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SCHEDULE A - APPROVED ECMS TO BE IMPLEMENTED BY ESCO

Schedule A - Approved ECMs for Phase III to be implemented by ESCO

ESCO	SCHOOL	ECM	STATUS	NOTES
SIEMENS	Arthur Ashe Middle School	Automated Irrigation & Flow Sensors	Approved	
	Broward Estates Elementary	Automated Irrigation & Flow Sensors	Approved	
		Water Conservation	Approved	
		Lighting Retrofit & Upgrade	Approved	
	Floranada Elementary	Automated Irrigation & Flow Sensors	Approved	
	James Rickards Middle School	Automated Irrigation & Flow Sensors	Approved	
		Water Conservation	Approved	
		Lighting Retrofit & Upgrade	Approved	
	New River Middle School	Automated Irrigation & Flow Sensors	Approved	
		Water Conservation	Approved	
		Lighting Retrofit & Upgrade	Approved	
	Northeast High School	Automated Irrigation & Flow Sensors	Approved	
		Water Conservation	Approved	
		Lighting Retrofit & Upgrade	Approved	
	Sunrise Middle School	Automated Irrigation & Flow Sensors	Approved	
		Water Conservation	Approved	
		Lighting Retrofit & Upgrade	Approved	
		Chiller Replacement	Approved	
	Sunland Elementary	Automated Irrigation & Flow Sensors	Approved	
	Virginia S. Young Elementary	Automated Irrigation & Flow Sensors	Approved	
		Water Conservation	Approved	
		Lighting Retrofit & Upgrade	Approved	
	Wilton Manors	Automated Irrigation & Flow Sensors	Approved	
		Water Conservation	Approved	

EQUIPMENT TO BE INSTALLED BY ESCO

The following tasks listed herein for each equipment type will be performed at the intervals planned. These tasks are designed to place the equipment into prime operating condition so that the equipment will operate effectively, reliably, and efficiently.

Arthur Ashe Middle School
- Automated Irrigation Control system & flow sensors

Broward Estates Elementary School
- Automated Irrigation Control system & flow sensors
- Water Conservation plumbing fixtures
- Lighting Retrofit & Upgrade

Floranada Elementary School
- Automated Irrigation Control system & flow sensors

James Rickards Middle School
- Automated Irrigation Control system & flow sensors
- Water Conservation plumbing fixtures
- Lighting Retrofit & Upgrade

New River Middle School
- Automated Irrigation Control system & flow sensors
- Water Conservation plumbing fixtures
- Lighting Retrofit & Upgrade

Northeast High School
- Automated Irrigation Control system & flow sensors
- Water Conservation plumbing fixtures
- Lighting Retrofit & Upgrade

Sunrise Middle School
- Automated Irrigation Control system & flow sensors
- Water Conservation plumbing fixtures
- Lighting Retrofit & Upgrade
- Chiller Replacement
- Refrigerant monitoring system, components, & exhaust fan
- Siemens BACNet DDC Control system for chiller plant including RS-232/485 to chiller control panel, pump, cooling tower, and chiller 2 controls & CHW, CW temperature sensing.

Virginia Young Elementary School
- Automated Irrigation Control system & flow sensors
- Water Conservation plumbing fixtures
- Lighting Retrofit & Upgrade

Wilton Manors Elementary School
- Automated Irrigation Control system & flow sensors
- Water Conservation plumbing fixtures

Please see the attached product specification sheets for further information regarding the equipment to be installed under the Phase III contract.

Proposal

Trane
A Division of American Standard Inc.

Prepared For:

Date: July 05, 2006

Proposal Number: H4-48958-1

Job Name:
Sunrise Middle School New Chiller

Engineer:

Delivery Terms:
Freight Allowed and Prepaid - F.O.B. Factory

Payment Terms:
Net 30 Days

Trane is pleased to provide the enclosed proposal for your review and approval.

Trane is pleased to provide the enclosed proposal for your review and approval.

Tag Data - Water-Cooled Series R(TM) (Qty: 1)

Item	Tag(s)	Qty	Description	Model Number
A1	CH-1	1	Water-Cooled Series R(TM) (RTHD)	RTHD

Product Data - Water-Cooled Series R(TM)

Item: A1 Qty: 1 Tag(s): CH-1

Water-Cooled Series R CenTraVac
200 Nominal Tons
Standard Cooling
Refrigeration Isolation Valves
UL/CUL Listing
2 Pass Evaporator
R.H. Evaporator Connection
2 Pass Condenser
L.H. Condenser Connection
Unit Mounted Star Delta Starter
Factory Mounted Non-Fused Disconnect Switch
460 Volt/60 Hertz/3 Phase
Under/Over Voltage Protection
Factory Mounted Microprocessor controller
2-5th Year Replacement Compressor Warranty
2-5th Year Labor Warranty - Motor/Compressor Only
Factory Start-up
First Year Parts & Labor Warranty

