT is low. When a short or shoot occurs, the extremely high current causes the voltage across the device to increase. When the electronic hardware on the IGBT Gate Driver Board senses the current rise, it immediately turns OFF all IGBT's in the module and the system will shut down immediately.

Additionally, if the IGBT's Gate Driver board's power supply voltage falls below the permissible limit, this same fault will be generated.

This is an auto-restart safety that will lock out on the third fault within 90 minutes. The fault will be a system fault for all units. Following is the Status display fault messages for all systems.

```
SYS X YYYYYYY GATE DRIVER
```

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart or LOCKOUT and will not restart until the operator clears the fault using the keypad.

High Baseplate Temperature (Software) Fault

Each phase bank assembly contains one liquid cooled heatsink to cool both the inverter power modules and the converter SCR/Diode modules. Each compressor's inverter power module (6 IGBT's and Gate Driver Board) contains an internal temperature sensor (5K ohm at 25°C) to monitor the baseplate temperature.

On two compressor chillers, the outputs from System 1 and System 2 sensors are each compared in software to a limit of 218°F (226°F for 380 and 400VAC). If either sensor exceeds this limit, the unit will fault and shut down with a controlled ramped shutdown.

This is an auto-restart safety that will lock out on the third fault within 90 minutes. The fault will be a system fault for all units. Below are the Status display fault messages for all systems.

```
SYS X YYYYYYY HIGH VSD BASEPLATE TEMP
```

The X indicates the system and YYYYYYY indicates the system is in a FAULT condition and will restart when the fault clears or LOCKOUT and will not restart until the operator clears the fault using the keypad.

After a fault, the fan(s) and water pump will remain energized until the inverter power module base plate temperature(s) falls below 165°F. The system will be allowed to restart when the inverter power module base plate temperatures drop below this value.

It is possible for an internal sensor to fail and not sense temperature without causing a high baseplate sensor fault.

High VSD Internal Ambient Temperature (Software) Fault

The VSD Logic board contains a temperature sensor, which monitors the unit's internal ambient temperature. If the VSD internal ambient temperature rises above the cutout of 158°F, the unit will fault and shut down with a controlled ramped shutdown.

This safety will not cause a lockout. The fault will be a unit fault for all units. Following is the Status display fault message.

```
UNIT YYYYYYYY
HIGH VSD INTERNAL AMBIENT TEMP
```

The unit will be allowed to restart when the internal ambient temperature drops 10°F below the cutout.

YYYYYYYY indicates the unit is in a Fault condition and will restart when the condition clears.

Single Phase Input (Hardware) Fault

The VSD's SCR Trigger Control board contains circuitry that checks the three phase mains for the presence of all three-line voltages. If any of the line voltages are not present, the system will immediately shut down on a fault.

This fault will not cause a lockout. The fault will be a unit fault. Below is the Status display fault message.

```
UNIT YYYYYYYY
SINGLE PHASE INPUT (HARDWARE) FAULT
```

Power Supply (Hardware) Fault

Various DC power supplies which power the VSD Logic Board are monitored via hardware located on the logic board. If any of these power supplies fall outside their allowable limits, the unit will immediately shut down on a fault.

This is an auto-restart safety that will restart after the fault clears and lock out on the 3rd fault in 90 minutes. The fault will be a unit fault for all units. Below is the Status display fault message.

```
UNIT YYYYYYYY
VSD LOGIC BOARD POWER SUPPLY
```

YYYYYYY indicates the system is in a FAULT condition and will restart when the fault clears or LOCKOUT and will not restart until the operator clears the fault using the keypad.

Run Relay (Software) Fault

Upon receipt of either of the two types of run commands (hardware and software) a 5 second timer will commence timing. The hardware run signal comes from the SYS X VSD Run Signal to the VSD Logic Board. The software run signal comes through the comms from the Chiller Control Board. If the missing run signal is not asserted within the 5-second window, the system will fault. In addition, if either run signal is disabled while the VSD is running, the remaining run signal must be disabled within 5 seconds after the VSD is shut down or the system will fault. If running, the unit will fault and shut down with a controlled ramped shutdown.

This is an auto-restart safety that will autostart after the 120 second anti-recycle timer times out and will lock out on the 3rd fault in 90 minutes. The fault will be a system fault.

VSD Logic Board Failure (Software) Fault

Upon receipt of the voltage and frequency commands, the PWM generator will acknowledge receipt of the command. If the system microprocessor does not receive the handshake within 1.5 seconds of issuing the command, the unit will trip. This safety is only active during pre charge and during running of a compressor. It is not active when all the compressors are shut down and the pre charge is disabled. If the VSD Logic Board Fault occurs while the chiller is running, all systems will immediately shut down on a fault.

This is an auto-restart safety that will auto restart after the 120 second anti-recycle timer times out and lock out on the 3rd fault in 90 minutes. The fault is a unit fault for all units. Following is the fault message.

```
UNIT YYYYYYYY
VSD LOGIC BOARD FAILURE
```

VSD CT Plug (Hardware) Fault

Jumpers are installed in each CT plug on the VSD Logic Board to feed back signals to indicate if the plugs are installed or not. If either plug is not installed, a low value is read on the digital input and the unit will immediate shutdown on a fault or will not run if OFF.

This is an auto-restart safety that will restart after the 120 second anti-recycle timer times out and lock out on the 3rd fault in 90 minutes. The fault is a unit fault for all units. Following is the fault message:

```
UNIT YYYYYYYY
VSD CT PLUG FAULT
```

YYYYYYYY indicates the system is in a FAULT condition and will restart or LOCKOUT and will not restart until the operator clears the fault using the keypad.

VSD Fault Data

When a fault has occurred, the VSD Logic Board will capture fault data. This data will be stored in the on-board battery backed RAM for safekeeping and transferred to the panel via the communications link as soon as possible.

A fault code will be set for the fault that initiated the system shutdown. This fault will appear as a specific fault in the Status message.

Any faults that occur after the initial fault, which occur within the comms transmission time frame following the inception of the first fault, will be stored and transmitted to the Micro Logic Board together with the first fault data. These faults will appear in the All Fault display in the History.

A snapshot of the operating parameters of the VSD is continuously updated in battery-backed memory once every program loop. Upon receipt of a first fault, the snapshot of the operating parameters will be stored in memory and are transmitted to the panel as the fault data.

Fault Relay/Fault Acknowledge Bit

Control of the Fault Relay is from the VSD Logic Board. The Fault Relay on the VSD will be closed during a non-fault condition.

When a running or pre-charge fault occurs on the VSD, the fault relay will immediately open. The relay will not open for non-running faults that occur.

When the Chiller Control Board sees the VSD fault relay open, it will immediately take a snapshot of system data and save it to the history buffer.

A fault acknowledge bit from the Chiller Control Board is sent to the VSD via comms after receiving valid fault data from the VSD. When the VSD Logic Board receives the fault acknowledge via comms from the panel it will reset (close) the Fault Relay. The fault acknowledge is reset by the Chiller Control Board after the Fault Relay is closed by the VSD Logic Board.

VSD Fault Compressor Start Inhibit

If a VSD fault condition exists while the compressor is not running or pre-charging, the Chiller Control Board will not try to start the faulted compressor(s). The start inhibit will be automatically cleared when the fault condition goes away.

VSD Logic Board Test Mode

The VSD Logic Board contains a manual TEST pushbutton, which enables the service person to perform gate testing of the IGBT's Gate Drivers in the VSD by observing the LED'S on the IGBT Gate Driver Board and the VSD Logic Board.

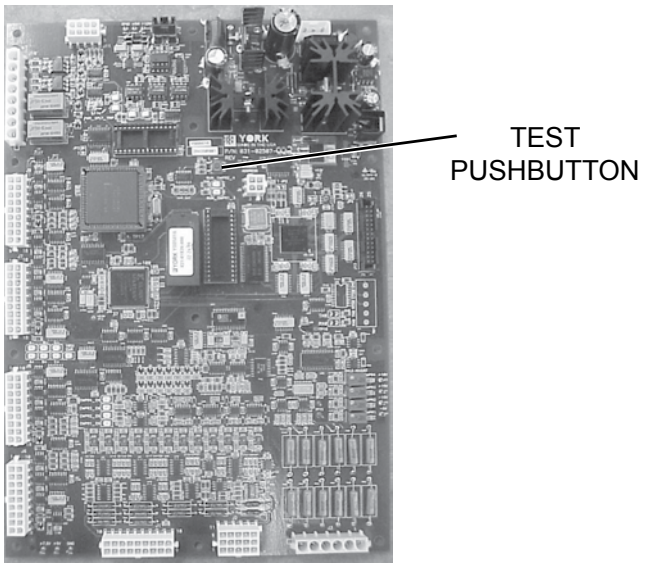


FIGURE 36 - VSD LOGIC BOARD

This should only be used when it is believed a VSD problem exists.

Once the test mode is enabled, the VSD Logic Board Processor will enable all compressor run signals.

When the TEST pushbutton is pressed, the PWM generator on the VSD Logic Board is programmed to pulse the output phase LED'S on the VSD Logic Board for all compressors in the following order:

- Upper 3 phases (+ LED's) for 1 second.
- All phases (+ and - LED's) for 1 second.
- Lower 3 phases (-LED's) for 1 second.
- All phases for 1 second.

At the same time, the 6 LED's on the GATE Driver Boards will alternate between dim and bright as the signals are sequenced.

The chiller will only be permitted to enter the Test mode under certain circumstances. The following conditions must exist:

- Pre-charge Enable 1 signal is disabled.
- Pre-charge Enable 2 signal is disabled.
- The system is not in the Run Mode.
- No system faults exist.
- DC Bus Voltage 1 is less than 50VDC.
- DC Bus Voltage 2 is less than 50VDC.
- No VSD Inhibits exist.

If the chiller is operating, the conditions required to allow the Test mode to be utilized require all systems to be manually shut down with the system switches and all faults must be cleared. After the DC Bus voltage bleeds down for several minutes, the Test mode can be utilized.

The Test pushbutton MUST be held down during the entire test. During the time the test takes place, the STATUS display message will indicate the systems are shutting down. An example is shown below:

SYSTEM 1 SHUTTING DOWN
SYSTEM 2 SHUTTING DOWN

No History will be created for a shutdown in the Test mode.

YORK®

MODEL – YAGK

OPERATING LOG SHEET SITE AND CHILLER INFORMATION

JOB NAME: _____

LOCATION: _____

TECHNICIAN NAME: _____

SALES ORDER #: _____ YORK ORDER #: _____ YORK CONTRACT #: _____

CHILLER

MODEL #: _____ CHILLER SERIAL #: _____

COMPRESSOR #1 MODEL #: _____ COMPRESSOR #2 MODEL #: _____

COMPRESSOR #1 SERIAL #: _____ COMPRESSOR #2 SERIAL #: _____

A. PROGRAMMED SETPOINT VALUES

Chilled Liquid Setpoint

B. PROGRAMMED OPTIONS

Display Language .....

Chilled Liquid Mode .....

Local/Remote Mode .....

Display Units .....

Lead/Lag Control .....

Remote Temperature Reset Input .....

Remote Current Reset Input .....

Remote Sound Limit Input .....

Low Ambient Cutout .....

C. PROGRAMMED CUTOUTS/LIMITS

Suction Press Cutout ..... PSIG (kPa)

Low Ambient Cutout ..... °F (°C)

Leaving Chilled Liq Temp Cutout ..... °F (°C)

Motor Current Limit ..... % FLA

Pulldown Current Limit ..... % FLA

Pulldown Current Limit Time..... MIN

D. VSD OPERATING DATA

Chilled Liquid Temperatures

Entering Temperature ..... °F (°C)

Leaving Temperature ..... °F (°C)

Outdoor Ambient Temperature

OAT ..... °F (°C)

VSD DC Bus Voltage

Bus 1 ..... VDC

VSD Frequency

	SYSTEM 1	SYSTEM 2	
Actual.....			Hz
Command.....			Hz

VSD Internal Ambient Temperature

Ambient Temperature ..... °F (°C)

VSD Cooling System Status

ON ☐ OFF ☐

VSD IGBT Baseplate Temps

T1 ..... °F (°C)

T2 ..... °F (°C)

VSD Compressor Current

	SYSTEM 1	SYSTEM 2	
			Amps
			%FLA

E. SYSTEM OPERATING TEMPERATURES, PRESSURES, CURRENTS

Chilled Liquid Temperature

Entering Temperature		°F (°C)
FC Exit Temperature		°F (°C)
Leaving Temperature		°F (°C)

System Pressures

	SYSTEM 1	SYSTEM 2	
Oil			PSIG(kPa)
Suction			PSIG(kPa)
Discharge			PSIG(kPa)
Cond Liquid			PSIG(kPa)

Motor Temperatures

	SYSTEM 1	SYSTEM 2	
T1			°F (°C)
T2			°F (°C)
T3			°F (°C)

Compressor Speed

	SYSTEM 1	SYSTEM 2	
Speed			%

Compressor Heater

(ON/OFF)		

System Temperatures

	SYSTEM 1	SYSTEM 2	
Oil			°F (°C)
Cond Liquid			°F (°C)
Subcooling			°F (°C)

	SYSTEM 1	SYSTEM 2	
Sat Discharge Temp			°F (°C)
Discharge Temp			°F (°C)
Discharge Superheat			°F (°C)
SAT Suction Temp			°F (°C
Suction Temp			°F (°C
Suction Superheat			°F (°C

F. SYSTEM OPERATING CONDITIONS

Economizer Valve % Open

	SYSTEM 1	SYSTEM 2	
Economizer			%

Condenser Drain Valve % Open

	SYSTEM 1	SYSTEM 2	
Drain Valve			%
FT Drain Valve			%

System Run Time

	DAYS	HOURS	MIN	SEC
System 1				
System 2				

VSD Fan Speed (If applicable)

	SYSTEM 1	SYSTEM 2	
Fan Speed			%

7

Condenser Fan Stage (0-4) (If applicable)

SYSTEM 1	SYSTEM 2

VI Step Solenoid

VI Step SOL 1 ..... (ON/OFF)

VI Step SOL 2 ..... (ON/OFF)

Oil Separator Level

Check oil separator oil levels

	SYSTEM 1	SYSTEM 2
Oil Level	◯	◯

G. WATER SYSTEM CONDITIONS

Evaporator Flow

Flow Rate..... GPM

Evap Pressure Drop..... FT / LBS (circle one)

Glycol Freeze Point ..... °F (°C)

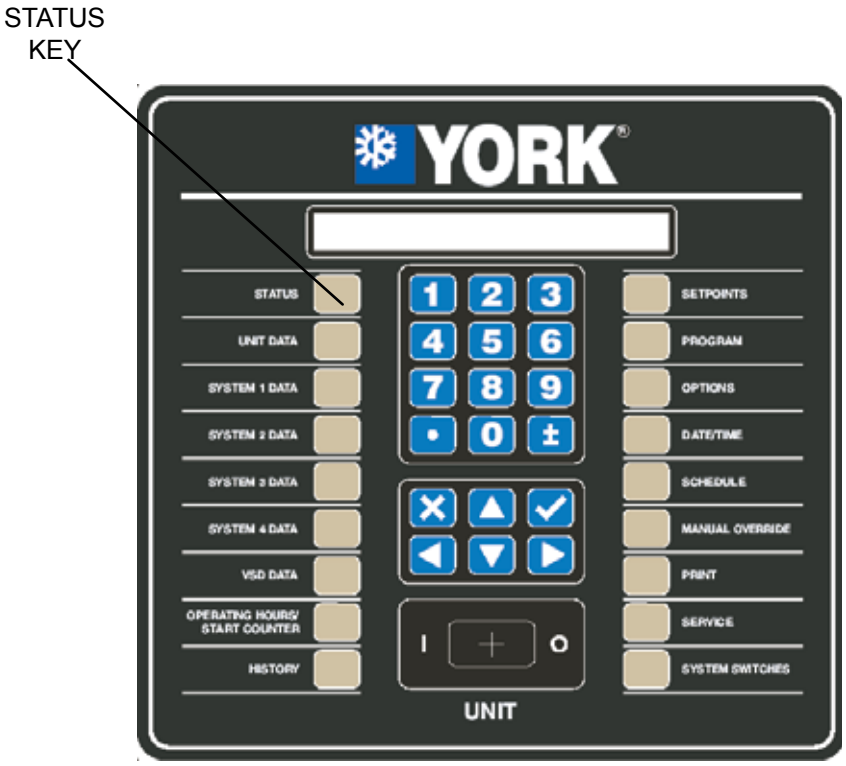
H. CONDENSER CONDITIONS

Air Temperature

Air On Temperature..... °F (°C)

Air Off Temperature..... °F (°C)

SECTION 8 - MICROPANEL
STATUS KEY



LD21844

8

Status Key Operation

The STATUS key displays the current chiller or system operational status. The messages displayed include running status, cooling demand, system faults, unit faults, VSD faults, unit warnings, external device status, load limiting, anti-recycle timer, status of unit/system switches, and a number of other messages. Pressing the STATUS key will enable the operator to view the current status of the chiller. The display will show one message relating to the highest priority information as determined by the microprocessor. There are three types of status data, which may appear on the display:

- General Status messages
- Unit Safeties
- System Safeties

When power is first applied to the control panel, the following message displaying York International Corporation, the EPROM version, date, and time will be displayed for 2 seconds, followed by the appropriate general status message:

(C)2004 YORK INTERNATIONAL CORPORATION
C.XXX.XX.XX 18-SEPT-2010 12:45: AM

Unit status messages occupy 2 lines of the Status message display. If no unit status message applies, individual status messages for each system will be displayed.

Any time the STATUS key is pressed or after the EPROM message disappears at power-up, a status display indicating chiller or system status will appear.

Multiple STATUS messages may appear and can be viewed by pressing the STATUS key repeatedly to allow scrolling through as many as three STATUS messages, which could possibly be displayed at any time on a 2 compressor chiller.

Examples of the typical Status messages are shown in the next topic.

General Status Messages

UNIT STATUS
MANUAL OVERRIDE

This message indicates the chiller is operating in MANUAL OVERRIDE mode. This message is a priority message and cannot be overridden by any other STATUS message. When in Manual Override, no other status message will ever be present.

UNIT STATUS
UNIT SWITCH OFF SHUTDOWN

This message indicates the UNIT SWITCH is in the OFF position and not allowing the unit to run.

UNIT STATUS
DAILY SCHEDULE SHUTDOWN

This message indicates that either the daily or holiday schedule programmed is keeping the chiller from running.

UNIT STATUS
REMOTE CONTROLLED SHUTDOWN

This message indicates that either an ISN or RCC has turned the chiller OFF and is not allowing it to run.

UNIT STATUS
FLOW SWITCH SHUTDOWN

This message indicates the flow switch is not allowing the chiller to run. There is a 1 second delay on this safety to assure the flow switch did not momentarily open.

UNIT STATUS
VSD COOLING SHUTDOWN

This message indicates the chiller is shutdown, but running all the condenser fans, VSD glycol pump, and VSD fan in an effort to bring the internal VSD ambient temperature down to an acceptable level before allowing the chiller to start.

SYS X REMOTE RUN CONTACT IS OPEN

This message indicates the remote start/stop contact between 2 and 15 or 2 and 16 of the 1TB terminal block is open. There is a 1 second delay on this safety to assure the remote contacts did not momentarily open.

SYS X SYSTEM SWITCH IS OFF

This message indicates the system switch (software via keypad) is turned OFF. The system will not be allowed to run until the system switch is turned ON via the keypad.

SYS X NOT RUNNING

This message indicates the system is not running because the chilled liquid is below the setpoint or the micro has not loaded the lead system far enough into the loading sequence to bring the lag system ON. This message will be displayed on the lag system until the loading sequence is ready for the lag system to start.

SYS X COOLING DEMAND SHUTDOWN

This message is only displayed in the Normal Shutdown History display to indicate a capacity control shutdown.

SYS X COMPRESSOR RUNNING

This message indicates the system is running as a result of cooling demand.

SYS X SHUTTING DOWN

The compressor shutting down message indicates the respective system is ramping down in speed prior to shutting OFF. This message is displayed after the software run signal is disabled until the VSD notifies the Chiller Control Board the compressor is no longer running.

SYS X ANTI-RECYCLE TIMER = XXX SEC

This message indicates the amount of time left on the respective system anti-recycle timer and the system is unable to start until the timer times out.

SYS X DISCHARGE PRESSURE LIMITING

The Discharge Pressure Limiting message indicates the discharge pressure load limit or discharge pressure unloading is in effect.

SYS X SUCTION PRESSURE LIMITING

The Suction Pressure Limiting message indicates the suction pressure load limit or suction pressure unloading is in effect.

SYS X MOTOR TEMP LIMITING

The Motor Temp Limiting message indicates the motor temp load limit or motor temp unloading is in effect.

SYS X MOTOR CURRENT LIMITING

The motor current limiting message indicates the motor current load limit or motor current unloading is in effect.

SYS X PULLDOWN MOTOR CURRENT LIMITING

The pulldown motor current limiting message indicates the pulldown motor current load limit or pulldown motor current unloading is in effect based on the programmed setpoint.

SYS X ISN CURRENT LIMITING

The ISN Current Limiting message indicates the motor current load limit or motor current unloading is in effect through the use of the YORKTalk setpoint.

SYS X REMOTE MOTOR CURRENT LIMITING

The Remote Motor Current Limiting message indicates the motor current load limit or motor current unloading is in effect through the use of the remote setpoint offset. The setpoint may be offset using a remote voltage or a current signal. The remote current limit must be activated for this function to operate.

SYS X VSD BASEPLATE TEMP LIMITING

The VSD Baseplate Temp Limiting message indicates the VSD Baseplate temp is high and load limit or unloading is in effect.

SYS X VSD INTERNAL AMBIENT TEMP LIMITING

The VSD Internal Ambient Temp Limiting message indicates the VSD internal ambient temp is high and load limit or unloading is in effect.

SYS X SOUND LIMITING

The sound limiting message indicates the sound load limit is in effect based on the locally programmed sound limit from the keypad. The sound limit must be activated for this function to operate.

SYS X ISN SOUND LIMITING

The ISN sound limiting message indicates the sound load limit is in effect based on the ISN transmitted sound limit setpoint. The sound limit must be activated for this function to operate.

SYS X REMOTE SOUND LIMITING

The Remote sound limiting message indicates the sound load limit is in effect based on the Remote controlled sound limit setpoint. The setpoint may be offset using a remote voltage or current signal. The sound limit option must be activated for this function to operate.

Unit Safety (Fault) Status Messages

A complete listing of the unit safeties and the corresponding status messages is provided in the *"Unit Safety Operation" on page 92*.

System Safety (Fault) Status Messages

A complete listing of the system safeties and the corresponding status messages is provided in *"System Safety (Fault) Operation" on page 94.*

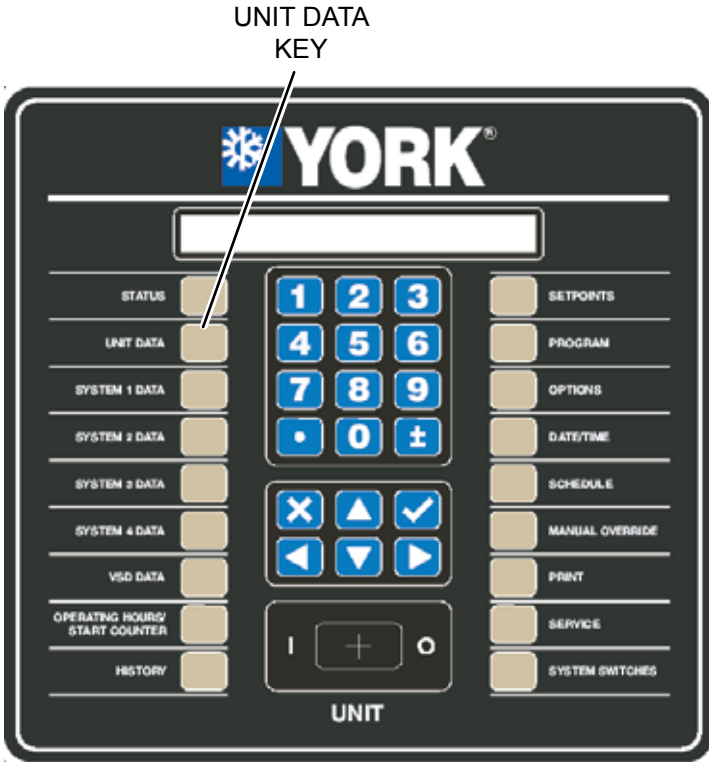
VSD Safety (Fault) Status Messages

A complete listing of VSD safeties and the corresponding status messages is provided in *"VSD Communications Failure Fault" on page 93.*

Unit Warning Messages

A complete listing of the unit warnings and the corresponding status messages is provided in *"Unit Warning Operation" on page 91*.

UNIT DATA KEY



LD10605

General

The UNIT DATA key provides the user with displays of unit temperatures, and unit related data. Displays can be selected by repeatedly pressing the UNIT DATA key or the ▲ or ▼ Keys.

Unit Data Key Operation

The first key press displays Evaporator Leaving and Return Chilled Liquid Temperatures.

```
UNIT  CHILLED  LIQUID  LEAVING = XXX.X °F
                       ENTERING = XXX.X °F
```

The ▼ key press of the UNIT DATA key or the ▼ key displays the ambient air temperature.

```
UNIT
   OUTSIDE  AMBIENT  AIR  TEMP = XXX.X °F
```

The ▼ key press will display the time remaining on the load and unload timers.

```
UNIT              LOAD  TIMER = XXX SEC
                  UNLOAD  TIMER = XXX SEC
```

The ▼ key press displays the error in temperature between the actual leaving chilled liquid temperature and the setpoint temperature. The display also shows the rate of change of the chilled liquid temperature.

```
UNIT          TEMP  ERROR = XXX.X °F
                    RATE = XXX.X °F/M
```

The ▼ key press displays the system designated as the lead system and the Flow Switch status (ON or OFF).

```
UNIT    LEAD  SYSTEM  NUMBER = X
                  FLOW SWITCH = XXX
```

The ▼ key press displays the status of the evaporator pump and heater, where XXX is either ON or OFF.

```
UNIT              EVAP PUMP RUN = XXX
                  EVAP HEATER = XXX
```

The ▼ key press displays the status of Active Remote Control.

```
UNIT  ACTIVE  REMOTE  CONTR0L = XXXXXX
```

XXXXX is either ACTIVE or NONE.

If no remote keys are active, the items on the second line are all blanked out. Any remote items that are active will be displayed, while the inactive items will be blanked out.

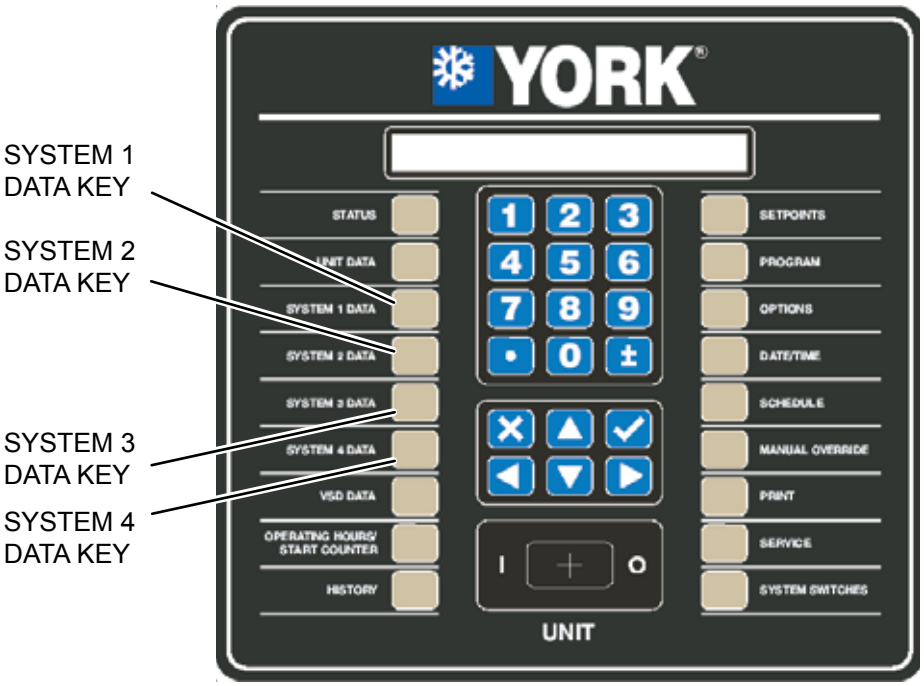
The types of remote control are listed as follows:

- NONE - No remote control is actively controlling the chiller; however, remote monitoring by a remote device may still be active.
- RCC - A Remote Control Center is providing remote control. The chiller is in remote mode.
- ISN - YorkTalk via ISN. The chiller in remote mode.
- CURR - Remote Current Limiting is enabled.
- TEMP - Remote Temperature Reset is enabled.
- SOUND - Remote Sound Limiting is enabled.

The ▼ key press displays the power absorbed of compressor and fan in system 1 and system 2.

SYS 1	COMP KW = XXX.X,	FAN KW = XXX.X
SYS 2	COMP KW = XXX.X,	FAN KW = XXX.X

SYSTEM DATA KEYS 1 THROUGH 4



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General

The data keys provide the user with many displays of individual system temperatures, pressures, and other operating data. These keys have multiple displays, which can be seen by repeatedly pressing the SYSTEM DATA or the ▲ or ▼ keys. An explanation of each key and its messages is provided below.

System 1 Data Key Operation

The SYSTEM 1 DATA key provides the user with access to System 1 operating parameters. The following is a list of the data in the order in which it appears.

The first key press of the SYSTEM X DATA key displays all of the measured system pressures (oil and discharge).

```
SYS 1 PRESSURES          OIL = XXXX PSIG
                    DISCHARGE = XXXX PSIG
```

The second key press of the SYSTEM DATA key or the ▼ key displays system suction and condenser liquid pressure.

```
SYS 1 PRESSURES       SUCTION = XXXX PSIG
                CONDENSER LIQUID = XXXX PSIG
```

The ▼ key press displays system oil and discharge temperatures.

```
SYS 1 TEMPERATURES
                      DISCHARGE = XXX.X °F
```

The ▼ key press displays system condenser liquid temperature, liquid line subcooling and saturated discharge temperature on the liquid line.

```
SYS 1 CONDENSER LIQUID TEMP = XXX.X °F
SUBCOOLING = XXX.X  SAT TEMP = XXX.X °F
```

The ▼ key press displays discharge temperature, discharge superheat and saturated discharge pressure at the compressor.

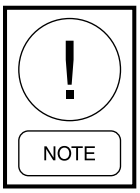
```
SYS 1 DISCHARGE          TEMP = XXX.X °F
SUPERHEAT = XXX.X    SAT TEMP = XXX.X °F
```

The ▼ key press displays the System 1 Suction Temp. Suction Superheat and Saturated Suction Temp.

```
SYS 1 SUCTION TEMP       TEMP = XXX.X °F
SUPERHEAT = XXX.X °F  SAT TEMP = XXX.X °F
```

The ▼ key press displays the System 1 motor thermistor temperatures.

SYS 1 MOTOR TEMPS	T1 = XXX.X °F
T2 = XXX.X °F	T3 = XXX.X °F



If any motor temp sensor is being ignored, (selectable under Unit Set-up Mode), that sensor's value will be displayed as XXXXX.

The ▼ key press displays the compressor speed in % (0 to 100%) and the compressor heater status (ON or OFF)

SYS 1 COMPRESSOR	SPEED = XXX.X %
	HEATER = XXX

The ▼ key press indicates the flash tank level low/high and the economizer valve % open.

SYS 1	FLASH TANK LEVEL = XXXX
	ECONOMIZER VALVE = XXX.X %

The ▼ key press displays the condenser liquid line subcooling and the drain valve position.

SYS 1	CONDENSER SUBCOOLING = XXX.X °F
	CONDENSER DRAIN VALVE = XXX.X %

The ▼ key press displays the suction superheat and the opening of the "Flash Tank Drain Valve."

SYS 1	SUCTION SUPERHEAT = XXX.X °F
	FLASH TANK DRAIN VALVE = XXX.X %

The ▼ key press indicates the number of condenser fans steps that are enabled (1 to 4), if the fans are not operating on a VSD.

SYS 1	CONDENSER FANS ON = X

If the fans are controlled by an optional VSD, the display will indicate fan speed signal control voltage to the VSD and the fan speed (0 to 100%).

SYS 1	CONDENSER FANS ON = X
	VSD FAN SPEED = XX.X V = XXX %

The ▼ key press will indicate the state of the optional VI solenoids where XXX indicates ON or OFF.

SYS 1	VI STEP SOLENOID 1 = XXX
	VI STEP SOLENOID 2 = XXX

The ▼ key press displays the system run time in days, hours, minutes and seconds.

SYS 1 RUN TIME			
XX DAYS	XX HOURS	XX MINUTES	XX SECONDS

The ▼ key press indicates the status of the RUN Relay where XXX is ON or OFF, the status of the RUN Permissive signal (flow switch/remote start/stop circuit 2 and 15 of 1TB, SYS 1, or 2 and 16 of 1TB, SYS 2) and whether the internal software is telling the system to run (ON or OFF).

SYS 1 RUN SIGNALS	RELAY = XXX
RUN PERM = XXX	SOFTWARE = XXX

System 2 Data Key Operation

System 2 keys function the same as the SYSTEM 1 DATA key except that it displays data for System 2.

On a 2 compressor system, the SYSTEM 3 and SYSTEM 4 data keys will display the following messages:

SYS 3 DATA NOT AVAILABLE

SYS 4 DATA NOT AVAILABLE

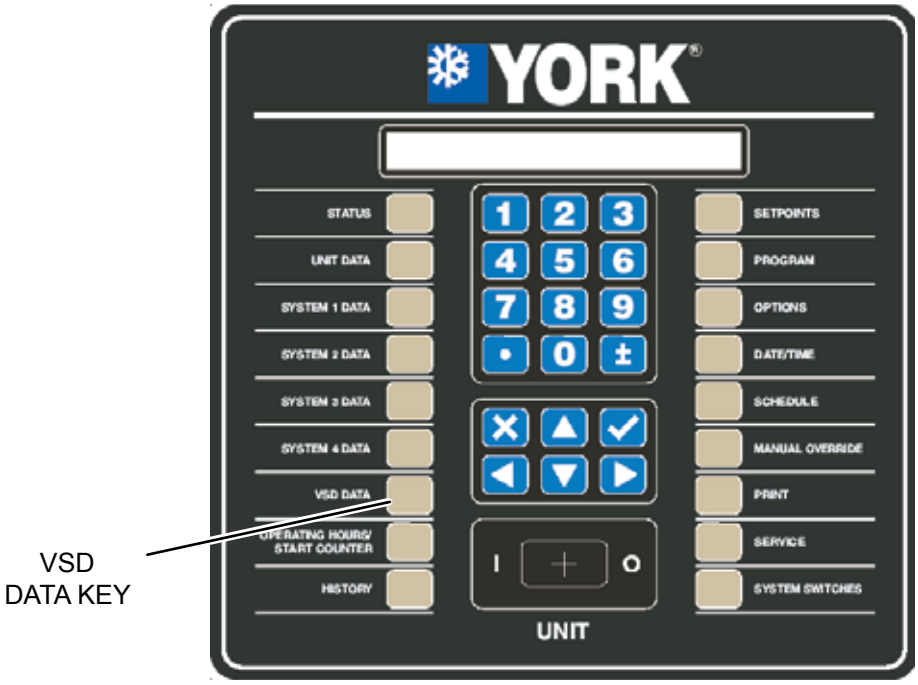
Sensor Displays

Sensor table lists all the sensors attached to the control board associated with system data keys. The minimum and maximum values displayed on the micro display are provided. If values exceed the limits in the table, a < (less than) or > (more than) sign will be display along with the minimum or maximum value.

TABLE 11 - SENSOR MIN / MAX OUTPUTS

SYSTEM SENSOR			
SENSOR / INPUT	**TYPE**	**MINIMUM VALUE**	**MAXIMUM VALUE**
Suction Pressure	Transducer	0.0 PSIG	125.0 PSIG
Condenser Liquid Pressure	Transducer	0.0 PSIG	400.0 PSIG
Discharge Pressure	Transducer	0.0 PSIG	400.0 PSIG
Oil Pressure	Transducer	0.0 PSIG	400.0 PSIG
Flash Tank Level	Switch	Low	High
Condenser Liquid Temp	Thermistor	-4.1 °F (-20.06 °C)	155.6 °F (68.67°C)
Leaving Chilled Liquid Temp	Thermistor	-19.1 °F (-28.49°C)	110.2 °F (43.44°C)
Return Chilled Liquid Temp	Thermistor	-19.1 °F (-28.49°C)	110.2° F (43.44°C)
Suction Temp	Thermistor	-19.1° F (-28.49°C)	110.2° F (43.44°C)
Ambient Air Temp	Thermistor	-4.6 °F (-20.33°C)	137.9° F (58.83°C)
Compressor Motor Temp	Thermistor	-30.2 °F (-34.56°C)	302.0° F (150.00°C)
Discharge Temp	Thermistor	40.3 °F (4.61°C)	302.6 °F (150.33°C)
Remote Temp Reset	4 to 20ma, 0 to 10 VDC, 0 to 20ma or 2 to 10VDC	0%	100%
Remote Current Limit	4 to 20ma, 0 to 10 VDC, 0 to 20ma or 2 to 10VDC	0%	100%
Remote Sound Limit	4 to 20ma, 0 to 10VDC, 0 to 20ma or 2 to 10VDC	0%	100%

VSD DATA KEY



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8

General

The VSD DATA key provides the user with displays of VSD temperatures, voltages, currents, and other operating data. This key has multiple displays, which can be seen by repeatedly pressing the VSD DATA or the ▲ or ▼ keys. An explanation of each message is provided below.

VSD Data Key Operation

The first VSD DATA key press displays the actual VSD Output Frequency and Command Frequency.

```
VSD  FREQUENCY        ACTUAL = XXX.X HZ
                      COMMAND = XXX.X HZ
```

The second key press of the VSD DATA key or the ▼ key displays the calculated compressor % FLA and measured motor currents in amps for systems 1 and 2. When measuring motor current keep in mind that measuring inverter PWM current is difficult and meter error can be significant.

```
VSD  COMP  1 = XXX  AMPS        = XXX %FLA
     COMP  2 = XXX  AMPS        = XXX %FLA
```

The ▼ key press displays the current limit values set locally on the panel under the PROGRAM key, remotely by an ISN, and remotely by the Current Limit input. Any current limits that are inactive will display XXX instead of a numeric value.

```
VSD  CURRENT  LIMIT      LOCAL = XXX %FLA
BAS = XXX                REMOTE = XXX %FLA
```

The ▼key press displays DC Bus voltage.

```
VSD        DC  BUS  VOLTAGE = XXX  VDC
```

The ▼ key press displays the Control Panel/VSD Internal Ambient Temperature and VSD Cooling Pump/ Fan Status. YYY will indicate ON or OFF.

```
VSD      INTERNAL  AMBIENT  TEMP = XXX.X °F
          COOLING SYSTEM STATUS = YYY
```

The ▼ key press displays the IGBT highest baseplate temperature.

```
VSD  IGBT  BASEPLATE  TEMPS  T1 = XXX °F
                            T2 = XXX °F
```

The ▼ key press displays the state of the Pre charge signal, where XXX is either ON or OFF.

