YORK BY JOHNSON CONTROLS	LIQUID COOLED OPTISPEED™ COMPRESSOR SPEED DRIVE	
OPERATION MANUAL	Supersedes: 160.00-O4 (1007)	Form 160.00-O4 (1111)

MODEL VSD
270, 292, 351, 385, 419, 424, 503, 608

00633VIP

270 HP – 60 HZ, 380 VAC (P/N 371-02767-XXX)
292 HP – 50 HZ, 400-415 VAC (P/N 371-03700-XXX)
351 HP – 60 HZ, 460 VAC (P/N 371-02767-XXX)
385 HP – 60 HZ, 380 VAC (P/N 371-03789-XXX)
419 HP – 50 HZ, 400-415 VAC (P/N 371-03789-XXX)
424 HP – 60 HZ, 575 VAC (P/N 371-04881-XXX)
503 HP – 60 HZ, 460 VAC (P/N 371-03789-XXX)
608 HP – 60 HZ, 575 VAC (P/N 371-04563-XXX)

Issue Date:
November 14, 2011

IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

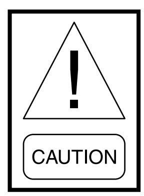
This equipment is a relatively complicated apparatus. During installation, operation maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of 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 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 this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

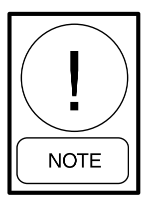
The following symbols are used in this document to alert the reader to specific situations:

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 owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls Service office.

Operating/service personnel maintain responsibility for the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, the technician 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.

ASSOCIATED LITERATURE

MANUAL DESCRIPTION	FORM NUMBER
Operation Manual (Unit) Model YT, (Centrifugal)	160.55-O1
Operation Manual (Unit) Model YK, (Centrifugal)	160.54-O1
Operation Manual (Control Panel) Model YT, (Centrifugal)	160.55-O1
Operation Manual (Control Panel) Model YK, (Centrifugal)	160.54-O1
Service Manual (Control Panel) Model YT, (Centrifugal)	160.55-M1
Service Manual (Control Panel) Model YK, (Centrifugal)	160.54-M1
Wiring Diagram (Control Panel) Model YT, (Centrifugal)	160.55-PW2
Wiring Diagram (Control Panel) Model YT, (Centrifugal) Model YK, (Centrifugal)	160.54-PW8
Wiring Field Connections (Variable Speed Drive) Model YT, (Centrifugal)	160.55-PW5
Wiring Field Connections (Variable Speed Drive) Model YK, (Centrifugal)	160.54-PW5
Service Manual (Control Panel) Model VSD (Variable Speed Drive)	160.00-M4
Renewal Parts (Variable Speed Drive)	160.00-RP4

NOMENCLATURE

V S D 3 5 1 _ R K F T - 4 6

- 46 — Voltage Rating: 40= 400VAC, 60Hz; 46= 460VAC, 60Hz; 50= 400VAC, 50Hz; 58= 575VAC, 60Hz; 68= 415VAC, 50Hz
- FT — Optional 519: Filter-Installed (FT) or Not (_)
- K — Chiller Type: YK (K), YT (T)
- R — Retrofit Package (R), Factory Package (_)
- 351 — Horsepower Rating: 270, 292, 351, 385, 419, 424, 503, 608
- VSD — Type of Drive

OPTISPEED™ MODEL PART NUMBER

The X in the part number below indicates which type of communications is used between the Micropanel and the OSCD: 1 = YORK Protocol, 7 = MODBUS Protocol.

MODEL NUMBER		PART NUMBER 60HZ	PART NUMBER 50HZ
270 HP 380 VAC	VSD270_T__-40	-	371-02767-X21
	VSD270_K__-40	-	371-02767-X22
	VSD270_TFT-40	-	371-02767-X25
	VSD270_KFT-40	-	371-02767-X26
	VSD270RT__-40	-	371-02767-X31
	VSD270RK__-40	-	371-02767-X32
	VSD270RTFT-40	-	371-02767-X35
	VSD270RKFT-40	-	371-02767-X36
292 HP 400 VAC	VSD292_T__-50	-	371-03700-X01
	VSD292_K__-50	-	371-03700-X02
	VSD292_TFT-50	-	371-03700-X05
	VSD292_KFT-50	-	371-03700-X06
	VSD292RT__-50	-	371-03700-X11
	VSD292RK__-50	-	371-03700-X12
	VSD292RTFT-50	-	371-03700-X15
	VSD292RKFT-50	-	371-03700-X16
292 HP 415 VAC	VSD292_T__-50	-	371-03700-X21
	VSD292_K__-50	-	371-03700-X22
	VSD292_TFT-50	-	371-03700-X25
	VSD292_KFT-50	-	371-03700-X26
	VSD292RT__-50	-	371-03700-X31
	VSD292RK__-50	-	371-03700-X32
	VSD292RTFT-50	-	371-03700-X35
	VSD292RKFT-50	-	371-03700-X36
351 HP 460 VAC	VSD351_T__-46	371-02767-X01	-
	VSD351_K__-46	371-02767-X02	-
	VSD351_TFT-46	371-02767-X05	-
	VSD351_KFT-46	371-02767-X06	-
	VSD351RT__-46	371-02767-X11	-
	VSD351RK__-46	371-02767-X12	-
	VSD351RTFT-46	371-02767-X15	-
	VSD351RKFT-46	371-02767-X16	-

MODEL NUMBER		PART NUMBER	
		60HZ	50HZ
385 HP 380 VAC	VSD385_T__-40	371-03789-X21	-
	VSD385_K__-40	371-03789-X22	-
	VSD385_TFT-40	371-03789-X23	-
	VSD385 KFT-40	371-03789-X24	-
	VSD385RT__-40	371-03789-X31	-
	VSD385RK__-40	371-03789-X32	-
	VSD385RTFT-40	371-03789-X33	-
	VSD385RKFT-40	371-03789-X34	-
419 HP 400 VAC	VSD419_T__-50	-	371-03789-X05
	VSD419_K__-50	-	371-03789-X06
	VSD419_TFT-50	-	371-03789-X07
	VSD419_KFT-50	-	371-03789-X08
	VSD419RT__-50	-	371-03789-X15
	VSD419RK__-50	-	371-03789-X16
	VSD419RTFT-50	-	371-03789-X17
	VSD419RKFT-50	-	371-03789-X18
419 HP 415 VAC	VSD419_T__-68	-	371-03789-X25
	VSD419_K__-68	-	371-03789-X26
	VSD419_TFT-68	-	371-03789-X27
	VSD419_KFT-68	-	371-03789-X28
	VSD419RT__-68	-	371-03789-X35
	VSD419RK__-68	-	371-03789-X36
	VSD419RTFT-68	-	371-03789-X37
	VSD419RKFT-68	-	371-03789-X38
424 HP 575 VAC	VSD424_T__-58	371-04881-X01	-
	VSD424_K__-58	371-04881-X02	-
	VSD424_TFT-58	371-04881-X03	-
	VSD424_KFT-58	371-04881-X04	-
	VSD424RT__-58	371-04881-X11	-
	VSD424RK__-58	371-04881-X12	-
	VSD424RTFT-58	371-04881-X13	-
	VSD424RKFT-58	371-04881-X14	-
503 HP 460 VAC	VSD503_T__-46	371-03789-X01	-
	VSD503_K__-46	371-03789-X02	-
	VSD503_TFT-46	371-03789-X03	-
	VSD503_KFT-46	371-03789-X04	-
	VSD503RT__-46	371-03789-X11	-
	VSD503RK__-46	371-03789-X12	-
	VSD503RTFT-46	371-03789-X13	-
	VSD503RKFT-46	371-03789-X14	-
608 HP 575 VAC	VSD608_T__-58	371-04563-X01	-
	VSD608_K__-58	371-04563-X02	-
	VSD608_TFT-58	371-04563-X03	-
	VSD608_KFT-58	371-04563-X04	-
	VSD608RT__-58	371-04563-X11	-
	VSD608RK__-58	371-04563-X12	-
	VSD608RTFT-58	371-04563-X13	-
	VSD608RKFT-58	371-04563-X14	-

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GENERAL INFORMATION

This instruction is to be used in conjunction with the Operation Instructions for YORK Centifugal chillers furnished with an optional OptiSpeed™ Compressor Drive (OSCD).