VSD PRECHARGE SIGNAL = XXX

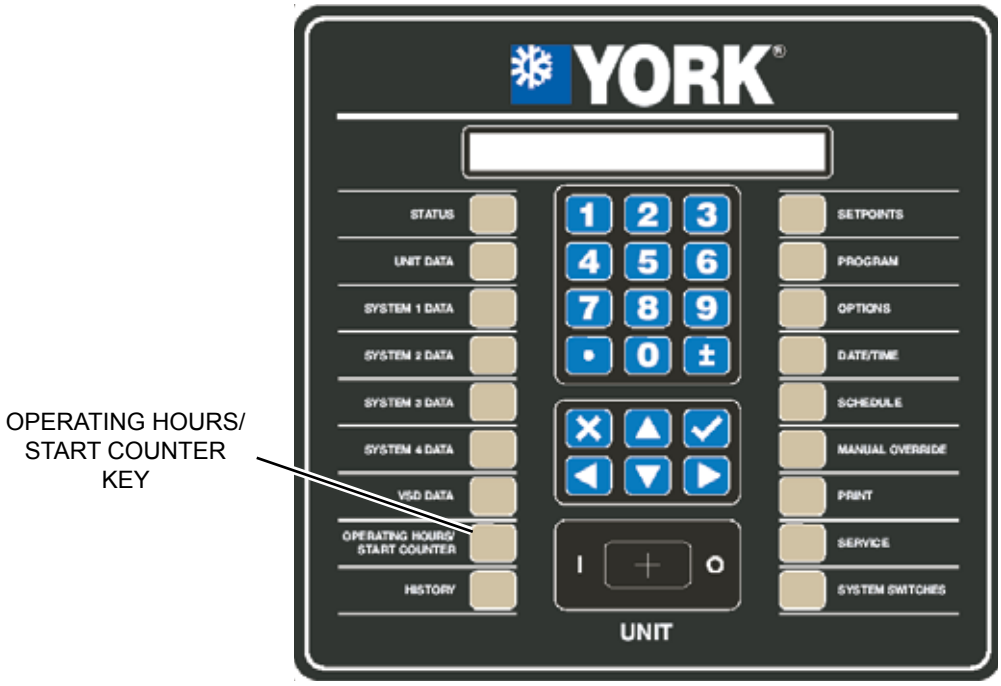
The ▼ key press displays the setting of the VSD's 105% FLA overload potentiometer for Compressor #1 and 2. The settings are determined by the adjustment of the overload potentiometers on the VSD Logic Board. These pots are factory set and should not require changing unless the circuit board is replaced. See *Table 12 below* for factory settings.

VSD COMP 1 MOTOR OVERLOAD = XXX AMPS
COMP 2 MOTOR OVERLOAD = XXX AMPS

TABLE 12 - SENSOR MIN / MAX OUTPUTS COMPRESSOR MOTOR OVERLOAD SETTINGS

		380V-60HZ		400V-50HZ		460V-60HZ (see note 1)	
MODEL		SYS # 1	SYS # 2	SYS # 1	SYS # 2	SYS # 1	SYS # 2
50/60 HZ TONS	50/60 HZ KW	OVERLOAD SETTING	OVERLOAD SETTING	OVERLOAD SETTING	OVERLOAD SETTING	OVERLOAD SETTING	OVERLOAD SETTING
YAGK0200	YAGK0700	338	338	338	338	283	283

OPERATING HOURS / START COUNTER KEY



Compressor operating hours and compressor starts are displayed with a single key press. The maximum value for both hours and starts is 99,999, at which point they will roll over to 0. A single display is available under this key and is displayed below

```
HOURS 1=XXXXX,  2=XXXXX
START 1=XXXXX,  2=XXXXX
```

History Key Operation

The HISTORY key provides the user access to many unit and system operating parameters captured at the instant a unit or system safety (fault) shutdown occurs. The history buffer will also capture system data at the time of normal shutdowns such as cycling shutdowns. When the HISTORY key is pressed the following screen is displayed:

```
HISTORY          CHOOSE HISTORY TYPE
◄ ►     XXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The ◄ and ► keys allow choosing between NORMAL SHUTDOWNS and FAULT SHUTDOWNS. Fault shutdowns provide information on safety shutdowns, while Normal shutdowns provide chiller cycling information on temperature (demand), cycling, remote, system switch, and so on, shutdowns that are non-safety related shutdowns. Once the selection is made, the ✓ (ENTER) key must be pressed to enter the selection.

Normal Shutdowns History

If the NORMAL SHUTDOWNS History is selected, the following screen will be displayed:

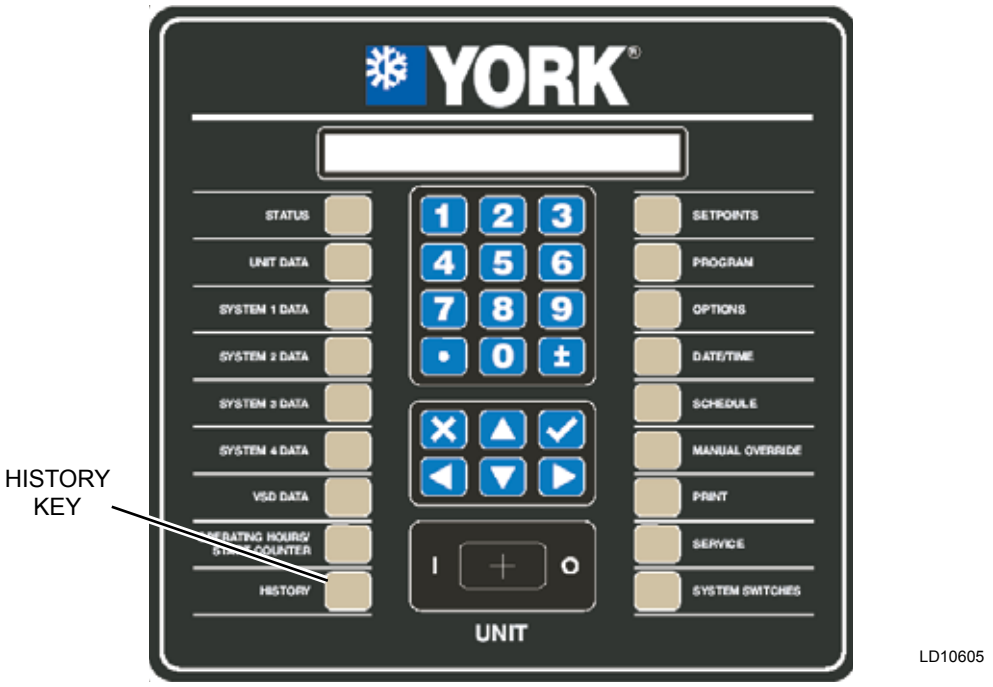
```
NORM HIST XX  18-JUN-20004 10:34:58 AM
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

XX is the normal shutdown number. The display will provide date and time of the shutdown and the reason for the cycling shutdown (YYY….).

The free cooling mode shall be considered a running state and the following normal shutdowns will be logged to history (excluding system switches):

- Daily Schedule Shutdown
- Unit Switch OFF
- Remote Controlled Shutdown
- Flow Switch
- Run Permissive
- Capacity Control

HISTORY KEY



History Key Operation

The HISTORY key provides the user access to many unit and system operating parameters captured at the instant a unit or system safety (fault) shutdown occurs. The history buffer will also capture system data at the time of normal shutdowns such as cycling shutdowns. When the HISTORY key is pressed the following screen is displayed:

```
HISTORY          CHOOSE HISTORY TYPE
◄ ►    XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The ◄ and ► keys allow choosing between NORMAL SHUTDOWNS and FAULT SHUTDOWNS. Fault shutdowns provide information on safety shutdowns, while Normal shutdowns provide chiller cycling information on temperature (demand), cycling, remote, system switch, and so on, shutdowns that are non-safety related shutdowns. Once the selection is made, the ✓ (ENTER) key must be pressed to enter the selection.

Normal Shutdowns History

If the NORMAL SHUTDOWNS History is selected, the following screen will be displayed:

```
NORM HIST XX  18-JUN-20004 10:34:58 AM
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

XX is the normal shutdown number. The display will provide date and time of the shutdown and the reason for the cycling shutdown (YYY….).

The free cooling mode shall be considered a running state and the following normal shutdowns will be logged to history (excluding system switches):

- Daily Schedule Shutdown
- Unit Switch OFF
- Remote Controlled Shutdown
- Flow Switch
- Run Permissive
- Capacity Control

The operator can view any of the stored 20 single display normal shutdown history buffers. History buffer number 1 provides the most recent shutdown information and buffer number 20 is the oldest safety shutdown information saved. The ◄ and ► keys allow scrolling between each of the history buffers. The ► key scrolls to the next normal history shutdown and the ◄ key scrolls to the previous normal history shutdown.

The following display will typically be displayed on a normal shutdown due to shutdown on lack of cooling demand.

```
NORM HIST XX  18-JUN-20004 10:34:58 AM
SYS X COOLING DEMAND SHUTDOWN
```

Fault Shutdowns History

If the FAULT SHUTDOWNS History is selected, the following screen will be displayed:

```
FAULT HIST XX  18-JUN-20004 10:34:58 AM
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

XX is the FAULT HISTORY shutdown number. The display will provide the date, time, and a description of the specific type of fault that occurred (YYY….).

The operator can view any of the stored 10 fault history buffers. History buffer number 1 provides the most recent safety shutdown information and buffer number 10 is the oldest safety shutdown information saved. The ◄ and ► keys allow scrolling between each of the FAULT HIST buffers 1 through 10. The ▲ and ▼ keys can be used to scroll forwards and backwards through the data in a specific history buffer, once it is displayed.

There is a large amount of data provided under each history. Rather than scroll sequentially through the data in a history, which is possible using the ▼ key, the use of a combination of the ◄, ►, ▲, and ▼ keys allows fast scrolling to specific data the user desires to view. To use this feature, the user needs to be aware the ◄ and ► keys allow scrolling to the top of the data subgroups. Once a specific history is selected, the history data is divided under the subgroups of Unit Data, VSD Data, System Data, Hours/Starts, Setpoints, Options, and Program data. The ◄ and ► keys allow moving to the first display under the next or previous subgroup at any time. Once the first display of a subgroup is displayed, the ▲, and ▼ keys allow scrolling though the data in the subgroup. The ▼ key allows scrolling though the data from first to last. When the last piece of data is displayed, the next press of the ▼ key scrolls to the first piece of data in the next subgroup. The ▲ key allows going to the previous display.

Listed below is a description of the fault data displays and their meaning. Data will be displayed in a specific order starting with the Status Display (System Faults only), Fault Display, All Fault Display, Unit Data, VSD Data, System Data, Operating Hours/Starts, Setpoints, Options, and Program Values at the time of the fault.

Status Fault Type

```
SYS X COMPRESSOR RUNNING
SYS X YYYYYYYY HIGH DIFF OIL PRESSURE
```

This message indicates the type of system fault. This screen is skipped if a UNIT Fault caused the shutdown.

Unit Fault Type

```
UNIT FAULT
LOW AMBIENT TEMP
```

This message indicates the type of unit fault. This screen is skipped if a SYSTEM Fault caused the shutdown.

All Fault Data

```
FAULT HIST XX  ALL FAULTS ZZ OF WW
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

The ALL FAULT display indicates whether a fault is occurring while the unit is shutting down on another fault.

If a control panel fault occurred while the unit is shutting down on a VSD fault before it is reset, the control panel fault is an ALL FAULT of the VSD fault.

If another VSD fault occurs while the unit is shutting down on a VSD fault, the next VSD fault will be registered as an ALL FAULT of the VSD fault.

If a VSD fault occurs during the ramp down shutdown of a control panel fault, the VSD fault is registered as a new fault, not an ALL FAULT.

XX is the history number, YYY is the ALL FAULT description, ZZ is the ALL FAULT number and WW is the total number of All Faults for the current history. Sometimes, multiple faults may occur during the shutdown and multiple displays will be observed when scrolling through the data using the ▼ key. In most cases, the ALL FAULT display will indicate NONE. The ALL FAULT display will only indicate the cause of the fault. No additional chiller information will be displayed under the ALL FAULT, since a snapshot of all chiller data was taken at the time of the first fault.

Unit Data

Evaporator Leaving and Entering Chilled Liquid Temperatures

```
UNIT CHILLED LIQUID LEAVING = XXX.X °F
                    ENTERING = XXX.X °F
```

This message indicates the leaving and entering chilled liquid temperatures at the time of the fault.

Ambient Air Temperature

```
UNIT
 OUTSIDE AMBIENT AIR TEMP = XXX.X °F
```

This message indicates the ambient air temperature at the time of the fault.

Load / Unload Timers

```
UNIT          LOAD TIMER = XXX SEC
            UNLOAD TIMER = XXX SEC
```

This message indicates remaining time on the load and unload timers at the time of the fault.

Chilled Liquid Temperature Error and Rate of Change

```
UNIT          TEMP ERROR = XXX.X °F
                    RATE = XXX.X °F/M
```

This message indicates the temperature error between the actual and the programmed setpoint at the time of the fault and the rate of temperature change.

Programmed Lead System Selection and Flow Switch Status

```
UNIT   LEAD SYSTEM NUMBER = X
            FLOW SWITCH = XXX
```

This message indicates the designated lead system at the time of the fault and whether the flow switch was ON (Closed) or OFF (Open) at the time of the fault.

Evaporator Pump and Evaporator Heater Status

```
UNIT          EVAP PUMP RUN = XXX
              EVAP HEATER = XXX
```

This message indicates the status of the evaporator pump and the evaporator heater at the time of the fault. XXX indicates ON or OFF.

Active Remote Control Status

```
UNIT ACTIVE REMOTE CONTR0L = XXXXXX
```

This message indicates whether the system was operating under Active Remote Control (RCC, ISN, LOAD, TEMP, or SOUND) or standard control (NONE) at the time of the fault.

```
UNIT SOUND LIMIT      LOCAL = XXX %
          ISN = XXX   REMOTE = XXX %
```

This message indicates that sound limiting was in effect, the amount, and whether it was local or remotely limited.

VSD Data

VSD Actual and Command Frequency

```
VSD FREQUENCY      ACTUAL = XXX.X HZ
                   COMMAND = XXX.X HZ
```

This message indicates the VSD actual operating frequency and the command frequency at the time of the fault. Actual and command may not match due to load/unload timers, limitation of 1 Hz per load/unload increment, and to allowable acceleration/deceleration of the motor.

Compressor Amps and %FLA

The message indicates the compressor %FLA and motor currents for systems 1 and 2 at the time of the fault.

```
COMP 1  = XXX AMPS        = XXX %FLA
COMP 2  = XXX AMPS        = XXX %FLA
```

VSD Current Limit

```
VSD CURRENT LIMIT  LOCAL = XXX %FLA
BAS = XXX          REMOTE = XXX %FLA
```

This message displays the current limit values as set locally, by an ISN, or a remote current limiting input at the time of the fault.

DC BUS Voltage

```
VSD            DC BUS VOLTAGE = XXX VDC
```

This message displays the DC Bus voltage at the time of the fault.

VSD Internal Ambient Temp

```
VSD      INTERNAL AMBIENT TEMP = XXX.X °F
         COOLING SYSTEM STATUS = YYY
```

This message displays the VSD/Microprocessor internal ambient cabinet temperature and the cooling system status (ON or OFF) at the time of the fault.

IGBT Baseplate Temperature

```
VSD IGBT BASEPLATE TEMPS T1 = XXX °F
                         T2 = XXX °F
```

This message displays the IGBT highest baseplate temperature for 2 and 3 compressor units at the time of the fault. 4 compressor units display temperatures for 1/3 (T1) and 2/4 (T2).

Pre charge Signal Status and VSD Cooling Status

```
VSD      PRECHARGE SIGNAL = XXX
```

This display provides the state of the pre charge signal, where XXX is either ON or OFF at the time of the fault.

Compressor #1 and #2, 105% FLA Motor Overload Current Setting

```
VSD      COMP 1 MOTOR OVERLOAD = XXX AMPS
         COMP 2 MOTOR OVERLOAD = XXX AMPS
```

This message displays the setting of the VSD's 100% FLA potentiometer for Compressor #1 and #2 at the time of the fault.

System Data

System #1 Pressures

```
SYS 1 PRESSURES          OIL = XXXX PSIG
                  DISCHARGE = XXXX PSIG
```

This message displays the measured system oil and discharge pressures at the time of the fault.

```
SYS 1 PRESSURES     SUCTION = XXXX PSIG
           CONDENSER LIQUID = XXXX PSIG
```

This message displays the measured system suction and condenser liquid line pressure at the time of the fault.

System # 1 Temperatures

```
SYS 1 TEMPERATURE
                  DISCHARGE = XXX.X °F
```

This message displays the measured system oil and discharge temperatures at the time of the fault.

```
SYS 1 CONDENSER LIQUID TEMP = XXX.X °F
SUBCOOLING = XXX.X   SAT TEMP = XXX.X °F
```

This message displays the condenser liquid, liquid line subcooling and saturated discharge temperatures at the time of the fault.

```
SYS 1 DISCHARGE          TEMP = XXX.X °F
SUPERHEAT = XXX.X    SAT TEMP = XXX.X °F
```

This message displays the system discharge, discharge superheat and saturated discharge temperatures at the time of the fault.

System #1 Motor Temperatures

```
SYS 1 MOTOR TEMPS        T1 = XXX.X °F
      T2 = XXX.X         T3 = XXX.X °F
```

This message displays the System 1 motor thermistor temperatures at the time of the fault.

Compressor Speed and Heater Status

```
SYS 1 COMPRESSOR      SPEED = XXX.X %
                   HEATER = XXX.X °F
```

This message indicates the compressor speed in % and the heater status at the time of the fault.

Flash Tank Level and Economizer Position

```
SYS 1          FLASH TANK LEVEL Y 512 ADC
               ECONOMIZER VALVE = XXX.X %
```

This message displays the flash tank level and the economizer valve position in % at the time of the fault.

Condenser Subcooling and Condenser Drain Valve Position

```
SYS 1     CONDENSER SUBCOOLING = XXX.X °F
          CONDENSER DRAIN VALVE = XXX.X %
```

This message displays the condenser subcooling and the Condenser Drain Valve position at the time of the fault.

Condenser Fans

```
SYS 1                    CONDENSER FANS ON = X
                    VSD FAN SPEED XX.X V = XXX %
```

This message displays the number of condenser fans ON or the optional VSD fan control speed signal to the inverter and the % of full speed.

VI Step Solenoid

```
SYS 1                    VI STEP SOLENOID 1 = XXX
                         VI STEP SOLENOID 2 = XXX
```

This message displays whether the VI solenoids were ON or OFF at the time of the fault.

Compressor #1 Run Time

```
SYS 1 RUN TIME
XX DAYS XX HOURS XX MINUTES XX SECONDS
```

This message displays the system run time since the last start in days, hours, minutes, and seconds at the time of the fault.

System #1 Run Signals

```
SYS 1 RUN SIGNALS              RELAY = XXX
 RUN PERM = XXX              SOFTWARE = XXX
```

This message displays the System Run Signal Relay (Relay Output Board) status, Run Permissive Input status, and the Internal Software (microprocessor command) ON/OFF Start status. The status of each will indicate either ON or OFF.

System 2 Data

Data for the system 2 at the time of the fault is displayed in the same sequence as the system #1 data.

Compressor Operating Hours and Starts

```
HOURS 1=XXXXX, 2=XXXXX
START 1=XXXXX, 2=XXXXX
```

This message displays compressor operating hours and compressor starts at the time of the fault.

Chilled Liquid Setpoint Cooling Setpoints

```
SETPOINTS
LOCAL COOLING SETPOINT     = XXX.X °F
```

This message displays the programmed cooling setpoint at the time of the fault.

```
SETPOINTS
LOCAL CONTROL RANGE        = +/- X.X °F
```

This message displays the programmed Control Range at the time of the fault.

Remote Setpoint and Range

```
SETPOINTS REMOTE SETPOINT = XXX.X °F
    REMOTE CONTROL RANGE = +/- X.X °F
```

This message displays the remote setpoint and Control Range at the time of the fault.

Maximum Remote Temperature Setpoint

```
SETPOINTS
MAXIMUM REMOTE TEMP RESET = XXX.X °F
```

This message displays the maximum remote reset programmed at the time of the fault.

Options

Display Language

```
OPTIONS          DISPLAY LANGUAGE
◄ ►        XXXXXXXXXXXXXXXXXXX
```

This message displays the language selected at the time of the fault.

Chilled Liquid Cooling Mode

```
OPTIONS          CHILLED LIQUID COOLING MODE
◄ ►              WATER COOLING
```

This message displays the chilled liquid temperature mode (water or glycol) selected at the time of the fault.

Local / Remote Control Mode

```
OPTIONS          CHILLED LIQUID COOLING MODE
◄ ►              GLYCOL COOLING
```

This message indicates whether Local or Remote Control Mode was selected at the time of the fault.

```
OPTIONS    LOCAL / REMOTE CONTROL MODE
◄ ►        XXXXXXXXXXXXXXXXXXX
```

When Remote Control Mode is selected, control of the Chilled Liquid Setpoint is from a remote device such as an ISN/BAS controller.

Display Units Mode

```
OPTIONS   DISPLAY UNITS
◄ ►       XXXXXXXXXXXXXXXXXXX
```

This message indicates whether SI (°C, Barg) or Imperial units (°F, PSIG) was selected at the time of the fault.

System Lead/Lag Control Mode

```
OPTIONS   LEAD / LAG CONTROL MODE
◄ ►       XXXXXXXXXXXXXXXXXXX
```

This message indicates the type of lead lag control selected at the time of the fault. Three choices are available:

- Automatic
- Sys 1 Lead
- Sys 2 Lead

The default mode will be AUTOMATIC.

Remote Temperature Reset

```
OPTIONS          REMOTE TEMP RESET INPUT
◄ ►                              XXXXXXXX
```

This message indicates whether temperature reset was active or disabled at the chiller keypad at the time of the fault and if active, the type of reset signal selected.

If this option is not factory enabled, the option will not appear.

Remote Current Reset

```
OPTIONS          REMOTE CURRENT LIMIT INPUT
◄ ►                            XXXXXXXXXXX
```

This message indicates whether remote current reset was active or disabled at the chiller keypad at the time of the fault and if active, the type of reset signal selected.

If this option is not factory enabled, the option will not appear.

Remote Sound Limit Selection

```
OPTIONS          REMOTE SOUND LIMIT INPUT
◄ ►                            XXXXXXXXXXX
```

This message indicates whether remote sound limit was active or disabled at the chiller keypad at the time of the fault and if active, the type of reset signal selected.

If this option is not factory enabled, the option will not appear.

Program Values

Suction Pressure Cutout

```
PROGRAM
SUCTION PRESSURE CUTOUT  = XXX.X PSIG
```

This message indicates the he suction pressure cutout programmed at the time of the fault.

Low Ambient Cutout

```
PROGRAM
LOW  AMBIENT TEMP CUTOUT = XXX.X °F
```

This message displays the low ambient temp cutout programmed at the time of the fault.

Low Leaving Chilled Liquid Temp Cutout

```
PROGRAM
 LEAVING LIQUID TEMP CUTOUT = XXX.X °F
```

This message displays the low leaving chilled liquid temperature cutout programmed at the time of the fault.

Motor Current Limit

```
PROGRAM
MOTOR CURRENT LIMIT        = XXX %FLA
```

This message indicates the motor current limit programmed at the time of the fault.

Pulldown Current Limit

```
PROGRAM
PULLDOWN CURRENT LIMIT    = XXX %FLA
```

This message indicates the pulldown current limit programmed at the time of the fault.

Pulldown Current Limit Time

```
PROGRAM
PULLDOWN CURRENT LIMIT TIME   = XXX MIN
```

This message indicates the pulldown current limit time programmed at the time of the fault.

Condenser Subcooling Setpoint

```
PROGRAM
SUBCOOLING SETPOINT                = XXX.X °F
```

This message indicates the liquid subcooling setpoint programmed at the time of the fault.

Sound Limit Setpoint

```
PROGRAM
SOUND LIMIT SETPOINT      = XXX %
```

This indicates the sound limit setpoint programmed at the time of the fault. If this option is not factory activated, the display will not appear.

Unit ID Number

```
PROGRAM
REMOTE UNIT ID NUMBER     = X
```

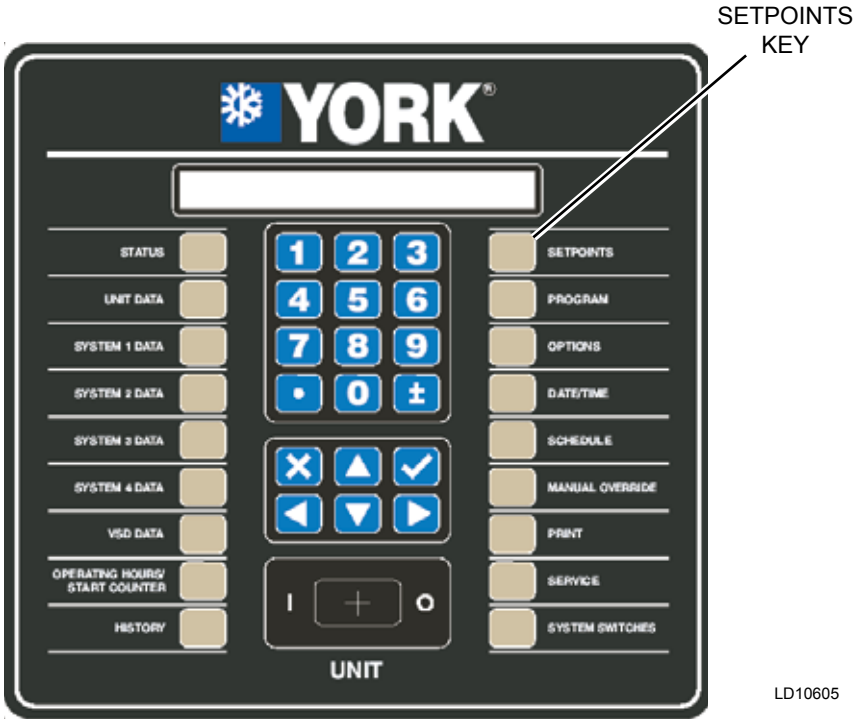
This indicates the unit ID # programmed at the time of the fault.

Motor Temperature Unload

```
PROGRAM ◄DEF XXXXX LO XXXXX HI XXXXX
MOTOR TEMPERATURE UNLOAD        = XXX °F
```

This message indicates the motor temperature programmed at the time of the fault.

SETPOINTS KEY



Setpoints Key Operation

Cooling setpoints and ranges may be programmed by pressing the SETPOINTS key. The first setpoint entry screen will be displayed as shown below. The first line of the display will show the chiller default (DEF), minimum acceptable value (LO) and maximum acceptable value (HI). The second line shows the actual programmed value. *"Table 13 - Setpoint Limits" on page 130* shows the allowable ranges for the cooling setpoints and Control Ranges. Note that the Imperial units are exact values while the Metric units are only approximate.

```
SETPOINTS  ◄DEF XXXXX LO XXXXX HI XXXXX
LOCAL COOLING SETPOINT     = XXX.X °F
```

Pressing the SETPOINTS key a second time or the ▼ key will display the leaving chilled liquid Control Range, default, and low/high limits.

```
SETPOINTS  ◄DEF XXXXX LO XXXXX HI XXXXX
LOCAL CONTROL RANGE     = +/- X.X °F
```

Pressing the SETPOINTS key or the ▼ key a third time will display the remote setpoint and cooling range. This display automatically updates about every 2 seconds. This remote setpoint message is show below:

```
SETPOINTS REMOTE SETPOINT = XXX.X °F
    REMOTE CONTROL RANGE = +/- X.X °F
```

If there is no remote setpoint being utilized, the remote setpoint value will be displayed as XXXXXX and the remote Control Range will display XXX.

Pressing the SETPOINTS key or the Arrow key a fourth time will bring up a screen that allows the Maximum Remote Temperature Reset to be programmed. This message is show below:

```
SETPOINTS  ◄DEF XXXXX LO XXXXX HI XXXXX
MAXIMUM REMOTE TEMP RESET   = XXX.X °F
```

The values displayed under each of the key presses may be changed by keying in new values and pressing the ✓ (ENTER) key to store the new value into memory. Where more than one value may be keyed in on a display, a portion of the data that does not need updating may be skipped by pressing the ✓ (ENTER) key. The ✓ (ENTER) key must also be pressed after the last value in the display to store the data into memory.

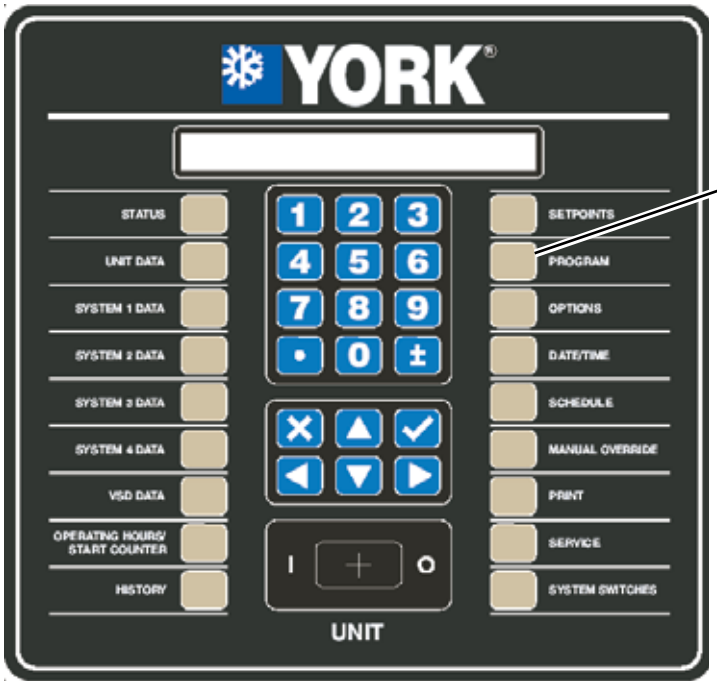
The ▲ key allows scrolling back through the setpoints displays.

The minimum, maximum, and default values allowed under the SETPOINTS key are provided in *"Table 13 - Setpoint Limits" on page 130*.

TABLE 13 - SETPOINT LIMITS

PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Leaving Chilled Liquid Setpoint	Water Cooling	40.0°F	70.0°F	44.0°F
		4.4°C	21.1°C	6.7°C
	Glycol Cooling	0°F	70.0°F	44.0°F
		-17.8°C	21.1°C	6.7°C
Leaving Chilled Liquid Control Range	-	1.5°F	2.5°F	2.0°F
		0.8°C	1.4°C	1.1°C
Maximum Remote Temperature Reset	-	2°F	40°F	20°F
		1°C	22°C	11°C

PROGRAM KEY



Program Key Operation

Various operating parameters are programmable by the user. These are modified by pressing the PROGRAM key and then the ✓ (ENTER) key to enter Program Mode. A list of the limits of the programmable values is found below. Note that the Imperial units are exact values, while Metric units are only approximate.

The ▲ and ▼ keys are used to scroll through the user programmable values. A value may be changed by keying in the new value and pressing the ✓ (ENTER) key to store the new value in memory. The cursor will be displayed on the screen when a number key is pressed. The first line of each message will indicate the chiller default (DEF) value, lowest acceptable programmable value (LO), and highest acceptable programmable value (HI). The user programmable value is programmed ON in the second line of the message.

When the PROGRAM key is first pressed, the following display will appear indicating the user is in the program mode:

```
PROGRAM MODE XXXX
PRESS ENTER KEY TO CONTINUE
```

Pressing the ✓ (ENTER) key again will display the first programmable selection.

Suction Pressure Cutout

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
SUCTION PRESSURE CUTOUT   = XXX.X PSIG
```

The suction pressure cutout protects the chiller from a low refrigerant condition. It also helps protect from a freeze-up due to low or no chilled liquid flow. However, it is only a back-up for a flow switch and cannot protect against an evaporator freeze under many conditions. This cutout is programmable and should generally be programmed for 24 PSIG (1.65 Barg) for chilled water cooling.

The cutout is programmable between 24.0 and 36.0 PSIG (1.65 and 2.48 Barg) in the Water Cooling mode and 5.0 and 36.0 (0.34 and 2.28 Barg) in the Glycol Cooling mode. The default value for both modes will be 24.0 PSIG (1.65 Barg) PSIG.

Low Ambient Cutout

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
LOW AMBIENT TEMP CUTOUT   = XXX.X °F
```

The low ambient temp cutout allows programming the outdoor temperature at which it is desired to shut down the chiller to utilize other methods of cooling.

The cutout is programmable between –2.0°F (-18.9°C) and 50°F (10.0 C) with a 25°F (-3.9°C) default.

Low Leaving Liquid Temp Cutout

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
LEAVING LIQUID TEMP CUTOUT = XXX.X °F
```

The leaving chilled liquid temp cutout is programmed to avoid freezing the evaporator due to excessively low chilled liquid temperatures. The cutout is automatically set at 36°F (2.2 °C) in the Water Cooling mode and is programmable in the Glycol Cooling mode. In the Glycol Cooling Mode, the cutout is programmable from 11.0°F to 36.0°F (-11.7 to 2.2°C) with a default of 36.0°F (2.2°C).

Motor Current Limit

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
MOTOR CURRENT LIMIT      = XXX % FLA
```

The motor current limit %FLA is programmable. This allows the microprocessor to limit a system before it faults on high current. Typically, the limit point is set at 100%. The unload point is programmable from 30 to 100% with a default of 103%.

Pulldown Current Limit

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
PULLDOWN CURRENT LIMIT      = XXX % FLA
```

The pulldown current limit %FLA is programmable. This allows the microprocessor to limit a system on pulldown limiting for the purpose of peak time energy savings. Typically, the limit point is set at 100%. The pulldown limit point is programmable from 30 to 100% with a default of 100%. Be aware when using pulldown motor current limit, the chiller may not be able to load to satisfy temperature demand

Pulldown Current Limit Time

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
PULLDOWN CURRENT LIMIT TIME      = XXX MIN
```

The pulldown current limit time is programmable. This allows the microprocessor to limit a system on pulldown limiting for a defined period of time for the purpose of peak time energy savings. The pulldown limit point is programmable from 0 to 255 minutes, with a default of 0 minutes.

Subcooling Setpoint

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
SUBCOOLING SETPOINT                = XXX.X °F
```

The liquid subcooling superheat setpoint is programmable from 0.0 to 20.0°F (0.0 to 11.1°C) with a 5.0°F (2.8°C) default. Typically the subcooling control will be programmed for 5.0 °F.

Sound Limit Setpoint

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
SOUND LIMIT SETPOINT      = XXX %
```

The sound limit setpoint is programmable from 0 to 100 % with a 0% default. 0% allows operating up to the full speed capability of the unit with no sound limiting. Typically the sound limit control setting will be programmed for 0 % unless sound limiting is utilized on the chiller. Sound limiting will only permit the unit to run to a frequency less than the maximum speed capability of the unit. Programming a value of 1% would be the minimum sound limiting that can be programmed and 100% will be the maximum. 100% will only allow the unit speed to operate at the minimum frequency. Usually, the sound limit % will be programmed somewhere between 0 and 100% according the limiting needed to satisfy the sound requirements of the site. Typically, sound limiting will be utilized in areas sensitive to noise during night-time hours. The sound limit display will only be present if the sound limit option is programmed at the factory.

Motor Temperature Unload

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
MOTOR TEMPERATURE UNLOAD      = XXX °F
```

The motor temperature unload is programmable from 150.0° F (65.6° C) to 250.0° F (121.1° C). The default value is 240.0° F (115.5° C). The programmed temperature assures the micro will sense a rise in motor temperature due to a lack of compressor cooling. If the temperature rises above the programmed threshold, the system will unload the compressor by reducing speed. An unload temperature of 240.0° F (115.5° C) is recommended to assure the system does provides maximum capacity.

Default Values

A listing of the low limits, high limits, and default values for each of the programmable values is noted in each display and can be found in *Table 14 on Page 133* below. Note that the Imperial units are exact values while the Metric units are only approximate.

Unit ID Number

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
REMOTE UNIT ID NUMBER = X
```

For purposes of remote communications, multiple chillers may be connected to an RS-485 communications bus. To allow communications to each chiller, a chiller ID number may be programmed into memory. On a single chiller application, the value will be 0.