OPTISPEED/HARMONIC FILTER COMPONENT OVERVIEW

OptiSpeed Compressor Drive 270, 292, 351 and 424 Hp

The YORK® OptiSpeed Compressor Drive (OSCD) is a liquid cooled, transistorized, PWM inverter in a highly integrated package. This package is small enough to mount directly onto the chiller motor, and small enough to be applied in many retrofit chiller applications. The power section of the drive is composed of four major blocks: an AC to DC rectifier section with an integrated pre-charge circuit, a DC link filter section, a three phase DC to AC inverter section and an output suppression network.

An electronic circuit breaker with ground fault sensing connects the AC line to an AC line inductor and then to the DC converter. The line inductor will limit the amount of fault current so that the electronic circuit breaker is sufficient for protecting the OSCD. Input fuses to the OSCD are no longer needed. The following description of operation is specific for the 351 Hp OSCD unless otherwise noted.

The AC to DC converter uses 3 Silicon Controlled Rectifiers (SCR's) and 3 diodes. One SCR and one diode are contained in each module. Three modules are required to converter the 3 phase input AC voltage into DC voltage. The modules are mounted on a liquid cooled heatsink. The use of the SCR's in the converter permits pre-charge of the DC link filter capacitors when the chiller enters the prelube cycle, and it also provides a fast disconnect from the AC line when the chiller enters the coastdown cycle. At this time, the OSCD is turned off, the SCR's in the converter are no longer turned on and remain in a turned off condition until the next pre-charge cycle. The DC link filter capacitors will start to discharge through the bleeder resistors. When the chiller enters the prelube cycle, the OSCD is commanded to pre-charge and the SCR's are gradually turned on to slowly charge the DC link filter capacitors. This is called the pre-charge period, which last for 20-seconds. At this time the SCR's are fully turned on. The SCR Trigger board provides the turn on and turn off commands for the SCR's. The OSCD Logic board provides the command to the SCR trigger board when to precharge.

WARNING

Although many of these parts are similar to the parts used in previous Variable Speed Drive (VSD) designs, these parts are only compatible with drives having the base part numbers included on the cover of this form. Failure to use the correct parts may cause major damage to these and other components in the drive. For example, the VSD logic board 031-02077-000 used in this drive is not compatible with 031-01433-000 logic board used in previous designs. A new VSD logic board was designed in 2006. The part number of the new board is 031-02506-002. The part number of the new board for the 575 VAC application is 031-02506-003. The software is not interchangeable between the 575 VAC version and all other applications. Also the software is not interchangeable between the 031-01433, 031-02077, or the 031-02506 boards.

The DC Link filter section of the drive consists of one basic component, a series of electrolytic filter capacitors. The capacitors provide a large energy reservoir for use by the DC to AC inverter section of the OSCD. The capacitors are contained in the OSCD Power Unit. "Bleeder" resistors are mounted on the side of the Power Unit to provide a discharge path for the stored energy in the capacitors.

The DC to AC inverter section of the OSCD serves to convert the DC voltage to AC voltage at the proper magnitude and frequency as commanded by the OSCD Logic board. The inverter section is actually composed of one power unit. This power unit is composed of very fast switching transistors mounted on the same liquid cooled heatsink as the converter modules, the DC Link filter capacitors, and an OSCD Gate Driver board. This board provides the turn on and turn off commands to the output transistors. The OptiSpeed Compressor Drive Logic board determines when the turn on and turn off commands should occur. The gate driver board is mounted directly on top of the transistor module, and it is held in place with mounting screws and soldered to the transistor module.

The OSCD output suppression network is composed of a series of capacitors and resistors. The job of the suppressor network is to increase the time it takes for the output voltage to switch as seen by the motor, and reduce the peak voltage applied to the motor windings. This network protects the compressor motor from problems commonly associated with PWM motor drives.

Other sensors and boards are used to provide safe operation of the OptiSpeed Compressor Drive. The transistor module and heatsink have thermistors mounted on them to provide temperature information to the OSCD logic board. These sensors protect the OSCD from over temperature conditions. A Bus Voltage Isolator board is used to ensure that the DC link filter capacitors are properly charged. Three output current transformers protect the OSCD and motor from over current conditions.

OptiSpeed Compressor Drive 385, 419, 503 and 608 Hp

The 385, 419, 503, and 608 Hp OSCD's function in the same manner as the 270, 292, 351 and 424 Hp and have the same basic components. The power requirements of these higher horse power drives require more capacitors in the DC Link and 3 output transistor modules are needed. One module is used for each output phase. Each transistor module contains a thermistor, which is connected to the OSCD logic board. The transistor gate driver board is mounted on top of the transistor module in the same manner as the lower horsepower model, but it only contains 2 transistor drivers. The modules and the boards are not interchangeable between the 292, 351 and 424, and 419, 503 and 608 Hp drives.

Harmonic Filter Option

The OptiSpeed Compressor Drive (OSCD) system may also include an optional harmonic filter and high frequency trap designed to meet the IEEE Std 519 -1992, "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems". The harmonic filter is offered as a means to improve the input current waveform drawn by the OSCD from the AC line, thus reducing the possibility of causing electrical interference with other sensitive electronic equipment connected to the same power source. An additional benefit of the optional harmonic filter is that it will correct the system power factor to nearly unity.

The power section of the Harmonic Filter is composed of three major blocks: a pre-charge section, a three phase inductor and a Filter Power Unit.

The pre-charge section contains pre-charge resistors, a pre-charge contactor and a supply contactor. The pre-charge network serves two purposes, to slowly charge the DC link filter capacitors associated with the Filter Power Unit, and to provide a means of disconnecting the filter power unit from the AC line. When the chiller is turned off, both contactors are de-energized and the filter power unit is disconnected from the AC line. When the chiller starts to run, the pre-charge resistors are switched into the circuit via the precharge contactor for a fixed time period of 5 seconds. This permits the filter capacitors in the filter power unit to slowly charge. After the 5-second time period, the supply contactor is energized and the pre-charge contactor is de-energized, permitting the filter power unit to completely charge. Three power fuses connect the filter power components to the AC line. Very fast semiconductor power fuses are utilized to ensure that the transistor module does not rupture if a catastrophic failure were to occur on the DC link of the filter power unit.

The three phase inductor provides some impedance for the filter to "work against". It effectively limits the rate of change in current at the input to the filter to a reasonable level.