Suction Superheat

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
SUCTION SUPERHEAT SETPOINT =  = XX.X °F
```

The Suction Superheat is programmable from 8.0°F /4.4°C to 12.0°F / 6.6°C, the default is 10.0°F / 5.6°C. The Suction Superheat programmable setting is used to control the Flash Tank Drain Valve. When actual superheat is higher than the programmable setting, the Flash Tank Drain Valve will open, vice versa. The opening of the valve depends on the gap between actual suction superheat and the programmable setting.

TABLE 14 - PROGRAMMABLE OPERATING PARAMETERS

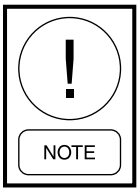
PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Suction Pressure Cutout	Water Cooling	24.0 PSIG	36.0 PSIG	24.0 PSIG
		1.65 Bars	2.48 Bars	1.65 Bars
	Glycol Cooling	0.0 PSIG	36.0 PSIG	24.0 PSIG
		0.0 Bars	2.48 Bars	1.65 Bars
Low Ambient Temp. Cutout	-	-2.0°F	50.0°F	25.0°F
		-18.9°C	10.0°C	-3.9°C
Leaving Chilled Liquid Temp. Cutout	Water Cooling	-	-	36.0°F
		-	-	2.2°C
	Glycol Cooling	-5.0°F	36.0°F	36.0°F
		-20.6°C	2.2°C	2.2°C
Motor Current Limit	-	30% FLA	103% FLA	103% FLA
Pulldown Motor Current Limit	-	30% FLA	100% FLA	100% FLA
Pulldown Motor Current Limit Time	-	0 Min	255 Min	0 Min
Condenser Subcooling Setpoint	-	0.0°F	20.0°F	5.0°F
		0.0°C	11.1°C	2.8°C
Sound Limit Setpoint	Sound Limit Option Enabled	0%	100%	0%
Motor Temperature Unload	-	150.0°F	250.0°F	240.0°F
		65.6°C	121.1°C	115.5°C
Suction Superheat Setpoint	York	8.0°C / 4.4°F	12.0°F / 6.6°C	10.0°F / 5.6C
Input Current Limit	Input Current Limit	100 Amps	Min (2000 Amps, Input Current Range Programmed)	500 Amps
Unit ID Number	-	0	7	0

SERIAL NUMBER PROGRAMMING

When changing a Chiller Control Board, a Chiller Control Board EPROM, or if a situation occurs where a chiller is not programmed from the factory, the chiller serial number will need to be programmed into the chiller. The serial number is the actual serial number displayed on the unit Data Plate. The serial number will be in a format similar to 0000RANX000000, where the first 4 are number followed by 4 characters of letter and the next 6 are numbers again. The lack of a serial number programmed into the panel will not prevent a chiller from operating. The STATUS display will inform the operator a serial number problem exists by displaying the following message:

```
UNIT WARNING:          INVALID SERIAL NUMBER
ENTER UNIT SERIAL NUMBER
```

If the following message appears, immediately contact Johnson Controls Product Technical Support. The appearance of this message may also mean the chiller has lost important factory programmed information and may need to be reprogrammed. Additional STATUS messages can be viewed by pressing the STATUS key repetitively to enable the technician to view any other messages that may be preventing the chiller from operating.



Changing the programming of this feature requires the date and time to be set on the chiller prior to programming. The password is also time sensitive and must be used on the date used to calculate the password.

Unit serial number entry mode will allow the programming of all the fields that make up the unit's serial number. These will either be programmed at the factory or by service personnel on the job. This mode may be entered by pressing the PROGRAM key, entering the unit serial number entry mode password (7562), and pressing ENTER.

"Table 15 - Serial Number Field" on page 134 lists the serial number fields that can be programmed in this mode.

TABLE 15 - SERIAL NUMBER FIELD

UNIT SERIAL NUMBER FIELD	LOW LIMIT	HIGH LIMIT	DEFAULT
Unit serial number position 1-4	0	9999	0000
Unit serial number position 5	0	Z	R
Unit serial number position 6	0	Z	A
Unit serial number position 7	0	Z	N
Unit serial number position 8	0	Z	X
Unit serial number position 9-11	0	999	O
Unit serial number position 12-14	0	999	O

```
S/N ENTRY UNIT S / N = PPPPYYYYXXXZZZ
UNIT SERIAL NUMBER POS 1-4 = PPPP
```

Key in the number (0 through 9) or letter (A through Z) in this position by using ◄ or ► and press the ✓ (ENTER) key, press the ▼ key to scroll to next position, and following message will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 5
◄ ►            Y
```

Key in the number (0 through 9) or letter (A through Z) in this position by using ◄ or ► and press the ✓ (ENTER) key, press the ▼ key to scroll to next position, and following message will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 6
◄ ►            Y
```

Key in the number (0 through 9) or letter (A through Z) in this position by using ◄ or ► and press the ✓ (ENTER) key, press the ▼ key to scroll to next position, and following message will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 7
◄ ►            Y
```

Key in the number (0 through 9) or letter (A through Z) in this position by using ◄ or ► and press the ✓ (ENTER) key, press the ▼ key to scroll to next position, and following message will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 8
◄ ►            Y
```

Key in the number (0 through 9) or letter (A through Z) in this position by using ◄ or ► and press the ✓ (ENTER) key, press the ▼ key to scroll to next position, and following message will appear:

```
S/N ENTRY UNIT S / N = PPPPYYYYXXXZZZ
UNIT SERIAL NUMBER POS 9-11 = XXX
```

Key in the number (0 through 9) or letter (A through Z) in this position by using ◄ or ► and press the ✓ (ENTER) key, press the ▼ key to scroll to next position, and following message will appear:

```
S/N ENTRY UNIT S / N = PPPPYYYYXXXZZZ
UNIT SERIAL NUMBER POS 12-14 = ZZZ
```

If the first four characters of the Unit Serial Number are all equal to 0, then only the remaining ten characters will be displayed on the screen and in the print data.

At this point, the letters entered for the YYYY and XXX inputs should now appear in the top line of the display and should match the first 7 characters of the serial number on the unit Data Plate. The next three digits of the serial number should now be keyed in (ZZZ). Press the ✓ (ENTER) key to store the input. The full serial number should now be displayed across the top of the display and the cursor should disappear.

Press the STATUS key to go to the next STATUS display to determine if additional Status messages are preventing the chiller from operating.

TABLE 16 - UNIT SETUP PROGRAMMABLE VALUES

SETUP MODE VALUE	LOW LIMIT	HIGH LIMIT	DEFAULT
Sys 1 Number of Cond Fans	4	14	6
Sys 2 Number of Cond Fans	4	14	6
Compressor 1 Operating Hours	0	99,999	0
Compressor 2 Operating Hours	0	99,999	0
Compressor 1 Starts	0	99,999	0
Compressor 2 Starts	0	99,999	0
Clear History Buffers	No	Yes	-
Remote Temp Reset Option	Disabled	Enabled	Disabled
Remote Current Limit Option	Disabled	Enabled	Disabled
Sound Limit Option	Disabled	Enabled	Disabled
Remote Inputs Service Time Standard	5 Min.	60 Min.	15 Min.
Remote Inputs Service Quick Start	15 Sec.	3600 Sec.	900 Sec.
Condenser Fan Control Free Cooling Enabled OPT VSD	Opt VSD	Opt VSD	Opt VSD
Sys 1 Compressor Displacement CTS70=187, CTS51=128, CTS45=100, CTS36=82, or CTS24=62	Cts24	Cts70	--
Sys 2 Compressor Displacement CTS70=187, CTS51=128, CTS45=100, CTS36=82, or CTS24=62	Cts24	Cts70	--
Maximum Compressor Speed	170.0 Hertz	210.0 Hertz	180.0 Hertz
Minimum Running Speed	50 Hertz	100 Hertz	50 Hertz
Sys 1 Motor Sensor To Ignore None, Temp Sensor T1, Temp Sensor T2, Temp Sensor T3	None	Temp Sensort3	None
Sys 2 Motor Sensor To Ignore None, Temp Sensor T1,Temp Sensor T2, Temp Sensor T3	None	Temp Sensort3	None
Fan Speed Multiplier 50 HZ PIN 52=M 1.11, 60 HZ PIN 52=M 1.05, 50/60 HZ PIN 52=V 1.00, 60 HZ PIN 52=K 0.86, 50 HZ PIN 52=K 0.83	50 Hz Pin 52= K 0.83	50 Hz Pin 52= M 1.11	50/60 Hz Pin 52= V 1.00
Sys 1 Cond EEV Multiplier	1.0 %/°F .6 %/C	5.0 %/°F 2.8 %/C	3.0 %/°F 1.7 %/C
Sys 2 Cond EEV Multiplier	1.0 %/°F .6 %/C	5.0 %/°F 2.8 %/C	3.0 %/°F 1.7 %/C
Sys 1 Cond EEV Time Interval	1 Sec	3 Sec	2 Sec
Sys 2 Cond EEV Time Interval	1 Sec	3 Sec	2 Sec
Sys 1 Cond EEV Divisor Standard	2 Hz/%	5 Hz/%	5 Hz/%
Sys 1 Cond EEV Divisor Quick Start	2 Hz/%	20 Hz/%	5 Hz/%
Sys 2 Cond EEV Divisor Standard	2 Hz/%	5 Hz/%	5 Hz/%
Sys 2 Cond EEV Divisor Quick Start	2 Hz/%	20 Hz/%	5 Hz/%
Sys 1 VI Differential Temp Setpoint	60.0 °F	90.0 °F	73.0 °F
	33.3 °C	50.0 °C	40.6 °C
Sys 2 VI Differential Temp Setpoint	60.0 °F	90.0 °F	73.0 °F
	33.3 °C	50.0 °C	40.6 °C
VI Deadband	2.0 °F	10.0 °F	4.0 °F
	1.1 °C	5.5 °C	2.2 °C
VI Differential Temp Setpoint Offset	2.0 °F	40.0 °F	20.0 °F
	1.1 °C	22.2 °C	11.1 °C
Sys 1 Maximum Fan Speed %	50 %	100 %	100 %

TABLE 17 - UNIT SET-UP PROGRAMMABLE VALUES (CONT'D)

SETUP MODE VALUE	LOW LIMIT	HIGH LIMIT	DEFAULT
Sys 2 Maximum Fan Speed %	50 %	100 %	100 %
Sys 1 Minimum Fan Speed %	0 %	50 %	0 %
Sys 2 Minimum Fan Speed %	0 %	50 %	0 %
Sys 1 Min Discharge Suction Diff	50 Psid	300 Psid	80 Psid
	3.45 Bard	20.69 Bard	5.52 Bard
Sys 2 Min Discharge Suction Diff	50 Psid	300 Psid	80 Psid
	3.45 Bard	20.69 Bard	5.52 Bard
*Free Cooling Control (DISABLED, OPEN LOOP, CLOSED LOOP)	Disabled	Closed Loop	Disabled
Remote Evaporator Control	Disabled	Enabled	Disabled
Condenser Type	Microchannel	Round Tube	Microchannel
Sys 1 Evaporator Level Control Setpoint	20.0%	80.0%	50.0%
Sys 2 Evaporator Level Control Setpoint	20.0%	80.0%	50.0%
Evaporator Level Control Valve Startup Position	5%	95%	30%
Evaporator Level Control Startup Delay	0 Minutes	10 Minutes	3 Minutes
Voltage Code 380, 400, 460	380	460	460
Fan Type	Low Noise	High Air Flo	Low Noise
Quick Start	Disabled	Enabled	Disabled
Discharge Pressure Cutout	275 Psig	325 Psig	325 Psig
Condenser Drain Valve Control	Standard	Optimized	Optimized
Soft Shutdown	Disabled	Enabled	Enabled
Anti-Recycle Timer	30 Sec	120 Sec	30 Sec
Economizer Transition Remote Evaporator Enabled	10.0 %	40.0 %	20.0 %
Update Software from SD Card	Disabled	Enabled	Disabled
Data Log to SD Card (OFF, ON, SKIP UNCHANGED)	Off	Skip Unchanged	Off
Serial Data Logging	Disabled	Enabled	Disabled
Serial Data Logging Timer	1	30	1
Skip Freq 1	Disable	Able	Disable
Skip Freq 1 Low Limit	51	205	56
Skip Freq 1 High Limit	57	68	68
Skip Freq 2	Disable	Able	Disable
Skip Freq 2 Low Limit	70	208	88
Skip Freq 2 High Limit	89	100	100
Input Current Limiting	Disable	Able	Disable
Refrigerant Type			R-134a

*NOTE: This value can only be changed when the unit switch is off.

UNIT SETUP MODE

Unit Setup Mode will allow the programming of all programmable values that the user should never change. These will either be programmed at the factory or by service personnel on the job. These values will also need to be checked when changing a Chiller Control Board or EPROM.

This mode may be entered by pressing the PROGRAM key, entering the password 4245, and pressing the ✓(ENTER) key. See "*Table 16 - Unit Setup Programmable Values" on page 136* for a list of values that can be programmed in this mode. Details relating to the actual message follow the table.

The following messages will be displayed for the Unit Setup Mode in the order they appear. The first group of displays relates to setup parameters that relate to unit configuration and factory setpoints.

```
SETUP MODE  ◄ DEF XXXXX LO XXXXX HI XXXXX
SYS 1 NUMBER OF COND FANS          = X
```

```
SETUP MODE  ◄ DEF XXXXX LO XXXXX HI XXXXX
SYS 2 NUMBER OF COND FANS          = X
```

```
SETUP MODE  ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 1 OPERATING HOURS             = XXXXX
```

```
SETUP MODE  ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 2 OPERATING HOURS             = XXXXX
```

```
SETUP MODE  ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 1 STARTS                      = XXXXX
```

```
SETUP MODE  ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 2 STARTS                      = XXXXX
```

The following setup display is selectable as YES or NO using the ◄ and ► keys.

```
SETUP MODE  CLEAR HISTORY BUFFERS?
◄ ►         XXXXXXXXXXXXXXXXXXXXXXX
```

The following (3) setup OPTION displays are selectable as ENABLED or DISABLED using the ◄ and ► keys according to the options installed on the chiller:

```
SETUP MODE  REMOTE TEMP RESET OPTION
◄ ►         XXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE  REMOTE CURRENT LIMIT OPTION
◄ ►         XXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE  SOUND LIMIT OPTION
◄ ►         XXXXXXXXXXXXXXXXXXXXXXX
```

The following setup OPTION display is selectable as ENABLED or DISABLED using the ◄ and ► keys:

```
SETUP MODE  ◄ DEF XXXXX LO XXXXX HI XXXXX
REMOTE INPUTS SERVICE TIME         = XX MIN
```

The following setup OPTION display allows programming of the type of fan control installed. This includes DISABLED (contactor fan control), STD, VSD (standard VSD) or OPT VSD (optimized) VSD). Only DISABLED and OPT VSD should be used based on whether VSD fan control is installed.

```
SETUP MODE  CONDENSER FAN CONTROL
            XXXXXXXXXXXXXXXXXXXXXXXXX
```

The Compressor Displacement Setup option displays the compressor type installed in the respective circuits. This must be programmed per the compressor data plate information to assure the control algorithms to cycle fans, perform correctly. The following are selectable using the ◄ and ► keys:

- CTS70 = 187
- CTS51 = 128
- CTS45 = 100
- CTS36 = 82
- CTS24 = 62

```
SETUP MODE SYS 1 COMPRESSOR DISPLACEMENT
            XXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE SYS 2 COMPRESSOR DISPLACEMENT
            XXXXXXXXXXXXXXXXXXXXXXX
```

The following setup OPTION display programs the Maximum Compressor Speed of the chiller. This must be programmed based on the PIN number (model number) on the chiller data plate. See PIN numbers 39, 40 and 41 in *"Table 5 - Complete Pin Number Description" on page 53.*

```
SETUP MODE ◄ DEF XXXXX  LO  XXXXX  HI  XXXXX
MAXIMUM COMPRESSOR SPEED   =   XXX.X HZ
```

The following setup OPTION display programs the Minimum Compressor Speed of the chiller. This is normally programmed for 50 Hz.

```
SETUP MODE ◄ DEF XXXXX  LO  XXXXX  HI  XXXXX
MINIMUM RUNNING SPEED   =   XXX HZ
```

The following Motor Temp Sensor OPTION displays are selectable as ENABLED or DISABLED using the ◄ and ► keys. The choices are:

- NONE (default)
- TEMP SENSOR 1

- TEMP SENSOR 2
- TEMP SENSOR 3

```
SETUP MODE   SYS 1 MOTOR SENSOR TO IGNORE
◄ ►          XXXXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE   SYS 2 MOTOR SENSOR TO IGNORE
◄ ►          XXXXXXXXXXXXXXXXXXXXXXXXX
```

If a motor temperature sensor fails, a single sensor may be ignored by making a program change in the Unit Setup Mode. The default setting is NONE, indicating all sensors are being monitored.

The Fan Speed Multiplier Option displays the multiplier programmed. The multiplier is based on the type of fan installed based on PIN 52 of the chiller data plate and the type of power (50 Hz or 60 Hz) applied to the chiller. The options are selectable using the ◄ and ► keys and are listed along with the display as follows:

- 50Hz PIN 52 = M 1.11
- 60Hz PIN 52 = M 1.05
- 50/60 Hz PIN 52 = V 1.00 (default)
- 60Hz PIN 52 = K 0.86
- 50Hz PIN 52 = K 0.83

```
SETUP MODE   FAN SPEED MULTIPLIER
◄ ►          XXXXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 COND EEV MULTIPLIER    = X.X %/°F
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 COND EEV MULTIPLIER  = X.X %/°F
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 COND EEV TIME INTERVAL= XX SEC
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 COND EEV TIME INTERVAL= XX SEC
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 COND EEV DIVISOR    = XX HZ/%
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 COND EEV DIVISOR    = XX HZ/%
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 VI DIFF TEMP SETPOINT = XX.X °F
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 VI DIFF TEMP SETPOINT = XX.X °F
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
VI DEADBAND          = XX.X °F
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
VI DIFF TEMP OFFSET      = XX.X °F
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 MAXIMUM FAN SPEED    = XXX %
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 MAXIMUM FAN SPEED    = XXX %
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 MINIMUM FAN SPEED    = XXX %
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 MINIMUM FAN SPEED    = XXX %
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 MIN DISCHARGE SUCT DIF= XX PSID
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 MIN DISCHARGE SUCT DIF= XX PSID
```

```
SETUP MODE   FREE COOLING   CONTROL
◄ ►      XXXXXXXXXXXXXXXXXXXXXXXXXXX
```

XXX = DISABLED, OPEN LOOP or CLOSED LOOP selectable via the ◄ and ► keys when the Unit Switch is off.

```
SETUP MODE  REMOTE EVAP CONTROL
◄ ►   XXXXXXXXXXXXXXXXXXXXXXXXXXX
```

XXX = DISABLED or ENABLED selectable via the ◄ and ► keys.

```
SETUP MODE  CONDENSER TYPE
◄ ►   XXXXXXXXXXXXXXXXXXXXXXXXXXX
```

XXX = MICROCHANNEL or ROUND TUBE selectable via the ◄ and ► keys.

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 1 EVAP LEVEL SETP = XX.X
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
SYS 2 EVAP LEVEL SETP = XX.X
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
EVAP VLV STARTUP POS = XX %
```

```
SETUP MODE   ◄DEF XXXXX LO XXXXX HI XXXXX
EVAP VLV START DELAY = XX MIN
```

```
SETUP MODE  VOLTAGE CODE
◄ ►       XXX V
```

XXX = 380 V, 400 V, 460 V, selectable via ◄ and ► keys.

```
SETUP MODE  FAN TYPE
◄ ►       XXXXXXXXXXXXX
```

XXX = LOW NOISE, ULTRA QUIET, HIGH AIR FLO, selectable via ◄ and ► keys.

```
SETUP MODE  QUICK START UNIT OPERATION
◄ ►       XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

XXX = DISABLED or ENABLED selectable via the ◄ and ► keys.

```
SETUP MODE    ◄DEF XXXXX LO XXXXX HI XXXXX
DISCHARGE PRESSURE CUTOUT  = XXX PSIG
```

```
SETUP MODE  CONDENSER EEV CONTROL
◄ ►       XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

XXX = OPTIMIZED or STANDARD selectable via the ◄ and ► keys when Condenser Type is Microchannel.

```
SETUP MODE  UNIT SOFT SHUTDOWN OPERATION
◄ ►       XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

XXX = DISABLED or ENABLED selectable via the ◄ and ► keys when Quick Start is enabled.

```
SETUP MODE  DATA CENTER OPERATION
◄ ►       XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

XXX = DISABLE OR ENABLE selectable via the ◄ or ► keys when a range of frequency need to be skipped due to vibration, 2 ranges can be set as SKIP FREQ 1 and SKIP FREQ 2, set the range by defining the low limit and high limit.

```
SETUP MODE  UPDATE SOFTWARE FROM SD CARD
◄ ►       XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The selection may be made for DISABLE or ENABLE when selecting ENABLE and copying the new file into the IPUII flash memory, the unit switch must be off. Press Enter to confirm, the Message below will displayed, immediately. Do not reset or power down the IPUII hardware until the update is finished.

```
FLASH CARD UPDATE
PLEASE WAIT . . . . . .
```

After the software is finished updating, the new software and database will be started with an automatic board reboot. If there was an error, the following display will appear with the error code and no reboot will occur.

```
FLASH CARD UPDATE
ERROR          XXXXX
```

FLASH CARD UPDATE	
ERROR CODE	**DEFINITION**
0	Okay
10	Flash card not found.
11	SOFTWARE.BIN file not found.
14	SOFTWARE.BIN file larger than expected.
15	RAM to IPU Flash transfer of DATABASE.BIN failed.
16	RAM to IPU Flash transfer of SOFTWARE.BIN failed.
17	Could not allocate sufficient memory to read or write file.
99	internal software error.

Data Log to Flash Card

The choices for this option are ON/OFF/SKIP UNCHANGED (Does not log unchanged data)

```
SETUP MODE                DATA LOG TO SD CARD
◄ ►       XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE                SERIAL DATA LOGGING
◄ ►       XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

When serial data logging is enabled, the baud rate shall be 19200.

```
SETUP MODE  ◄  DEF XXXXX LO XXXXX HI XXXXX
SERIAL          DATA LOGGING TIMER = XX SEC
```

```
SETUP MODE                  SKIP FREQ 1
◄ ►                       XXXXXXXXXXX
```

```
SETUP MODE    ◄DEF  XX    LO  XX    HI  XXX
SKIP FREQ 1   LOW LIMIT             = XXHZ
```

```
SETUP MODE    ◄DEF  XX    LO  XX    HI  XX
SKIP FREQ 1   HIGH LIMIT            = XXHZ
```

```
SETUP MODE                  SKIP FREQ 2
◄ ►                       XXXXXXXXXXX
```

```
SETUP MODE      ◄DEF XX     LO X      HI XXX
SKIP FREQ 2     LOW LIMIT             = XXHZ
```

```
SETUP MODE      ◄DEF XXX    LO XX     HI XXX
SKIP FREQ 2     HIGH LIMIT            = XXXHZ
```

```
SETUP MODE    ◄DEF XXXXX LO XXXXX HI XXXXX
ANTI RECYCLE TIMER       = XXX SECS
```

This option is available when Quick Start is enabled.

```
 SETUP MODE    INPUT CURRENT LIMITING
 ◄ ►                    DISABLE
```

```
SETUP MODE              REFRIGERANT TYPE
◄ ►                      R-134A
```

DEFAULT PROGRAMMABLE VALUES

To quickly program or reset most of the user programmable values to their default values, press PROGRAM, 6140, ENTER. The following message will then be displayed, allowing a choice to reset the operating parameters to their default values.

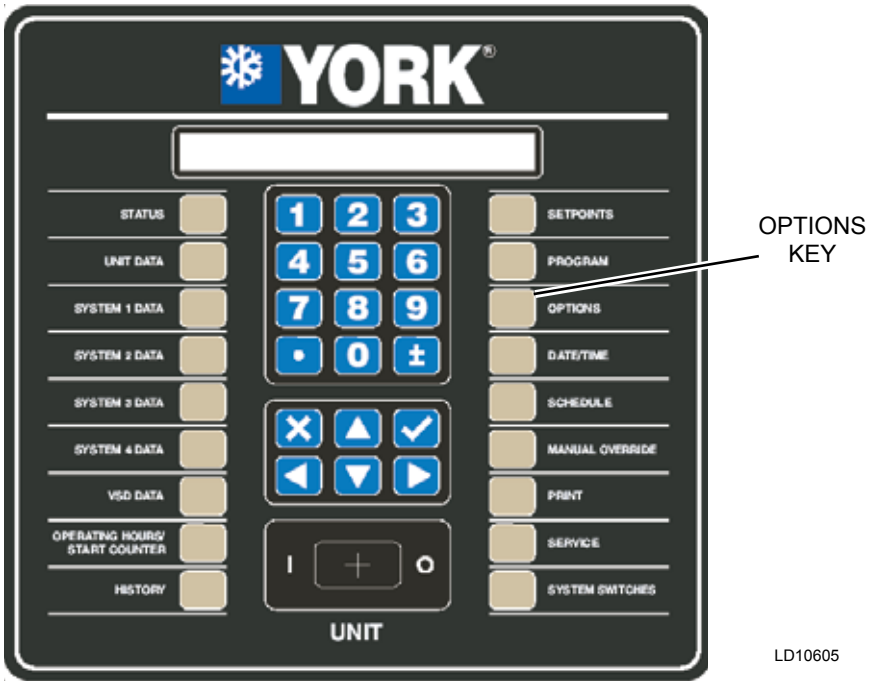
```
DEFAULTS SET PROG VALUES TO DEFAULT?
◄ ►              XXX
```

YES or NO may be selected for XXX using the ◄ and ► keys to change the selection.

Following is a list of the operating parameters that will be reset to their default values:

- Suction Pressure Cutout = 24.0 PSIG
- Low Ambient Air Temp Cutout = 25°F
- Leaving Chilled Liquid Temp Cutout = 36°F
- High Motor Current Limit = 103%
- Pulldown Current Limit = 100%
- Pulldown Current Limit Time = 0 Min.
- Subcooling Setpoint = 5°F
- Sound limit Setpoint = 0%

OPTIONS KEY



Options Key Operation

The OPTIONS key provides the user with a display of unit configuration and the capability to modify the configuration. These options can only be viewed under the OPTIONS key. To view the current options settings, press the OPTIONS key. Each press of the OPTIONS key or press of the ▲ or ▼ keys will scroll to the next option setting. The ◄ and ► keys allow changing the option choices. The ✓ (ENTER) key must be pressed after a selection is made to save the change in memory.

An explanation of each option message is provided below.

Display Language Selection

The display language can be selected for English, Italian, Polish, Hungarian, German, French, Portuguese, and Spanish.

OPTIONS	DISPLAY LANGUAGE
◄ ►	XXXXXXXXXXXXXXXXX

The default language will be English.

Chilled Liquid Cooling Mode Selection

The Chilled liquid cooling mode can be selected for Water Cooling or low temperature Glycol Cooling or Data Center.

OPTIONS	CHILLED LIQUID COOLING MODE
◄ ►	XXXXXXXXXXXXXXXXX

When Water Cooling is chosen, the chilled liquid temperature setpoint can only be programmed from 40°F to 60°F

OPTIONS	CHILLED LIQUID COOLING MODE
◄ ►	WATER COOLING

When Glycol Cooling is chosen, the chilled liquid temperature setpoint can be programmed from 15°F to 60°F.

OPTIONS	CHILLED LIQUID COOLING MODE
◄ ►	GLYCOL COOLING

When Data Center is chosen, the chilled liquid temperature setpoint can be programmed from 40°F to 70°F.

OPTIONS	CHILLED LIQUID COOLING MODE
◄ ►	DATA CENTER

The default Chilled Liquid Mode will be WATER COOLING.

Local / Remote Control Mode Selection

Local or Remote Control Mode allows the user to select the chilled liquid temperature control mode.

OPTIONS	LOCAL / REMOTE CONTROL MODE
◄ ►	XXXXXXXXXXXXXXXXX

When LOCAL CONTROL mode is selected, chilled liquid control is from the keypad of the chiller. In local mode, a remote device can read system data, but not reset operating parameters.

OPTIONS	LOCAL / REMOTE CONTROL MODE
◄ ►	LOCAL CONTROL

When REMOTE CONTROL mode is selected, control of the chilled liquid setpoint is from a remote device such as an ISN/BAS controller.

OPTIONS	LOCAL / REMOTE CONTROL MODE
◄ ►	REMOTE CONTROL

The default mode will be LOCAL CONTROL.

Display Units Selection

Imperial or SI display units may be selected for data display.

OPTIONS	DISPLAY UNITS
◄ ►	XXXXXXXXXXXXXXXXX

The user may select system operating temperatures and pressures to be displayed in either SI (°C, Barg) or Imperial units (°F, PSIG).

OPTIONS	DISPLAY UNITS
◄ ►	IMPERIAL

OPTIONS	DISPLAY UNITS
◄ ►	SI

The default mode is IMPERIAL.

System Lead/Lag Control Mode Selection

The operator may select the type of lead/lag control desired.

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	XXXXXXXXXXXXXXXXX

In most cases, automatic lead/lag will be selected. When automatic lead/lag is selected, the microprocessor will attempt to balance run time by switching the lead compressor whenever all compressors are shut OFF. If a compressor is not able to run when the microprocessor attempts a start, the microprocessor will select another compressor in an effort to control chilled liquid temperature. Manual lead/lag allows selecting a specific compressor to be the lead.

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	AUTOMATIC

The default mode will be AUTOMATIC.

Lag selections of individual systems will appear as:

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	MANUAL SYS 1 LEAD

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	MANUAL SYS 2 LEAD

Remote Temperature Reset Selection

Remote temperature reset from an external source may be tied directly into the chiller microprocessor board.

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	XXXXXXXXXXXXXXXXX

Selections may be made for DISABLED (no signal), 0 to 10VDC, 2 to 10VDC, 0 to 20ma, and 4 to 20ma.

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	DISABLED

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	2.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	4.0 TO 20.0 MILLIAMPS

The default setting for Remote Temp Reset is DISABLED. This display will only appear if the remote temperature limit option is enabled under the Unit Setup Mode.

Remote Current Limit Input Selection

Remote current limit from an external source may be tied directly into the chiller microprocessor board.

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	XXXXXXXXXXXXXXXXXXX

Selections may be made for DISABLED (no signal), 0 to 10VDC, 2 to 10VDC, 0 to 20ma, and 4 to 20ma.

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	DISABLED

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	2.0 TO 10 VOLTS DC

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	4.0 TO 20.0 MILLIAMPS

The default setting for Remote Current Reset is DISABLED. This display will only appear if the remote current limit option is enabled under the Unit Setup Mode.

Remote Sound Limit Selection

Remote sound limit from an external source may be tied directly into the chiller microprocessor board.

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	XXXXXXXXXXXXXXXXXXX

Selections may be made for DISABLED (no signal), 0 to 10VDC, 2 to 10VDC, 0 to 20ma, and 4 to 20ma.

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	DISABLED

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	2.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	4.0 TO 20.0 MILLIAMPS

The default setting for Remote Sound Limit is DISABLED. This display will only appear if the remote sound limit option is enabled under the Unit Setup Mode.

Low Ambient Cutout Enable/Disable

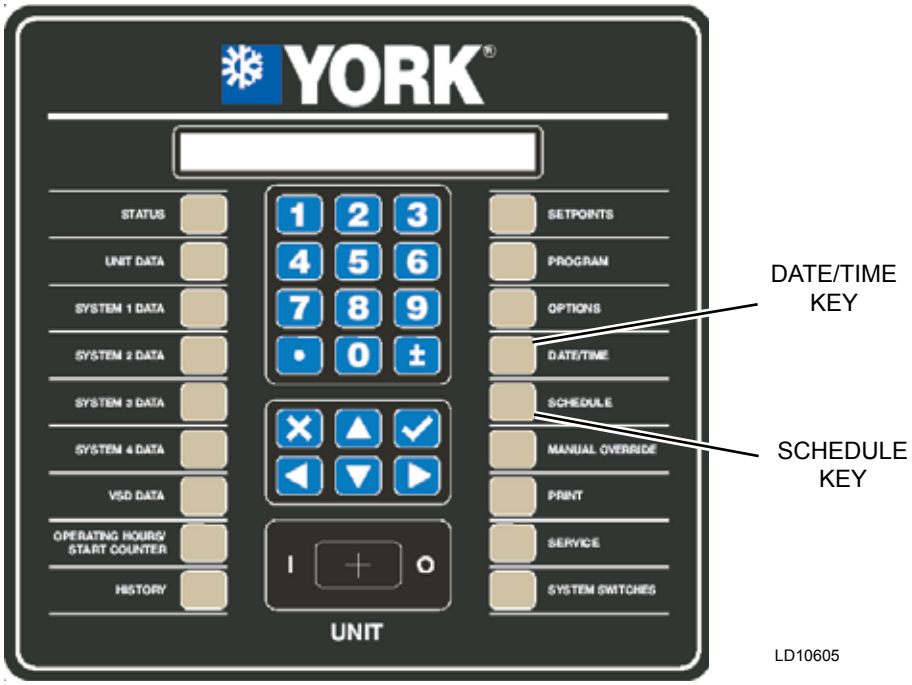
The low ambient cutout may be enabled or disabled. When enabled, the chiller will cut OFF when the low ambient cutout is reached. When disabled, the chiller will run at any temperature.

OPTIONS	LOW AMBIENT TEMPERATURE CUTOUT
◄ ►	ENABLED

OPTIONS	LOW AMBIENT TEMPERATURE CUTOUT
◄ ►	DISABLED

The default setting for the low ambient cutout will be ENABLED.

DATE/TIME AND SCHEDULE KEYS



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Date/Time Key Operation

When the DATE/TIME key is pressed, the chiller microprocessor will display the date and the time. This feature is useful and required for using the Daily Schedule. It is also a valuable tool for troubleshooting to allow a technician to determine the time of the fault, which is stored in the history memory buffers. When the DATE/TIME key is pressed, the first display screen shown below will be displayed:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
DAY OF WEEK ◄ ►              = XXX
```

Whenever any changes are made, the ✓ (ENTER) key must be pressed to store the data.

Pressing the ▲ or ▼ keys allows scrolling to the next programmed item. Pressing the ▼ key scrolls to the next item that can be programmed and the ▲ key scrolls to the previous item.

The day of the week is the first display and can be changed by pressing either the ◄ or ► key to select the day. After the day is selected, the ✓ (ENTER) key must be pressed to store the data.

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
DAY OF MONTH                 = XX
```

Pressing the ▼ key again scrolls to the day of the month:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
DAY OF MONTH                 = XX
```

The day of the month can be selected by keying in the numerical value to select the day. After the day of the month is selected, the ✓ (ENTER) key must be pressed to store the data.

NOTE

A 0 must be typed in to select dates for days of the 1st through the 9th.

Pressing the ▼ key again scrolls to month:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
MONTH ◄ ►                    = XXX
```

The month can be selected by scrolling through the months with the ◄ or ► keys. After the month is selected, the ✓ (ENTER) key must be pressed to store the data.

Pressing the ▼ key again scrolls to the year:

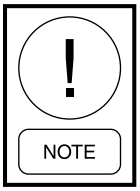
```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
YEAR                          = XXXX
```

The year can be selected by keying in the numerical value to select the year. After the year is selected, the ✓ (ENTER) key must be pressed to store the data.

Pressing the ▼ key again scrolls to the hour:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
HOUR                          = XX
```

The hour can be selected by keying in the numerical value for the hour. After the hour is selected, the ✓ (ENTER) key must be pressed to store the data.

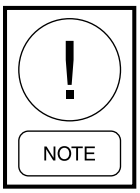


One or two 0's must be keyed in for hours 00-09.

Pressing the ▼ key again scrolls to the minute:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
MINUTE                        = XX
```

The minute can be selected by keying in the numerical value for the hour. After the minute is selected, the ✓ (ENTER) key must be pressed to store the data.



One or two 0's must be keyed in for minutes 00 through 09.

Pressing the ▼ key again scrolls to AM/PM:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
AM/PM ◄ ►                     = XX
```

AM/PM can be selected by pressing the ◄ or ► keys. After the meridian is selected, the ✓(ENTER) key must be pressed to store the data.

Pressing the ▼ key again scrolls to the time format selection:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
TIME FORMAT ◄ ►               = XXXXXXX
```

The time format may be displayed in either a 12 hour or 24 hour format. Selection can be changed by pressing the ◄ or ► keys. The ✓(ENTER) key must be pressed to store the data.

Schedule Key Operation

The Daily Schedule must be programmed for the unit start and stop times. To set the schedule, press the SCHEDULE key. The display will provide a message allowing access to 2 types of schedule information:

```
SCHEDULE      CHOOSE SCHEDULE TYPE
◄ ►           XXXXXXXXXXXXXXXXXXXXXXXX
```

The schedule types are:

- UNIT OPERATING SCHEDULE
  (Default selection)
- SOUND LIMIT SCHEDULE
  (Only if Sound Limiting is enabled by the factory when the option is installed.)

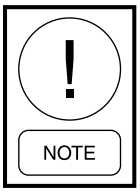
The schedule type (UNIT OPERATING SCHEDULE or SOUND LIMIT SCHEDULE) may be changed by pressing the ◄ or ► keys followed by the ✓(ENTER) key. The selection must be entered by pressing the ✓ (ENTER) key before a schedule display will appear.

Unit Operating Schedule

The Unit Operating Schedule is used to enable/disable the chiller unit on time of day. The chiller can be enabled and disabled once each day or it can be programmed to run continuously. Any time the daily or holiday schedule shuts the chiller down, the running system(s) will go through a controlled ramped shutdown. If the UNIT OPERATING SCHEDULE is selected under the CHOOSE SCHEDULE display, the following message will appear:

```
SCHEDULE      UNIT OPERATING
MON  START = 06:00 AM   STOP = 10:00 PM
```

The line under the 0 above is the cursor. If the start time is wrong, it can be changed by keying in the new time from the numeric keypad. Once the correct values for the START hour and minute are entered, press the ✓ (ENTER) key. The cursor will then move to the AM/PM selection. The meridian (AM/PM) value may be changed by the ◄ or ► keys and entered by pressing the ✓ (ENTER) key. Repeat this process for the STOP time. Once a schedule is entered, the schedule for the next day will appear. The start and stop time of each day may be programmed differently. To view the schedule without making a change, simply press the SCHEDULE key until the day you wish to view appears. The ▲ key will scroll backwards to the previous screen.



If at any time the schedule is changed for Monday, all the other days will change to the new Monday schedule. This means if the Monday times are not applicable for the whole week, then the exceptional days would need to be reprogrammed to the desired schedule.

To program the chiller for 24 hour operation, program the start and stop times of each day of the week for 00:00.

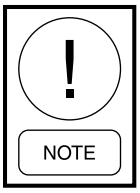
After the SUN (Sunday) schedule appears on the display, a subsequent press of the SCHEDULE or ▲ key will display the Holiday schedule. This is a two-part display. The first reads:

```
SCHEDULE      UNIT OPERATING
HOL START = 00:00 AM  STOP = 00:00 PM
```

The holiday times may be set using the same procedure as described above for the days of the week. Be sure to press the ✓ (ENTER) key after setting the START and STOP times to save the change in memory. Pressing the SCHEDULE key a second time, will display the individual days.

```
SCHEDULE      UNIT OPERATING
S M T W T F S  HOLIDAY NOTED BY *
```

The line below the empty space is the cursor and will move to the next or previous empty space when the ◄ or ► keys and pressed. To set a day for the Holiday Schedule, the cursor must be moved to the space following the day of the week. The * key is then pressed and an * will appear in the space signifying that day as a holiday. The Holiday schedule must be programmed weekly. If there is no holiday, the * key is also used to delete the *. The ✓ (ENTER) key is used to accept the holiday schedule for the entire week.



The HOLIDAY SCHEDULE is a temporary schedule. Once the schedule is executed, the selected holidays will be cleared from memory for the following week.

Sound Limit Schedule

The SOUND LIMIT SCHEDULE allows setting the day and time when the user desires using the SILENT NIGHT factory programmed option to limit chiller loading and fan operation for reduced audible noise in the surrounding area. If the SOUND LIMIT SCHEDULE is selected under the CHOOSE SCHEDULE display, the following message will appear:

```
SCHEDULE      SOUND LIMIT    = XXX %
MON  START = 06:00 AM    STOP = 10:00 PM
```

The Sound Limit option can be enabled and disabled once each day or the chiller can be set to run continuously in this mode for sound limiting whenever the chiller is operating. When sound limiting is enabled, the unit will be limited by the Sound Limit setpoint % as set under the PROGRAM key. XXX in the display above will show the Sound Limit Setpoint % programmed under the PROGRAM key. 0% will cause no speed reduction, while 100% only allows running at minimum speed.

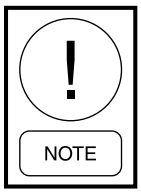
The START Time for a specific day (hour and minute) is entered using the same guidelines used for the start/stop schedules, and press the ✓ (ENTER) key to store it into memory. The cursor will then move to the AM/PM selection.

The AM/PM selection may be chosen using the ◄ or ► keys and pressing ✓ (ENTER) key to store the value.

This process is repeated for the STOP time.

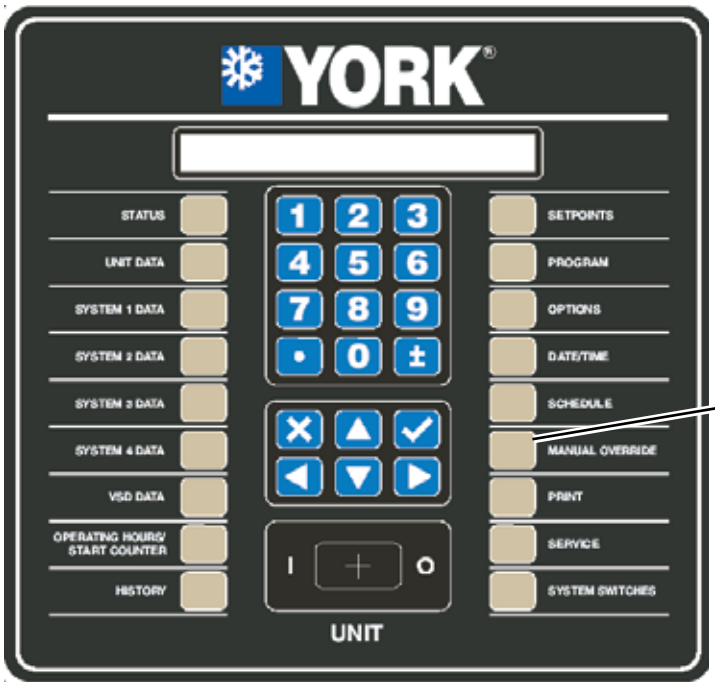
Once the schedule for a specific day is programmed and entered, the schedule for the next day will appear. The schedule for each day may be programmed the same or differently.

To view the schedule without changing it, simply press the SCHEDULE key or the ▼ key until the desired day is displayed. The ▲ key will scroll backwards to the previous screen.



If the schedule is changed for Monday, all other days will change to the Monday schedule. Be aware of this when programming.

MANUAL OVERRIDE KEY

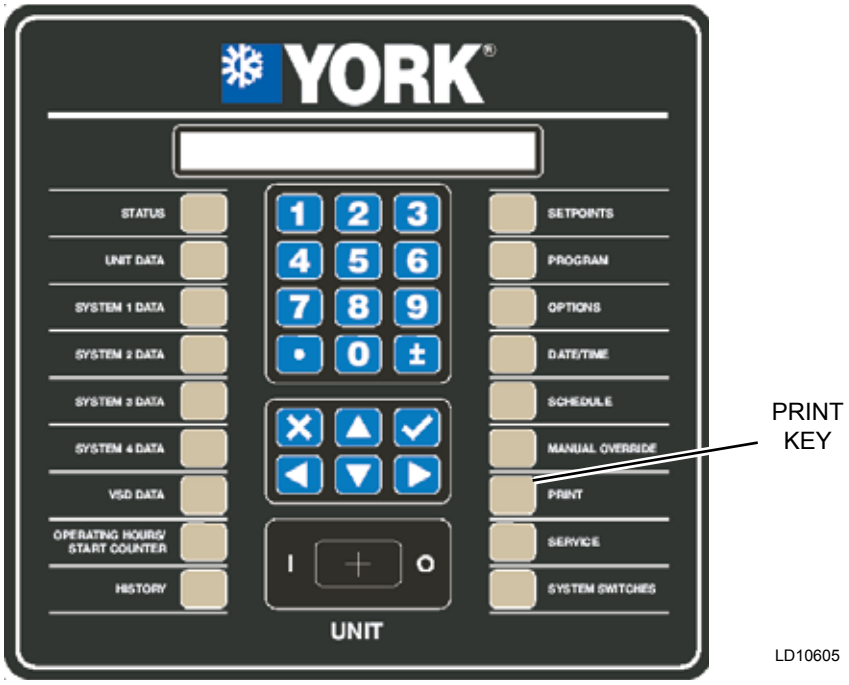


Manual Overrride Key Operation

If the MANUAL OVERRIDE key is pressed during a schedule shutdown, the STATUS display will display the message below. This indicates that the Daily Schedule is being ignored and the chiller will start when chilled liquid temperature allows, Remote Contacts, UNIT switch and SYSTEM switches permitting. This is a priority message and cannot be overridden by anti-recycle messages, fault messages, and so on, when in the STATUS display mode. Therefore, do not expect to see any other STATUS messages when in the MANUAL OVERRIDE mode. MANUAL OVERRIDE is to only be used in emergencies or for servicing. Manual override mode automatically disables itself after 30 minutes.

MANUAL OVERRIDE

PRINT KEY



Print Key Operation

The PRINT key is used to initiate a printout of current operating data (real time data), a complete history printout of all history (fault) buffers, a printout of all normal shutdowns (compressor cycling, chiller shutdown, and so on) or history (fault) data printout of a specific fault. History Buffer 1 will always be the most recent fault history printout. Printing may also be canceled by selecting the CANCEL PRINTING option. When the port is configured for BAS, the print operation will be canceled. The following message is displayed when the PRINT key is pressed.

```
PRINT  CHOOSE PRINT REPORT
◄ ►    XXXXXXXXXXXXXXXXXXXX
```

After pressing the PRINT key, the printout type is selected by pressing the ◄ or ► keys until the desired printout is displayed.

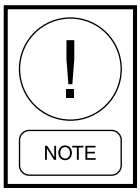
The following table shows the available printout types.

TABLE 17 - PRINTOUT TYPES

PRINTOUT TYPES
Operating Data (Default Selection)
All History Buffers
Normal Shutdowns
History Buffer 1
History Buffer 2
History Buffer 3
History Buffer 4
History Buffer 5
History Buffer 6
History Buffer 7
History Buffer 8
History Buffer 9
History Buffer 10
Cancel Printing

The specific printout is initiated by pressing the ✓ (ENTER) key.

A sample of the operating data printout is shown below. The operating data printout is a snapshot of current system operating conditions when the printout was selected. The sample shows combined printouts of 2, 3, and 4 circuit units. The actual printout will only show data for the appropriate chiller type.



Bold italic text below a line of print is not on the actual printout. Bold italic text indicates information that may not be available on all printouts or is additional information to help explain the difference in a 2, 3 or 4-circuit printout.

Operating Data Printout

SCREW CHILLER
OPERATING DATA
2:04:14 PM 30 APR 10

SYS 1
NOT RUNNING
SYS 2
COMPRESSOR RUNNING

OPTIONS

CHILLED LIQUID	WATER
LOCAL/REMOTE MODE	REMOTE
LEAD/LAG CONTROL	AUTOMATIC
REMOTE TEMP RESET	DISABLED
REMOTE CURRENT LIMIT	0 TO 10 V
REMOTE SOUND LIMIT	4 TO 20 MA
(if Sound Limiting enabled)	
LOW AMBIENT CUTOUT	ENABLED
CONDENSER TYPE	MICROCHANNEL

PROGRAM VALUES

SUCT PRESS CUTOUT	44 PSIG
LOW AMBIENT CUTOUT	25.0 DEGF
LEAVING LIQUID CUTOUT	36.0 DEGF
MOTOR CURRENT LIMIT	100 %FLA
PULLDOWN CURRENT LIMIT	100 %FLA
PULLDOWN LIMIT TIME	0 MIN
SUBCOOLING SETPOINT	12.0 DEGF
EDUCTOR DIFFERENTIAL	50.0 DEGF
EDUCTOR SAFETY TIME	1000 MIN
MOTOR TEMP UNLOAD	250.0 DEGF
UNIT ID NUMBER	0
SOUND LIMIT SETPOINT	100 %
(if Sound Limiting enabled)	
SUCTION SUPERHEAT SETUP	12.0 DEGF

UNIT DATA

LEAVING LIQUID TEMP	49.0 DEGF
RETURN LIQUID TEMP	58.2 DEGF
TEMP RATE	XXX.X DEGF/MIN
COOLING RANGE	42.0 +/- 2.0 DEGF
REMOTE SETPOINT	44.0 DEGF
AMBIENT AIR TEMP	74.8 DEGF
GLYCOL PUMP RUN	OFF
GLYCOL PUMP SPEED	XXX.X %
GLYCOL HEATER	OFF
COOLING COIL BYPASS VLV	XXX.X %
COOLING COIL VALVE	XXX.X %
COOLING COIL TEMP	XXX.X DEGF
HEAT EXCH LEAVE TEMP	XXX.X DEGF
HEAT EXCH ENTER TEMP	XXX.X DEGF
FREE COOLING VALVE	CLOSED
(if FC enabled)	
EVAP ENTER LIQ TEMP	XXX.X DEGF
(if FC enabled)	
LEAD SYSTEM	SYS 2
FLOW SWITCH	ON
EVAPORATOR PUMP RUN	ON
EVAPORATOR HEATER	OFF
ACTIVE REMOTE CONTROL	NONE
OPERATING HOURS	1=XXXXX, 2=XXXXX
START COUNTER	1=XXXXX, 2=XXXXX
SOFTWARE VERSION	Y.ACS.20.00
SERIAL NUMBER	PPPPYYYYXXXZZZ
INPUT CURRENT	XXXX AMPS

VSD DATA

ACTUAL FREQUENCY	XXX.X HZ
COMMAND FREQUENCY	XXX.X HZ
DC BUS VOLTAGE	XXX VDC
INTERNAL AMBIENT TEMP	XXX.X DEGF
COOLING SYSTEM STATUS	XXX
BASEPLATE TEMPS	XXX XXX DEGF
PRECHARGE SIGNAL	XXX
MOTOR OVERLOADS 1/2	XXX XXX AMPS
VSD SOFTWARE VERSION	C.VSD.XX.00

SYSTEM 1 DATA

COMPRESSOR STATUS	OFF
RUN TIME	0- 0- 0- 0 D-H-M-S
MOTOR CURRENT	0 AMPS 0 %FLA
SUCTION PRESSURE	125 PSIG
DISCHARGE PRESSURE	131 PSIG

OIL PRESSURE	130 PSIG
CONDENSER LIQUID TEMP	68.4 DEGF
DISCHARGE TEMPERATURE	68.8 DEGF
EDUCTOR TEMPERATURE	68.8 DEGF
SAT CONDENSER TEMP	71.8 DEGF
SUBCOOLING	3.4 DEGF
SAT DISCHARGE TEMP	74.5 DEGF
DISCHARGE SUPERHEAT	6.3 DEGF
MOTOR TMP	XXX.X XXX.X XXX.X DEGF
COMPRESSOR SPEED	XXX.X %
FLASH TANK LEVEL	HIGH
COND DRAIN % OPEN	XXX.X %
ECONOMIZER % OPEN	XXX.X %
CONDENSER FANS ON	0
CONDENSER FAN SPEED	XXX % (vsd)
COMPRESSOR HEATER	ON
VI STEP SOLENOID 1	OFF
VI STEP SOLENOID 2	OFF
RUN PERMISSIVE	ON
VSD RUN RELAY	OFF
VSD SOFTWARE RUN SIGNAL	OFF
EVAP LIQ LEVEL (round tube)	XXX.X %
FLASH TANK LIQ TEMP (if FC enabled)	XXX.X DEGF
SUCTION TEMPERATURE	XXX.X DEGF
SAT SUCTION TEMP	XXX.X DEGF
SUCTION SUPERHEAT	XXX.X DEGF
FLASH TANK DRAIN % OPEN	XXX.X %

SYSTEM 2 DATA

COMPRESSOR STATUS	ON
RUN TIME	0- 0-15-26 D-H-M-S
MOTOR CURRENT	104 AMPS 87 %FLA
SUCTION PRESSURE	57 PSIG
DISCHARGE PRESSURE	233 PSIG
OIL PRESSURE	218 PSIG
CONDENSER LIQUID TEMP	42.9 DEGF
DISCHARGE TEMPERATURE	145.5 DEGF
EDUCTOR TEMPERATURE	102.8 DEGF
SAT CONDENSER TEMP	31.7 DEGF
SUBCOOLING	11.2 DEGF
SAT DISCHARGE TEMP	112.1 DEGF
DISCHARGE SUPERHEAT	33.4 DEGF
MOTOR TMP	XXX.X XXX.X XXX.X DEGF
COMPRESSOR SPEED	XXX.X %
FLASH TANK LEVEL	LOW
COND DRAIN % OPEN	XXX.X %
ECONOMIZER % OPEN	XXX.X %
CONDENSER FANS ON	3
CONDENSER FAN SPEED	XXX % (vsd)
COMPRESSOR HEATER	OFF
VI STEP SOLENOID 1	OFF
VI STEP SOLENOID 2	OFF
RUN PERMISSIVE	ON
VSD RUN RELAY	OFF
VSD SOFTWARE RUN SIGNAL	OFF
EVAP LIQ LEVEL (round tube)	XXX.X %
FLASH TANK LIQ TEMP (if FC enabled)	XXX.X DEGF
SUCTION TEMPERATURE	XXX.X DEGF
SAT SUCTION TEMP	XXX.X DEGF
SUCTION SUPERHEAT	XXX.X DEGF
FLASH TANK DRAIN % OPEN	XXX.X %

UNIT OPERATING SCHEDULE

S M T W T F S *=HOLIDAY

MON START=00:00AM	STOP=00:00AM
TUE START=00:00AM	STOP=00:00AM
WED START=00:00AM	STOP=00:00AM
THU START=00:00AM	STOP=00:00AM
FRI START=00:00AM	STOP=00:00AM
SAT START=00:00AM	STOP=00:00AM
HOL START=00:00AM	STOP=00:00AM

SOUND LIMIT SCHEDULE (if enabled)

MON START=00:00AM	STOP=00:00AM
TUE START=00:00AM	STOP=00:00AM
WED START=00:00AM	STOP=00:00AM
THU START=00:00AM	STOP=00:00AM
FRI START=00:00AM	STOP=00:00AM
SAT START=00:00AM	STOP=00:00AM
HOL START=00:00AM	STOP=00:00AM

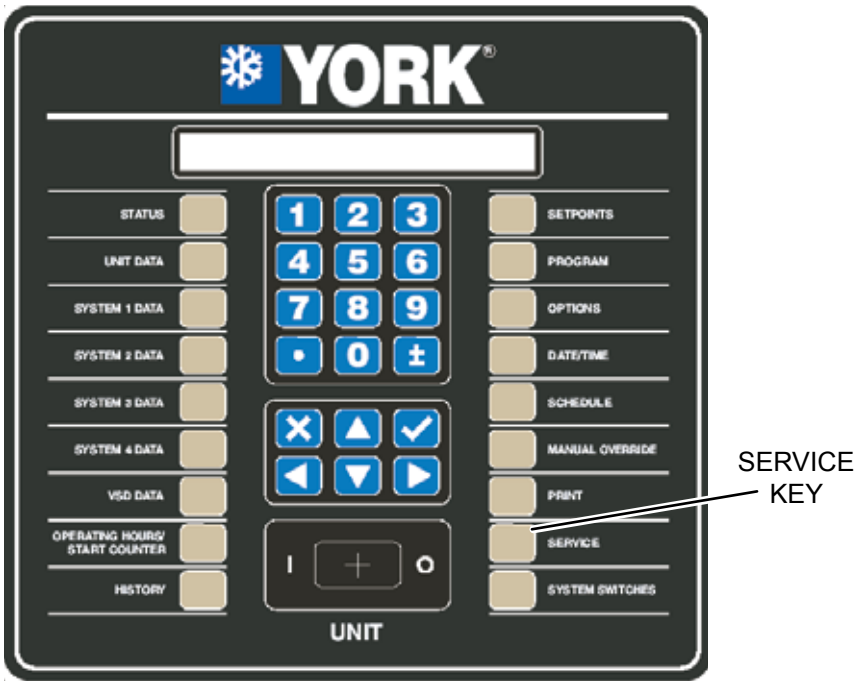
History Data Printout

History printouts, when selected, provide stored data relating to all specific system and chiller operating conditions at the time of the fault, regardless of whether a lockout occurred. History information is stored in battery-backed memory on the Chiller Control Board and is not affected by power failures or resetting of faults. Whenever a fault of any type occurs, all system operating data is stored in battery-backed memory at the time of the fault. The history printout is similar to the operating data printout except for the change in the header information shown below:

```
      YORK INTERNATIONAL CORPORATION
            YAGK SCREW CHILLER
             HISTORY NUMBER 1
           2:04:14 PM  30 APR 11
SYS 1 YYYYYYY
         HIGH DSCH PRESS SHUTDOWN
        STATUS AT TIME OF SHUTDOWN
SYS 1 XXXXXXXXXXXXXXXXXXXXXXXXX
SYS 2 XXXXXXXXXXXXXXXXXXXXXXXXX
                ALL FAULTS
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The most recent fault will always be stored as HISTORY BUFFER #1.

SERVICE KEY



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Service Key Operation

The SERVICE key allows viewing data related to the internal function of the chiller system electronics. Data such as circuit board output status as controlled by the Chiller Control software while operating can be viewed and compared to actual chiller operation in the event servicing is required. The SERVICE key allows controlling of analog and digital outputs for troubleshooting purposes when the unit is not running. The Unit Serial Number and Optimized IPLV Control mode are also entered using the SERVICE key.

The ▲▼ keys allow scrolling through the displays. The ▼ key scrolls through the displays in the forward direction.

When the SERVICE key is pressed, the following message will appear:

```
SERVICE MODE XXXX
 PRESS ENTER KEY TO CONTINUE
```

XXXX will display a password, if a numerical password is entered.

Pressing the ✓ (ENTER) key allows view only Service Mode operation. All control board I/O will be viewable in this mode. No outputs can be changed. For troubleshooting or startup commissioning purposes, the Chiller Micro Board and some VSD outputs can be toggled or changed by turning OFF the UNIT SWITCH, pressing the SERVICE key, entering password 9675, and pressing the ✓ (ENTER) key. Once the password is entered, the Digital Outputs (DO) can be toggled by pressing the ✓ (ENTER) key. The Analog Outputs can be programmed to output a specific value using the keypad and programming in the desired value, which will usually be noted as a % or VDC. If the UNIT SWITCH is turned back on, the chiller will revert to normal viewable only control.

Displays can be viewed by pressing the ▲and ▼ keys. The ▼ key scrolls through the displays in the forward direction.

The ◄ and ► keys allow jumping from data section to data section to avoid scrolling sequentially through all the data. Once in a data section, the ▲and ▼ keys allow scrolling through the data under the section. Pressing the ◄ and ► keys at any time moves to the top of the next data section.

The data sections are listed below:

- Software Versions / Unit Serial Number
- Analog Inputs
- Digital Inputs
- Digital Outputs
- Analog Outputs
- VSD Logic Digital Output

Software Version / Unit Serial Number

```
SERVICE        SOFTWARE CONTROL = Y.AJJ.KK.LL
CC = QQ.RR.SS                BUILD = XXXXXXXXXX
```

```
SERVICE   SOFTWARE   I/O                = Y.PIC.01.LL
```

```
SERVICE   SOFTWARE   VSD                = C.VJJ.KK.LL
```

```
SERVICE                    UNIT S/N   =   XXXXXXXXXX
```

The software version of the chiller Micro Control Board, the I/O board and the VSD microprocessor are viewable in first 3 data sections. The QQ = CC Family Code, RR = Major Revision, and SS=Minor Revision, JJ, KK, LL will be filled in with alphanumeric characters.

Analog Inputs

The second data section displays the Analog Inputs (AI). Displays for 3 and 4 compressor chillers are skipped if the unit does not have those systems. These messages will only be displayed in English. The voltage displayed is referenced to common (return, ground) in the system. J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See the wiring diagrams.

```
SERVICE AI J17-11        REMOTE TEMP RESET
                X.X VDC                = XXX.X %
```

```
SERVICE AI J17-12      REMOTE CURRENT LIMIT
                X.X VDC                = XXX.X %
```

```
SERVICE AI J17-13        REMOTE SOUND LIMIT
                X.X VDC                = XXX.X %
```

The Remote Temp Reset, Remote Current Limit Reset, and Remote Sound Limit inputs have onboard voltage dividers, if the jumper is set for a voltage input. This will cause the voltage read on the display to be less than the voltage on the board header inputs between TB1-17 and 18, TB1-19 and 20, or TB1-40 and 41. To correct for this when measuring voltage at the remote device supplying voltage to the board header while troubleshooting, use the following calculation:

Voltage = 10 x VDC volts / 4.5

If the input is programmed for a current input, the voltage read by the MUX is displayed. If the input is disabled under the OPTIONS key, the voltage display will display DISABLED.

The analog inputs display will continue to sequence as follows. The inputs indicate voltages read between the input terminal to the Chiller Logic Board and the plug GND or Drain.

```
SERVICE AI  J17-14     SYS 1 COND LIQUID PRS
                X.X VDC
```

```
SERVICE AI  J17-15     SYS 2 COND LIQUID PRS
                X.X VDC
```

```
SERVICE AI  J18-7       LEAVING LIQUID TEMP
                X.X VDC          = XXX.X °F
```

```
SERVICE AI  J18-8       RETURN LIQUID TEMP
                X.X VDC          = XXX.X °F
```

```
SERVICE AI              J18-9 AMBIENT AIR TEMP
                X.X VDC          = XXX.X °F
```

```
SERVICE AI J19-1        SYS1 MOTOR TEMP T1
                X.X VDC          = XXX.X °F
```

```
SERVICE AI J19-2        SYS1 MOTOR TEMP T2
                X.X VDC          = XXX.X °F
```

```
SERVICE AI J19-3        SYS1 MOTOR TEMP T3
                X.X VDC          = XXX.X °F
```

```
SERVICE AI J19-6        SYS2 MOTOR TEMP T1
                X.X VDC          = XXX.X °F
```

```
SERVICE AI J19-7        SYS2 MOTOR TEMP T2
                X.X VDC          = XXX.X °F
```

```
SERVICE AI J19-8        SYS2 MOTOR TEMP T3
                X.X VDC          = XXX.X °F
```

```
SERVICE AI     J20-1              SPARE ANALOG
                X.X VDC
```

```
SERVICE AI     J20-2              SPARE ANALOG
                X.X VDC
```

```
SERVICE AI    J20-3          SPARE ANALOG
              X.X VDC
```

```
SERVICE AI    J20-6          SPARE ANALOG
              X.X VDC
```

```
SERVICE AI    J20-7          SPARE ANALOG
              X.X VDC
```

```
SERVICE AI    J20-8          SPARE ANALOG
              X.X VDC
```

```
SERVICE    AI    J21-3  SYS 1 SUCTION TEMP
              X.X VDC = XXX.X °F
```

```
SERVICE AI  J21-6        SYS1 FL TANK LEVEL
              X.X VDC        = XXX ADC %
```

```
SERVICE AI  J21-13     SYS1 COND LIQUID TEMP
              X.X VDC        = XXX.X °F
```

```
SERVICE AI  J21-16     SYS1 DISCHARGE TEMP
              X.X VDC        = XXX.X °F
```

```
SERVICE AI  J21-20     SYS1 SUCTION PRESS
              X.X VDC        = XXX.X PSIG
```

```
SERVICE AI  J21-22          SYS1 OIL PRESS
              X.X VDC        = XXX.X PSIG
```

```
SERVICE AI  J21-24    SYS1 DISCHARGE PRESS
              X.X VDC        = XXX.X PSIG
```

```
SERVICE    AI  J22-3    SYS 2 SUCTION TEMP
              X.X VDC = XXX.X °F
```

```
SERVICE AI  J22-6        SYS2 FL TANK LEVEL
              X.X VDC        = XXX ADC %
```

```
SERVICE AI  J22-13     SYS2 COND LIQUID TEMP
              0.0 VDC        = XXX.X °F
```

```
SERVICE AI  J22-16     SYS2 DISCHARGE TEMP
              X.X VDC        = XXX.X °F
```

```
SERVICE AI  J22-20     SYS2 SUCTION PRESS
              X.X VDC        = XXX.X PSIG
```

```
SERVICE AI  J22-22          SYS2 OIL PRESS
              X.X VDC
```

```
SERVICE AI  J22-24    SYS2 DISCHARGE PRESS
              X.X VDC        = XXX.X PSIG
```

```
SERVICE AI  J23-3          SPARE ANALOG INPUT
              0.0 VDC
```

```
SERVICE AI  J23-6          SPARE ANALOG INPUT
              X.X VDC
```

```
SERVICE AI  J23-13         SPARE ANALOG INPUT
              X.X VDC
```

```
SERVICE AI  J23-16         SPARE ANALOG INPUT
              0.01 VDC
```

The above message appears when the Free Cooling Control is enabled.

```
SERVICE AI  J23-20         SPARE ANALOG INPUT
              X.X VDC
```

```
SERVICE AI  J23-22         SPARE ANALOG INPUT
              X.X VDC
```

```
SERVICE AI  J23-24         SPARE ANALOG INPUT
              X.X VDC
```

```
SERVICE AI  J24-3          SPARE ANALOG INPUT
              0.01 VDC
```

```
SERVICE AI  J24-6          SPARE ANALOG INPUT
              X.X VDC
```

```
SERVICE AI  J24-13         SPARE ANALOG INPUT
              0.0 VDC
```

```
SERVICE    AI  J24-16      SPARE ANALOG INPUT
              0.0 VDC
```

```
SERVICE AI  J24-20         SPARE ANALOG INPUT
              0.0 VDC
```

```
SERVICE AI  J24-22         SPARE ANALOG INPUT
              X.X VDC
```

```
SERVICE AI  J24-24         SPARE ANALOG INPUT
              X.X VDC
```

Digital Inputs

The third data section displays the Digital Inputs (DI) to the Chiller Control Board that can be viewed from the Service Mode. Displays for systems 3 and 4 are skipped if the systems are not present on the chiller. In this case, XXX is replaced with ON or OFF in the actual display. These messages will only be displayed in English.