The Filter Power Unit is the most complicated power component in the optional filter. Its purpose is to generate the harmonic currents required by the OSCD's AC-to-DC converter so that these harmonic currents are not drawn from the AC line. The Filter Power Unit is identical to the OSCD's Power Unit in the 351 Hp drive, except for 2 less capacitors in the filter capacitor "bank", and a smaller transistor module and modified gate driver board. The Harmonic Filter Gate Driver board provides turn on and turn off commands as determined by the Harmonic Filter Logic board. "Bleeder" resistors are mounted on the side of the Filter Power Unit to provide a discharge path for the DC Link filter capacitors.

Other sensors and boards are used to provide safe operation of the harmonic filter. The transistor module contains a temperature sensor that provides temperature information back to the Filter Logic Board. This sensor protects the filter transistor module from over temperature conditions. A Bus Isolator board is used to ensure that the DC link filter capacitors are properly charged and that the voltage is balanced. Two output current sensors are used to protect the filter against an over current or an overload condition. Input current transformers sense the input current drawn by the OSCD's AC to DC converter. The Line Voltage Isolation board provides AC line voltage information to the Harmonic Filter Logic board. This information is used to determine the proper bus voltage value.

The “trap” filter is standard on all OSCD's that contain an optional Harmonic Filter. The “trap” filter is composed of a series of capacitors, inductors, and resistors. The “trap” filter is used to reduce the effects of the PWM switching frequency of the filter.

OPTISPEED COMPRESSOR DRIVE CONTROL SYSTEM OVERVIEW

The OSCD control system can be connected to a Microcomputer Control Center or to an OptiView Control Center. Regardless of which control center is used each component performs the same function.

The OSCD control system is composed of various components located within both the Control Center and the OSCD. Thus integrating the Control Center with the OSCD. The OSCD system utilizes various microprocessors, which are linked together through a network of communications links.

The Control Center before 2005

The Control Center contains two boards that act upon OSCD related information, the Microboard and the Adaptive Capacity Control board (ACC). The ACC board performs two major functions in the OSCD control system - (1) to act as a gateway for information flow between the Control Center and the OSCD. (2) To determine the optimum operating speed for maximum chiller system efficiency.

The ACC board acts as an information gateway for all data flowing between the OSCD and the Control Center. The ACC board has a communication link to the OSCD logic board, and one communication link from the optional Harmonic Filter logic board. Once the ACC board receives the information, the information is then passed onto the Control Center via a software communication link. The Microcomputer Control Center communicates in a parallel fashion via two ribbon cables connecting the ACC board to the Microboard. The OptiView™ Control Center communicates through communications port via a bi-directional serial port via a three wire cable connecting the ACC board to the Microboard.

In order to achieve the most efficient operation of a centrifugal compressor, the speed of the compressor must be reduced to match the “lift” or “head” of the load. This “lift” or “head” is determined by the evaporator and condenser refrigerant pressures. However, if the compressor speed is reduced too much, the refrigerant gas will flow backwards through the compressor wheel causing the compressor to “surge”, an undesirable and extremely inefficient operating condition. Thus there exists one particular optimum operating speed (on the “edge” of surge) for a given head, which provides the optimum system efficiency. The compressor’s inlet guide vanes, which are used in fixed speed applications to control the amount of refrigerant gas flowing through the compressor, are controlled together with the compressor speed on an OSCD chiller system to obtain the required chilled liquid temperature while simultaneously requiring minimum power from the AC line.

The ACC board automatically generates its own “Adaptive” three-dimensional surge surface map while the chiller system is in operation. This “Adaptive” operation is accomplished through the use of a patented surge detection algorithm. The novel surge detection system utilizes pressure information obtained from the chiller’s two pressure transducers or the OSCD’s instantaneous power output to determine if the system is in “surge”. Thus the adaptive system permits construction of a customized compressor map for each individual chiller system. Benefits of this new adaptive system include: (1) a customized compressor map for each chiller which eliminates inefficient operation due to the safety margin built into the previous designs to compensate for compressor manufacturing tolerances (2) the ability to update the system’s surge surface as the unit ages and (3) automatic updating of the compressor map if changes in refrigerant are implemented at a later date.

The Control Center beginning in 2005

A major change in the control system took place in 2005. Several redesigns took place in the OptiView panel and the OSCD. The redesign replaced microprocessors that were becoming obsolete. This was a time to take advantage of new components that were now available. An additional communications port was added so that the communications between the microboard and the OSCD logic board was faster. In the changes to the microboard the function of the Adaptive Capacity Board was placed into the microboard, and the ACC board was longer needed in new production. The new microboard is also compatible with the older designs microboards used in the OptiView panel. The new OSCD logic also added this new communication port, but also retained all of the functions required to still communicate with the ACC board.

OptiSpeed and Optional Harmonic Filter Logic Control Boards

Within the OSCD enclosure, the OSCD logic board and optional Harmonic Filter logic board are interconnected via a 16-position ribbon cable. This cable provides power for the Filter logic board and a method of communications between the two boards.

The OSCD Logic board performs numerous functions, control of the OSCD's cooling fans and pumps, when to pre-charge the bus capacitors, and generates the PWM.

The OSCD Logic board also determines shutdown conditions by monitoring the three phases of motor current, heatsink temperature, baseplate temperature, internal ambient temperature, and the DC Link voltage.

The optional Harmonic Filter logic board determines when to precharge the harmonic filter power unit, when to switch the transistors in the harmonic filter power unit, and collects data to determine power calculations. This board also uses this data to determine shutdown conditions.

Microcomputer Control Panel VSD Related Keypad Functions

Refer to 160.00-M4 for related keypad functions. Some of the displayed data in this form is different from the 160.00-M1. Under the Options Key – the following changes will be displayed:

VSD PHASE A INVERTER HEATSINK TEMP = ___°F.

VSD PHASE B INVERTER HEATSINK TEMP = ___°F.

VSD PHASE C INVERTER HEATSINK TEMP = ___°F.

These three temperature values are replaced with

VSD BASEPLATE TEMP = ___°F

for the 270, 292, 351 and 424 Hp drives. The 385, 419, 503 and 608 Hp drives will display 3 phases of Baseplate temperature. When the Filter is Present the following data will change.

FILTER HEATSINK TEMP = ___°F.

This temperature data will now be called.

FILTER BASEPLATE TEMP = ___°F.

The names for the above data were changed because the temperature sensor is now inside the transistor module instead on the chill plate where the transistor modules are mounted. This new sensor gives a better indication of true temperature of the power electronics.

OptiView Control Panel VSD Functions

Refer to the specific OptiView™ Control Panel service book for detailed information. All of the OSCD related information is contained under the Motor and Compressor Screens.

VSD ADAPTIVE CAPACITY CONTROL

The YORK® OptiSpeed™ Compressor Drive utilizes a different approach to speed reduction compared to earlier variable speed products. There is no longer a pre-programmed surge map – the YORK® adaptive system experiments with the speed and vanes to find the optimum speed for any given condition. It does not always encounter a "Surge" in the process, but when it does, the Adaptive Capacity Control (ACC) stores into memory, the conditions surrounding the Surge, and therefore remembers to avoid the stored operating point anytime in the future.

Early versions of the ACC software required that the drive always start and run up to full speed. ACC software starting with version C.ACC.01.04 applies a new slow ramp up of the drive speed. This new software lowers the peak current demand from the drive during start up, saves additional energy, and reduces the possibility of the chiller running in a stall condition. With the OSCD, the chiller will always run at fixed speed until two conditions are met.

The new software will ramp the drive speed up to 30 Hz quickly, and then takes 5 minutes to ramp up to 60 Hz. During this slow ramp up period the vanes will open to meet the cooling demand. If the leaving chilled liquid temperature is within +0.5 or lower of the leaving chilled liquid temperature setpoint, then the drive speed will stop increasing speed and start to search for a surge map point. On extremely hot days the chiller may surge during the slow ramp period. The new software has a method to limit the surging. If 2 surges were to occur during the slow ramp period, then the speed of the drive will increase to 60 Hz.