```
SERVICE DI  J4-2           UNIT SWITCH 1
                           STATUS = XXX
```

```
SERVICE DI  J4-3           UNIT SWITCH 2
                           STATUS = XXX
```

SERVICE DI J4-4	SYS 1 HPCO STATUS = XXX
SERVICE DI J4-5	SYS 2 HPCO STATUS = XXX
SERVICE DI J4-6	VSD FAULT RELAY STATUS = XXX
SERVICE DI J5-1	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J5-2	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J5-3	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J6-2	FLOW SWITCH STATUS = XXX
SERVICE DI J6-3	PRINT STATUS = XXX
SERVICE DI J6-4	SYS 1 RUN PERM STATUS = XXX
SERVICE DI J6-5	SYS 2 RUN PERM STATUS = XXX
SERVICE DI J6-6	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J7-2	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J7-4	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J7-6	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J7-8	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J7-10	SPARE DIGITAL INPUT STATUS = XXX

Digital Outputs

The fourth data section displays the Digital Outputs (DO) from the Chiller Control Board that can be viewed in the Service Mode. Displays for Systems 3 and 4 are skipped if the systems are not present on the chiller. In this case, XXX is replaced with ON or OFF in the actual dispay. These messages will only be displayed in English.

SERVICE DO J9-1 RB1 TB1-20	EVAP HEATER STATUS = XXX
SERVICE DO J9-2 RB1 TB1-18	SYS 1 VSD RUN STATUS = XXX
SERVICE DO J9-3 RB1 TB1-16	SYS 1 ALARM STATUS = XXX
SERVICE DO J9-4 RB1 TB1-14	EVAP HEATER 2 STATUS = XXX
SERVICE DO J9-5 RB1 TB1-12	SYS 1 VI STEP 1 STATUS = XXX
SERVICE DO J9-6 RB1 TB1-10	SYS 1 VI STEP 2 STATUS = XXX
SERVICE DO J9-7 RB1 TB1-8	SYS 1 COND FAN OUT 4 STATUS = XXX
SERVICE DO J9-8 RB1 TB1-6	SYS 1 COND FAN OUT 1 STATUS = XXX
SERVICE DO J9-9 RB1 TB1-5	SYS 1 COND FAN OUT 2 STATUS = XXX
SERVICE DO J9-10 RB1 TB1-4	SYS 1 COND FAN OUT 3 STATUS = XXX
SERVICE DO J9-11 RB1 TB1-3	SYS 1 COMP HEATER STATUS = XXX

SERVICE DO J9-12 FREE COOLING VALVE RB1 TB1-2 STATUS = XXX

The above message appears when Free Cooling Control is Open Loop.

SERVICE DO J9-12 GLYCOL HEATER RB1 TB1-2 STATUS = XXX

The above message appears when Free Cooling Control is Closed Loop.

SERVICE DO J9-12 SPARE DIGITAL OUTPUT RB1 TB1-2 STATUS = XXX

The above message appears when Free Cooling Control is disabled and Remote Evaporator Control is disabled.

SERVICE DO J9-12 RB1 TB1-2	FREE COOLING VALVE STATUS = XXX

The above message appears when the Free Cooling Control is enabled.

SERVICE DO J9-12	SPARE DIGITAL OUTPUT
RB1 TB1-2	STATUS = XXX

The above message appears when the Free Cooling Control is disabled and Remote Evaporator Control is disabled.

SERVICE DO J10-1	EVAP PUMP RUN
RB1 TB1-20	STATUS = XXX

SERVICE DO J10-2	SYS 2 VSD RUN
RB2 TB1-18	STATUS = XXX

SERVICE DO J10-3	SYS 2 ALARM
RB2 TB1-16	STATUS = XXX

SERVICE DO J10-4	CHILLER RUN
RB1 TB1-14	STATUS = XXX

SERVICE DO J10-5	SYS 2 COND FAN OUT 4
RB2 TB1-12	STATUS = XXX

SERVICE DO J10-6	SYS 2 VI STEP 1
RB2 TB1-10	STATUS = XXX

SERVICE DO J10-7	SYS 2 VI STEP 2
RB2 TB1-8	STATUS = XXX

SERVICE DO J10-8	SYS COND 2 FAN OUT 1
RB1 TB1-6	STATUS = XXX

SERVICE DO J10-9	SYS COND 2 FAN OUT 2
RB1 TB1-5	STATUS = XXX

SERVICE DO J10-10	SYS COND 2 FAN OUT 3
RB1 TB1-4	STATUS = XXX

SERVICE DO J10-11	SYS 2 COMP HEATER
RB1 TB1-3	STATUS = XXX

SERVICE DO J10-12	GLYCOL PUMP RUN
RB2 TB1-2	STATUS = XXX

The above message appears when Free Cooling Control is Closed Loop.

SERVICE DO J10-12	SPARE DIGITAL OUTPUT
RB2 TB1-2	STATUS = XXX

SERVICE DO J11-1	SPARE DIGITAL OUTPUT
RB3 TB1-20	STATUS = XXX

SERVICE DO J11-2	SPARE DIGITAL OUTPUT
RB3 TB1-18	STATUS = XXX

SERVICE DO J11-3	SPARE DIGITAL OUTPUT
RB3 TB1-16	STATUS = XXX

SERVICE DO J11-4	SPARE DIGITAL OUTPUT
RB3 TB1-14	STATUS = XXX

SERVICE DO J11-5	SPARE DIGITAL OUTPUT
RB3 TB1-12	STATUS = XXX

SERVICE DO J11-6	SPARE DIGITAL OUTPUT
RB3 TB1-10	STATUS = XXX

SERVICE DO J11-7	SPARE DIGITAL OUTPUT
RB3 TB1-8	STATUS = XXX

SERVICE DO J11-8	SPARE DIGITAL OUTPUT
RB3 TB1-6	STATUS = XXX

SERVICE DO J11-9	SPARE DIGITAL OUTPUT
RB3 TB1-5	STATUS = XXX

SERVICE DO J11-10	SPARE DIGITAL OUTPUT
RB3 TB1-4	STATUS = XXX

SERVICE DO J11-11	SPARE DIGITAL OUTPUT
RB3 TB1-3	STATUS = XXX

SERVICE DO J11-12	SPARE DIGITAL OUTPUT
RB3 TB1-2	STATUS = XXX

Analog Outputs

The fifth data section displays the Analog Outputs (AO) that can be viewed from the Service Mode. The Analog Output signals are typically referenced to the common (return, ground) in the system. Terminal J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See the wiring diagrams. Displays for systems 3 and 4 are skipped if the systems are not present on the chiller. XXX is replaced with ON or OFF in the actual display. The state of these outputs is only viewable unless the password 9675 ✓(ENTER) key was entered from the initial Service Mode display with the UNIT switch in the OFF position. The chiller will not be permitted to run when the outputs are made active. The outputs can be programmed for a specific % output by keying in the value and pressing the ✓(ENTER) key. These messages will only be displayed in English.

SERVICE AO J15-1	SYS 1 COND VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J15-3	SYS 1 ECON VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J15-5	SYS 2 COND VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J15-7	SYS 2 ECON VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J14-1	SYS 2 FT DRAIN VALVE
XX.X %	= XX.X VDC

The above message appears when Free Cooling Control is Closed Loop. SPARE ANALOG OUTPUT shall appear when Free Cooling Control is not Closed Loop.

SERVICE AO J14-2	SYS 2 FT DRAIN VALVE
XXX.X %	= XX.X VDC

The above message appears when Free Cooling Control is Closed Loop. SPARE ANALOG OUTPUT shall appear when Free Cooling Control is not Closed Loop.

SERVICE AO J14-3	SPARE ANALOG OUTPUT
XXX.X %	= XX.X VDC

SERVICE AO J14-4	SPARE ANALOG OUTPUT
XXX.X %	= XX.X VDC

Vout = 6.0 V*% Full Scale/1000 Optimized VSD Fans
Vout = 5.0 V*% Full Scale/1000 Standard VSD Fans

SERVICE AO J25-1	SYS 1 COND FAN SPEED
XXX.X %	= XX.X VDC

Vout = 6.0 V*% Full Scale/1000 Optimized VSD Fans
Vout = 5.0 V*% Full Scale/1000 Standard VSD Fans

SERVICE AO J25-2	SYS 2 COND FAN SPEED
XXX.X %	= XX.X VDC

SERVICE AO J25-3	SPARE ANALOG OUTPUT
XXX.X %	= XX.X VDC

The above message appears when Free Cooling Control is Closed Loop to indicate the pump speed. SPARE ANALOG OUTPUT shall appear when Free Cooling Control is not Closed Loop.

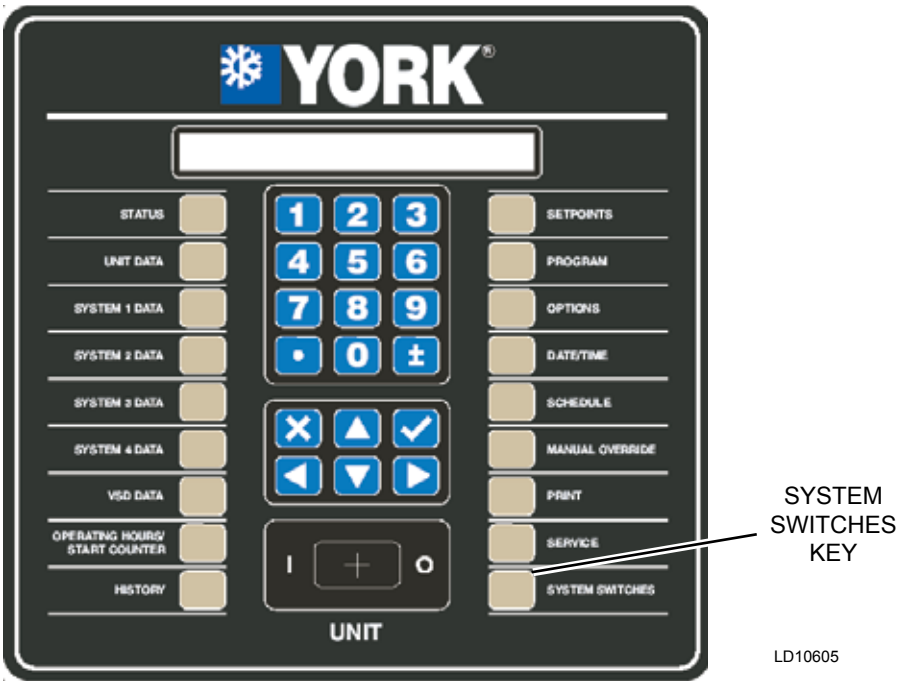
SERVICE AO J25-4	SPARE
XXX.X %	= XX.X VDC

VSD Digital Outputs

The sixth data section displays the VSD digital outputs (DO) that can be viewed from the Service Mode. The Digital Output signals indicate the status of the output. The 0 to 120VAC digital outputs are referenced to neutral (Wire 2).

SERVICE DO J10-2	VSD COOLING FAN/PUMP
VSD LOGIC	STATUS = XXX

SYSTEM SWITCHES KEY



System Switches Key Operation

The SYSTEM SWITCHES key allows the operator to turn individual systems ON and OFF. Safety lockouts are also reset by selecting the respective system switch RESET. When the SYSTEM SWITCHES key is pressed, the following message will appear:

SYSTEM SWITCHES	SYS 1 ON / OFF / RESET
◄ ►	=XXXXXXXXXXXXXXX

The display indicates the respective system and it's ON/OFF /reset switch status. The ▲▼ keys allow scrolling to the next and previous system switch (System 1 and 2).

SYSTEM SWITCHES	SYS 2 ON / OFF / RESET
◄ ►	=XXXXXXXXXXXXXXX

The ◄ or ► keys allow scrolling through the choices of:

- SYSTEM OFF (default)
- SYSTEM ON
- RESET (LOCKOUT)

The switch selection is accepted into memory by pressing the ✓ (ENTER) key.

When the RESET selection is made and accepted, it will not change the position of the switch (either ON or OFF).

NOTE

Whenever possible, except in emergencies, always use the associated system switch to turn off a compressor, which allows the compressors to go through a controlled shutdown. Avoid using the UNIT switch to turn off the compressors.

INPUTS AND OUTPUTS

Serial Port Connections

The *"Table 18 - Serial Port Connections" on page 160* lists the serial ports and the circuit board where they are located. The serial communications lines provide communications to external devices outside the chiller and between microprocessors located in the chiller control panel.

TB2 allows connecting to a remote OptiView RCC or Microgateway. The OptiView RCC option is not yet available. The OptiView RCC and Microgateway option cannot both be used. Only one or the other is permitted to be connected to the chiller.

Analog Input Connections

The Analog Input Connections in Table 19 on Page 161 lists the Analog inputs and the circuit board they are located on. Not all of the sensors are installed in every unit, as some of them are optional. The software must read the optional sensors if installed. The Analog input signals are typically referenced to the common (return, ground) in the system.

J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. The +DC Bus, -DC Bus and ½ DC Bus voltages are measured in reference to one of the other DC Bus points. For example: +DC Bus measured to ½ DC Bus.

TABLE 18 - SERIAL PORT CONNECTIONS

BOARD	HEADER	PORT TYPE	PORT USE
Control Board	TB1 / TB2	RS-232 / RS-485	Printer / ISN
Control Board	J2 / J1	RS-485	VSD #1 / #2 <-> Control Panel
Control Board	TB3/PL2	RS-485	BAS Port
Control Board	TB5	RS-485	Spare/Future Remote Monitoring
VSD Logic Board	J12	Opto-Coupled RS-485	VSD <-> Control Panel

TABLE 19 - ANALOG INPUT CONNECTIONS

CIRCUIT BOARD	PLUG	INPUT
Control Board	J17-11	Remote Temperature Reset
Control Board	J17-12	Remote Current Limit
Control Board	J17-13	Remote Sound Limit
Control Board	J17-14	Sys 1 Condenser Liquid Pressure
Control Board	J17-15	Sys 2 Condenser Liquid Pressure
Control Board	J18-7	Leaving Chilled Liquid Temp Sensor
Control Board	J18-8	Return Chilled Liquid Temp Sensor
Control Board	J18-9	Ambient Air Temp Sensor
Control Board	J19-1	Comp 1 Motor Temperature 1
Control Board	J19-2	Comp 1 Motor Temperature 2
Control Board	J19-3	Comp 1 Motor Temperature 3
Control Board	J19-6	Comp 2 Motor Temperature 1
Control Board	J19-7	Comp 2 Motor Temperature 2
Control Board	J19-8	Comp 2 Motor Temperature 3
Control Board	J20-1	Spare
Control Board	J20-2	Spare
Control Board	J20-3	Spare
Control Board	J20-6	Spare
Control Board	J20-7	Spare
Control Board	J20-8	Spare
Control Board	J21-3	Sys 1 Suction Temperature
Control Board	J21-6	Sys 1 Flash Tank Level Sensor
Control Board	J21-13	Sys 1 Condenser Liquid Temperature
Control Board	J21-16	Sys 1 Discharge Temperature
Control Board	J21-20	Sys 1 Suction Pressure
Control Board	J21-22	Sys 1 Oil Pressure
Control Board	J21-24	Sys 1 Discharge Pressure
Control Board	J22-3	Sys 2 Suction Temperature
Control Board	J22-6	Sys 2 Flash Tank Level Sensor
Control Board	J22-13	Sys 2 Condenser Liquid Temperature
Control Board	J22-16	Sys 2 Discharge Temperature
Control Board	J22-20	Sys 2 Suction Pressure
Control Board	J22-22	Sys 2 Oil Pressure
Control Board	J22-24	Sys 2 Discharge Pressure
Control Board	J23-3	Spare
Control Board	J23-6	Spare
Control Board	J23-13	Spare
Control Board	J23-16	Spare
Control Board	J23-20	Spare
Control Board	J23-22	Spare
Control Board	J23-24	Spare
Control Board	J24-3	Spare
Control Board	J24-6	Spare
Control Board	J24-13	Spare
Control Board	J24-16	Spare
Control Board	J24-20	Spare
Control Board	J24-22	Spare
Control Board	J24-24	Spare
VSD Logic Board	J1-1,2	Comp 1 Phase A Motor Current
VSD Logic Board	J1-3,4	Comp 1 Phase B Motor Current
VSD Logic Board	J1-5,6	Comp 1 Phase C Motor Current
VSD Logic Board	J1-13,14	Comp 3 Phase A Motor Current (N/A)
VSD Logic Board	J1-15,16	Comp 3 Phase B Motor Current (N/A)
VSD Logic Board	J1-17,18	Comp 3 Phase C Motor Current (N/A)
VSD Logic Board	J2-1,2	Comp 2 Phase A Motor Current
VSD Logic Board	J2-3,4	Comp 2 Phase B Motor Current
VSD Logic Board	J2-5,6	Comp 2 Phase C Motor Current
VSD Logic Board	J2-9,10	Comp 4 Phase A Motor Current (N/A)
VSD Logic Board	J2-11,12	Comp 4 Phase B Motor Current (N/A)
VSD Logic Board	J2-13,14	Comp 4 Phase C Motor Current (N/A)
VSD Logic Board	J3-1	+DC Bus Voltage 1
VSD Logic Board	J3-2	½ DC Bus Voltage 1
VSD Logic Board	J3-3	-DC Bus Voltage 1
VSD Logic Board	J3-4	-DC Bus Voltage 2 (Frame F)
VSD Logic Board	J3-5	½ DC Bus Voltage 2 (Frame F)
VSD Logic Board	J3-6	+DC Bus Voltage 2 (Frame F)
VSD Logic Board	J6-8	Comp 1 IGBT Baseplate Temperature
VSD Logic Board	J8-8	Comp 2 IGBT Baseplate Temperature
VSD Logic Board	R19	Comp 1 Overload Adjust
VSD Logic Board	R64	Comp 2 Overload Adjust

DIGITAL INPUT CONNECTIONS

The table below lists the digital inputs and the circuit board where they are located. The Digital input signals are typically referenced to the common (return, ground) in the system.

TABLE 20 - DIGITAL INPUT CONNECTIONS (CONT'D)

CIRCUIT BOARD	PLUG	INPUT
Control Board	J4-2	Unit Switch 1
Control Board	J4-3	Unit Switch 2
Control Board	J4-4	Sys 1 HPCO
Control Board	J4-5	Sys 2 HPCO
Control Board	J4-6	VSD Fault Relay 1
Control Board	J5-1	Spare
Control Board	J5-2	Spare
Control Board	J5-3	Spare
Control Board	J6-2	Flow Switch
Control Board	J6-3	Print
Control Board	J6-4	Sys 1 Run Permissive
Control Board	J6-5	Sys 2 Run Permissive
Control Board	J6-6	Spare
Control Board	J7-1,2	Spare
Control Board	J7-3,4	Spare
Control Board	J7-5,6	Spare
Control Board	J7-7,8	Spare
Control Board	J7-9,10	Spare
Control Board	J7-11,12	Spare
VSD Logic Board	J1-10	2 Compressor Select (Standard) (N/A Frame F)
VSD Logic Board	J1-11	3 Compressor Select (N/A)
VSD Logic Board	J1-12	4 Compressor Select (N/A Standard) (Frame F)
VSD Logic Board	J5-1,2	MODBUS Address Bit 0
VSD Logic Board	J5-3,4	MODBUS Address Bit 1
VSD Logic Board	J6-2	Comp 1 Phase A Gate Driver Fault

J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. For further information, see the wiring diagrams in "SECTION 5 - TECHNICAL DATA" on page 53.

TABLE 20 - DIGITAL INPUT CONNECTIONS (CONT'D)

CIRCUIT BOARD	PLUG	INPUT
VSD Logic Board	J6-5	Comp 1 Phase C Gate Driver Fault
VSD Logic Board	J6-12	Comp 1 Phase B Gate Driver Fault
VSD Logic Board	J7-2	Comp 3 Phase A Gate Driver Fault (N/A)
VSD Logic Board	J7-5	Comp 3 Phase C Gate Driver Fault (N/A)
VSD Logic Board	J7-12	Comp 3 Phase B Gate Driver Fault (N/A)
VSD Logic Board	J8-2	Comp 2 Phase A Gate Driver Fault
VSD Logic Board	J8-5	Comp 2 Phase C Gate Driver Fault
VSD Logic Board	J8-12	Comp 2 Phase B Gate Driver Fault
VSD Logic Board	J9-2	Comp 4 Phase A Gate Driver Fault (N/A)
VSD Logic Board	J9-5	Comp 4 Phase C Gate Driver Fault (N/A)
VSD Logic Board	J9-12	Comp 4 Phase B Gate Driver Fault (N/A)
VSD Logic Board	J11-2	Phase Loss Fault 1
VSD Logic Board	J11-6	Phase Loss Fault 2
VSD Logic Board	SW1	Test Pushbutton
VSD Logic Board	J10-5,6	Comp 1 Run (from control panel)
VSD Logic Board	J10-7,8	Comp 2 Run (from control panel)

ANALOG OUTPUT CONNECTIONS

The table below lists the analog outputs and the circuit board where they are located. The analog output signals are feed to the associated control device from the 2 wires connected to the pins in the associated plug.

TABLE 20 - ANALOG OUTPUTS CONNECTIONS

BOARD	PLUG	ANALOG OUTPUT
Control Board	J15-1,2	Sys 1 Condenser Drain Valve
Control Board	J15-3,4	Sys 1 Economizer Feed Valve
Control Board	J15-5,6	Sys 2 Condenser Drain Valve
Control Board	J15-7,8	Sys 2 Economizer Feed Valve
Control Board	J14-1,6	Sys 1 FT Drain Valve
Control Board	J14-2,7	Sys 2 FT Drain Valve
Control Board	J14-3,8	Spare
Control Board	J14-4,9	Spare
Control Board	J25-1,5	Sys 1 Condenser Fan Speed
Control Board	J25-2,6	Sys 2 Condenser Fan Speed
Control Board	J25-3,7	Spare
Control Board	J25-4,8	Spare

DIGITAL OUTPUT CONNECTIONS

The following table lists the digital outputs and the plug/terminals of the circuit board they originate from. Not all of the outputs will be used on every unit. Signal levels may be 12VDC, 120VAC, or a dry contact (no voltage closure). 120VAC signals typically may show only one connection point; the other will be neutral (Wire 2). Outputs which reference multiple boards, such as Chiller Control Board / Relay Board 1 indicate the signal originates on the Chiller Control Board as a 0 to 12VDC digital signal (example: J9-1) that is then fed to the Relay board and output as a dry contact closure between TB1-20 and 19. In this case, outputs from both boards are called out in the table.

The 0 to 120VAC single digital outputs from the Relay Output Boards are referenced to neutral (Wire 2). For example, the fan output on TB1-6 is a single 120VAC output. The 0 to 12VDC outputs from the Chiller Control Board are referenced to common (return, ground) in the system. J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See *"Figure 16 - BUS Bar Outer Phase Aggreko Aux Panel" on page 51* to the wiring diagrams whenever there is a requirement for tracing out these signals.

TABLE 21 - DIGITAL OUTPUTS CONNECTIONS

BOARD	PLUG	DIGITAL OUTPUT
Control Board / Relay Board 1	J9-1 / TB1-20/19	Evaporator Heater
Control Board / Relay Board 1	J9-2 / TB1-18/17	Sys 1 VSD Run
Control Board / Relay Board 1	J9-3 / TB1-16/15	Sys 1 Alarm
Control Board / Relay Board 1	J9-4 / TB1-14/13	Evaporator Heater 2
Control Board / Relay Board 1	J9-5 / TB1-12/11	Sys 1 VI Step 1
Control Board / Relay Board 1	J9-6 / TB1-10/9	Sys 1 VI Step 2
Control Board / Relay Board 1	J9-7 / TB1-8/7	Sys 1 Condenser Fans Output 4
Control Board / Relay Board 1	J9-8 / TB1-6	Sys 1 Condenser Fans Output 1
Control Board / Relay Board 1	J9-9 / TB1-5	Sys 1 Condenser Fans Output 2
Control Board / Relay Board 1	J9-10 / TB1-4	Sys 1 Condenser Fans Output 3
Control Board / Relay Board 1	J9-11 / TB1-3	Sys 1 Compressor Heater
Control Board / Relay Board 1	J9-12 / TB1-2	Spare
Control Board / Relay Board 2	J10-1 / TB1-20/19	Evaporator Pump Start
Control Board / Relay Board 2	J10-2 / TB1-18/17	Sys 2 VSD Run
Control Board / Relay Board 2	J10-3 / TB1-16/15	Sys 2 Alarm
Control Board / Relay Board 2	J10-4 / TB1-14/13	Chiller Run
Control Board / Relay Board 2	J10-5 / TB1-12/11	Sys 2 Condenser Fans Output 4
Control Board / Relay Board 2	J10-6 / TB1-10/9	Sys 2 VI Step 1
Control Board / Relay Board 2	J10-7 / TB1-8/7	Sys 2 VI Step 2
Control Board / Relay Board 2	J10-8 / TB1-6	Sys 2 Condenser Fans Output 1
Control Board / Relay Board 2	J10-9 / TB1-5	Sys 2 Condenser Fans Output 2
Control Board / Relay Board 2	J10-10 / TB1-4	Sys 2 Condenser Fans Output 3
Control Board / Relay Board 2	J10-11 / TB1-3	Sys 2 Compressor Heater
Control Board / Relay Board 2	J10-12 / TB1-2	Spare
Control Board / Relay Board 3	J11-1 / TB1-20/19	Spare
Control Board / Relay Board 3	J11-2 / TB1-18/17	Spare

TABLE 22- DIGITAL OUTPUTS CONNECTIONS (CONT'D)

BOARD	PLUG	DIGITAL OUTPUT
Control Board / Relay Board 3	J11-3 / TB1-16/15	Spare
Control Board / Relay Board 3	J11-4 / TB1-14/13	Spare
Control Board / Relay Board 3	J11-5 / TB1-12/11	Spare
Control Board / Relay Board 3	J11-6 / TB1-10/9	Spare
Control Board / Relay Board 3	J11-7 / TB1-8/7	Spare
Control Board / Relay Board 3	J11-8 / TB1-6	Spare
Control Board / Relay Board 3	J11-9 / TB1-5	Spare
Control Board / Relay Board 3	J11-10 / TB1-4	Spare
Control Board / Relay Board 3	J11-11 / TB1-3	Spare
Control Board / Relay Board 3	J11-12 / TB1-2	Spare
VSD Logic Board	J6-1	Comp 1 Phase A+ IGBT Gating Signal
VSD Logic Board	J6-3	Comp 1 Phase B- IGBT Gating Signal
VSD Logic Board	J6-4	Comp 1 Phase C+ IGBT Gating Signal
VSD Logic Board	J6-10	Comp 1 Phase A- IGBT Gating Signal
VSD Logic Board	J6-11	Comp 1 Phase B+ IGBT Gating Signal
VSD Logic Board	J6-13	Comp 1 Phase C- IGBT Gating Signal
VSD Logic Board	J6-14	Comp 1 Enable
VSD Logic Board	J7-1	Comp 3 Phase A+ IGBT Gating Signal (N/A)
VSD Logic Board	J7-3	Comp 3 Phase B- IGBT Gating Signal (N/A)
VSD Logic Board	J7-4	Comp 3 Phase C+ IGBT Gating Signal (N/A)
VSD Logic Board	J7-10	Comp 3 Phase A- IGBT Gating Signal (N/A)
VSD Logic Board	J7-11	Comp 3 Phase B+ IGBT Gating Signal (N/A)
VSD Logic Board	J7-13	Comp 3 Phase C- IGBT Gating Signal (N/A)
VSD Logic Board	J7-14	Comp 3 Enable (N/A)
VSD Logic Board	J8-1	Comp 2 Phase A+ IGBT Gating Signal
VSD Logic Board	J8-3	Comp 2 Phase B- IGBT Gating Signal
VSD Logic Board	J8-4	Comp 2 Phase C+ IGBT Gating Signal
VSD Logic Board	J8-10	Comp 2 Phase A- IGBT Gating Signal
VSD Logic Board	J8-11	Comp 2 Phase B+ IGBT Gating Signal
VSD Logic Board	J8-13	Comp 2 Phase C- IGBT Gating Signal
VSD Logic Board	J8-14	Comp 2 Enable
VSD Logic Board	J9-1	Comp 4 Phase A+ IGBT Gating Signal (N/A)
VSD Logic Board	J9-3	Comp 4 Phase B- IGBT Gating Signal (N/A)
VSD Logic Board	J9-4	Comp 4 Phase C+ IGBT Gating Signal (N/A)
VSD Logic Board	J9-10	Comp 4 Phase A- IGBT Gating Signal (N/A)
VSD Logic Board	J9-11	Comp 4 Phase B+ IGBT Gating Signal (N/A)
VSD Logic Board	J9-13	Comp 4 Phase C- IGBT Gating Signal (N/A)
VSD Logic Board	J9-14	Comp 4 Enable (N/A)
VSD Logic Board	J11-3	Pre-charge Enable 1
VSD Logic Board	J11-7	Pre-charge Enable 2 (N/A Standard) (Frame F)
VSD Logic Board	J10-1,2	VSD Fan / Pump Run
VSD Logic Board	J10-3,4	VSD Fault Relay (to control panel)

BUILDING AUTOMATION SYSTEM (BAS) COMMUNICATIONS

There are 3 different ways the chiller communicates to the BAS.

- Via board native communication protocal;
- Using an E-Link Gateway, or
- Using a SC-EQ Gateway.

Data can be read and some setpoints modified using a BAS serial communication protocol. This capability allows communications of chiller operating parameters and external control changes to chilled liquid temperature setpoint, load limiting, and start/stop commands.

ON-BOARD NATIVE COMMUNICATION PROTOCOLS

The 031-03478-xxx microboard has native communication capabilities to BACnet or N2 systems connected to Port 1 TB3 terminals providing a RS-485 interface.

Native Modbus communication is available on Port 2 TB1 for RS-232 and TB2 for RS-485 interfaces. The hardware select parameter found in the program settings is used to select which port is active.

NOTE: If a LON interface is needed with the 03478 microboard, the E-Link option must be applied.

BACnet MS/TP or N2

- RS-485: connect to TB3 +, - REF and SHLD

Modbus RTU

- RS-485: connect to TB2 +, - GND and SHLD
- RS-232: connect to TB1 TXD, RXD and GND

NOTE: The hardware select parameter in the program settings is used to select which port to use for Modbus.

See *Figure 37 on Page 165 for TB1, and TB2 locations.*

In most cases, communication parameters will need to be modified. *Table 24 on Page 167* lists setup parameters for the available protocols. In the 03478 microboard, press the PROGRAM key then enter the password 5255. The list below shows the displays for the values that may be modified:

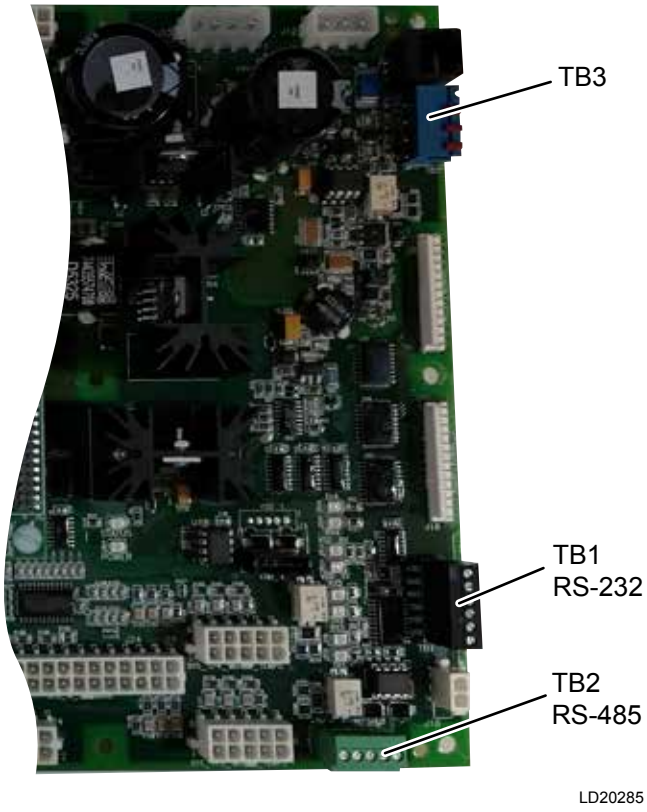


FIGURE 37 - BAS CONNECTORS IN MICROBOARD

The table below shows set-up requirements for each communication protocol.

TABLE 22 - VALUES REQUIRED FOR BAS COMMUNICATION

SETTING DESCRIPTION	Protocol		
	BACnet MS/TP	Modbus RTU[5]	N2
DE MODIFIER ADDRESS	0 to 41943(3)	1	N/A
DE MODIFIER OFFSET	0 to 99(4)	0	N/A
P1 PROTOCOL	BACNET	N/A	N2
P1 MANUAL MAC ADDRESS	0-127(1)	N/A	0-127(1)
P1 BAUD RATE	9600 To 76800 or Auto Selectable(1)	N/A	9600 or 19200
P1 PARITY	NONE	N/A	NONE
P1 STOP BITS	1	N/A	1
P2 PROTOCOL	N/A	MODBUS SVR	N/A
P2 MANUAL MAC ADDRESS	N/A	0-127(1)	N/A
P2 BAUD RATE	N/A	19,200(2)	N/A
P2 PARITY	N/A	NONE(2)	N/A
P2 STOP BITS	N/A	1	N/A
P2 HW SELECT BIT	wN/A	RS-485 or RS-232(1)	N/A
RESET REAL TIME ERROR	N/A	N/A	N/A
CHILLER ID	N/A	N/A	N/A

Note:
[1]as Required By Network
[2]or Other As Required By Network
[3]number Is Multiplied By 100, Set As Required By Network
[4]number Is Added To De Modifier Address, Set As Required By Network
[5]unit Operating Software Version C.Mmc.13.03 Or Later Required For Modbus Protocol.

TABLE 23 - REAL TIME ERROR NUMBERS

ERROR NUMBER (##)	DESCRIPTION
0	ALL OK
1	DATUM TYPE OK TEST FAILED
2	ENGLISH TEXT TOO LONG
3	FLOATING POINT EXCEPTION
4	GET PACKET FAILED
5	GET TYPE FAILED
6	INVALID UNIT CONVERSION
7	INVALID HARDWARE SELECTION
8	REAL TIME FAULT
9	SPANISH TEXT TOO LONG
10	THREAD EXITED
11	THREAD FAILED
12	THREAD STALLED
13	IO BOARD RESET
14	RTC/BRAM INVALID
15	BACNET SETUP FAILED

This data can be read and in some cases modified using a BACnet, Modbus, or N2 network connection. The BACnet Name is a 12 character or shorter name used to identify the data in BACnet. The AI, AV, BI, and BV columns are indexes used to select the data.

The AI, AV, BI, and BV number associated with a BACnet Name should not be changed. If a value is not wanted in this table, change the BACnet Name to SPARE_XX_##. SPARE rows can be used for new values.

When set to BACnet or N2, communications automatically sets Stop Bit (1) and Parity (None) for port.

When connected via BAS and port is set for BACnet, Modbus, or N2, the remote settings will continue to follow the remote setpoints until the port is changed to another protocol or Demodifier address is set to -1.

TABLE 24 - YAGK NATIVE ACTIVE COMMUNICATIONS DATA MAP

YVAA YVFA YAGK			Modbus, BACnet MS/TP, N2 Data Map	Board: 031-03478
Item	Version	York P/N	Comments	
1	Y.ACS.20.02	031-03476-010	New	
2	Y.ACS.20.04	031-03476-010	Updated	
3				
4				
5				
6				
7				
8				
9				
10				

Item Ref Num	BACnet Name	BACnet Object Instance	Modbus Address	Modbus Data Type Supported	Modbus Scaling (See Note 5)	N2 Metasys	Engineering Units		Point List Code: S = Standard O = Optional N = Not Available										
							Imperial	SI	Point List Description	1	2	3	4	5	6	7	8	9	10
ANALOG WRITE POINTS																			
1	REM_SETP	AV1	1026	03,06,16	Div 10	ADF 1	°F	°C	Remote Setpoint	S	S								
2	DMD_LIMIT	AV2	1027	03,06,16	Div 10	ADF 2	% FLA	% FLA	Remote Current Limit Setpoint	S	S								
3	SND_LIMIT	AV3	1028	03,06,16	Div 10	ADF 3	%	%	Remote Sound Limit	S	S								
4	SPARE AV1	AV4	1029	03,06,16	Div 10	ADF 4	None	None	Spare	N	N								
BINARY WRITE POINTS																			
5	START_STOP	BV1	1538	01,03,05,06,15	N/A	BD 1	0/1	0/1	Remote Start / Stop Command [0=Stop, 1=Run]	S	S								
6	SPARE_BV1	BV2	1539	01,03,05,06,15	N/A	BD 2	0/1	0/1	Spare	N	N								
7	SPARE_BV2	BV3	1540	01,03,05,06,15	N/A	BD 3	0/1	0/1	Spare	N	N								
8	SPARE_BV3	BV3	1541	01,03,05,06,15	N/A	BD 3	0/1	0/1	Spare	N	N								
ANALOG READ ONLY POINTS																			
9	LCHLT	AI1	514	03,04	x10	ADF 5	°F	°C	Leaving Chilled Liquid Temperature	S	S								
10	ECHLT	AI2	515	03,04	x10	ADF 6	°F	°C	Entering Chilled Liquid Temperature	S	S								
11	EV_ELT	AI3	516	03,04	x10	ADF 7	°F	°C	Evaporator Entering Liquid Temperature (Free Cooling)	O	O								
12	VSD_IA_TEMP	AI4	517	03,04	x10	ADF 8	°F	°C	VSD Internal Ambient Temperature	S	S								
13	S1_COND_TEMP	AI5	518	03,04	x10	ADF 9	°F	°C	Sys 1 Condenser Temperature	S	S								
14	S2_COND_TEMP	AI6	519	03,04	x10	ADF 10	°F	°C	Sys 2 Condenser Temperature	S	S								
15	S1_DSCH_TEMP	AI7	520	03,04	x10	ADF 11	°F	°C	Sys 1 Discharge Temperature	S	S								
16	S2_DSCH_TEMP	AI8	521	03,04	x10	ADF 12	°F	°C	Sys 2 Discharge Temperature	S	S								
17	OAT	AI9	522	03,04	x10	ADF 13	°F	°C	Ambient Air Temperature	S	S								
18	S1_EDT_TEMP	AI10	523	03,04	x10	ADF 14	°F	°C	Sys 1 Eductor Temperature	S	O								
19	S2_EDT_TEMP	AI11	524	03,04	x10	ADF 15	°F	°C	Sys 2 Eductor Temperature	S	O								
20	S1_OIL_PRESS	AI12	525	03,04	x10	ADF 16	PSI	BAR	Sys 1 Oil Pressure	S	S								
21	S2_OIL_PRESS	AI13	526	03,04	x10	ADF 17	PSI	BAR	Sys 2 Oil Pressure	S	S								
22	S1_SUCT_PRES	AI14	527	03,04	x10	ADF 18	PSI	BAR	Sys 1 Suction Pressure	S	S								
23	S2_SUCT_PRES	AI15	528	03,04	x10	ADF 19	PSI	BAR	Sys 2 Suction Pressure	S	S								
24	S1_DSCH_PRES	AI16	529	03,04	x10	ADF 20	PSI	BAR	Sys 1 Discharge Pressure	S	S								
25	S2_DSCH_PRES	AI17	530	03,04	x10	ADF 21	PSI	BAR	Sys 2 Discharge Pressure	S	S								
26	S1_MC_FLA	AI18	531	03,04	x10	ADF 22	%	%	Sys 1 Motor Current FLA	S	S								
27	S2_MC_FLA	AI19	532	03,04	x10	ADF 23	%	%	Sys 2 Motor Current FLA	S	S								
28	S1_OP_HRS	AI20	533	03,04	x1	ADF 24	None	None	Sys 1 Operating Hours	S	S								
29	S2_OP_HRS	AI21	534	03,04	x1	ADF 25	None	None	Sys 2 Operating Hours	S	S								
30	S1_COMP_ST	AI22	535	03,04	x1	ADF 26	None	None	Sys 1 Compressor Starts	S	S								
31	S2_COMP_ST	AI23	536	03,04	x1	ADF 27	None	None	Sys 2 Compressor Starts	S	S								
32	S1_HI_MTR_T	AI24	537	03,04	x10	ADF 28	°F	°C	Sys 1 Highest Motor Temperature	S	S								
33	S2_HI_MTR_T	AI25	538	03,04	x10	ADF 29	°F	°C	Sys 2 Highest Motor Temperature	S	S								

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TABLE 25 - YAGK NATIVE COMMUNICATIONS DATA MAP (CONT'D)

Item Ref Num	BACnet Name	BACnet Object Instance	Modbus Address	Modbus Data Type Supported	Modbus Scaling (See Note 5)	N2 Metasys	Engineering Units		Point List Code: S = Standard O = Optional N = Not Available										
							Imperial	SI	Point List Description	1	2	3	4	5	6	7	8	9	10
34	VSD_OUT_FR	AI26	539	03,04	x10	ADF 30	Hz	Hz	VSD Output Frequency	S	S								
35	VSD_CMD_FR	AI27	540	03,04	x10	ADF 31	Hz	Hz	VSD Command Frequency	S	S								
36	S1_COND_DR	AI28	541	03,04	x10	ADF 32	%	%	Sys 1 Condenser Drain Valve % Open	S	S								
37	S2_COND_DR	AI29	542	03,04	x10	ADF 33	%	%	Sys 2 Condenser Drain Valve % Open	S	S								
38	S1_OP_CODE	AI30	543	03,04	x1	ADF 34	None	None	Sys 1 Operational Code	S	S								
39	S2_OP_CODE	AI31	544	03,04	x1	ADF 35	None	None	Sys 2 Operational Code	S	S								
40	S1_FTL_CODE	AI32	545	03,04	x1	ADF 36	None	None	Sys 1 Fault Code	S	S								
41	S2_FLT_CODE	AI33	546	03,04	x1	ADF 37	None	None	Sys 2 Fault Code	S	S								
42	S1_FAN_STG	AI34	547	03,04	x1	ADF 38	None	None	Sys 1 Condenser Fan Stage [0-14]	S	S								
43	S2_FAN_STG	AI35	548	03,04	x1	ADF 39	None	None	Sys 2 Condenser Fan Stage [0-14]	S	S								
44	S1_FAN_SPD	AI36	549	03,04	x10	ADF 40	%	%	Sys 1 Condenser Fan Speed (VSD)	O	O								
45	S2_FAN_SPD	AI37	550	03,04	x10	ADF 41	%	%	Sys 2 Condenser Fan Speed (VSD)	O	O								
46	LEAD	AI38	551	03,04	x1	ADF 42	None	None	Lead System	S	S								
47	LCHLT_SETP	AI39	552	03,04	x10	ADF 43	°F	°C	Leaving Chilled Liquid Setpoint	S	S								
48	LCHLT_CUTOUT	AI40	553	03,04	x10	ADF 44	°F	°C	Leaving Chilled Liquid Cutout	S	S								
49	S1_ECON_VLV	AI41	554	03,04	x10	ADF 45	%	%	Sys 1 Economizer Valve % Open	S	S								
50	S2_ECON_VLV	AI42	555	03,04	x10	ADF 46	%	%	Sys 2 Economizer Valve % Open	S	S								
51	SUCT_PRS_CUT	AI43	556	03,04	x10	ADF 47	PSI	BAR	Suction Pressure Cutout	S	S								
52	VSD_DCB_VT	AI44	557	03,04	x1	ADF 48	Volts	Volts	VSD DC Bus Voltage (Unit) VSD DC Bus Voltage Sys 1 (Frame E/F) VSD DC Bus Voltage Sys 2 (Frame E/F)	S	S								
53	VSD_DCB_VT2	AI45	558	03,04	x1	ADF 49	Volts	Volts		O	O								
54	REM_SETPOINT	AI46	559	03,04	x10	ADF 50	°F	°C	Remote Leaving Chilled Liquid Setpoint	S	S								
55	S1_SUBCOOL	AI47	560	03,04	x10	ADF 51	°F (diff)	°C (diff)	Sys 1 Subcooling (Microchannel)	O	O								
56	S1_EVAP_LL	AI48	561	03,04	x10	ADF 52	%	%	Sys 1 Evaporator Liquid Level (Round Tube)	S	S								
57	S2_SUBCOOL	AI49	562	03,04	x10	ADF 53	°F (diff)	°C (diff)	Sys 2 Subcooling (Microchannel)	O	O								
58	S2_EVAP_LL	AI50	563	03,04	x10	ADF 54	%	%	Sys 2 Evaporator Liquid Level (Round Tube)	S	S								
59	COOLING_RNG	AI51	564	03,04	x10	ADF 55	°F	°C	Cooling Range	S	S								
60	S1_DSC_SHEAT	AI52	565	03,04	x10	ADF 56	°F (diff)	°C (diff)	Sys 1 Discharge Superheat	S	S								
61	S2_DSC_SHEAT	AI53	566	03,04	x10	ADF 57	°F (diff)	°C (diff)	Sys 2 Discharge Superheat	S	S								
62	S1_SYS_STATE	AI54	567	03,04	x1	ADF 58	None	None	Sys 1 System State [0=Stopped, 1=Running, 2=Faulted, 4=Locked Out, 5=Pre-Run	S	S								
63	S2_SYS_STATE	AI55	568	03,04	x1	ADF 59	None	None	Sys 2 System State [0=Stopped, 1=Running, 2=Faulted, 4=Locked Out, 5=Pre-Run	S	S								
64	S1_MTR_OVER	AI56	569	03,04	x1	ADF 60	Amps	Amps	Sys 1 Motor Current Overload Setting	S	S								
65	S2_MTR_OVER	AI57	570	03,04	x1	ADF 61	Amps	Amps	Sys 2 Motor Current Overload Setting	S	S								
66	FAN_TYPE	AI58	571	03,04	x1	ADF 62	None	None	Condenser Fan Control Type [1-4]	S	S								
67	FC_MODE	AI59	572	03,04	x1	ADF 63	None	None	Free Cooling Mode [0=Mech, 1=Free Cool, 2=Hybrid] (Free Cooling)	O	O								
68	FC_CTRL	AI60	573	03,04	x1	ADF 64	%	%	Free Cooling Control Programmed [0=Disabled, 1=Open Loop, 2=Closed Loop] (Free Cooling)	N	O								
69	CC_BYP_VALVE	AI61	574	03,04	x10	ADF 65	%	%	Cooling Coil Bypass Valve (Free Cooling Closed Loop)	N	O								
70	CC_VALVE	AI62	575	03,04	x10	ADF 66	%	%	Cooling Coil Valve (Free Cooling Closed Loop)	N	O								
71	CC_TEMP	AI63	576	03,04	x10	ADF 67	°F	°C	Cooling Coil Temperature (Free Cooling Closed Loop)	N	O								
72	HX_LEAVE_TEMP	AI64	577	03,04	x10	ADF 68	°F	°C	Heat Exchanger Leaving Temperature (Free Cooling Closed Loop)	N	O								
73	HX_ENTER_TEMP	AI65	578	03,04	x10	ADF 69	°F	°C	Heat Exchanger Entering Temperature (Free Cooling Closed Loop)	N	O								