Now that the ACC function is provided by the microboard in the OptiView panel future control changes will be covered by the operation manual for the chiller model of interest.

All versions of software require that two conditions be met for speed reduction to occur. These two conditions are:

Setpoint Requirements

The leaving chilled liquid temperature must be within +0.5 °F or lower from the leaving chilled liquid temperature setpoint. A programmable value is now available through the OptiView panel on software versions C.OPT.01.21.307 for the YK chiller. This programmable value is not available on the YT chiller. Speed reduction will not occur until the leaving chilled liquid temperature reaches this range.

Stability Requirements

The leaving chilled liquid temperature must be stable. Lack of stability will be indicative of the vanes hunting, the leaving chilled liquid temperature varying, and the green LED on the ACC will be on. Once the above conditions are met, the ACC may begin to lower the speed of the compressor motor 1/10 of a hertz at a time. As the ACC lowers the speed, the leaving chilled liquid temperature will begin to creep up. As this occurs, the control center will begin to open the vanes slightly, just enough to maintain the leaving chilled liquid temperature within +/- 0.5°F of the leaving chilled liquid temperature setpoint. The ACC will continue to lower speed, with the leaving chilled liquid temperature control in turn driving the vanes to a more open position. This process will continue until one of three following situations occur. This setting is no longer available after software version C.OPT.01.21.307 for the YK chiller.

Full Open Vane Operation

Once the vanes reach the full open position, the ACC knows it can no longer reduce speed and maintain the leaving chilled liquid temperature setpoint. The ACC will maintain operation at this point, with the vanes full open, and the speed at the last point reached when the vanes hit 100%. If there is an increase in load while at this point, the ACC will increase speed until the vanes are closed to 95% of open. The ACC will then be allowed to continue to reduce speed again.

Effects of Surge

If in the process of reducing speed and opening vanes the compressor should surge, the ACC will boost the speed up by 0.8 Hz. The ACC will store in memory a value that represents the ratio of condenser pressure to evaporator pressure, the vane position, and the speed of the drive. The ratio of condenser pressure to evaporator pressure is displayed as Delta P/P on the Control Panel. The ACC will then know not to reduce speed this low again, if the same delta pressure, and the vane position conditions are encounter again in the future. As the chiller encounters various conditions, which result in surge, it will store more points, and eventually this storing of points creates a “Surge Map”. Surge may be detected in two ways, by monitoring the pressure differential across the compressor, or by monitoring the compressor motor current. Either detection will light the Red LED on the ACC, indicating a surge was detected. The chiller may surge 6 to 8 times before the ACC can raise the speed enough to get the chiller back out of surge. Each surge is counted on the surge counter, which may be viewed on the control center. This surge counter will always display the total number of surges encountered by the chiller as determined by the ACC. Surging which occurs at fixed speed will increment the surge counter as well, but only surges that occur when speed reduction is possible are recorded in the surge map.

Drive Not Reducing Speed

The ACC may begin the process of reducing speed, but may stop speed reduction if instability is encountered. This is the same instability discussed as one of the two conditions which must be met to begin reducing speed initially (See “Stability Requirements”). Once the system again becomes unstable, no additional speed reduction can occur. The most common causes for instability are:

- High Condenser liquid temperature.
- Dirty Condenser tubes.
- Chillers with very light loads.
- Rapid changes to chilled or condenser liquid flow.
- Valves on air-handler coils closing rapidly causing changes in heat-load.
- Extremely short chilled liquid loop.
- Parallel chiller with poor control is causing temperature variations.
- Parallel Chiller with poor control of chilled or condenser water flows.
- Inproper evaporator refrigerant level.

If you experience a problem with an OSCD not reducing speed at all, make certain the system is not in manual speed control, or locked into fixed speed. Either situation will cause the chiller to maintain full speed. If the OSCD is reducing speed, but not running as slow as you expect it should, it is likely because it is either in an unstable condition, or running just above a mapped surge point. As described above, the chiller must achieve stability, which is evidenced by the Green LED being extinguished, before speed reduction will commence. Instability will cause the Green LED to be illuminated.

Stability Limit Adjustment

Stability Limit Adjustment allows the system to properly function with larger amounts of temperature instability. Consult YORK Service to make this adjustment.

Surge Margin Adjustment

Surge Margin Adjustment allows the Service Technician to increase the speed of the drive for all mapped surge points. This parameter is rarely used, and it decreases the efficiency of the OSCD chiller system.

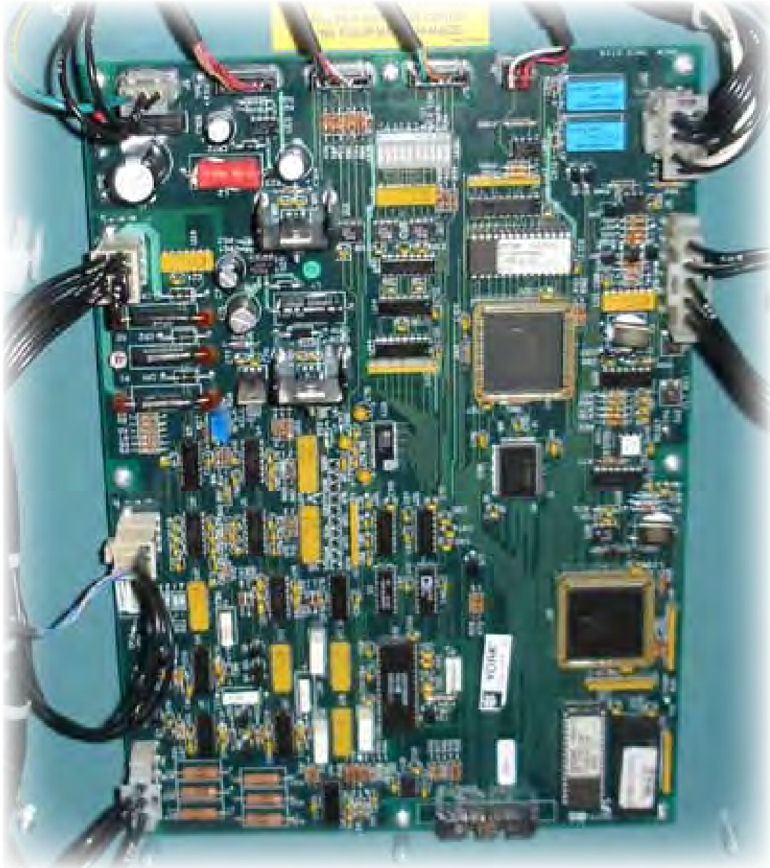
NOTE: Variable Speed Drive Model VSD351 Shown

LD13164

FIGURE 1 - OPTISPEED™ SYSTEM ARCHITECTURE

NOTE: Variable Speed Drive Model VSD351 Shown

FIGURE 1 - OPTISPEED™ SYSTEM ARCHITECTURE (CONT'D)