74	GLY_PMP_SPD	AI66	579	03,04	x10	ADF 70	%	%	Glycol Pump Speed (Free Cooling Closed Loop)	N	O								
75	1_SUCT_TEMP	AI67	580	03,04	x10	ADF 71	°F	°C	Sys 1 Suction Temperature (YAGK)	N	O								
76	1_SAT_SUCT	AI68	581	03,04	x10	ADF 72	°F	°C	Sys 1 Sat Suction Temperature (YAGK)	N	O								
77	1_SUCT_SHEAT	AI69	582	03,04	x10	ADF 73	°F (diff)	°C (diff)	Sys 1 Suction Superheat (YAGK)	N	O								

TABLE 25 - YAGK NATIVE COMMUNICATIONS DATA MAP (CONT'D)

Item Ref Num	BACnet Name	BACnet Object Instance	Modbus Address	Modbus Data Type Supported	Modbus Scaling (See Note 5)	N2 Metasys	Engineering Units		Point List Code: S = Standard O = Optional N = Not Available										
							Imperial	SI	Point List Description	1	2	3	4	5	6	7	8	9	10
78	1_FTDV_CMD	AI70	583	03,04	x10	ADF 74	%	%	Sys 1 Flash Tank Drain Valve % (YAGK)	N	O								
79	2_SUCT_TEMP	AI71	584	03,04	x10	ADF 75	°F	°C	Sys 2 Suction Temperature (YAGK)	N	O								
80	2_SAT_SUCT	AI72	585	03,04	x10	ADF 76	°F	°C	Sys 2 Sat Suction Temperature (YAGK)	N	O								
81	2_SUCT_SHEAT	AI73	586	03,04	x10	ADF 77	°F (diff)	°C (diff)	Sys 2 Suction Superheat (YAGK)	N	O								
82	2_FTDV_CMD	AI74	587	03,04	x10	ADF 78	%	%	Sys 2 Flash Tank Drain Valve % (YAGK)	N	O								
83	INPUT_CURR	AI75	588	03,04	x10	ADF 79	Amps	Amps	Unit Input Current Amps	N	S								
BINARY READ ONLY POINTS																			
84	CH_ALARM	BI1	1282	01,02,03	N/A	BD5	0/1	0/1	Chiller Alarm [0=No Alarm, 1=Alarm]	S	S								
85	CH_RUN	BI2	1283	01,02,03	N/A	BD6	0/1	0/1	Chiller Run [0=No Run, 1=Run]	S	S								
86	EVAP_HEATER	BI3	1284	01,02,03	N/A	BD7	0/1	0/1	Evaporator Heater Status	S	S								
87	EVAP_PUMP	BI4	1285	01,02,03	N/A	BD8	0/1	0/1	Evaporator Pump Status	S	S								
88	S1_COMP_RUN	BI5	1286	01,02,03	N/A	BD9	0/1	0/1	Sys 1 Compressor Run Status	S	S								
89	S2_COMP_RUN	BI6	1287	01,02,03	N/A	BD10	0/1	0/1	Sys 2 Compressor Run Status	S	S								
90	S1_VI_STEP1	BI7	1288	01,02,03	N/A	BD11	0/1	0/1	Sys 1 VI Step Solenoid Valve 1 Status	S	S								
91	S2_VI_STEP1	BI8	1289	01,02,03	N/A	BD12	0/1	0/1	Sys 2 VI Step Solenoid Valve 1 Status	S	S								
92	S1_VI_STEP2	BI9	1290	01,02,03	N/A	BD13	0/1	0/1	Sys 1 VI Step Solenoid Valve 2 Status	S	S								
93	S2_VI_STEP2	BI10	1291	01,02,03	N/A	BD14	0/1	0/1	Sys 2 VI Step Solenoid Valve 2 Status	S	S								
94	WATER_GLYCOL	BI11	1292	01,02,03	N/A	BD15	0/1	0/1	Cooling Type [0=Water, 1=Glycol]	S	S								
95	LOCAL_REMOTE	BI12	1293	01,02,03	N/A	BD16	0/1	0/1	Local Remote Control Mode [0=Local, 1=Remote]	S	S								
96	DISP_UNITS	BI13	1294	01,02,03	N/A	BD17	0/1	0/1	Display Units [0=Imperial, 1=SI]	S	S								
97	S1_LOCKOUT	BI14	1295	01,02,03	N/A	BD18	0/1	0/1	Sys 1 Lockout	S	S								
98	S2_LOCKOUT	BI15	1296	01,02,03	N/A	BD19	0/1	0/1	Sys 2 Lockout	S	S								
99	FC_VALVE	BI16	1297	01,02,03	N/A	BD20	0/1	0/1	Free Cooling Valve [0=Off, 1=On] (Free Cooling)	S	S								
100	SOFT_SHUT	BI17	1298	01,02,03	N/A	BD21	0/1	0/1	Soft Shutdown [0=Disabled, 1=Enabled]	S	S								
101	REM_EVAP	BI18	1299	01,02,03	N/A	BD22	0/1	0/1	Remote Evaporator [0=Disabled, 1=Enabled]	S	S								
102	QUICK_ST	BI19	1300	01,02,03	N/A	BD23	0/1	0/1	Quick Start [0=Disabled, 1=Enabled]	S	S								
103	FRAME_EF	BI20	1301	01,02,03	N/A	BD24	0/1	0/1	Frame E/F [0=Disabled, 1=Enabled]	S	S								
104	SOUND_OP	BI21	1302	01,02,03	N/A	BD25	0/1	0/1	Sound Limit Option [0=Disabled, 1=Enabled]	S	S								
105	GLY_PMP_RUN	BI22	1303	01,02,03	N/A	BD26	0/1	0/1	Glycol Pump Run [0=Off, 1=On] (Free Cooling Closed Loop)	O	O								
106	GLY_HEATER	BI23	1304	01,02,03	N/A	BD27	0/1	0/1	Glycol Heater [0=Off, 1=On] (Free Cooling Closed Loop)	O	O								

NOTES	
1	Units have Native BACnet MS/TP, Modbus RTU, and N2 communications. No external Gateway is required for these interfaces unless the customer is using Connected Services.
2	BACnet Object Types: 0 = Analog In, 1 = Analog Out, 2 = Analog Value, 3 = Binary In, 4 = Binary Out, 8 = Device, 15 = Alarm Notification (0-127 are reserved ASHRAE Objects)
3	WC = Inches of water Column, CFM = Cubic Feet per Minute, FPM = Feet Per Minute, PSI = Pounds per Square Inch, Pa = Pascals, kPa = kiloPascals, PPM = Parts Per Million, kJ/kg = kiloJoules per kilogram
4	Values that are not applicable due to unit configuration and options will be sent as zero (0).
5	Modbus values are all of type signed. Scaling values in **x10** (Bold) indicate scaling in metric is x100. Scaling and signing may not be modified in the field.
6	
7	
8	
9	
10	

TABLE 25 - YAGK NATIVE COMMUNICATIONS DATA MAP (CONT'D)

Code Value	Operational Code	Code Value	Fault/Inhibit Code
63	Manual Override	0	No Fault Code
64	Daily Schedule Shutdown	1	Low Ambient Temperature
65	Unit Switch OFF	2	High Ambient Temperature
66	Remote Controlled Shutdown	3	Low Chilled Liquid Temperature
67		4	VSD Initialization Failure
68	Flow Switch Shutdown	5	Low RTC Battery Voltage
69	VSD Cooling Shutdown	6	Invalid Number of Compressors Selected
70	Serial Number Shutdown	7	VSD Communications Failure
71		8	Pre-charge Low DC Bus Voltage (Unit)
72	Discharge Superheat Recovery	9	Pre-charge DC Bus Voltage Imbalance (Unit)
73		10	High DC Bus Voltage (Unit)
74	No Run Permissive	11	Low DC Bus Voltage (Unit)
75	Anti-Recycle Timer Active	12	DC Bus Voltage Imbalance (Unit)
76	System Switch OFF	13	High VSD Ambient Temperature
77	System Not Running	14	Single Phase Input (Unit)
78	System Running	15	VSD Power Supply Fault
79	Discharge Pressure Limiting	16	VSD Logic Board Fault
80	Suction Pressure Limiting	17	Motor Current Overload (Hardware)
81	Motor Current Limiting	18	CT Plug Fault
82	Free Cooling	19	
83	ISN/BAS Motor Current Limiting	20	
84	Remote Motor Current Limiting	21	
85	System Shutting Down	22	
86	VSD Pre-Charging	23	
87	VSD Baseplate Temp Limiting	24	
88	VSD Internal Ambient Temp Limiting	25	
89	Sound Limiting	26	
90	ISN Sound Limiting	27	High Discharge Pressure (Software)
91	Remote Sound Limiting	28	High Differential Oil Pressure
92	Pulldown Motor Current Limiting	29	Low Differential Oil Pressure
93	Cooling Demand Shutdown	30	Low Suction Pressure
94	Input Current Limiting	31	High Discharge Temperature
95	ISN Input Current Limiting	32	
96	Remote Input Current Limiting	33	Eductor Clog Fault
97	Pulldown Input Current Limiting	34	Sensor Failure
98		35	Low Motor Current
99		36	High Motor Temperature
		37	Pre-charge Low DC Bus Voltage (System, Frame E/F)
		38	Pre-charge DC Bus Voltage Imbalance (System, Frame E/F)
		39	High DC Bus Voltage (System, Frame E/F)
		40	Low DC Bus Voltage (System, Frame E/F)
		41	DC Bus Voltage Imbalance (System, Frame E/F)
		42	High Motor Current
		43	Motor Current Overload (Software)
		44	IGBT Gate Driver Fault
		45	High Baseplate Temperature
		46	Single Phase Input (System, Frame E/F)
		47	VSD Run Signal Fault
		48	High Discharge Pressure (Hardware - HPCO)
		49	Low Suction Superheat
		50	Control Voltage Fault
		51	Low Discharge Superheat

SC-EQ COMMUNICATION CARD

The SC-EQUIP (SC-EQ) Communication Card supersedes the E-Link Gateway and provides BAS network connectivity for Johnson Controls® and YORK® mechanical equipment, such as chillers and rooftop units. It is designed with four active serial ports: The J12 BAS (RS-485) port, the J7 Equipment (RS-232) port, the J8 Equipment (RS-485) port and the J11 CS port which allows equipment data to be sent to the Johnson Controls Remote Operation Center for remote chiller monitoring and diagnostics.

To simplify the installation and setup, the SC-EQ Communication Card automatically determines the BAS protocol and Baud rate and the model of the connected chiller or rooftop unit. The only user setting is the MAC address for the SC-EQ on the BAS network.

Several SC-EQ Communication Card models are available for connection to various types of input voltage and equipment. For chillers using the OptiView™ 01730, 02430 or 03630 microboards, the SC-EQ Communication Card consists of a single circuit board attached to four studs inside the Micro Panel, using the accessory mounting kit. The microboard supplies 12 VDC input power, eliminating the need for an external power supply.

For screw compressor chillers using the 02478 or 03478 microboards, the SC-EQ Communication Card is installed inside the Micro Panel, using the accessory mounting kit. The microboard supplies 12 VDC input power, eliminating the need for an external power supply.

For scroll compressor chillers using the 02050 or 02550 microboards, the SC-EQ Communication Card is installed inside the Micro Panel and requires an additional transformer to supply power to the SC-EQ Communication Card. The transformer is included in the SC-EQ Scroll Chiller Installation Kit.

For other types of chillers, the SC-EQ Communication Card is packaged in its own enclosure. In addition to the SC-EQ Communication Card circuit board, a transformer is included inside the enclosure that converts a 120VAC or 240VAC input to 24 VAC power.

TABLE 25 - SC-EQ COMMUNICATION CARD PRODUCT CODE NUMBERS

DESCRIPTION	PRODUCT CODE NUMBERS
SC-EQ with Serial Outputs (BACnet Master-Slave/Token-Passing [MS/TP], Modbus Remote Terminal Unit [RTU], and N2)	SE-SCC1001-0 (031-03610-000)
SC-EQ with Serial Outputs in Enclosure	YK-SCCPNL-0
SC-EQ OptiView Panel Installation Kit	331-03607-000
SC-EQ Screw Chiller Panel Installation Kit	392-41228-000
SC-EQ Scroll Chiller Panel Installation Kit	392-41230-000

NOTE: For LON integration use the appropriate E-Link.

For more information, please look through Form 450.50-PB1 so you can learn more about the SC-Equipment Communication Card including features, connections introduction and technical specification, and Form 450.50-N1 to learn more about the installation, troubleshooting, SC-AP Gateway and its application.

SC-EQ and SC-AP Gateway can interface with Johnson Controls Connected Chiller Service and can be used when trouble shooting connectivity issues.

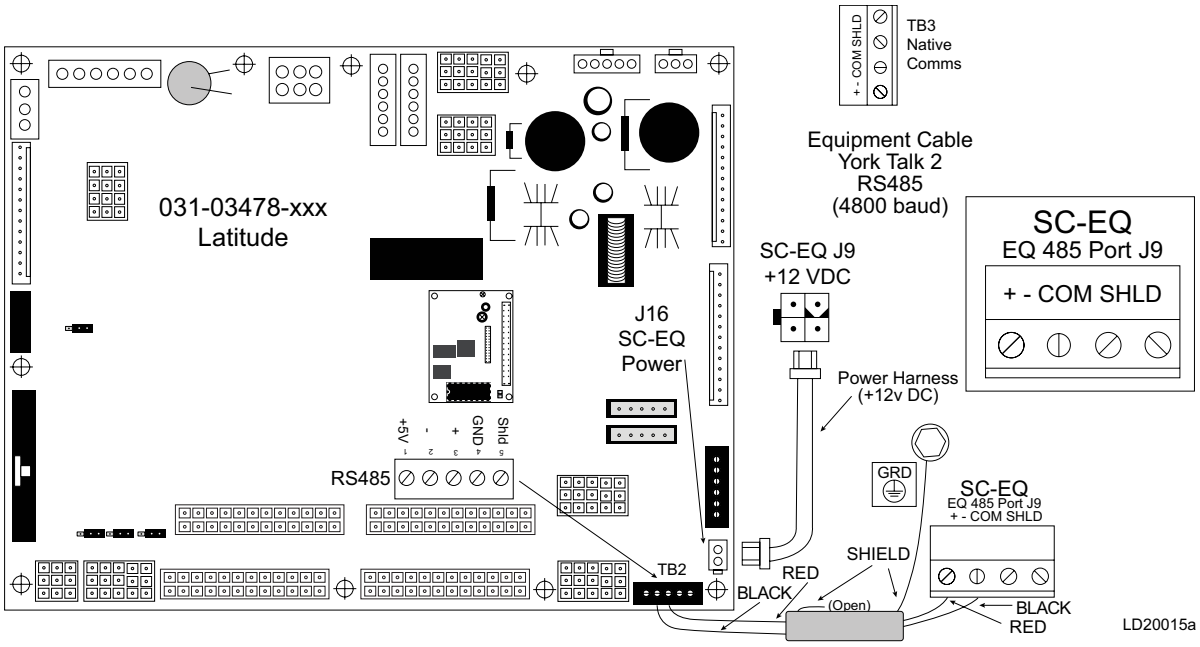


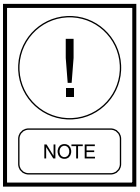
FIGURE 38 - SQ-EG COMMUNICATIONS CARD CONNECTIONS FOR CHILLERS WITH 03478 MICROBOARD YAGK

SECTION 9 - MAINTENANCE

GENERAL REQUIREMENTS

The units have been designed to operate continuously, provided they are regularly maintained and operated within the limitations given in this manual. Each unit should be included in a routine schedule of daily maintenance checks by the operator/customer, backed up by regular service inspection and maintenance visits by a suitably qualified Service Engineer.

It is entirely the responsibility of the owner to provide for these regular maintenance requirements and/or enter into a maintenance agreement with a Johnson Controls service organization to protect the operation of the unit. If damage or a system failure occurs due to improper maintenance during the warranty period, Johnson Controls shall not be liable for costs incurred.



This Maintenance section applies to the basic unit only and may, on individual contracts, be supplemented by additional requirements to cover any modifications or ancillary equipment as applicable.

The Safety section of this manual should be read carefully before attempting any maintenance operations on the unit.

Weekly Maintenance

The following maintenance checks should be carried out on a weekly basis by the operator/customer. Please note that the units are not generally user serviceable and no attempt should be made to rectify faults or problems found during daily checks unless competent and equipped to do so. If in any doubt, contact your local Johnson Controls Service Agent.

Unit Status

Press the 'STATUS' key on the keypad and ensure no fault messages are displayed.

Refrigerant Leaks

Visually check the heat exchangers, compressors and pipework for damage and gas leaks.

Operating Conditions

Read the operating pressures and temperatures at the control panel using the display keys and check that these are within the operating limitations given in the manual.

Compressor Oil Level

Compressor oil level will typically run below the bottom of the sight glass. Oil levels will only be visible in the sight glass after running for periods of 15 to 30 minutes at full compressor speed. Do not run with oil levels above the sight glass. Be careful when viewing the sight glass not to confuse a full sight glass with an empty sight glass.

REFRIGERANT REMOVAL, EVACUATION AND CHARGING A YAGK CHILLER

Refrigerant Removal

Carefully review the following caution below before proceeding with the recommended process.

Incorrect removal of refrigerant will result in catastrophic freeze damage to the evaporator and possible additional damage to other chiller components. Whenever there is water in the evaporator, the chilled liquid pumps must be ON and circulating liquid through the evaporator above minimum recommended flow rates. When liquid refrigerant is being removed, monitor the pressure and do not allow the pressure to drop below the freeze point of the chilled liquid flowing through the evaporator until all liquid refrigerant has been removed from the evaporator and only gas remains. Once all liquid has been removed, the remaining refrigerant vapor can be removed while allowing the pressure to drop below the freeze point with the pump circulating liquid through the evaporator.

To remove refrigerant from the evaporator, follow the procedure below:

1. Turn the chilled liquid pump ON and assure the flow is above the minimum recommended flow.
2. Assure all manual valves in the system are open. Open Condenser Drain and Economizer Feed valves to 100% in the service mode.
3. Connect the recovery unit to a recovery cylinder sitting on an accurate scale.
4. Turn the recovery unit ON and observe the liquid refrigerant flowing from the line into the cylinder. The flow of liquid should be obvious.
5. Monitor the pressure gauge to assure that the pressure does not drop below the freeze point of the chilled liquid. Throttle the flow as needed with the manifold gauge valves to prevent pressures from dropping below the freeze point.
6. Continue to remove the liquid refrigerant while observing the flow and the pressure. Note the charge in the system based on the nameplate data to determine when the charge removal is nearly complete. Monitor the weight of the recovery cylinder to determine when the cylinder is full. Change the cylinder as needed.
7. Continue removing refrigerant until liquid is no longer observed flowing in the manifold hoses.
8. Once the liquid is removed and no longer visible in the hose, the remaining gas can be pumped out with the recovery unit while the pressure is allowed to drop to 0 PSIG.
9. Servicing may now be performed on the system as needed.

Glycol Disposal Attentions

To effectively protect the environment including soil, water and air, Glycol disposal must observe the national or local code and all of the regulations on glycol disposal or chemical material disposal.

Evacuating a System

To evacuate a system, follow the procedure below:

1. Turn the chilled liquid pump ON and assure the flow is above the minimum recommended flow.
2. Assure all manual valves are open. Open the Condenser Drain (Flash Tank Feed) and Economizer Valves in the Service Mode to 100 %
3. Connect vacuum hoses to as many points as possible. Be sure that at least one connection is made on both the high and low side of the piping. A connection to the evacuation fitting on the compressor is also recommended. Evacuate the system to a minimum of 500 microns. Close the valves at the evacuation points and assure the pressure in the chiller does not rise more than 50 microns in 10 minutes. Check for leaks if the pressure rises.

Charging Refrigerant into a System

To charge the system with refrigerant, follow the procedure below:

1. Turn the chilled liquid pump ON and assure the flow is above the minimum recommended flow. Open all manual system valves and open the Condenser Drain Valve to 100% by manually opening them in the Service Mode. Charge refrigerant vapor into the high side of the empty system at the charging port on the line between the flash tank and the evaporator. Continue charging vapor until the pressure is above the freeze point of the chilled liquid. Once above the freeze point, liquid can be charged according to the recommended nameplate charge.
2. Close (0%) the Condenser Drain Valve in the Service Mode. Recycle the chiller power.
3. Once the system is operating, the charge will distribute itself throughout the system. Trim the charge as needed based on required subcooling while system is running full load at least 15 minutes.

Evaporator pumps must be run while servicing chiller. Liquid above the minimum flow rate must be circulated through the evaporator to prevent risk of evaporator freezing while transferring refrigerant or evacuating refrigerant systems.

MICROCHANNEL COIL CLEANING

The coil cleaning procedure for microchannel coils is significantly different than tube and fin type coils. As such, care must be taken to understand the differences

to avoid damage to the microchannel coil. These differences require a number of DO NOT's that must be observed:

- DO NOT use coil cleaners or any chemical on a microchannel coil. This can cause severe damage to the coils.
- DO NOT use a pressure washer to clean the coils. While it is possible to clean a coil with a pressure washer, it's also possible to destroy it.
- DO NOT contact the coil with a hard surface such as a hose nozzle or metal vacuum nozzle or any other tool.

CHILLED LIQUID SYSTEM MAINTENANCE

Whenever the chilled liquid system requires maintenance, adhere to and observe all precautions noted below.

Scheduled Maintenance

The maintenance operations detailed in "*Table 26 - Scheduled Maintenance Requirements*" on page 176, should be carried out on a regular basis by a suitably qualified Service Engineer. It should be noted that the interval necessary between each 'minor' and 'major' service can vary depending on, for instance, application, site conditions and expected operating schedule. Normally a 'minor' service should be carried out every three to six months and a 'major' service once a year. It is recommended that your local Johnson Controls Service Center is contacted for recommendations for individual sites.

Chiller / Compressor Operating Log

A Chiller/Compressor Operating Log is supplied at the end of this section for logging compressor and chiller operating data.

Before Applying Power To The Chiller, Assure The Chilled Liquid System Is Filled

DO NOT apply power to the chiller unless the system is filled with water or glycol. If the chiller is equipped with the -20°F option, applying power to an empty chilled liquid system will cause the evaporator immersion heaters to fail.

Removing Water/Glycol From The Evaporator

If the chiller is equipped with a -20°F evaporator freeze protection option, which incorporates immersion heaters, power must be removed from the chiller before the evaporator is drained to assure the heaters are not damaged. Failure to remove power will cause the evaporator immersion heaters to fail.

Evaporator Freeze Damage

Power must remain on the chiller whenever the ambient temperature drops below 32°F with water in the evaporator to avoid evaporator damage. To avoid damage, assure the correct heater option for 0°F minimum ambient or -20°F minimum ambient temperature is installed, based on the lowest expected ambient temperature at the chiller location.

During operation, the glycol freeze point must also be below the lowest expected refrigerant temperature.

MAINTENANCE REQUIREMENTS FOR YAGK CHILLERS

TABLE 26 - SCHEDULED MAINTENANCE REQUIREMENTS

PROCEDURE	WEEKLY	MONTHLY	QUARTERLY	SEMI-ANNUALLY	ANNUALLY	EVERY 5 YEARS
Check Oil Level in Oil Separator Sight Glass.	x					
Check Liquid Line Sight Glass/ Moisture Indicator.	x					
Record System Operating Temperatures and Pressures.	x					
Check Condenser Coils for dirt / debris and clean as necessary.		x				
Check Programmable Operating Setpoints and Safety Cutouts, Assure they are correct for the application.		x				
Check Compressor and Evaporator Heater operation.		x				
Check fan operation status.		x				
Leak check the chiller.		x				
Check for dirt in the Panel, Check Door Gasket sealing integrity.			x			
Sample Compressor Oil, check for Acid, and replace if necessary.					x	
Disconnect Power Source and Lock out, Check tightness of Power Wiring connections.					x	
VSD Glycol Charge.						x

TABLE 27 - TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	ACTION
NO DISPLAY ON CONTROL PANEL UNIT WILL NOT RUN	Supply to the Panel is missing.	High Voltage to the Chiller is missing.
		Check 1FU, 2FU, 4FU, 5FU 17FU, or 19FU.
		Check 2T or 10T Transformer.
	Line Fuse is blown.	Check Fuses.
	Chiller Control Board is defective.	Replace Chiller Control Board.
	Display Board defective.	Replace Display Board.
LINE FUSE BLOWS	SCR Diode Module is defective.	Check SCR/Diode Module.
	IBGT Module is defective.	Check IBGT Module.
	VSD Logic Board is defective.	Replace VSD Logic Board.
	SCR Trigger Board is defective.	Replace SCR Trigger Board.
CHILLER FAULT: LOW AMBIENT TEMPERATURE	Ambient temperature is lower than the programmed operating limit.	Check the programmed cutout and determine if it is programmed correctly.
	Ambient Sensor is defective.	Check the panel against the thermometer reading of ambient temperature.
CHILLER FAULT: HIGH AMBIENT TEMPERATURE	Ambient Temperature is above the maximum operating limit.	Check outside air temperature.
	Ambient Sensor is defective.	Check the Panel Display against Thermometer reading of Ambient Temperature at the sensor.
CHILLER FAULT: LOW LEAVING CHILLED LIQUID	Leaving chilled liquid temperature drops faster than the unit can unload.	Check for restricted flow.
		Check for rapid flow changes.
		Water loop is too small.
		Flow is below minimum for chiller.
	Chilled Water Sensor is defective.	Check Sensor against Temp. Gauge in water line.
		Check Sensor for intermittent operation.
		Check Wiring for shorts or opens.
SYSTEM FAULT: CONTROL VOLTAGE	System Fuse is blown.	Check respective system Fuse 20FU or 21FU.
SYSTEM FAULT: HIGH OIL TEMPERATURE	Oil Temperature Sensor is defective.	Check Sensor with infrared to determine if reading is reasonable.
	Condenser Fans NOT operating or running backwards.	Check Fans.
	Coils dirty.	Check and clean Coils.

NOTE: Always remove power to the chiller and the assure the DC Bus voltage has bled off.

TABLE 28 - TROUBLESHOOTING GUIDE (CONT'D)

SYSTEM FAULT: HIGH DISCHARGE PRESSURE	Coils dirty.	Check and clean coils.
	Coils are damaged.	Comb out fins.
	Fans NOT operating.	Check fan fuses.
		Check fan rotation.
		Check fan motor/blade.
	System is overcharged.	Remove charge and check subcooling.
SYSTEM FAULT: HIGH DISCHARGE TEMPERATURE	Discharge Temperature Sensor is defective.	Check Sensor.
	Condenser Fans NOT operating or are running backwards.	Check Fans.
	Coils dirty.	Check and clean Coils.
	High Superheat.	Measure Superheat with gauges and thermocouple. Determine cause.
SYSTEM FAULT: HIGH MOTOR TEMPERATURE	High Motor temperature input from one of the sensors.	Refrigerant charge low. Check evaporator sight glass.
		Excess charge in system, High discharge pressure. Check subcooling.
		High Superheat. Flash Tank Feed Valve NOT controlling. Isolate cause.
		Motor Sensor reading incorrectly. Program panel to ignore a single sensor.
		Economizer Solenoid energized at low speeds. Valve is leaking through.
SYSTEM FAULT: LOW SUCTION PRESSURE	Low charge.	Check evaporator sight glass.
	Transducer reads incorrectly.	Check transducer against a gauge.
	Suction Temp. Sensor reads incorrectly.	Check sensor against a thermocouple.
	Low flow.	Check flow.
	Condenser Drain (Flash Tank Feed) Valve NOT operating.	Check Flash Tank Feed Valve operation. Check superheat.
	Condenser or Drain (Flash Tank Feed) Valve defective.	Check Flash Tank Feed Valve operation. Check superheat.
SYSTEM FAULT: DISCHARGE PRESSURE LIMITING	Discharge Transducer is defective.	Check transducer against a gauge.
	Ambient temperature very high.	Normal operation.
	Fans NOT operating.	Check fan operation.
	Remote or local discharge pressure load limiting is programmed.	Normal operation.

NOTE: Always remove power to the chiller and assure the DC Bus voltage has bled off.

TABLE 28 - TROUBLESHOOTING GUIDE (CONT'D)

SYSTEM STATUS: MOTOR CURRENT LIMITING	A high motor current anticipatory control has activated current limiting.	Ambient temperature is high, normal response from controller.
		Remote or panel limiting is in effect, Normal response.
		Excess charge in system, adjust charge.
		Condenser coils dirty, Clean condenser.
		Fans NOT operating. Check fans.
VSD FAULT: HIGH BASEPLATE TEMPERATURE	Coolant level low.	Add coolant.
	Glycol Pump is defective.	Replace Glycol Pump.
	VSD Board is defective.	Replace VSD Logic Board.
	IBGT Module is defective.	Check defective IGBT Module.
VSD FAULT: LOW DC BUS VOLTAGE	SCR / Diode Module is defective.	Check SCR / Diode Module.
	SCR Trigger Board is defective.	Check SCR Trigger Board.

NOTE: Always remove power to the chiller and assure the DC Bus voltage has bled off.

R-134A CONVERSION TABLES

The following table can be used for converting R-134a pressures to their equivalent saturated temperatures.

TABLE 28 - R-134A PRESSURE TO SATURATED TEMPERATURE CONVERSION

PRESSURE PSIG (BAR)	DEW POINT TEMP. ºF (ºC)	PRESSURE PSIG (BAR)	DEW POINT TEMP. ºF (ºC)	PRESSURE PSIG (BAR)	DEW POINT TEMP. ºF (ºC)
0.0 (0)	-14.9 (-26.1)	135.0 (9.31)	105.0 (40.6)	270.0 (18.62)	152.0 (66.7)
5.0 (.34)	-3.0 (-19.4)	140.0 (9.65)	107.2 (41.8)	275.0 (18.96)	153.4 (67.4)
10.0 (.69)	6.7 (-14.1)	145.0 (10.0)	109.4 (43)	280.0 (19.31)	154.7 (68.2)
15.0 (1.03)	14.9 (-9.5)	150.0 (10.34)	111.5 (44.2)	285.0 (19.65)	156.1 (68.9)
20.0 (1.38)	22.2 (-5.4)	155.0 (10.69)	113.6 (45.3)	290.0 (19.99)	157.4 (69.7)
25.0 (1.72)	28.7 (-1.8)	160.0 (11.03)	115.6 (46.4)	295.0 (20.34)	158.7 (70.4)
30.0 (2.07)	34.6 (1.4)	165.0 (11.38)	117.6 (47.6)	300.0 (20.68)	160.0 (71.1)
35.0 (2.41)	40.0 (4.4)	170.0 (11.72)	119.6 (48.7)	305.0 (21.03)	161.3 (71.8)
40.0 (2.76)	45.0 (7.2)	175.0 (12.07)	121.5 (49.7)	310.0 (21.37)	162.5 (72.5)
45.0 (3.10)	49.6 (9.8)	180.0 (12.41)	123.3 (50.7)	315.0 (21.72)	163.8 (73.2)
50.0 (3.45)	54.0 (12.2)	185.0 (12.76)	125.2 (51.8)	320.0 (22.06)	165.0 (73.9)
55.0 (3.79)	58.1 (14.5)	190.0 (13.10)	126.9 (52.7)	325.0 (22.41)	166.2 (74.6)
60.0 (4.14)	62.0 (16.7)	195.0 (13.44)	128.7 (53.7)	330.0 (22.75)	167.4 (75.2)
65.0 (4.48)	65.7 (18.7)	200.0 (13.79)	130.4 (54.7)	335.0 (23.10)	168.6 (75.9)
70.0 (4.83)	69.2 (20.7)	205.0 (14.13)	132.1 (55.6)	340.0 (23.44)	169.8 (76.6)
75.0 (5.17)	72.6 (22.6)	210.0 (14.48)	133.8 (56.6)	345.0 (23.79)	171.0 (77.2)
80.0 (5.52)	75.9 (24.4)	215.0 (14.82)	135.5 (57.5)	350.0 (24.13)	172.1 (77.8)
85.0 (5.86)	79.0 (26.1)	220.0 (15.17)	137.1 (58.4)	355.0 (24.48)	173.3 (78.5)
90.0 (6.21)	82.0 (27.8)	225.0 (15.51)	138.7 (59.3)	360.0 (24.82)	174.4 (79.1)
95.0 (6.55)	84.9 (29.4)	230.0 (15.86)	140.2 (60.1)	365.0 (25.17)	175.5 (79.7)
100.0 (6.89)	87.7 (30.9)	235.0 (16.20)	141.8 (61)	370.0 (25.51)	176.6 (80.3)
105.0 (7.24)	90.4 (32.4)	240.0 (16.55)	143.3 (61.8)	375.0 (25.86)	177.7 (80.9)
110.0 (7.58)	93.0 (33.9)	245.0 (16.89)	144.8 (62.3)	380.0 (26.20)	178.8 (81.6)
115.0 (7.93)	95.5 (35.3)	250.0 (17.24)	146.3 (63.5)	385.0 (26.54)	179.9 (82.2)
120.0 (8.27)	98.0 (36.7)	255.0 (17.58)	147.7 (64.3)	390.0 (26.89)	180.9 (82.7)
125.0 (8.62)	100.4 (38)	260.0 (17.93)	149.2 (65.1)	395.0 (27.23)	182.0 (83.3)
130.0 (8.96)	102.7 (39.3)	265.0 (18.27)	150.6 (65.9)	400.0 (27.58)	183.0 (83.9)

CHILLED LIQUID AND SUCTION TEMPERATURE SENSOR INPUT VOLTAGE

TABLE 29 - TEMPERATURE INPUT VOLTAGE SENSOR (MEASURED SIGNAL TO SHIELD AT THE SENSOR)

TEMP. ºF (°C)	VOLTAGE	TEMP. °F (°C)	VOLTAGE	TEMP. °F (°C)	VOLTAGE
16.1 (-8.8)	1.52	35.9 (2.2)	2.19	55.6 (13.1)	2.85
16.7 (-8.5)	1.54	36.5 (2.5)	2.21	56.3 (13.5)	2.87
17.3 (-8.2)	1.56	37.0 (2.8)	2.23	56.9 (13.8)	2.89
17.9 (-7.8)	1.58	37.6 (3.1)	2.25	57.5 (14.2)	2.91
18.5 (-7.5)	1.60	38.2 (3.4)	2.27	58.1 (14.5)	2.93
19.1 (-7.2)	1.62	38.7 (3.7)	2.29	58.7 (14.8)	2.95
19.7 (-6.8)	1.64	39.3 (4.1)	2.30	59.4 (15.2)	2.97
20.3 (-6.5)	1.66	39.9 (4.4)	2.32	60.0 (15.6)	2.99
20.9 (-6.2)	1.68	40.4 (4.7)	2.34	60.6 (15.9)	3.01
21.5 (-5.8)	1.70	41.0 (5.0)	2.36	61.3 (16.3)	3.03
22.1 (-5.5)	1.72	41.6 (5.3)	2.38	61.9 (16.6)	3.05
22.7 (-5.2)	1.74	42.1 (5.6)	2.40	62.5 (16.9)	3.07
23.3 (-4.8)	1.76	42.7 (5.9)	2.42	63.2 (17.3)	3.09
23.9 (-4.5)	1.78	43.3 (6.3)	2.44	63.8 (17.7)	3.11
24.5 (-4.2)	1.80	43.9 (6.6)	2.46	64.5 (18.1)	3.13
25.0 (-3.9)	1.82	44.4 (6.9)	2.48	65.1 (18.4)	3.14
25.6 (-3.6)	1.84	45.0 (7.2)	2.50	65.8 (18.8)	3.16
26.2 (-3.2)	1.86	45.6 (7.5)	2.52	66.5 (19.2)	3.18
26.8 (-2.9)	1.88	46.2 (7.9)	2.54	67.1 (19.5)	3.20
27.3 (-2.6)	1.90	46.7 (8.2)	2.56	67.8 (19.9)	3.22
27.9 (-2.8)	1.91	47.3 (8.5)	2.58	68.5 (20.3)	3.24
28.5 (-1.9)	1.93	47.9 (8.8)	2.60	69.2 (20.7)	3.26
29.0 (-1.7)	1.95	48.5 (9.2)	2.62	69.9 (21.1)	3.28
29.6 (-1.3)	1.97	49.1 (9.5)	2.64	70.6 (21.4)	3.30
30.2 (-1)	1.99	49.7 (9.8)	2.66	71.3 (21.8)	3.32
30.8 (-0.7)	2.01	50.3 (10.2)	2.68	72.0 (22.2)	3.34
31.3 (-0.4)	2.03	50.8 (10.4)	2.70	72.7 (22.6)	3.36
31.9 (-0.1)	2.05	51.4 (10.8)	2.71	73.4 (23)	3.38
32.5 (0.3)	2.07	52.0 (11.1)	2.73	74.2 (23.4)	3.40
33.0 (0.6)	2.09	52.6 (11.4)	2.75	74.9 (23.8)	3.42
33.6 (0.9)	2.11	53.2 (11.8)	2.77		
34.2 (1.2)	2.13	53.8 (12.1)	2.79		
34.8 (1.5)	2.15	54.5 (12.5)	2.81		
35.3 (1.8)	2.17	55.0 (12.8)	2.83		

TABLE 30 - OUTSIDE AIR TEMPERATURE SENSOR INPUT VOLTAGE - (MEASURED SIGNAL TO SHIELD AT THE SENSOR)

TEMP. ºF (°C)	VOLTAGE	TEMP. ºF (°C)	VOLTAGE	TEMP. ºF (°C)	VOLTAGE
0.24 (-17.6)	0.68	49.8 (9.9)	2.00	93.3 (34.1)	3.31
1.79 (-16.8)	0.71	50.7 (10.4)	2.03	94.4 (34.7)	3.34
3.30 (-15.9)	0.74	51.6 (10.9)	2.06	95.6 (35.3)	3.37
4.76 (-15.1)	0.77	52.5 (11.4)	2.09	96.8 (36)	3.40
6.19 (-14.3)	0.80	53.4 (11.9)	2.11	98.0 (36.7)	3.43
7.58 (-13.6)	0.83	54.3 (12.4)	2.14	99.2 (37.3)	3.46
8.94 (-12.8)	0.85	55.3 (12.9)	2.17	100.4 (38)	3.49
10.3 (-12.1)	0.88	56.2 (13.4)	2.20	101.6 (38.7)	3.52
11.6 (-11.3)	0.91	57.1 (13.9)	2.23	102.9 (39.4)	3.55
12.8 (-10.7)	0.94	58.0 (14.4)	2.26	104.2 (40.1)	3.57
14.1 (-9.9)	0.97	58.9 (14.9)	2.29	105.5 (40.8)	3.60
15.3 (-9.3)	1.00	59.8 (15.4)	2.32	106.8 (41.6)	3.63
16.5 (-8.6)	1.03	60.7 (15.9)	2.35	108.1 (42.3)	3.66
17.7 (-7.9)	1.06	61.6 (16.4)	2.38	109.5 (43.1)	3.69
18.9 (-7.3)	1.09	62.6 (17)	2.41	110.9 (43.8)	3.72
20.0 (-6.7)	1.12	63.5 (17.5)	2.44	112.3 (44.6)	3.75
21.2 (-6)	1.15	64.4 (18)	2.47	113.8 (45.4)	3.78
22.3 (-5.4)	1.18	65.3 (18.5)	2.50	115.2 (46.2)	3.81
23.4 (-4.8)	1.21	66.3 (19.1)	2.52	116.7 (47.1)	3.84
24.4 (-4.2)	1.24	67.2 (19.5)	2.55	118.3 (47.9)	3.87
25.5 (-3.6)	1.26	68.1 (20.1)	2.58	119.9 (48.8)	3.90
26.6 (-3)	1.26	69.1 (20.6)	2.61	121.5 (49.7)	3.93
27.6 (-2.4)	1.32	70.0 (21.1)	2.64	123.2 (50.7)	3.96
28.7 (-1.8)	1.35	70.9 (21.6)	2.67	124.9 (51.6)	3.98
29.7 (-1.3)	1.38	71.9 (22.2)	2.70	126.6 (52.6)	4.01
30.7 (-0.7)	1.41	72.8 (22.7)	2.73	128.4 (53.6)	4.04
31.7 (-0.2)	1.44	73.8 (23.2)	2.76	130.3 (54.6)	4.07
32.7 (0.4)	1.47	74.8 (23.8)	2.76		
33.7 (0.9)	1.50	75.8 (24.3)	2.82		
34.7 (1.5)	1.53	76.7 (24.8)	2.85		
35.7 (2.1)	1.56	77.7 (25.4)	2.88		
36.7 (2.6)	1.59	78.7 (25.9)	2.91		
37.6 (3.1)	1.62	79.7 (26.5)	2.93		
38.6 (3.7)	1.65	80.7 (27.1)	2.96		
39.6 (4.2)	1.67	81.7 (27.6)	2.99		
40.5 (4.7)	1.70	82.7 (28.2)	3.02		
41.4 (5.2)	1.73	83.6 (28.7)	3.05		
42.4 (5.8)	1.76	84.6 (29.2)	3.08		
43.3 (6.3)	1.79	85.7 (29.8)	3.11		
44.3 (6.8)	1.82	86.7 (30.4)	3.13		
45.2 (7.3)	1.85	87.8 (31)	3.16		
46.1 (7.8)	1.88	88.9 (31.6)	3.19		
47.0 (8.3)	1.91	90.1 (32.3)	3.22		
48.0 (8.9)	1.94	91.1 (32.8)	3.25		
48.9 (9.4)	1.97	92.2 (33.4)	3.28		

TABLE 31 - PRESSURE TRANSDUCER OUTPUT VOLTAGE - (MEASURED SIGNAL TO RETURN AT THE TRANSDUCER)

SUCTION PRESSURE TRANSDUCER (125 PSIG)		DISCHARGE CONDENSER LIQUID PRESSURE AND DISCHARGE PRESSURE TRANSDUCER (400 PSIG)	
PRESSURE	**VOLTAGE**	**PRESSURE**	**VOLTAGE**
0	0.50	0	0.50
5	0.66	25	0.75
10	0.82	50	1.00
15	0.98	75	1.25
20	1.14	100	1.50
25	1.30	125	1.75
30	1.46	150	2.00
35	1.62	175	2.25
40	1.78	200	2.50
45	1.94	225	2.75
50	2.10	250	3.00
55	2.26	275	3.25
60	2.42	300	3.50
65	2.58	325	3.75
70	2.74	350	4.00
75	2.90	375	4.25
80	3.06	400	4.50
85	3.22		
90	3.38		
95	3.54		
100	3.70		
105	3.86		
110	4.02		
115	4.18		
120	4.34		
125	4.50		

TABLE 32 - MOTOR TEMPERATURE SENSOR RESISTANCE - (CHECK AT THE MOTOR)

TEMP. ºF (ºC)	R NOMINAL (OHMS)	R TOL (± %)	RMIN (OHMS)	RMAX (OHMS)
-4 (-20)	97,062	5.00	92,209	101,915
5 (-15)	77,941	4.60	69,586	76,296
14 (-10)	55,391	4.20	52,996	57,643
23 (-5)	42,324	3.85	40,695	43,954
32 (0)	32,654	3.50	31,511	33,797
41 (5)	25,396	3.15	24,596	26,196
50 (10)	19,903	2.80	19,346	20,461
59 (15)	15,713	2.50	15,321	16,106
68 (20)	12,493	2.20	12,218	12,768
77 (25)	10,000	2.00	9,800	10,200
86 (30)	8,056	2.40	7,863	8,250
95 (35)	6,531	2.70	6,354	6,707
104 (40)	5,326	3.00	5,166	5,485
113 (45)	4,368	3.25	4,226	4,510
122 (50)	3,602	3.50	3,476	3,728
131 (55)	2,986	3.75	2,874	3,098
140 (60)	2,488	4.00	2,389	2,588
149 (65)	2,083	4.25	1,995	2,172
158 (70)	1,753	4.50	1,674	1,832
167 (75)	1,481	4.75	1,411	1,551
176 (80)	1,257	5.00	1,194	1,321
185 (85)	1,071	5.20	1,016	1,127
194 (90)	916.9	5.40	867.4	966.4
203 (95)	787.7	5.60	743.6	831.9
212 (100)	679.3	5.80	639.9	718.7
221 (105)	587.9	6.00	552.6	623.2
230 (110)	510.6	6.20	479.9	542.3
239 (115)	445.0	6.40	416.5	473.5
248 (120)	389.0	6.60	363.4	414.7
257 (125)	341.2	6.70	318.4	364.1
266 (130)	300.2	6.90	279.5	320.9
275 (135)	264.9	7.10	246.1	283.7
284 (140)	234.4	7.30	217.3	251.5
293 (145)	208.0	7.40	192.6	223.3
302 (150)	185.0	7.50	171.1	198.9

PRINTER WIRING

A serial printer may be connected to the TB1 connector on the Chiller Logic Board for the purposes of logging data and troubleshooting. Weigh-tronix Imp-2600, Seiko DPU-414, and Okidata Microline 184 printers or equivalents may be used.

NOTE

Printer designs change rapidly. The user should use the printer manual for the respective printer for set-up and wiring.

Data from the chiller is transmitted at 1200 baud. Wiring diagrams for cables are shown below:

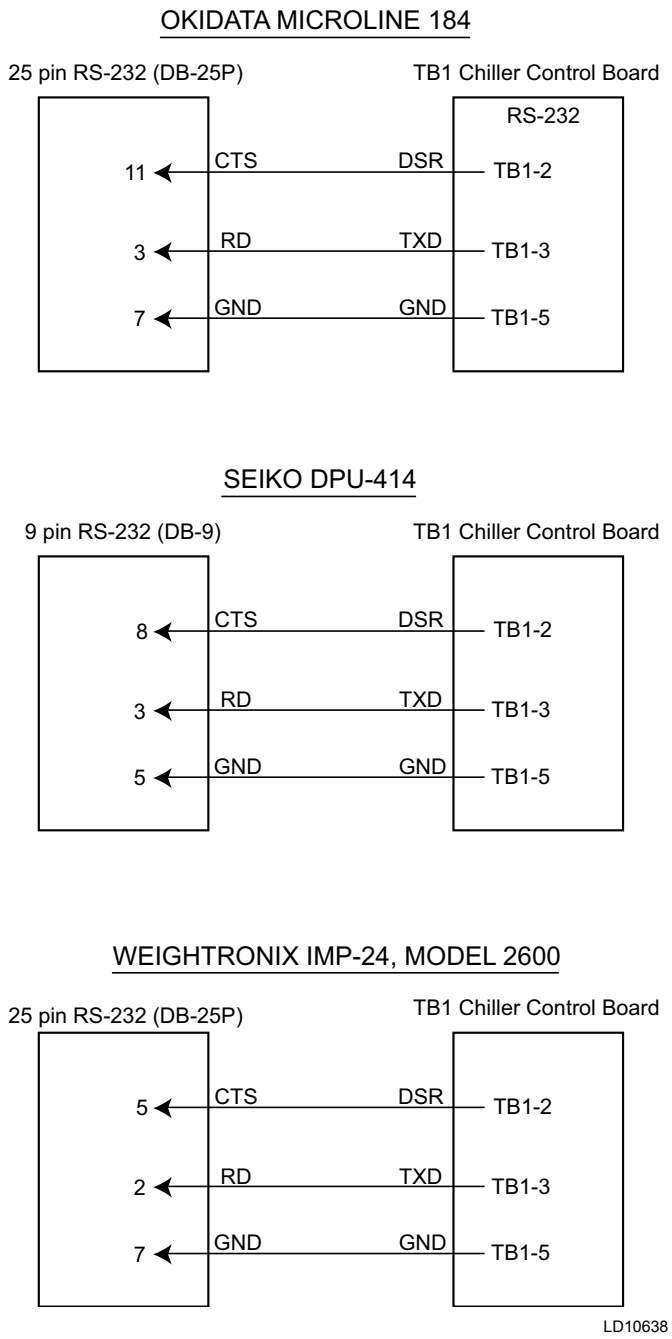


FIGURE 39 - PRINT CABLE - CHILLER TO SERIAL PRINTER

Printer Cables

Printer cables should be shielded coaxial, #18AWG, stranded wire cables, not to exceed 50' in length. On long cable runs or whenever permanent installation is required, the shield of the coax should be tied to the chassis ground at the chiller only, not at the printer.

Printer Setup

The following information may be useful for quick set up of a printer. Specific printer manuals should be utilized, if problems occur, since functions often change as new versions of printers are introduced with enhancements requiring control code, signal programming, and wiring changes.

Okidata 184

Control Board Switch Settings

SW1 – ON: Unslashed 0
2 – OFF: Unslashed 0
3 – OFF: Unslashed 0
4 – OFF: Form Length 11 in.
5 – ON: Form Length 11 in.
6 – OFF: Auto Line feed OFF
7 – ON: 8 bit data
8 – OFF: Enable front panel

With Super Speed Serial Board

SW1-1 – ON: Odd or even parity
1-2 – ON: No parity
1-3 – ON: 8 bit data
1-4 – ON: Protocol ready/busy
1-5 – ON: Test select
1-6 – ON: Print mode
1-7 – OFF: SDD(-) pin 11
1-8 – ON: SDD(-) pin 11
2-1 – ON: 1200 baud
2-2 – ON: 1200 baud
2-3 – OFF: 1200 baud
2-4 – OFF: DSR active
2-5 – ON: Buffer threshold 32 bytes
2-6 – ON: Busy signal 200ms
2-7 – ON: DTR space after power on
2-8 – Not used

With High Speed Serial Board

SW1 – OFF: (-) Low when busy
2 – OFF: 1200 baud
3 – OFF: 1200 baud
4 – ON: 1200 baud
5 – Not used
6 – OFF: no parity
7 – OFF: Pin 20 and pin 11 act as busy line

Weigh-tronix IMP 24 Model 2600

SW1 – OFF: 1200 baud
2 – ON: 1200 baud

Seiko

DipSW1-1 – OFF: Input -Serial
1-2 – ON: Printing speed high
1-3 – ON: Auto loading - ON
1-4 – OFF: Auto LF - OFF
1-5 – ON: Setting Command - Enable
1-6 – OFF: Printing density - 100%
1-7 – ON: Printing density - 100%
1-8 – ON: Printing density - 100%
DipSW2-1 – ON: Printing Columns - 40
2-2 – ON: User Font Back-up - ON
2-3 – ON: Character Select - normal
2-4 – OFF: Zero - slash
2-5 – ON: International character set- American
2-6 – ON: International character set - American
2-7 – ON: International character set - American
2-8 – OFF: International character set - American
DipSW3-1 – ON: Data length - bits
3-2 – ON: Parity Setting - no
3-3 – ON: Parity condition - odd
3-4 – ON: Busy control – H/W busy
3-5 – ON: Baud rate select - 1200
3-6 – OFF: Baud rate select - 1200
3-7 – ON: Baud rate select - 1200
3-8 – OFF: Baud rate select - 1200

SECTION 10 - DECOMMISSIONING, DISMANTLING AND DISPOSAL

Never release refrigerant to the atmosphere when emptying the refrigerating circuits. Suitable retrieval equipment must be used. If reclaimed refrigerant cannot be reused. It must be returned to the manufacturer.

Never discard used compressor oil, as it contains refrigerant in solution. Return used oil to the oil manufacturer.

Never discard used compressor oil, as it contains refrigerant in solution. Return used oil to the oil manufacturer.

Unless otherwise indicated, the operations described below can be performed by any properly trained maintenance technician.

GENERAL

Isolate all sources of electrical supply to the unit including any control system supplies switched by the unit. Ensure that all points of isolation are secured in the 'OFF' position. The supply cables may then be disconnected and removed. For connection points see *"SECTION 4 - INSTALLATION" on page 43*.

Remove all refrigerant from each system of the unit into a suitable container using a refrigerant reclaim or recovery unit. This refrigerant may then be re-used, if appropriate, or returned to the manufacturer for disposal. Under NO circumstances should refrigerant be vented to atmosphere. Drain the refrigerant oil from each system into a suitable container and dispose of according to local laws and regulations governing the disposal of oily wastes. Any spilled oil should be mopped up and similarly disposed of.

Isolate the unit heat exchanger from the external water systems and drain the heat exchanger section of the system. If no isolation valves are installed it may be necessary to drain the complete system.

If glycol or similar solutions have been used in the water system, or chemical additives are contained, the solution MUST be disposed of in a suitable and safe manner. Under NO circumstances should any system containing glycol or similar solutions be drained directly into domestic waste or natural water systems.

After draining, the water pipework can be disconnected and removed.

Packaged units can generally be removed in one piece after disconnection as above. Any fixing down bolts should be removed and then the unit should be lifted from position using the points provided and equipment of adequate lifting capacity.

See *SECTION 4 - INSTALLATION* for unit installation instructions, and *SECTION 9 - MAINTENANCE* for unit weights.

Units which cannot be removed in one piece after disconnection as above must be dismantled in position. Special care should be taken regarding the weight and handling of each component. Where possible units should be dismantled in the reverse order of installation.

Residual refrigerant oil and glycol or similar solutions may remain in some parts of the system. These should be mopped up and disposed of as described above.

It is important to ensure that while components are being removed the remaining parts are supported in a safe manner.

Only use lifting equipment of adequate capacity.

After removal from position the unit parts may be disposed of according to local laws and regulations.

The following factors can be used to convert from English to the most common SI Metric values.

TABLE 33 - SI METRIC CONVERSION

MEASUREMENT	MULTIPLY ENGLISH UNIT	BY FACTOR	TO OBTAIN METRIC UNIT
Capacity	Tons Refrigerant Effect (ton)	3.516	Kilowatts (kW)
Power	Horsepower	0.7457	Kilowatts (kW)
Flow Rate	Gallons / Minute (gpm)	0.0631	Liters / Second (l/s)
Length	Feet (ft)	0.3048	Meters (m)
	Inches (in)	25.4	Millimeters (mm)
Weight	Pounds (lbs)	0.4538	Kilograms (kg)
Velocity	Feet / Second (fps)	0.3048	Meters / Second (m/s)
Pressure Drop	Feet of Water (ft)	2.989	Kilopascals (kPa)
	Pounds / Square Inch (psi)	6.895	Kilopascals (kPa)

TEMPERATURE

To convert degrees Fahrenheit (°F) to degrees Celsius (°C), subtract 32° and multiply by 5/9 or 0.5556.

Example: (45.0°F - 32°) x 0.5556 = 7.22°C

To convert a temperature range (that is a range of 10°F) from Fahrenheit to Celsius, multiply by 5/9 or 0.5556.

Example: 10.0°F range x 0.5556 = 5.6 °C range

APPENDIX A - CUT SHEETS

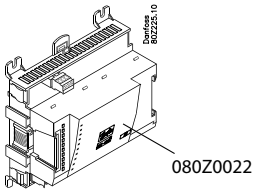
REFRIGERATION AND AIR CONDITIONING

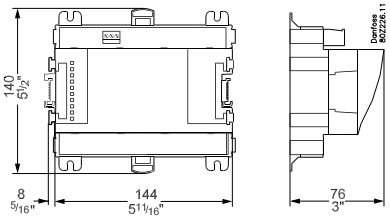
Instructions

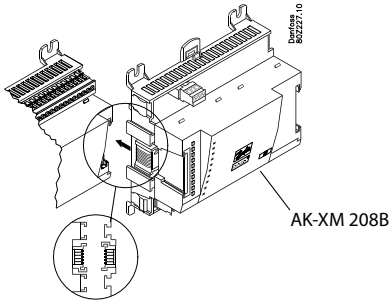
080R9255

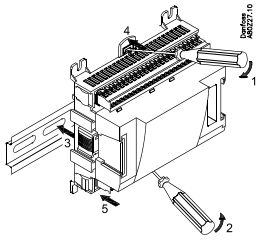
RI8KG602

Stepper output module AK-XM 208B









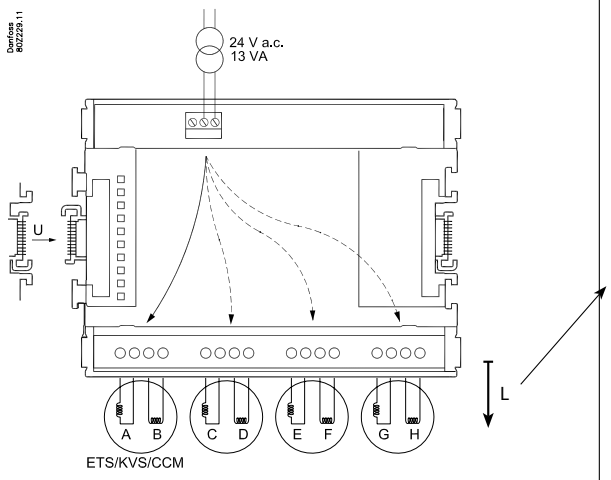
CE

-20°< t_{amb} < 55°C°
-0°F < t_{amb} < 130°F
0 - 95% RH, non condensing
IP10 / VBG4

Warning

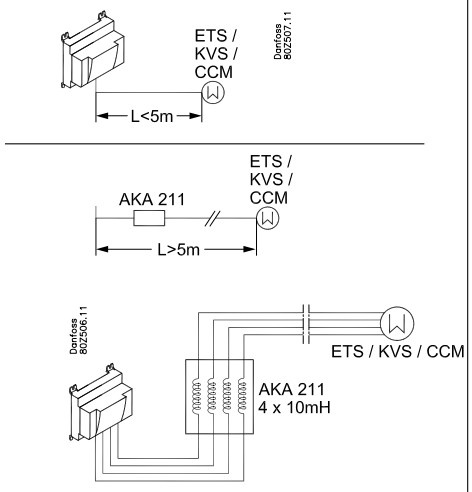
Ensure power is disconnected before adding or removing Modules

4 x stepper valve output



Output:
24 V d.c.
$I_{max.}$ = 500 m A / coil

L



RI8KG602 03-2011

MAKING MODERN LIVING POSSIBLE

Technical brochure

Electronic Expansion valves, type ETS

ETS is a series of electronic expansion valves for precise liquid injection in evaporators for air conditioning and refrigeration applications.

The valve piston and linear positioning design is fully balanced, providing bi-flow feature as well as solenoid tight shut-off function in both flow directions.

The valve design uses bipolar drive providing very precise flow regulation.
ETS valves are compatible with electronic control solutions from Danfoss and other manufacturers.

Features

- Precise positioning for optimal control of liquid injection.
- Wide range for all common Refrigerants R410A, R407C, R404A, R134a, R22 and R507 (special valves for R744 (CO_2)are available).
- ETS 12.5, ETS25, ETS 50, ETS100 provides working pressure of 45.5 bar (660 psig) and ETS 250, ETS 400 provides 34 bar (493 psig).
- Balanced design (ETS 50 to 400) providing bi-flow operation as well as solenoid tight shut-off function in both flow directions.
- ETS 50 & ETS 100 feature improved process and productivity due to waterless brazing i.e soldering without wet cloth for cooling.
- ETS 50 to 400 are all designed with built-in sight glass with moisture indicator.
- Internal and external corrosion resistant design.
- Low power consumption.
- Cable and connector assemblies as accessories.
- EKC 316A, 312 and EKD316 are examples of Danfoss controllers with drivers matching the ETS needs.
- For manual operation and service of ETS valves an AST-g service driver is available.

PRESSURE GAUGES DIFFERENTIAL

DIFFERENTIAL PRESSURE GAUGE AND SWITCH

APPLICATIONS

Changes in differential pressure indicated by a differential pressure gauge are only apparent if an operator is available to look at the instrument.

An automatic warning signal on high or low conditions can be provided by a Bailey & Mackey differential pressure switch.

The photograph and drawing show a 100 mm (4" dia) type 93 differential pressure gauge and type 118 differential pressure switch piped up together as a convenient means of providing both indication and alarm or control. This unit comes complete with brackets for wall mounting.

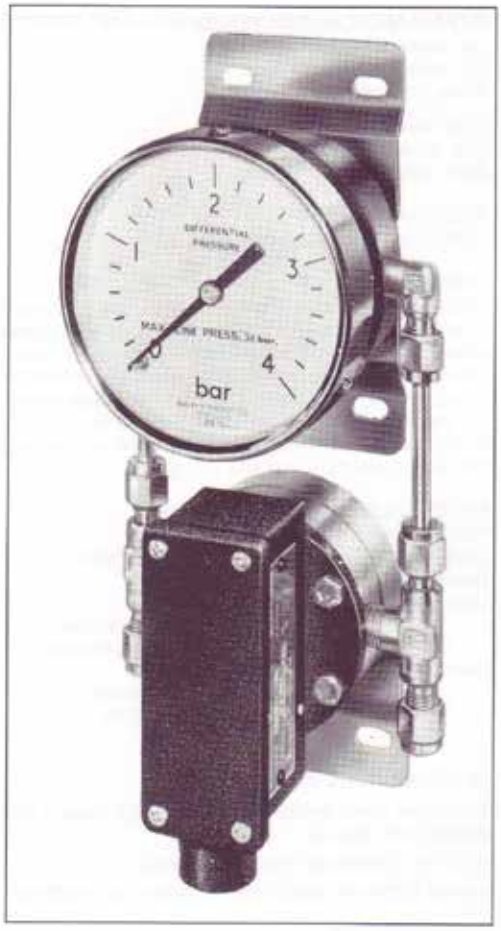
A flush panel mounted version is available in the 150 mm (6" dia) size only; a drawing showing this arrangement is available if required.

The type 118 differential pressure switch has an electric rating of 5A at 250V AC and can be wired directly to a warning light or buzzer.

LOWER PRESSURE RANGES

Both the wall mounted and 150 mm flush mount versions are available with a range of 250 mbar; use of a differential pressure switch on this low pressure provides a much more stable electric switching operation than that obtained from contacts operated by a gauge pointer.

The general arrangement of low pressure type 97 differential pressure gauge and type 167 differential pressure switch assembly is similar to that shown here except that pressure connections are further apart, conduit connection is at one side and the vertical distance between mounting slots is greater. A drawing showing dimensions is available if required.



NEW DEVELOPMENT

ANALOGUE OUTPUT

An ancillary unit which contains a Hall effect sensor can be built onto the back of Bailey & Mackey differential pressure gauges.

The small electric signal from the sensor is amplified by a specially developed electronic circuit to provide a 0-10 volt analogue output.

An electric supply between 12 and 24 volts DC is required.

Series 9C
F6

Bailey & Mackey Ltd
Pressure Switch, Pressure Gauge and Pressure Transducer Manufacturers
Baltimore Road, Birmingham B42 1DE U.K. Tel: +44 (0)121 357 5351
Fax: +44 (0)121 357 8319 www.baileymackey.com

Technical Data **TD03801003E**

Effective March 2014
Supersedes July 2010

N-Frame 310+ molded-case circuit breaker 320–1200A

Product description

- The Series G® N-Frame is NEMA®, UL®, and CSA® rated
- Zone selective interlocking and Arcflash Reduction Maintenance System™ can now be enabled on the N-Frame
- The 310+ electronic trip unit eliminates the need for rating plugs and is compatible with the cause of trip display and cause of trip LED
- All N-Frame circuit breakers are suitable for reverse-feed use

Table 1. Frame Trip Ratings

Frame	Interrupting Capacity (kAIC)	Ampere Rating
NGS	50	320–800 ① or 500–1200 ②
NGH	65	
NGC	100	
NGU	150	

① 800A frame.

② 1200A frame.

Powering Business Worldwide

Table 2. NGS, NGH, NGC, and NGU Rating and Ampere Range

Specification		Description			
Breaker type		NGS	NGH	NGC	NGU
Short-Circuit Current Ratings (kA rms) AC 50–60 Hz					
NEMA UL 489	240 Vac	85	100	200	300
	480 Vac	50	65	100	150
	600 Vac	25	35	50	75
Number of poles		3, 4	3, 4	3, 4	3
Adjustable long-time pickup CSA 22.2 No. 5	800A	A = 320 E = 600	B = 400 F = 630	C = 450 G = 700	D = 500 H = 800
	1200A	A = 500 E = 800	B = 600 F = 900	C = 630 G = 1000	D = 700 H = 1200
Electronic rms		LS, LSI, LSG, LSIG, ALSI, ALSIG			
Dimensions in inches (mm)	Three-pole	H	W	D	
		16.00 (406.4)	8.25 (209.6)	5.50 (139.7)	
	Four-pole	H	W	D	
		16.00 (406.4)	11.13 (280.0)	5.50 (139.7)	
Weight (approximate) lbs (kg)		Three-pole	Four-pole		
		46.8 (21.3)	62.0 (28.3)		
Current sensor for ground fault	Catalog number	Breaker ampere range			
	NGFCT120	320–1200			

Table 3. Line and Load Terminals

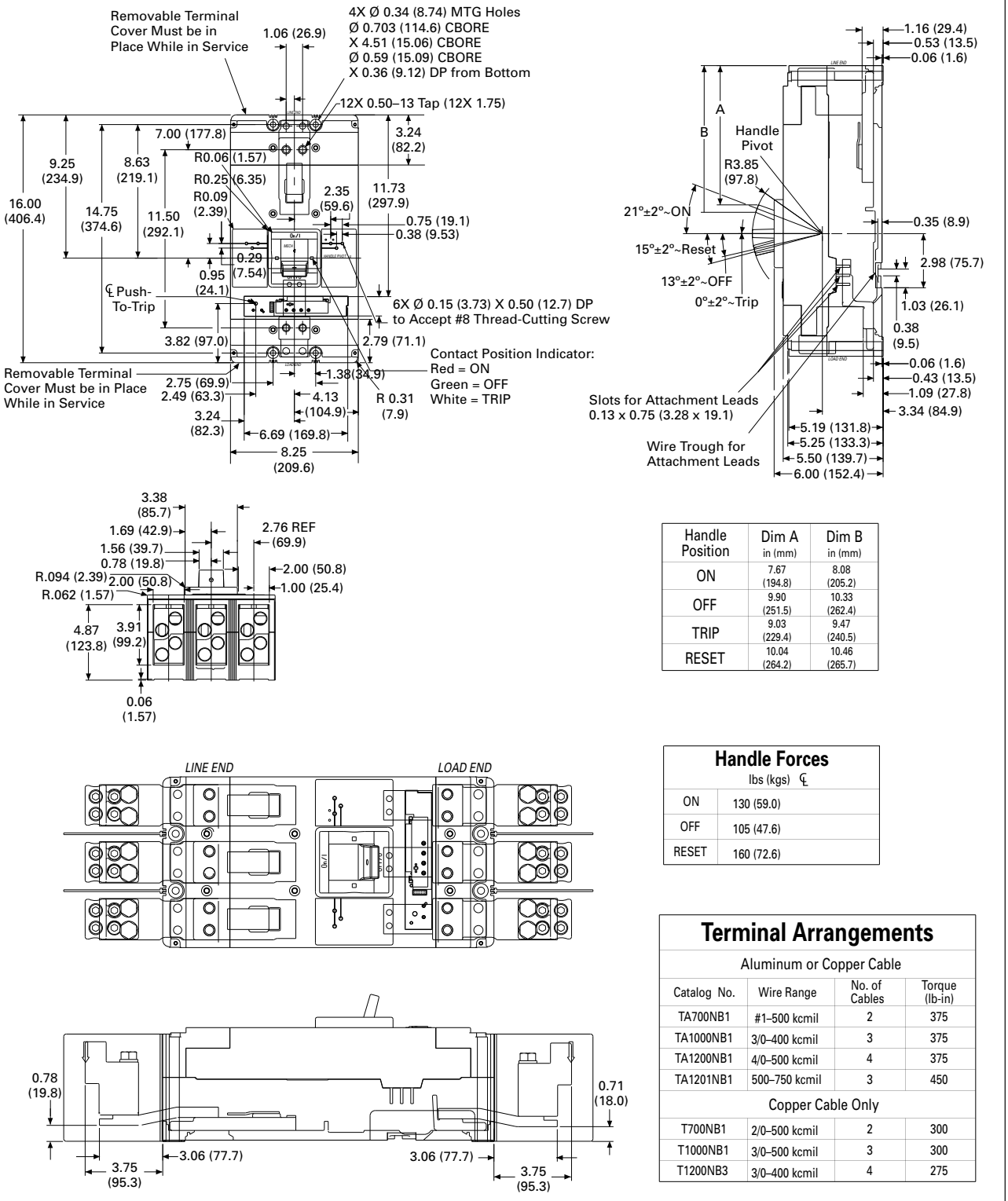
Maximum Breaker Amperes	Terminal Body Material	Wire Type	AWG Wire Range/ No. of Conductors	Metric Wire Range (mm^2)	Catalog Number
Standard Copper/Aluminum Pressure Terminals					
700	Aluminum	Cu/Al	(2) 1–500 kcmil	50–240	**TA7000NB1**
1000	Aluminum	Cu/Al	(3) 3/0–400 kcmil	95–185	**TA1000NB1** ①
1200	Aluminum	Cu/Al	(4) 4/0–500 kcmil	120–240	**TA1200NB1** ①
1200	Aluminum	Cu/Al	(3) 500–750 kcmil	300–400	**TA1201NB1** ②
Optional Copper Pressure Type Terminals					
700	Copper	Cu	(2) 2/0–500 kcmil	70–240	**T700NB1**
1000	Copper	Cu	(3) 3/0–500 kcmil	95–240	**T1000NB1**
1200	Copper	Cu	(4) 3/0–400 kcmil	95–185	**T1200NB3**

① Terminal rating is AL9CU.

② Terminal rating is AL7CU.

N-Frame 310+ molded-case
circuit breaker 320–1200A

Technical Data **TD03801003E**
Effective March 2014



Handle Position	Dim A in (mm)	Dim B in (mm)
ON	7.67 (194.8)	8.08 (205.2)
OFF	9.90 (251.5)	10.33 (262.4)
TRIP	9.03 (229.4)	9.47 (240.5)
RESET	10.04 (264.2)	10.46 (265.7)

Handle Forces

	lbs (kgs) ℄
ON	130 (59.0)
OFF	105 (47.6)
RESET	160 (72.6)

Terminal Arrangements

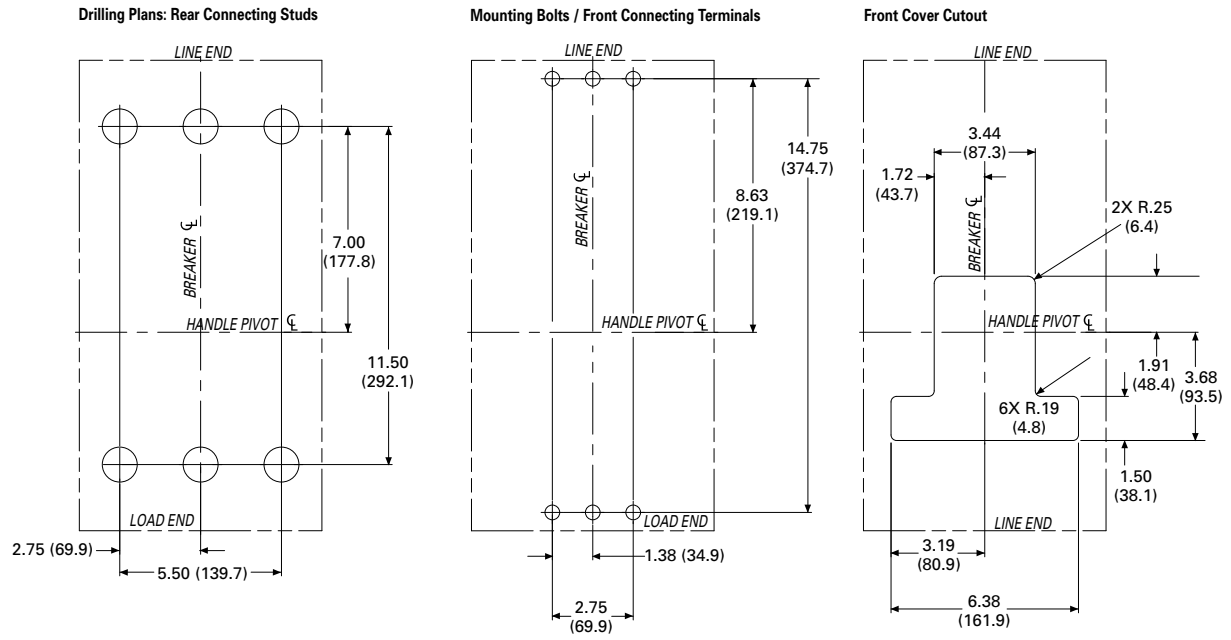
Aluminum or Copper Cable

Catalog No.	Wire Range	No. of Cables	Torque (lb-in)
TA700NB1	#1–500 kcmil	2	375
TA1000NB1	3/0–400 kcmil	3	375
TA1200NB1	4/0–500 kcmil	4	375
TA1201NB1	500–750 kcmil	3	450
Copper Cable Only			
T700NB1	2/0–500 kcmil	2	300
T1000NB1	3/0–500 kcmil	3	300
T1200NB3	3/0–400 kcmil	4	275

Figure 1. AB DE-ION® Circuit Breaker—NG 310+ Frame

Technical Data **TD03801003E**
Effective March 2014

N-Frame 310+ molded-case
circuit breaker 320–1200A



Ampere Rating	Hole Ø
700 and 800	Ø 1.188
900–1200	Ø 1.312

Figure 2. Type NG 310+ Three-Pole Breakers

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

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Printed in USA
Publication No. TD03801003E / Z15043
March 2014

Powering Business Worldwide

Eaton is a registered trademark.

All other trademarks are property
of their respective owners.

Product data sheet
Characteristics

RM35TF30
multifunction phase control relay RM35-T - range 194..528 V AC

Main

Range of product	Zelio Control
Product or component type	Modular measurement and control relays
Relay type	Multifunction control relay
Product specific application	For 3-phase supply
Relay name	RM35TF
Relay monitored parameters	Asymmetry Phase failure detection Phase sequence Undervoltage and overvoltage in window mode
Time delay	Adjustable 0.1...10 s, 10 %
Switching capacity in VA	1250 VA
Measurement range	194...528 V AC

Complementary

Reset time	<= 1500 ms for at 480 V
Maximum switching voltage	250 V AC 250 V DC
Minimum switching current	10 mA at 5 V DC
Maximum switching current	5 A AC 5 A DC
[Us] rated supply voltage	220...480 V AC
Supply voltage limits	194...528 V AC 3 phases
Control circuit voltage limits	- 12 %, + 10 % Un
Power consumption	<= 2.9 VA AC
Voltage detection threshold	< 194 V
Control circuit frequency	50...60 Hz +/- 10 %
Output contacts	2 C/O
Nominal output current	5 A
Hysteresis	2 %
Run up delay at power up	0.5 s time delay
Measuring cycle	<= 140 ms measurement cycle as true rms value
Threshold adjustment voltage	+2...+10 % in the range 480 V AC +2...+20 % in the range 220...440 V AC -12...-2 % in the range 220 V AC 2...20 % of Un selected -20...-2 % in the range 380...480 V AC
Voltage range	220 V phase to phase 380 V phase to phase 400 V phase to phase 415 V phase to phase 440 V phase to phase 480 V phase to phase
Adjustment of asymmetry threshold	5...15 % of Un selected
Measurement accuracy	+/- 10 % of the full scale value
Repeat accuracy	0.3 % for time delay 0.5 % for input and measurement circuit
Measurement error	< 1 % over the whole range with voltage variation 0.05 %/°C with temperature variation
Response time	< 200 ms in the event of a fault

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein.
This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications.
It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof.
Neither Schneider Electric Industries SAS nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein.

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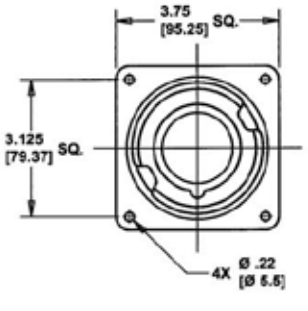
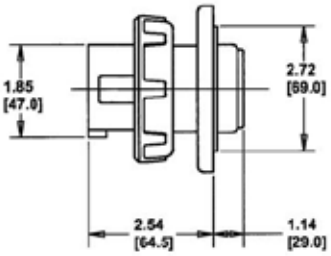




CAT. NO.	CONFIGURATION	RATING	COMMENTS	HOUSING MATERIAL	HOUSING COLOR
HBL320B4W HBL316B4W		20 A 125 VAC		NYLON	BLUE
HBL320B6W		20 A 250 VAC		NYLON	BLUE
HBL316B6W		16 A 220-240 VAC		NYLON	BLUE

CAT. NO.	CONFIGURATION	RATING	COMMENTS	HOUSING MATERIAL	HOUSING COLOR
HBL320B7W		20 A 480 VDC		NYLON	RED

NOTES (UNLESS OTHERWISE SPECIFIED)
1) TOLERANCES ARE:
DECIMALS ± .03
ANGLES ± 2°
2) DIMENSIONS ARE: INCHES
[MILLIMETERS]

CODE 74645

LIST OF PARTS

DESCRIPTION	MATERIAL	FINISH
HOUSING	SEE TABLE	
GASKET	NEOPRENE	
LOCK RING	POLYESTER	
INTERIOR	THERMOSET	
PINS	BRASS	
TERMINAL SCREWS	ST. STEEL	
FLANGE	NYLON	
ASSEMBLY SCREWS	ST. STEEL	

SYM	REVISIONS	APP	DATE
4	REDRAWN ON CAD WITH CHANGES. ADDED NOTES 1 & 2, "16A" TO DWG. TITLE AND "HOUSING" AND "COMMENTS" COLUMNS TO TABLE . "B" WAS "DIA." AND "[XX.X]" WAS "MM" IN LIST OF PARTS, "SEE TABLE" WAS "NYLON" AND "NEOPRENE" WAS "RUBBER". SUPERSEDES DWG. DATED 5/2/03 PER DCN #12944. JMN	DJP	5/23/06

THE DESIGN AND DIMENSIONS OF THE PRODUCT SHOWN ON THIS DRAWING ARE SUBJECT TO CHANGE WITHOUT NOTICE

TITLE 16A & 20A 2 POLE 3 WIRE PIN AND SLEEVE INLETS

TOLERANCES UNLESS OTHERWISE SPECIFIED	WIRING DEVICE-KELLEMS HUBBELL INCORPORATED BRIDGEPORT, CT
FRACTIONS ± 1/64	DR. BY W.T.C. APP. BY DJP
DECIMALS ± .005	TR. BY JMN SCALE NONE
ANGLES ± 2°	CHK'D BY DJP DATE 5/23/06

MATERIAL SHEET FOR CAT. NO. SEE TABLE

REPAIRABLE ☐ NON-REPAIRABLE ☒

B

M-6054

3

Data sheet

INSTA
CP SNT 24W 24V 1A

Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 16
D-32758 Detmold
Germany
Fon: +49 5231 14-0
Fax: +49 5231 14-292083
www.weidmueller.com

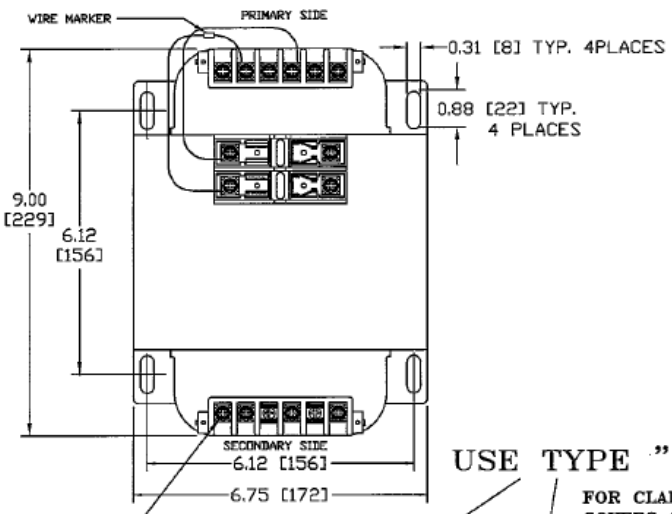
One-phase switched-mode power unit in installation housing in performance classes 24 and 48 W. .
The INSTA power units can be universally deployed because of their wide input range from 85 V AC to 265 V AC.
They are available with output voltages from 5 V to 48 V.

General ordering data

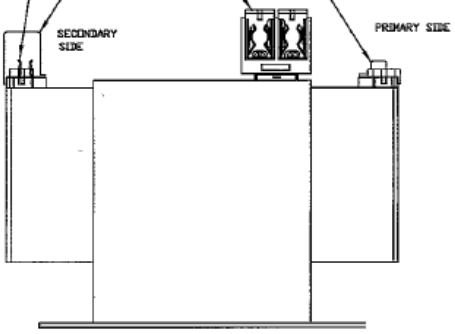
Type	CP SNT 24W 24V 1A
Order No.	9928890024
Version	Power supply, switch-mode power supply unit, 24 V
GTIN (EAN)	4032248217557
Qty.	1 pc(s).

1000 Cherrington Parkway
Moon Township, PA 15108

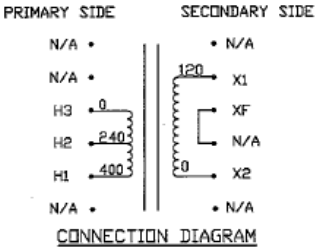
CE2000KCLFBQFS



USE TYPE "Q" FUSE CLIPS



Transformer Specifications	
PRIMARY VOLTAGE(S)	240/400
SECONDARY VOLTAGE(S)	120
RATED V.A.	2000
RATED FREQUENCY	50/60
INSULATION CLASS	180
AGENCY APPROVALS	UL, CSA, IEC-550-2-2
ESTIMATED WEIGHT	57.7 LBS



CONNECTION DIAGRAM

NOTE:
1. ALL DIMENSIONS IN INCHES (MM)

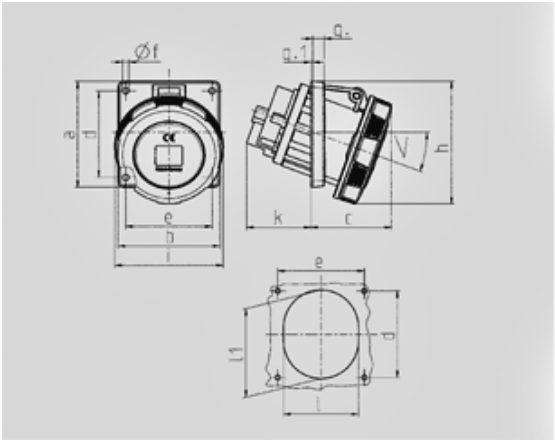
MENNEKES®
Plugs for the world

Panel mounted socket - Part no. 205A

- screw terminals
- SoftCONTACT
- 20° inclination
- receptacles with pilot contact: part no. + index P

Protection type	IP 67
Ampere	63 A
Poles	4p
Voltage	400
Hertz	50-60Hz
Earth position	6h
Contact	standard
Connection technology	Screw terminals, SoftCONTACT

Std. Pack. 5 Qty.



1 MB 298 / 1 MB 601	Amp.	63			125		
Dim. in mm	Poles	3	4	5	3	4	5
	a	110	110	110	114	114	114
	b	106	106	106	110	110	110
	c	85	85	85	75	75	75
	d	85	85	85	90	90	90
	e	77	77	77	90	90	90
	f	6,2	6,2	6,2	6,2	6,2	6,2
	g.	12	12	12	13	13	13
	g.1	2	2	2	2	2	2
	h	128	128	128	133	133	133
	i	113	113	113	126	126	126
	k	67	67	67	103	103	103
	l	92	92	92	94	94	94
	l1	98	98	98	107	107	107
	<	20°	20°	20°	15°	15°	15°
Terminal for cond. cross section (mm²) min.-max.		6 —25	6 —25	6 —25	25 70	25 70	25 70

Technical Datasheet **1SBC101423D0201** *06/04/11*

AF26-40-00-.. / AF26Z-40-00-.. 4-pole Contactors AC / DC Operated - with Screw Terminals

AF26(Z) contactors are used for controlling power circuits up to 690 V AC and 440 V DC.
They are mainly used for controlling non-inductive or slightly inductive loads (i.e. resistance furnaces...).

- AF..(Z) contactors include an electronic coil interface providing reduced pull-in and holding consumption, particularly for AC control circuits
- Only four coils are needed to cover control voltages between 24...500 V 50/60 Hz or 20...500 V DC.
  AF..(Z) offer extended operating limits and are suitable worldwide for different control voltages. e.g.: the coil 100...250 V 50/60 Hz - DC is suitable for Europe (230 V 50 Hz) and for North America (120 V 60 Hz and 208 V 60 Hz).
  AF..(Z) contactors can manage large control voltage variations.
- AF..Z contactors equipped with a 24...60 V 50/60 Hz - 20...60 V DC coil allow direct control by 24 V DC 500 mA PLC-output
- AF..Z contactors withstand short voltage dips and voltage sags (SEMI F47-0706 compliance)
- AF..(Z) contactors have built-in surge protection and do not require additional surge suppressors.

45 A

3D CAD outline drawings available on «Control Product 3D» portal

Ordering Details

IEC AC-1 Rated current θ ≤ 40 °C A	UL/CSA General use rating 600 V AC A	Control voltage Uc min. ... Uc max. V 50/60 Hz	 V DC	Auxiliary contacts fitted	Type	Order code	EAN		Weight Pack(ing) 1 piece kg
4-pole Contactors 4 N.O. Main Poles									
45	45	24...60	20...60	0 0	**AF26-40-00-11**	**1SBL 237 201 R1100**	3471523115217		0.360
		48...130	48...130	0 0	**AF26-40-00-12**	**1SBL 237 201 R1200**	3471523115224		0.360
		100...250	100...250	0 0	**AF26-40-00-13**	**1SBL 237 201 R1300**	3471523115231		0.360
		250...500	250...500	0 0	**AF26-40-00-14**	**1SBL 237 201 R1400**	3471523115248		0.400

Note: AF26-40-00-11 not suitable for a direct control by PLC-output. AF26-40-00-11 available in some countries: please consult your ABB representative.

4-pole Contactors 4 N.O. Main Poles - Low Consumption

45	45	-	12...20	0 0	**AF26Z-40-00-20**	**1SBL 236 201 R2000**	3471523116009		0.400
		24...60	20...60	0 0	**AF26Z-40-00-21**	**1SBL 236 201 R2100**	3471523116016		0.400
		48...130	48...130	0 0	**AF26Z-40-00-22**	**1SBL 236 201 R2200**	3471523116023		0.400
		100...250	100...250	0 0	**AF26Z-40-00-23**	**1SBL 236 201 R2300**	3471523116030		0.400

Note: Only AF..Z contactors with DC control voltage 12...20 V DC need to respect the connection polarities indicated close to the coil terminals: A1+ for the positive pole and A2- for the negative pole

Certifications and Approvals

CE cULus CCC GOST C-Tick

APPENDIX B - MSDS SHEETS

SAFETY DATA SHEET
THE DOW CHEMICAL COMPANY

Product name: DOWCAL™ 200 Heat Transfer Fluid

Issue Date: 04/16/2015
Print Date: 08/06/2015

THE DOW CHEMICAL COMPANY encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. IDENTIFICATION

Product name: DOWCAL™ 200 Heat Transfer Fluid

Recommended use of the chemical and restrictions on use
Identified uses: Intended as a heat transfer fluid for closed-loop systems. We recommend that you use this product in a manner consistent with the listed use. If your intended use is not consistent with the stated use, please contact your sales or technical service representative.

COMPANY IDENTIFICATION
THE DOW CHEMICAL COMPANY
2030 WILLARD H DOW CENTER
MIDLAND MI 48674-0000
UNITED STATES

Customer Information Number: 800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: 800-424-9300
Local Emergency Contact: 800-424-9300

2. HAZARDS IDENTIFICATION

Hazard classification
This material is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Other hazards
no data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature: Mixture
This product is a mixture.

Component	CASRN	Concentration

Propylene glycol	US WEEL	TWA	10 mg/m3

Exposure controls

Engineering controls: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

Individual protection measures

Eye/face protection: Use safety glasses (with side shields). If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles.

Skin protection

Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Examples of preferred glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Polyvinyl chloride ("PVC" or "vinyl"). Polyvinyl alcohol ("PVA"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Other protection: Wear clean, body-covering clothing.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	Liquid.
Color	Color is variable
Odor	Characteristic
Odor Threshold	No test data available
pH	7.2 - 8.2 50% *Literature*
Melting point/range	Not applicable to liquids
Freezing point	-51 - -12 °C (-60 - 10 °F) *Literature*
Boiling point (760 mmHg)	170 °C (338 °F) *Literature*
Flash point	**closed cup** 101 °C (214 °F) at 760 mmHg *Literature*
Evaporation Rate (Butyl Acetate = 1)	<0.5 *Estimated.*
Flammability (solid, gas)	Not applicable to liquids
Lower explosion limit	2.6 % vol *Literature* (based on major component)
Upper explosion limit	12.5 % vol *Literature* (based on major component)

Vapor Pressure	3 mbar *Literature*
Relative Vapor Density (air = 1)	>1.0 *Literature*
Relative Density (water = 1)	1.045 - 1.055 at 20 °C (68 °F) / 20 °C *Literature*
Water solubility	Miscible in all proportions
Partition coefficient: n-octanol/water	no data available
Auto-ignition temperature	420 °C (788 °F) *Literature* Propylene glycol.
Decomposition temperature	No test data available
Kinematic Viscosity	50 - 75 mm2/s at 20 °C (68 °F) *Literature*
Explosive properties	no data available
Oxidizing properties	no data available
Molecular weight	No test data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: no data available

Chemical stability: Stable under recommended storage conditions. See Storage, Section 7. Hygroscopic

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Exposure to elevated temperatures can cause product to decompose. Generation of gas during decomposition can cause pressure in closed systems. Avoid direct sunlight or ultraviolet sources.

Incompatible materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Aldehydes. Alcohols. Ethers. Organic acids.

11. TOXICOLOGICAL INFORMATION

Toxicological information on this product or its components appear in this section when such data is available.

Acute toxicity

Acute oral toxicity

Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

As product: Single dose oral LD50 has not been determined.

For the major component(s):
LD50, Rat, > 20,000 mg/kg

Acute dermal toxicity
Prolonged skin contact is unlikely to result in absorption of harmful amounts.

As product: The dermal LD50 has not been determined.

For the major component(s):
LD50, Rabbit, > 20,000 mg/kg

Acute inhalation toxicity
Vapors are primarily water; single exposure is not likely to be hazardous. Mist may cause irritation of upper respiratory tract (nose and throat).

As product: The LC50 has not been determined.

For the major component(s):
LC50, Rat, 4 Hour, vapour, 6.15 mg/l No deaths occurred following exposure to a saturated atmosphere.

Skin corrosion/irritation
Prolonged contact is essentially nonirritating to skin.
Repeated contact may cause flaking and softening of skin.

Serious eye damage/eye irritation
May cause slight temporary eye irritation.
Corneal injury is unlikely.
Mist may cause eye irritation.

Sensitization
For the major component(s):
Did not cause allergic skin reactions when tested in humans.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
In rare cases, repeated excessive exposure to propylene glycol may cause central nervous system effects.
For the minor component(s):
In animals, effects have been reported on the following organs:
Liver.
Blood
Testes

Carcinogenicity
For the major component(s): Did not cause cancer in laboratory animals.

Teratogenicity

For the major component(s): Did not cause birth defects or any other fetal effects in laboratory animals. In laboratory animals, boron compounds have caused birth defects only at doses toxic to the mother and have been toxic to the fetus at doses nontoxic to the mother.

Reproductive toxicity
For the major component(s): In animal studies, did not interfere with reproduction. In animal studies, did not interfere with fertility. In animal studies, boron compounds have been shown to interfere with fertility in males, and to a lesser degree in females.

Mutagenicity
For the major component(s): In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicological information on this product or its components appear in this section when such data is available.

Toxicity

Propylene glycol

Acute toxicity to fish
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LC50, Oncorhynchus mykiss (rainbow trout), static test, 96 Hour, 40,613 mg/l, OECD Test Guideline 203

Acute toxicity to aquatic invertebrates
LC50, Ceriodaphnia dubia (water flea), static test, 48 Hour, 18,340 mg/l, OECD Test Guideline 202

Acute toxicity to algae/aquatic plants
ErC50, Pseudokirchneriella subcapitata (green algae), 96 Hour, Growth rate inhibition, 19,000 mg/l, OECD Test Guideline 201

Toxicity to bacteria
NOEC, Pseudomonas putida, 18 Hour, > 20,000 mg/l

Chronic toxicity to aquatic invertebrates
NOEC, Ceriodaphnia dubia (water flea), semi-static test, 7 d, number of offspring, 13,020 mg/l

Sodium benzoate

Acute toxicity to fish
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LC50, Pimephales promelas (fathead minnow), static test, 96 Hour, > 100 mg/l

Acute toxicity to aquatic invertebrates
EC50, Daphnia magna (Water flea), static test, 96 Hour, > 100 mg/l

Acute toxicity to algae/aquatic plants
ErC50, Pseudokirchneriella subcapitata (green algae), static test, 72 Hour, > 100 mg/l

BORON POTASSIUM OXIDE (B4K2O7), TETRAHYDRATE

Acute toxicity to fish
For this family of materials:
Material is slightly toxic to aquatic organisms on an acute basis (LC50/EC50 between 10 and 100 mg/L in the most sensitive species tested).
For this family of materials:
LC50, dab (Limanda limanda), flow-through, 96 Hour, 74 mg/l

Acute toxicity to aquatic invertebrates
For this family of materials:
LC50, Daphnia magna (Water flea), static test, 48 Hour, 173 mg/l, OECD Test Guideline 202 or Equivalent

Persistence and degradability

Propylene glycol

Biodegradability: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Biodegradation may occur under anaerobic conditions (in the absence of oxygen).
10-day Window: Pass
Biodegradation: 81 %
Exposure time: 28 d
Method: OECD Test Guideline 301F or Equivalent
10-day Window: Not applicable
Biodegradation: 96 %
Exposure time: 64 d
Method: OECD Test Guideline 306 or Equivalent

Theoretical Oxygen Demand: 1.68 mg/mg

Chemical Oxygen Demand: 1.53 mg/mg

Biological oxygen demand (BOD)

Incubation Time	BOD
5 d	69.000 %
10 d	70.000 %
20 d	86.000 %

Photodegradation
Atmospheric half-life: 10 Hour
Method: Estimated.

Sodium benzoate

Biodegradability: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability.
10-day Window: Pass

Biodegradation: > 74 %
Exposure time: 28 d
Method: OECD Test Guideline 301B or Equivalent