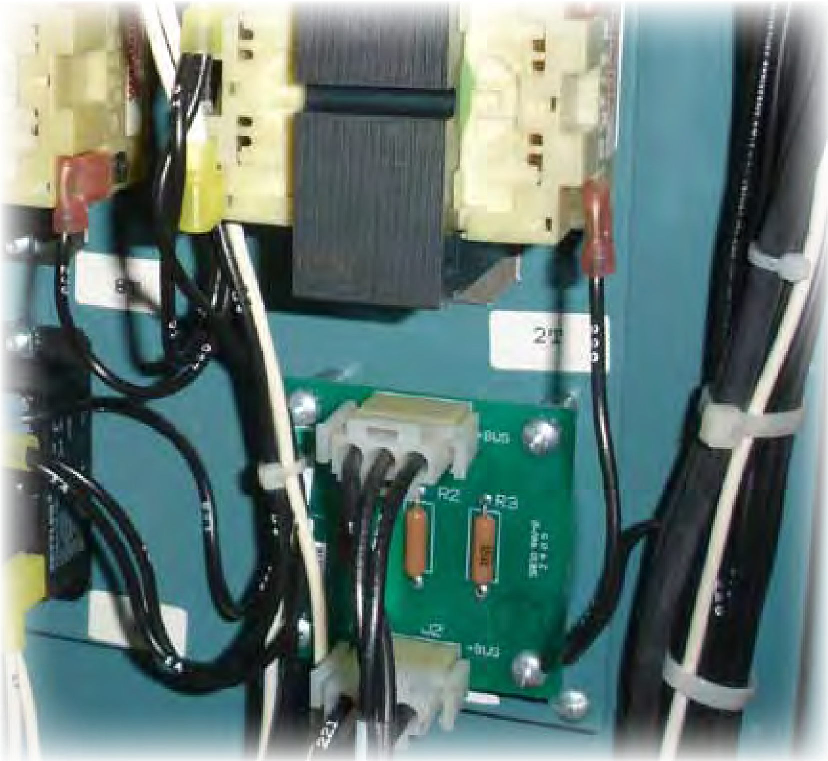


LD13165

FIGURE 2 - VSD LOGIC BOARD (LOCATED ON PANEL DOOR)

LD13166

FIGURE 3 - SCR TRIGGER BOARD



LD13167

FIGURE 4 - DC ISOLATOR BOARD

LD13168

FIGURE 5 - GATE DRIVER BOARD

SAFETY SHUTDOWNS

General Information

The Shutdowns are organized in alphabetical order based on the OptiView™ Control Center messages. The Microcomputer Control Center messages are also included under these headings.

Whenever a Safety Shutdown is generated by the OSCD or Harmonic Filter Logic Board, a series of events will occur.

- If the chiller is not running at the time of the shutdown, the OSCD Logic Board will not turn on the gate drivers.
- The K1 relay on the OSCD logic board will de-energize to indicate to the Control Center that the OSCD has shutdown. The K1 relay will remain de-energized until the cause of the shutdown has been corrected.
- If the chiller is running at the time of the shutdown, the Control Center will start a coastdown period (150 seconds for centrifugal chillers or shorter for those chillers that contain the optional "Quick Start" feature).
- The message "VSD Shutdown - Requesting Fault Data"...will be displayed when the Control Center is requesting the fault data from the OSCD.
- The OSCD or Harmonic Filter Logic Board will send a shutdown code via the communications link to the Control Center. The Micro Board will interpret the shutdown code and display a shutdown message on the display of the Control Center.

After the coastdown period has timed out, the chiller may be restarted if the shutdown is no longer active. Place the Compressor Switch in the Stop/Reset position, and then into the Start position and release. The chiller will start if no faults are active.

TABLE 1 - SAFETY SHUTDOWNS

MESSAGE	DESCRIPTION
Motor or Starter – Current Imbalance MOTOR OR STARTER – CURRENT IMBALANCE	The OSCD logic board generates this shutdown. This shutdown will become active when the highest of the three motor currents exceeds 80% of the programmed FLA. After these conditions are met, if any one phase of motor current exceeds 30% of the average current for 45 seconds, a Safety shutdown will be activated.
VSD - 105 % Motor Current Overload 105% MOTOR CURRENT OVERLOAD	The OSCD logic board generates this shutdown by reading the current from the 3 output current transformers. The shutdown is generated when the OSCD logic board has detected that the highest of the three output phase currents has exceeded 105% of the programmed 100% full load amps (FLA) value for more than 40 seconds. This shutdown requires a manual reset via the Reset push-button on the OSCD logic board.
VSD - High Converter Heatsink Temperature HIGH CONVERTER HEATSINK TEMP	A thermistor sensor is located of the copper chill plate of the OSCD Power Unit. If at anytime this thermistor detects a temperature of 170°F (76°C) or higher a shutdown will occur. The cooling fans and coolant pump on the OSCD will continue to run after the shutdown until the thermistor temperature has dropped below 160°F (71°C). This shutdown requires a manual reset via the Reset push-button on the OSCD logic board.
VSD - High Inverter Baseplate Temperature (270, 292, 351 and 424 Hp drives) HIGH INVERTER BASEPLATE TEMPERATURE FLT	A thermistor sensor is located inside the transistor module on the OSCD power unit. If at anytime this thermistor detects a temperature of 175°F (79°C) or higher a shutdown will occur. The cooling fans and coolant pump on the OSCD will continue to run after the shutdown until the thermistor temperature has dropped below 165°F (74°C). This shutdown requires a manual reset via the Reset push-button on the OSCD logic board.

TABLE 1 - SAFETY SHUTDOWNS (CONT'D)

<table>
<tr><th>MESSAGE</th><th>DESCRIPTION</th></tr>
<tr><td>VSD - High Phase (X) Inverter Baseplate Temperature (385, 419, 503 and 608 Hp drives)

HIGH PHASE (X) BASEPLATE TEMPERATURE FAULT</td><td>NOTE
The X will indicate the phase that the high temperature has occurred.

A thermistor sensor is located inside the transistor module on the OSCD power unit. If at anytime this thermistor detects a temperature of 175°F (79°C) or higher a shutdown will occur. The cooling fans and coolant pump on the OSCD will continue to run after the shutdown until the thermistor temperature has dropped below 165°F (74°C). This shutdown requires a manual reset via the Reset push-button on the OSCD logic board.</td></tr>
<tr><td>VSD - Precharge Lockout

PRE-CHARGE FAULT LOCKOUT</td><td>If the OSCD fails to meet the pre-charge criteria (refer to pre-charge faults), the pre-charge circuit will wait for a period of 10 seconds before another pre-charge attempt. The unit’s cooling fans and coolant pump shall remain energized during this time period. Following this 10-second period, the pre-charge shall again be initiated. The unit shall attempt to meet the pre-charge criteria three consecutive times before the OCSD will shutdown, lockout, and display this message.</td></tr>
<tr><td>Harmonic Filter - High Baseplate Temperature

HIGH FILTER BASEPLATE TEMPERATURE FAULT</td><td>A thermistor sensor is located inside the transistor module on the harmonic filter power unit. If at anytime this thermistor detects a temperature higher then the threshold value a shutdown will occur. Refer to the chart below for the shutdown threshold values. A manual reset is required by pressing the “Overtemp Reset” pushbutton located on the Filter Logic board.
<table>
<tr><th>DRIVE HP RATING</th><th>THRESHOLD SHUTDOWN VALUE</th></tr>
<tr><td>270/292/351</td><td>175° F (79° C)</td></tr>
<tr><td>385/419/424/503/608</td><td>190° F (88° C)</td></tr>
</table></td></tr>
<tr><td>Harmonic Filter - High Total Demand Distortion

FLTR HIGH TDD FLT</td><td>The control center determines this shutdown by using data supplied from the harmonic filter logic board. This shutdown indicates that the filter is not operating correctly or the input current to the OSCD/filter system is not sinusoidal. This shutdown will occur if the Total Demand Distortion (TDD) in any one phase exceeds 25% continuously for 45 seconds. TDD is an acronym for Total Demand Distortion, a term defined by the IEEE Std 519-1992 standard as “the total root - sum - square harmonic current distortion, in percent of the maximum demand load current (15 or 30 min demand)”. The harmonic filter option was designed to provide an input current TDD level of 8% or less for the OSCD system. A standard OSCD less the optional filter typically has an input current TDD level on the order of 28 - 30%.</td></tr>
</table>

CYCLING SHUTDOWNS

General Information

The Shutdowns are organized in alphabetical order based on the OptiView Control Center Panel messages. The Microcomputer Control Panel messages are also included under these headings.