BORON POTASSIUM OXIDE (B4K2O7), TETRAHYDRATE
Biodegradability: Biodegradation is not applicable.

Bioaccumulative potential

Propylene glycol
Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient: n-octanol/water(log Pow): -1.07 Measured
Bioconcentration factor (BCF): 0.09 Estimated.

Sodium benzoate
Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient: n-octanol/water(log Pow): -2.27 Estimated.

BORON POTASSIUM OXIDE (B4K2O7), TETRAHYDRATE
Bioaccumulation: No relevant data found.

Mobility in soil

Propylene glycol
Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process.
Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient(Koc): < 1 Estimated.

Sodium benzoate
No relevant data found.

BORON POTASSIUM OXIDE (B4K2O7), TETRAHYDRATE
No relevant data found.

13. DISPOSAL CONSIDERATIONS

Disposal methods: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Recycler. Reclaimer. Incinerator or other thermal destruction device.

14. TRANSPORT INFORMATION

DOT

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

Not regulated for transport

Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Not regulated for transport

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard
This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312
This product is not a hazardous chemical under 29CFR 1910.1200, and therefore is not covered by Title III of SARA.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Pennsylvania Worker and Community Right-To-Know Act:
The following chemicals are listed because of the additional requirements of Pennsylvania law:

Components	CASRN
Propylene glycol	57-55-6

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

This product contains no listed substances knownto the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

United States TSCA Inventory (TSCA)
The product contains an intentional component that is not on the inventory.

16. OTHER INFORMATION

Hazard Rating System
NFPA

Health	Fire	Reactivity
0	1	0

Revision
Identification Number: 101266728 / A001 / Issue Date: 04/16/2015 / Version: 2.0
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

TWA	8-hr TWA
US WEEL	USA. Workplace Environmental Exposure Levels (WEEL)

Information Source and References
This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

THE DOW CHEMICAL COMPANY urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

GOLDENWEST LUBRICANTS, INC
Supplier of this and other fine lubricants
1-800-540-5823
GWLinc.com

SAFETY DATA SHEET

THE DOW CHEMICAL COMPANY

Product name: DOWFROST™ Heat Transfer Fluid

Issue Date: 04/09/2015
Print Date: 05/13/2015

THE DOW CHEMICAL COMPANY encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. IDENTIFICATION

Product name: DOWFROST™ Heat Transfer Fluid

Recommended use of the chemical and restrictions on use
Identified uses: Intended as a heat transfer fluid for closed-loop systems. This product is acceptable for use where there is possibility of incidental food contact and as a product for use in the immersion or spray freezing of wrapped meat and packaged poultry products. We recommend that you use this product in a manner consistent with the listed use. If your intended use is not consistent with the stated use, please contact your sales or technical service representative.

COMPANY IDENTIFICATION
THE DOW CHEMICAL COMPANY
2030 WILLARD H DOW CENTER
MIDLAND MI 48674-0000
UNITED STATES

Customer Information Number: 800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: 800-424-9300
Local Emergency Contact: 800-424-9300

2. HAZARDS IDENTIFICATION

Hazard classification
This material is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Other hazards
no data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature: Glycol

® ™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Product name: DOWFROST™ Heat Transfer Fluid **Issue Date:** 04/09/2015

This product is a mixture.

Component	CASRN	Concentration
Propylene glycol	57-55-6	> 95.0 %
Dipotassium hydrogen phosphate	7758-11-4	< 3.0 %
Water	7732-18-5	< 3.0 %

4. FIRST AID MEASURES

Description of first aid measures
General advice: If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air; if effects occur, consult a physician.

Skin contact: Wash off with plenty of water.

Eye contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

Ingestion: No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed: Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed
Notes to physician: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIREFIGHTING MEASURES

Suitable extinguishing media: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Unsuitable extinguishing media: Do not use direct water stream. May spread fire.

Special hazards arising from the substance or mixture
Hazardous combustion products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.

Unusual Fire and Explosion Hazards: Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Advice for firefighters
Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.

Special protective equipment for firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up: Small spills: Absorb with materials such as: Cat litter. Sawdust. Vermiculite. Zorb-all®. Collect in suitable and properly labeled containers. Large spills: Dike area to contain spill. Recover spilled material if possible. See Section 13, Disposal Considerations, for additional information.

7. HANDLING AND STORAGE

Precautions for safe handling: No special precautions required. Keep container closed. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.

Conditions for safe storage: Do not store in: Galvanized steel. Opened or unlabeled containers. Store in original unopened container. See Section 10 for more specific information. Additional storage and handling information on this product may be obtained by calling your sales or customer service contact.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
Exposure limits are listed below, if they exist.

Component	Regulation	Type of listing	Value/Notation
Propylene glycol	US WEEL	TWA	10 mg/m3

Exposure controls

Propylene glycol	US WEEL	TWA	10 mg/m3

Exposure controls

Engineering controls: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

Individual protection measures

Eye/face protection: Use safety glasses (with side shields). If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles.

Skin protection

Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Examples of preferred glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Polyvinyl chloride ("PVC" or "vinyl"). Polyvinyl alcohol ("PVA"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Other protection: Wear clean, body-covering clothing.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	Liquid.
Color	Color is variable
Odor	Characteristic
Odor Threshold	No test data available
pH	7.2 - 8.2 50% *Literature*
Melting point/range	Not applicable to liquids
Freezing point	-51 - -12 °C (-60 - 10 °F) *Literature*
Boiling point (760 mmHg)	170 °C (338 °F) *Literature*
Flash point	**closed cup** 101 °C (214 °F) at 760 mmHg *Literature*
Evaporation Rate (Butyl Acetate = 1)	<0.5 *Estimated.*
Flammability (solid, gas)	Not applicable to liquids
Lower explosion limit	2.6 % vol *Literature* (based on major component)
Upper explosion limit	12.5 % vol *Literature* (based on major component)

Vapor Pressure	3 mbar *Literature*
Relative Vapor Density (air = 1)	>1.0 *Literature*
Relative Density (water = 1)	1.045 - 1.055 at 20 °C (68 °F) / 20 °C *Literature*
Water solubility	Miscible in all proportions
Partition coefficient: n-octanol/water	no data available
Auto-ignition temperature	420 °C (788 °F) *Literature* Propylene glycol.
Decomposition temperature	No test data available
Kinematic Viscosity	50 - 75 mm2/s at 20 °C (68 °F) *Literature*
Explosive properties	no data available
Oxidizing properties	no data available
Molecular weight	No test data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: no data available

Chemical stability: Stable under recommended storage conditions. See Storage, Section 7. Hygroscopic

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Exposure to elevated temperatures can cause product to decompose. Generation of gas during decomposition can cause pressure in closed systems. Avoid direct sunlight or ultraviolet sources.

Incompatible materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Aldehydes. Alcohols. Ethers. Organic acids.

11. TOXICOLOGICAL INFORMATION

Toxicological information on this product or its components appear in this section when such data is available.

Acute toxicity

Acute oral toxicity

Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

As product: Single dose oral LD50 has not been determined.

For the major component(s):
LD50, Rat, > 20,000 mg/kg

Acute dermal toxicity
Prolonged skin contact is unlikely to result in absorption of harmful amounts.

For the major component(s): Propylene glycol.
LD50, Rabbit, > 20,000 mg/kg

Acute inhalation toxicity
At room temperature, exposure to vapor is minimal due to low volatility. Mist may cause irritation of upper respiratory tract (nose and throat).

For the major component(s):
LC50, Rat, 4 Hour, vapour, 6.15 mg/l No deaths occurred following exposure to a saturated atmosphere.

Skin corrosion/irritation
Prolonged contact is essentially nonirritating to skin.
Repeated contact may cause flaking and softening of skin.

Serious eye damage/eye irritation
May cause slight temporary eye irritation.
Corneal injury is unlikely.

Sensitization
For the major component(s):
Did not cause allergic skin reactions when tested in humans.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
In rare cases, repeated excessive exposure to propylene glycol may cause central nervous system effects.

Carcinogenicity
Similar formulations did not cause cancer in laboratory animals.

Teratogenicity
For the major component(s): Did not cause birth defects or any other fetal effects in laboratory animals.

Reproductive toxicity
For the major component(s): In animal studies, did not interfere with reproduction. In animal studies, did not interfere with fertility.

Mutagenicity
In vitro genetic toxicity studies were negative. For the major component(s): Animal genetic toxicity studies were negative.

Aspiration Hazard

Based on physical properties, not likely to be an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicological information on this product or its components appear in this section when such data is available.

Toxicity

Propylene glycol

Acute toxicity to fish
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LC50, Oncorhynchus mykiss (rainbow trout), static test, 96 Hour, 40,613 mg/l, OECD Test Guideline 203

Acute toxicity to aquatic invertebrates
LC50, Ceriodaphnia dubia (water flea), static test, 48 Hour, 18,340 mg/l, OECD Test Guideline 202

Acute toxicity to algae/aquatic plants
ErC50, Pseudokirchneriella subcapitata (green algae), 96 Hour, Growth rate inhibition, 19,000 mg/l, OECD Test Guideline 201

Toxicity to bacteria
NOEC, Pseudomonas putida, 18 Hour, > 20,000 mg/l

Chronic toxicity to aquatic invertebrates
NOEC, Ceriodaphnia dubia (water flea), semi-static test, 7 d, number of offspring, 13,020 mg/l

Dipotassium hydrogen phosphate

Acute toxicity to fish
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LC50, Leuciscus idus (Golden orfe), static test, 48 Hour, > 900 mg/l, Method Not Specified.

Persistence and degradability

Propylene glycol

Biodegradability: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Biodegradation may occur under anaerobic conditions (in the absence of oxygen).
10-day Window: Pass
Biodegradation: 81 %
Exposure time: 28 d
Method: OECD Test Guideline 301F or Equivalent
10-day Window: Not applicable
Biodegradation: 96 %
Exposure time: 64 d
Method: OECD Test Guideline 306 or Equivalent

Theoretical Oxygen Demand: 1.68 mg/mg

Chemical Oxygen Demand: 1.53 mg/mg

Biological oxygen demand (BOD)

Incubation Time	BOD
5 d	69.000 %
10 d	70.000 %
20 d	86.000 %

Photodegradation
Atmospheric half-life: 10 Hour
Method: Estimated.

Dipotassium hydrogen phosphate
Biodegradability: Biodegradation is not applicable.

Bioaccumulative potential

Propylene glycol
Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient: n-octanol/water(log Pow): -1.07 Measured
Bioconcentration factor (BCF): 0.09 Estimated.

Dipotassium hydrogen phosphate
Bioaccumulation: No bioconcentration is expected because of the relatively high water solubility.

Mobility in soil

Propylene glycol
Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process.
Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient(Koc): < 1 Estimated.

Dipotassium hydrogen phosphate
No relevant data found.

13. DISPOSAL CONSIDERATIONS

Disposal methods: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR

14. TRANSPORT INFORMATION

DOT

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

Not regulated for transport

Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Not regulated for transport

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard
This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312
This product is not a hazardous chemical under 29CFR 1910.1200, and therefore is not covered by Title III of SARA.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Pennsylvania Worker and Community Right-To-Know Act:
The following chemicals are listed because of the additional requirements of Pennsylvania law:

Components	**CASRN**
Propylene glycol	57-55-6

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

This product contains no listed substances knownto the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

United States TSCA Inventory (TSCA)
The product contains an intentional component that is not on the inventory.

16. OTHER INFORMATION

Hazard Rating System
NFPA

Health	Fire	Reactivity
0	1	0

Revision
Identification Number: 101266728 / A001 / Issue Date: 04/16/2015 / Version: 2.0
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

TWA	8-hr TWA
US WEEL	USA. Workplace Environmental Exposure Levels (WEEL)

Information Source and References
This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

THE DOW CHEMICAL COMPANY urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

NATIONAL REFRIGERANTS, INC.

R-134a

Safety Data Sheet

R-134a

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: R-134a
OTHER NAME: 1,1,1,2-Tetrafluoroethane
USE: Refrigerant Gas
DISTRIBUTOR: National Refrigerants, Inc.
661 Kenyon Avenue
Bridgeton, New Jersey 08302

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-262-0012

IN CASE OF EMERGENCY CALL:
CHEMTREC: 1-800-424-9300

2. HAZARDS IDENTIFICATION

CLASSIFICATION: **Gases under pressure, Liquefied Gas**
SIGNAL WORD: **WARNING**
HAZARD STATEMENT: **Contains gas under pressure, may explode if heated**
SYMBOL: **Gas Cylinder**
PRECAUTIONARY STATEMENT: **STORAGE: Protect from sunlight, store in a well ventilated place**

EMERGENCY OVERVIEW: Colorless, volatile liquid with ethereal and faint sweetish odor. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels, CNS depression and cardiac arrhythmia may result from exposure. Vapors displace air and can cause asphyxiation in confined spaces. At higher temperatures, (>250°C), decomposition products may include Hydrofluoric Acid (HF) and carbonyl halides.

POTENTIAL HEALTH HAZARDS

SKIN: Irritation would result from a defatting action on tissue. Liquid contact could cause frostbite.

EYES: Liquid contact can cause severe irritation and frostbite. Mist may irritate.

INHALATION: R-134a is low in acute toxicity in animals. When oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur.

INGESTION: Ingestion is unlikely because of the low boiling point of the material. Should it occur, discomfort in the gastrointestinal tract from rapid evaporation of the material and consequent evolution of gas would result. Some effects of inhalation and skin exposure would be expected.

DELAYED EFFECTS: None Known

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

NATIONAL REFRIGERANTS, INC.

R-134a

INGREDIENT NAME	NTP STATUS	IARC STATUS	OSHA LIST
No ingredients listed in this section			

3. COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT %
1,1,1,2-Tetrafluoroethane	811-97-2	100

COMMON NAME AND SYNONYMS
R-134a; HFC134a

There are no impurities or stabilizers that contribute to the classification of the material identified in Section 2

4. FIRST AID MEASURES

SKIN: Promptly flush skin with water until all chemical is removed. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Get medical attention if symptoms persist.

EYES: Immediately flush eyes with large amounts of water for at least 15 minutes (in case of frostbite, water should be lukewarm, not hot) lifting eyelids occasionally to facilitate irrigation. Get medical attention if symptoms persist.

INHALATION: Immediately move to fresh air. If breathing has stopped, give artificial respiration. Use oxygen as required, provided a qualified operator is available. Get medical attention immediately. DO NOT give epinephrine (adrenaline).

INGESTION: Ingestion is unlikely because of the physical properties and is not expected to be hazardous. DO NOT induce vomiting unless instructed to do so by a physician.

ADVICE TO PHYSICIAN: Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: Gas, not applicable per DOT regulations
FLASH POINT METHOD: Not applicable
AUTOIGNITION TEMPERATURE: >750°C
UPPER FLAME LIMIT (volume % in air): None*
LOWER FLAME LIMIT (volume % in air): None*
*Based on ASHRAE Standard 34 with match ignition
FLAME PROPAGATION RATE (solids): Not applicable
OSHA FLAMMABILITY CLASS: Not applicable

EXTINGUISHING MEDIA:
Use any standard agent...choose the one most appropriate for type of surrounding fire (material itself is not flammable)

Current Issue Date: April 2015

NATIONAL REFRIGERANTS, INC.

R-134a

UNUSUAL FIRE AND EXPLOSION HAZARDS:

R-134a is not flammable at ambient temperatures and atmospheric pressure. However, this material will become combustible when mixed with air under pressure and exposed to strong ignition sources.
Contact with certain reactive metals may result in formation of explosive or exothermic reactions under specific conditions (e.g. very high temperatures and/or appropriate pressures).

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

Firefighters should wear self-contained, NIOSH-approved breathing apparatus for protection against possible toxic decomposition products. Proper eye and skin protection should be provided. Use water spray to keep fire-exposed containers cool.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: (Always wear recommended personal protective equipment.)

Evacuate unprotected personnel. Product dissipates upon release. Protected personnel should remove ignition sources and shut off leak, if without risk, and provide ventilation. Unprotected personnel should not return to the affected area until air has been tested and determined safe, including low-lying areas.

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING: (Always wear recommended personal protective equipment.)

Avoid breathing vapors and liquid contact with eyes, skin or clothing. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Use authorized cylinders only. Follow standard safety precautions for handling and use of compressed gas cylinders.

R-134a should not be mixed with air above atmospheric pressure for leak testing or any other purpose.

STORAGE RECOMMENDATIONS:

Store in a cool, well-ventilated area of low fire risk and out of direct sunlight. Protect cylinder and its fittings from physical damage. Storage in subsurface locations should be avoided. Close valve tightly after use and when empty.

INCOMPATIBILITIES:

Freshly abraded aluminum surfaces at specific temperatures and pressures may cause a strong exothermic reaction.
Chemically reactive metals: potassium, calcium, powdered aluminum, magnesium, and zinc.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:

Provide local ventilation at filling zones and areas where leakage is probable. Mechanical (general) ventilation may be adequate for other operating and storage areas.

NATIONAL REFRIGERANTS, INC.

R-134a

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION:

Skin contact with refrigerant may cause frostbite. General work clothing and gloves (leather) should provide adequate protection. If prolonged contact with liquid or gas is anticipated, insulated gloves constructed of PVA, neoprene or butyl rubber should be used. Any contaminated clothing should be promptly removed and washed before reuse.

EYE PROTECTION:

For normal conditions, wear safety glasses. Where there is reasonable probability of liquid contact, wear chemical safety goggles.

RESPIRATORY PROTECTION:

None generally required for adequately ventilated work situations. For accidental release or non-ventilated situations, or release into confined space, where the concentration may be above the PEL of 1,000 ppm, use a self-contained, NIOSH approved breathing apparatus or supplied air respirator. For escape: use the former or a NIOSH approved gas mask with organic vapor canister.

ADDITIONAL RECOMMENDATIONS:

Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn. High dose-level warning signs are recommended for areas of principle exposure. Provide eyewash stations and quick-drench shower facilities at convenient locations. For tank cleaning operations, see OSHA regulations, 29 CFR 1910.132 and 29 CFR 1910.133.

EXPOSURE GUIDELINES

INGREDIENT NAME	ACGIH TLV	OSHA PEL	OTHER LIMIT
1,1,1,2-Tetrafluoroethane	None	None	*1000 ppm TWA (8hr)

* = Workplace Environmental Exposure Level (AIHA)

OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS:
Hydrogen Fluoride: ACGIH TLV: 2 ppm ceiling, 0.5 ppm TLV-TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Clear, colorless liquid and vapor
PHYSICAL STATE:	Gas at ambient temperatures
MOLECULAR WEIGHT:	102
CHEMICAL FORMULA:	F_3CCH_2F
ODOR:	Faint ethereal odor
SPECIFIC GRAVITY (water = 1.0):	<1.22
SOLUBILITY IN WATER (weight %):	0.15 wt%
pH:	Neutral
BOILING POINT:	-26.2°C (-15.1°F)
FREEZING POINT:	-92.5°C (-141.9°F)
VAPOR PRESSURE:	85.8 psia @ 70°F 213.4 psia @ 130°F
VAPOR DENSITY (air = 1.0):	3.5
EVAPORATION RATE:	>1 **COMPARED TO:** $CC1_4$ = 1
% VOLATILES:	100

NATIONAL REFRIGERANTS, INC.

R-134a

ODOR THRESHHOLD: Not established
FLAMMABILITY: Not applicable
LEL/UEL: None/None
RELATIVE DENSITY: 1.21g/cm^3 at 25˚C
PARTITION COEFF (n-octanol/water) Log Pow: 1.06
AUTO IGNITION TEMP: >750˚C
DECOMPOSITION TEMPERATURE: >250˚C
VISCOSITY: Not applicable
FLASH POINT: Not applicable
(Flash point method and additional flammability data are found in Section 5.)

10. STABILITY AND REACTIVITY

NORMALLY STABLE: (CONDITIONS TO AVOID):

The product is stable.
Do not mix with oxygen or air above atmospheric pressure. Any source of high temperatures, such as lighted cigarettes, flames, hot spots or welding may yield toxic and/or corrosive decomposition products.

INCOMPATIBILITIES:

(Under specific conditions: e.g. very high temperatures and/or appropriate pressures) – Freshly abraded aluminum surfaces (may cause strong exothermic reaction). Chemically reactive metals: potassium, calcium, powdered aluminum, magnesium, and zinc.

HAZARDOUS DECOMPOSITION PRODUCTS:

Halogens, halogen acids and possibly carbonyl halides.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:

LC_{50} :Inhalation 4 hr. (rat) - > 500,000 ppm / Cardiac Sensitization threshold (dog) 80,000 ppm. NOEL – 50,000 ppm

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Not mutagenic in four tests
Teratogenic NOEL (rat and rabbit) – 40,000 ppm
Subchronic inhalation (rat) NOEL – 50,000 ppm
Chronic NOEL – 10,000 ppm

REPEATED DOSE TOXICITY:

Lifetime inhalation exposure of male rats was associated with a small increase in salivary gland fibrosarcomas.

FURTHER INFORMATION:

Acute effects of rapid evaporation of the liquid may cause frostbite. Vapors are heavier than air and can displace oxygen causing difficulty breathing or suffocation. May cause cardiac arrhythmia.

OTHER DATA:

Metabolism <0.5% as CO_2 in tests at 50,000 ppm, late developing benign tumors were found.

NATIONAL REFRIGERANTS, INC.

R-134a

12. ECOLOGICAL INFORMATION

Degradability (BOD): R-134a is a gas at room temperature; therefore, it is unlikely to remain in water.
Octanol Water Partition Coefficient: See Section 9

13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded? Not a hazardous waste
If yes, the RCRA ID number is: Not applicable

OTHER DISPOSAL CONSIDERATIONS:

Disposal must comply with federal, state, and local disposal or discharge laws. R-134a is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT ID NUMBER: UN3159
US DOT PROPER SHIPPING NAME: 1,1,1,2-Tetrafluoroethane or Refrigerant Gas R 134a
US DOT HAZARD CLASS: 2.2
US DOT PACKING GROUP: Not applicable
For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Listed on the TSCA inventory
OTHER TSCA ISSUES: Subject to Section 12(b) export notification. May contain 0-10 ppm Ethane, 2-chloro-1,1,1-trifluoro, CAS# 75-88-7

SARA TITLE III / CERCLA

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

INGREDIENT NAME	SARA / CERCLA RQ (lb.)	SARA EHS TPQ (lb.)
No ingredients listed in this section		

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: IMMEDIATE
PRESSURE

SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

INGREDIENT NAME	COMMENT
No ingredients listed in this section	

NATIONAL REFRIGERANTS, INC.

R-134a

12. ECOLOGICAL INFORMATION

Degradability (BOD): R-134a is a gas at room temperature; therefore, it is unlikely to remain in water.
Octanol Water Partition Coefficient: See Section 9

13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded? Not a hazardous waste
If yes, the RCRA ID number is: Not applicable

OTHER DISPOSAL CONSIDERATIONS:

Disposal must comply with federal, state, and local disposal or discharge laws. R-134a is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

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For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

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OTHER TSCA ISSUES: Subject to Section 12(b) export notification. May contain 0-10 ppm Ethane, 2-chloro-1,1,1-trifluoro, CAS# 75-88-7

SARA TITLE III / CERCLA

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

INGREDIENT NAME	SARA / CERCLA RQ (lb.)	SARA EHS TPQ (lb.)
No ingredients listed in this section		

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: IMMEDIATE
PRESSURE

SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

INGREDIENT NAME	COMMENT
No ingredients listed in this section	

NATIONAL REFRIGERANTS, INC.

R-134a

STATE RIGHT-TO-KNOW

In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

INGREDIENT NAME	WEIGHT %	COMMENT
No ingredients listed in this section		

ADDITIONAL REGULATORY INFORMATION:

R-134a is subject to U.S. Environmental Protection Agency Clean Air Act Regulations at 40 CFR Part 82.

WARNING: DO NOT vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered. **Contains 1,1,1,2-Tetrafluoroethane (HFC-134a),** a greenhouse gas which may contribute to global warming.

WHMIS CLASSIFICATION (CANADA):

This product has been evaluated in accordance with the hazard criteria of the CPR and the SDS contains all the information required by the CPR.

FOREIGN INVENTORY STATUS:

Canada – Listed on DSL
EU - EINECS # 223770

16. OTHER INFORMATION

CURRENT ISSUE DATE: April, 2015
PREVIOUS ISSUE DATE: November, 2012

OTHER INFORMATION:

HMIS Classification: Health – 1, Flammability – 1, Reactivity – 0
NFPA Classification: Health – 2, Flammability – 1, Reactivity – 0
ANSI/ASHRAE 34 Safety Group – A1
UL Classified

Regulatory Standards:
1. OSHA regulations for compressed gases: 29 CFR 1910.101
2. DOT classification per 49 CFR 172.101

Toxicity information per PAFT Testing

DISCLAIMER:

National Refrigerants, Inc. believes that the information and recommendations contained herein (including data and statements are accurate as of the date hereof. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specific product designated and may not be valid where such product is used in combination with any other methods of use of the product and of the information referred to herein are beyond the control of National Refrigerants. National Refrigerants expressly disclaims any and all liability as to any results obtained or arising from any use of the product or reliance on such information.

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Sediment Toxicity
No data available

Toxicity to Terrestrial Plants
No data available

Toxicity to Above-Ground Organisms
No data available

Toxicity to microorganisms
No data available

Persistence and Degradability
Biodegradation
No data available

Bioaccumulative Potential
Bioconcentration Factor (BCF)
No data available

Partition Coefficient n-octanol / water (log Kow)
No data available

Mobility:
No data available

Other Adverse Effects: No data available.

13. Disposal considerations

Disposal instructions: Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations.
Since emptied containers retain product residue, follow label warnings even after container is emptied.

Contaminated Packaging: Container packaging may exhibit hazards.

14. Transport information

DOT
Not regulated.

IMDG
Not regulated.

IATA
Not regulated.

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
None known.

Shipping descriptions may vary based on mode of transport, quantities ,temperature of the material, package size, and/or origin and destination It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material. Review classification requirements before shipping materials at elevated temperatures.

15. Regulatory information

Version: 1.0
Revision Date: 03/04/2015

US Federal Regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)
None present or none present in regulated quantities.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
None known.

SARA 302 Extremely Hazardous Substance
SARA 304 Emergency Release Notification
SARA 311/312 Hazardous Chemical
SARA 313 (TRI Reporting)
This product may contain chemical(s) regulated under the Superfund Amendments and Reauthorization Act (SARA). For additional information please contact Lubrizol Customer Assistance: America(s): AmerLZAMCustomerAssistance@Lubrizol.com ; Europe: EMEAICustomerAssistance@Lubrizol.com ; Asia: APCustomerAssistance@Lubrizol.com

US State Regulations

US. California Proposition 65
No ingredient regulated by CA Prop 65 present.

Inventory Status

Australia (AICS)
All components are in compliance with chemical notification requirements in Australia.

Canada (DSL/NDSL)
All components are in compliance with the Canadian Environmental Protection Act and are present on the Domestic Substances List.

China (IECSC)
All components of this product are listed on the Inventory of Existing Chemical Substances in China.

European Union (REACh)
To obtain information on the REACH compliance status of this product, please visit Lubrizol.com/REACH, or e-mail us at REACH_MSDS_INQUIRIES@Lubrizol.com

Japan (ENCS)
All components are in compliance with the Chemical Substances Control Law of Japan.

Korea (ECL)
All components are in compliance in Korea.

New Zealand (NZIoC)
All components are in compliance with chemical notification requirements in New Zealand.

Philippines (PICCS)
All components are in compliance with the Philippines Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (R.A. 6969).

Switzerland (SWISS)
May require notification before sale in Switzerland.

Taiwan (TCSCA)
All components of this product are listed on the Taiwan inventory.

United States (TSCA)
All components of this material are on the US TSCA Inventory.

The information that was used to confirm the compliance status of this product may deviate from the chemical information shown in Section 3.

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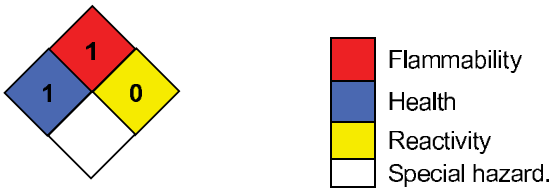
16.Other information, including date of preparation or last revision

HMIS Hazard ID

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; RNP - Rating not possible; *Chronic health effect

NFPA Hazard ID



Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; RNP - Rating not possible

Issue Date:	03/04/2015
Version #:	1.0
Source of information:	Internal company data and other publically available resources.
Further Information:	Contact supplier (see Section 1)
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