Whenever the OSCD or Harmonic Filter Logic Board generates a Cycling Shutdown a series of events will occur.

- If the chiller is not running at the time of the shutdown, the OSCD Logic Board will not turn on the output transistors.
- The K1 relay on the OSCD logic board will de-energize. This action will indicate to the Control Center that the OSCD has shutdown. The K1 relay will remain de-energized until the cause of the shutdown has been corrected.
- If the chiller is running at the time of the shutdown, the Control Center will start a coastdown period (150 seconds for centrifugal chillers).
- The message "VSD Shutdown - Requesting Fault Data"...will be displayed when the Control Center is requesting the fault data from the OSCD.
- The OSCD or Harmonic Filter Logic Board will send a shutdown code to the Control Center. The Micro Board will interpret the shutdown code, and display a shutdown message on the display of the Control Center.

After the coastdown period has timed out, the chiller will automatically restart if the shutdown is no longer active. Leave the Compressor Switch in the Run position. The chiller will start if no faults are active.

TABLE 2 - CYCLING SHUTDOWN MESSAGE

MESSAGE	DESCRIPTION
VSD - DC Bus Voltage Imbalance **BUS VOLTAGE IMBALANCE FAULT**	The DC link is filtered by many large capacitors, which are rated for 450 VDC. These capacitors are connected in series to achieve a 900 VDC capability for the DC link. It is important that the voltage is shared equally between the 2 sets of series capacitors. Each set of capacitors must share approximately ½ of the total DC link voltage. If the difference in the voltage between the 2 sets of capacitors is greater than ± 88 VDC then this shutdown will occur.
VSD - High DC Bus Voltage **BUS OVER-VOLTAGE FAULT**	The DC bus voltage is continuously monitored and a shutdown will occur if the DC bus voltage exceeds 745 VDC (for 400 VAC & 460 VAC units) or 909 VDC (for 575 VAC units). This shutdown will protect the capacitors from a voltage that exceeds their rating.
VSD - High Internal Ambient Temperature **HIGH AMBIENT TEMPERATURE FLT**	The ambient temperature of the OSCD is monitored by a temperature sensor mounted on the OSCD logic board. The high ambient trip threshold is 145°F (63°C) for all HP units except 424 HP which has a trip threshold of 153°F (67°C). If this fault occurs, the fans and coolant pump will remain on until the internal ambient temperature has fallen to 137°F (58°C) for all HP units except 424 HP which will run the fans and coolant pump until the internal ambient has fallen to 145°F (63°C).

TABLE 2 - CYCLING SHUTDOWN MESSAGE (CONT'D)

<table>
<tr><th>MESSAGE</th><th>DESCRIPTION</th></tr>
<tr><td>VSD - High Phase A (or B, C) Instantaneous Current

PHASE A (OR B, C) OVERCURRENT FAULT</td><td>This shutdown is generated by the OSCD logic board. If any one phase of motor current as measured by the Output Current Transformers exceeds a threshold. Refer to the chart below for the shutdown threshold value.
<table><tr><td>DRIVE HP RATING</td><td>THRESHOLD SHUTDOWN VALUE</td></tr><tr><td>292/351/424</td><td>771 AMPS PEAK</td></tr><tr><td>419/503/608</td><td>1200 AMPS PEAK</td></tr></table>If an Instantaneous Current Fault occurs but the chiller restarts and runs without a problem, the cause may be attributed to a voltage sag on the utility power feeding the OSCD that is in excess of the specified dip voltage rating for this product. This is especially true if the chiller was running at, or near, full load. If there is a sudden dip in line voltage, the current to the motor will increase. The chiller vanes cannot close quickly enough to correct for this sudden increase in current and the chiller will trip on this fault.</td></tr>
<tr><td>VSD - Initialization Failed

VSD INITIALIZATION FAILED</td><td>At power-up, the OSCD logic board will go through a process called initialization. At this time, memory locations are cleared, jumper positions are checked, and communications links are established between the OSCD logic board, and the Control Center.</td></tr>
<tr><td>VSD - Invalid Current Scale Selection

INVALID CURRENT SCALE FAULT</td><td>The J1 connector on the OSCD logic board contains jumpers along with wires from the output CTs. The jumpers configure the OSCD logic board to the HP rating of the OSCD being used in this application in order to properly scale the output current. If the jumper configuration is found by the logic board to be invalid, the system will be shut down and the above message will be generated. The proper jumper configuration is shown on the wiring label for the OSCD.</td></tr>
<tr><td>VSD - Logic Board Power Supply

MAIN BOARD POWER SUPPLY</td><td>This shutdown is generated by the OSCD logic board, and it indicates that one of the low voltage power supplies for the OSCD logic board has dropped below their allowable operating limits. The power supplies for the logic boards are derived from the secondary of the 120 to 24 VAC transformer which in turn is derived from the 480 to 120 VAC control transformer.</td></tr>
<tr><td>VSD - Logic Board Processor

PWM COMMUNICATIONS FAULT</td><td>This shutdown is generated by the OSCD logic board. If a communications problem occurs between the two microprocessors on the OSCD logic board this shutdown will occur.</td></tr>
<tr><td>VSD - Low Converter Heatsink Temperature

LOW CONV HEATSINK TEMP.</td><td>A thermistor sensor is located on the SCR/Diode block side of the copper chill plate on the OSCD Power Unit. Anytime this thermistor detects a temperature of 37°F (3°C) or lower a shutdown will occur.</td></tr>
<tr><td>VSD - Low DC Bus Voltage

LOW DC BUS VOLTAGE FLT</td><td>If the line voltage were to quickly drop the current seen by the motor could exceed it's rating. The low bus voltage shutdown will prevent this from happening. The shutdown is generated when the DC link voltage drops below 500 VDC for 460 VAC input voltage, 414 VDC for 400 VAC and 415 VAC input voltage or 600 VDC for 575 VAC input voltage.</td></tr>
<tr><td>VSD - Low Inverter Baseplate Temperature

LOW INVERTER BASEPLATE TEMPERATURE FLT</td><td>A thermistor sensor is located inside the transistor module(s) on the OSCD power unit. Anytime this thermistor detects a temperature of 37°F (3°C) or lower a shutdown will occur.</td></tr>
</table>

TABLE 2 - CYCLING SHUTDOWN MESSAGE (CONT'D)

MESSAGE	DESCRIPTION
VSD - Phase A (or B, C) Gate Driver PHASE A (B, C) GATE DRIVER FLT	A second level of overcurrent current protection exists on the OSCD gate driver board. The collector-to-emitter voltage of each transistor module is checked while the device is turned on. This is called the collector-to-emitter saturation voltage. If the voltage across the transistor module is greater than a set threshold, the transistor module is turned off. This fault can also be caused if the transistor is not being turned on when it should.
VSD - Precharge - DC Bus Voltage Imbalance PRECHARGE BUS V IMBALANCE	The definition for this fault is identical to " VSD - DC Bus Voltage Imbalance" except that the fault has occurred during the precharge period, which begins during prelube. Refer to " VSD - DC Bus Voltage Imbalance" shutdown for possible problems.
VSD - Precharge - Low DC Bus Voltage PRECHARGE LOW VOLTAGE FAULT	This fault has two different timing events. First, the DC Bus voltage must be equal to or greater than 50 VDC for 460 VAC input voltage, 41 VDC for 400 or 415 VAC input voltage, or 60 VDC for 575 VAC input voltage, 4 seconds after pre-charge has begun. Second, the DC Bus voltage must be equal to or greater than 500 VDC for 460 VAC input voltage, 414 VDC for 400 or 415 VAC input voltage or 600 VDC for 575 VAC input voltage, 20 seconds after pre-charge has begun.
VSD - Run Signal RUN RELAY FAULT	Two run signals are generated by the Control Center, one via hardware and the second via the communications link. Upon receipt of either of the two run signals by the OSCD logic board, a 5-second timer will begin. If the missing run signal is not received within the 5-second window the OSCD logic board will shut down and the Control Center will display the shutdown message.
VSD - Serial Communications SERIAL RECEIVE FAULT	This message is generated when communications between the micro board and the ACC board, or the ACC board and OSCD logic board is disrupted for a least 22 seconds. If the optional Harmonic Filter is installed then the fault can be generated when the communications between the OSCD logic board and the Harmonic Filter logic board, or the Harmonic Filter logic board and the ACC board is disrupted.
VSD - Single Phase Input Power SINGLE PHASE POWER SUPPLY	This shutdown is generated by the SCR Trigger board and relayed to the OSCD logic board to initiate a system shutdown. The single phase control uses circuitry to detect the loss of any one of the three input phases. The trigger board will detect the loss of a phase within one half line cycle of the phase loss. An LED on the SCR Trigger board will indicate that the board is detecting the fault, and not a wiring problem between the trigger board and the OSCD logic board. This message is also displayed every time power to the OSCD is restored, or if the input power dips to a very low level. Usually it indicates that someone has opened the circuit breaker.
VSD - Stop Contacts Open INVERTER INITIATED STOP FAULT	Whenever the OSCD initiates a fault, it first opens the fault relay on the OSCD logic board. When the relay opens a message is sent to the ACC board, detailing the cause of the fault. If this circuit ever opens without receiving an accompanying cause for the fault over the communication link (within 11 communication tries, approximately 22 seconds) this message will be displayed. This fault may be replaced with a Serial Communications fault if the serial link has failed.

TABLE 2 - CYCLING SHUTDOWN MESSAGE (CONT'D)

<table>
<tr><th>MESSAGE</th><th>DESCRIPTION</th></tr>
<tr><td>Harmonic Filter - 110 % Input Current Overload

FLTR OVERLOAD FLT</td><td>The three phases of RMS filter current are measured by the output DCCTs'. This information is sent to the harmonic filter logic board. If any one phase of filter current exceeds a threshold for 40 seconds a shutdown will occur. Refer to the chart below for the shutdown threshold value.
<table><tr><th>DRIVE HP RATING</th><th>THRESHOLD SHUTDOWN VALUE</th></tr><tr><td>270/292/351/424</td><td>128 AMPS RMS</td></tr><tr><td>385/419/503/608</td><td>176 AMPS RMS</td></tr></table></td></tr>
<tr><td>Harmonic Filter - DC Bus Voltage Imbalance

FLTR BUS V IMBALANCE FLT</td><td>The DC link is filtered by many large capacitors. These capacitors are connected in series to achieve a higher DC link voltage then can be supported by a signal capacitor. It is important that the voltage is shared equally between the two sets of series capacitors. Each set of capacitors must share approximately 1/2 of the total DC link voltage. The harmonic filter logic board then measures the voltage of the 2 sets of the bus capacitors. If at anytime while the harmonic filter is running that the difference in the voltage between the 2 sets of capacitors is greater than 50 VDC (for 460, 415 and 400 VAC input voltage) 65 VDC (for 575 VAC input voltage), then a shutdown will occur.</td></tr>
<tr><td>Harmonic Filter - DC Current Transformer 1(or 2)

FILTER DCCT 1 (OR 2) ERROR</td><td>During initialization, with no current flowing through the Direct Current Current Transducers (DCCT's), the DCCT's output voltages are measured and compared with a preset limit in the harmonic filter logic board. If the measured values exceed the preset limits, the DCCT's are presumed to be bad and this shutdown will be generated.</td></tr>
<tr><td>Harmonic Filter - High DC Bus Voltage

FLTR BUS OVER-VOLTAGE FLT</td><td>The harmonic filter logic board continuously monitors the harmonic filter DC link voltage if the level of the DC link voltage exceeds a range of 822 to 900 VDC (for 380 through 460 VAC input voltage) or 999 to 1099 VDC (for 575 VAC input voltage) this shutdown is initiated. Keep in mind that the harmonic filter has its own DC Link as part of the harmonic filter power unit. The harmonic filter DC Link is not connected in any way with the drive's DC Link.</td></tr>
<tr><td>Harmonic Filter - High Phase A (or B, C) Current

FLTR PHASE A (B, C) OVERCURRENT</td><td>The output current of the harmonic filter is read by the Direct Current-Current Transducer (DCCT). This current information is sent to the harmonic filter logic board where it is compared against a threshold. If the output current of the harmonic filter power unit is greater than the threshold, then the harmonic filter will turn off for 5-6 line cycles. After that time the filter operation will resume. If the harmonic filter operation is stopped 3 times within a period of 60 line cycles, then the filter and VSD power units are shut down and this message is generated.
<table><tr><th>DRIVE HP RATING</th><th>THRESHOLD SHUTDOWN VALUE</th></tr><tr><td>270/292/351/424</td><td>378 ± 59 AMPS Pk</td></tr><tr><td>385/419/503/608</td><td>523 ± 84 AMPS Pk</td></tr></table></td></tr>
<tr><td>Harmonic Filter - Logic Board Or Communications

IEEE-519 FILTER FAULT</td><td>This shutdown states that the hardware on the harmonic filter logic board is indicating a fault, but the software on the harmonic filter logic board does not state why. The harmonic filter logic board signals a fault condition to the OSCD logic board but does not respond to a software request for fault information.</td></tr>
<tr><td>Harmonic Filter - Logic Board Power Supply

FLTR POWER SUPPLY FLT</td><td>This shutdown indicates that one of the low voltage power supplies on the harmonic filter logic board have dropped below their permissible operating voltage range. The harmonic filter logic board receives its power from the OSCD logic board. The power supplies for the OSCD logic board are in turn derived from the secondary of the 120 to 24 VAC transformer.</td></tr>
</table>

TABLE 2 - CYCLING SHUTDOWN MESSAGE (CONT'D)

<table>
<tr><th>MESSAGE</th><th>DESCRIPTION</th></tr>
<tr><td>Harmonic Filter - Low DC Bus Voltage

FLTR LOW BUS VOLTAGE FLT</td><td>The harmonic filter dynamically generates its own filter DC link voltage by the interaction of the harmonic filter inductor and switching its transistors. This DC level is actually higher than the level obtained by simply rectifying the input line voltage.

NOTE: The DC link voltage is always higher on the harmonic filter power unit then on the OSCD VSD power unit.

Thus the harmonic filter actually performs a voltage “boost” function. This is necessary in order to permit current to flow into the AC line from the harmonic filter when the AC line is at its peak level. This particular shutdown and its accompanying message are generated when the harmonic filter’s DC link voltage drops to a level less than 80 VDC (for 380 through 460 VAC input voltage) and 110 VDC (for 575 VAC input voltage) below the harmonic filter DC link voltage setpoint.</td></tr>
<tr><td>Harmonic Filter - Phase Locked Loop

FLTR PHASE LOCK LOOP FLT</td><td>This shutdown indicates that a circuit called a “phase locked loop” on the harmonic filter logic board has lost synchronization with the incoming power line for a period of time.</td></tr>
<tr><td>Harmonic Filter - Precharge - Low DC Bus Voltage

FLTR PCHARGE LOW BUS V FLT</td><td>Two minimum voltage thresholds must be met in order to complete the precharge cycle. The first occurs 1/10th of a second after pre-charge is initiated and the other occurs 5 seconds after precharge is initited. See table below for specific values.
<table>
<tr><th>NOMINAL INPUT VOLTAGE VALUE</th><th>1st MINIMUM VOLTAGE VALUE</th><th>2nd MINIMUM VOLTAGE VALUE</th></tr>
<tr><td>380-460 VAC</td><td>41 VDC</td><td>425 VDC</td></tr>
<tr><td>575 VAC</td><td>60 VDC</td><td>630 VDC</td></tr>
</table></td></tr>
<tr><td>Harmonic Filter - Run Signal

FLTR RUN RELAY FLT</td><td>When a digital run command is received at the harmonic filter logic board from the OSCD logic board, a 1/10 second timer is started. A redundant run command must also occur on the communication link from the OSCD logic board before the timer expires or the OSCD will be shut down.</td></tr>
</table>

WARNING MESSAGES

General Information

A WARNING message will indicate that the operation of the OptiSpeed Compressor Drive or the Harmonic Filter is affected in some manner but the OptiSpeed Compressor Drive is still functioning.

TABLE 3 - WARNING MESSAGES

WARNING	DESCRIPTION
Warning - Vanes Uncalibrated - Fixed Speed	This message is displayed when the Pre-Rotation Vanes are not calibrated or have failed to calibrate, and the OptiSpeed Compressor Drive is enabled. Under this condition the OSCD will run at a constant maximum speed. This message will no longer appear after a successful calibration.
Warning - Harmonic Filter - Data Loss FILTER - DATA LOSS	This message is displayed if the communications link between the OSCD logic, and the harmonic filter logic, or the ACC boards are interrupted for at least a period of 20 seconds. This message can also occur as a background message when the chiller is running. When this message is displayed all harmonic filter related values are replaced with X's. If communications is re-established, the message will disappear, and normal values will again be displayed.
Warning - Harmonic Filter - Operation Inhibited FILTER - OPERATION INHIBITED	This message is displayed when the function of the Harmonic Filter is inhibited at the Control Center. This message is no longer displayed when the function of the Harmonic Filter is enabled at the Control Center. The function of the harmonic filter can only be inhibited or turned on when the chiller is not running.

VSD FREQUENTLY ASKED QUESTIONS

Why doesn't the measured input amps of the OSCD agree with the rated FLA?

The input current to the OSCD may be considerably lower, compared to the output current. This is due to the power factor at the input to the OSCD being greater than .95, and nearly unity when the Harmonic Filter option is included. Chiller FLA must be measured at the motor terminals, where the power factor is the normal motor power factor. Use a true RMS reading meter to make these measurements.

Is a Condenser Water Strainer used with the shell and tube heat exchanger?

Since the shell and tube heat exchanger can be cleaned with a rifle brush, no extra precautions are needed to keep the heat exchanger cleaned. No strainer is provided with this OSCD. The intent is to have the heat exchanger cleaned annually. Gaskets are available (refer to the service parts list).

What is the timing of the Anti-Recycle when an OSCD is applied?

The anti-recycle time is much quicker with an OSCD than with a starter. The reason is the elimination of inrush current on start-up. The OptiSpeed compressor drive slowly accelerates the compressor motor so that the motor does not consume more than 100% of the motor's nameplate full load amps. The anti-recycle time is five (5) starts in succession, followed by a ten minute wait. After ten minutes, the OSCD can be started five more successive starts. This is permitted on OSCD units only, due to the low current draw and reduced motor heating during startup.

Should the customer install isolation between the Power Conduits and the OptiSpeed Compressor Drive?

We no longer require a section of non-metallic conduit at the entrance and exit of the OSCD as we did on previous products. If any customer or installer wishes to continue to follow this practice, we have no objections as long as the OSCD is properly grounded.

When is a Booster Pump required on a Retrofit OptiSpeed Compressor Drive?

Detailed information is supplied in Form 160.05-N4. In general, the OSCD requires 8 ft of head for proper water flow to the OSCD heat exchanger. If this amount of head is not available, then a booster pump is required.

Can I apply an OptiSpeed Compressor Drive to a generator?

Yes, the OSCD can be applied to a generator. No modifications are required for a generator application. We have several OSCD installations running on generator power without difficulty. It is necessary that the generator's output voltage and frequency be maintained within the specified range for that particular OSCD. This is usually not a problem for most generators, since motor current at startup is limited to less than 1X the Full Load Amps (FLA).

My chiller will not slow down, why?

The OSCD will not reduce the motor speed until the leaving chilled water temperature is below 0.5 degree from setpoint. Once in this window, the speed still cannot be reduced until the operation is deemed to be stable, based upon the vanes are not continually moving open and closed to maintain temperature. This hunting effect is normally due to one of the following:

- Chilled water and Condenser water flows are not at design GPMs. The rate of change in flow maybe too fast for the chiller to be determined as stable.
- Return water temperature is varying due to 3-way valves or other system configuration, and the chiller is simply following changes in load.
- Vane stroke is too large. Remove the sensitivity jumper in the Micro Computer Control Center, or program a lower sensitivity on the OptiView Control Center. Also, check the vane motor to see that the fullest possible stroke is being utilized. Moving the vane motor arm pivot point closer to center, and extending the degrees of travel by adjusting the internal end stops, will reduce the amount of vane action for the same period of operation.

- Verify that the condenser is clean.
- Verify that the liquid level control is working properly, and maintaining a refrigerant level in the condenser.
- Ensure that the condenser water temperature is proper for the load on the chiller. In many cases, the condenser water temperature is still at 85°F.

Failure to reduce speed may also be due to the system having been placed in Manual Speed when in VSD Service Mode.

Do I have a problem with my coolant? The pink color is no longer visible?

The coolant normally has a pink or rose color when new. After several months of operation, this color may dissipate, and the coolant may appear almost colorless. The lack of the color in the coolant does not necessarily indicate a problem. Most colorless samples test above 1000 PPM nitrite, which is normal. There is no need to flush the system unless you find the coolant becoming opaque or cloudy. In this case we suggest you obtain a sample for analysis, then flush the system with coolant and install fresh coolant. The coolant must be changed every year regardless of color or test results. The coolant is required to be changed every year.

The following factors can be used to convert from English to the most common SI Metric values.

TABLE 4 - 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)	304.8	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 = 27.2°C

To convert a temperature range (i.e., 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

P.O. Box 1592, York, Pennsylvania USA 17405-1592
800-861-1001
www.johnsoncontrols.com

Form 160.00-O4 (1111)
Issue Date: November 14, 2011
Supersedes: 160.00-O4 (1007)