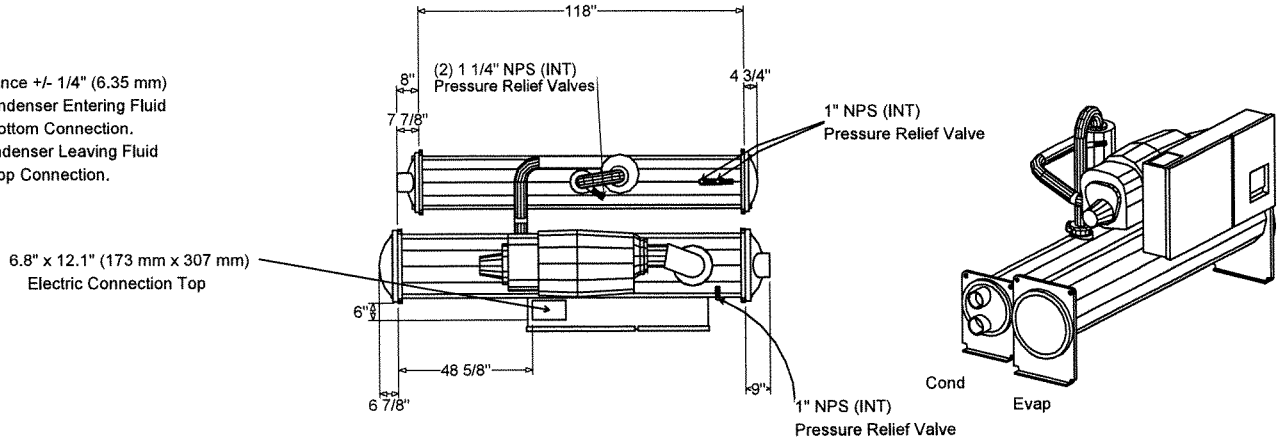
Electrical Lug Size L1-L3 (Each Phase)		
Evaporator Water Connection Size	8	NPS Pipe Size
Condenser Water Connection Size	6	NPS Pipe Size
Short Circuit Withstand Rating (RMS Symetrical AMPS)		

Terminal/Disconnect Connection Size		AMPS

To Be Used With Circuit Breakers		

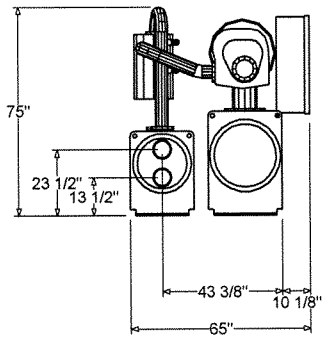
NOTES:

1. Dimensional Tolerance +/- 1/4" (6.35 mm)
2. Evaporator and Condenser Entering Fluid Connection is the Bottom Connection. Evaporator and Condenser Leaving Fluid Connection is the Top Connection.

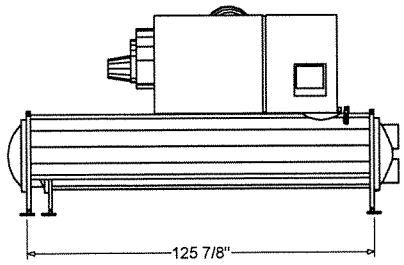


PLAN VIEW

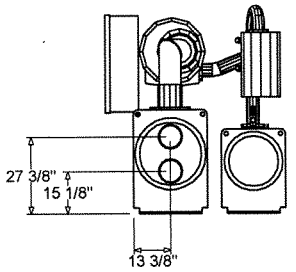
ISOMETRIC VIEW



LEFT END VIEW



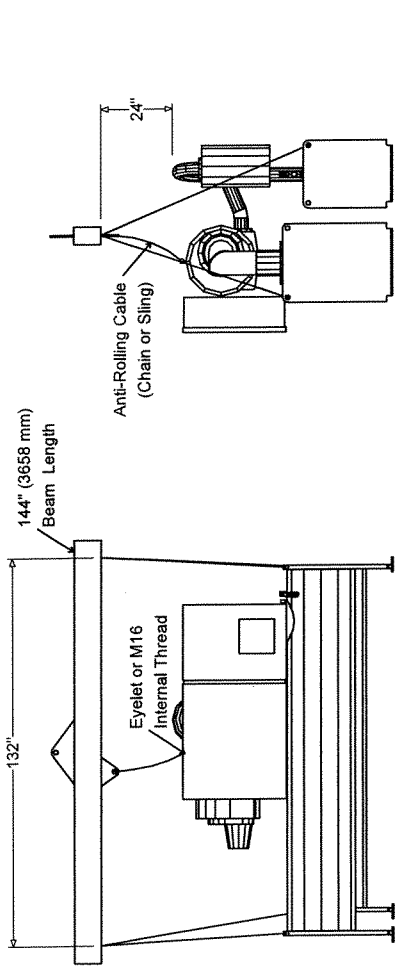
FRONT VIEW



RIGHT END VIEW

Weight, Clearance & Rigging Diagram - Water-Cooled Series R(TM)

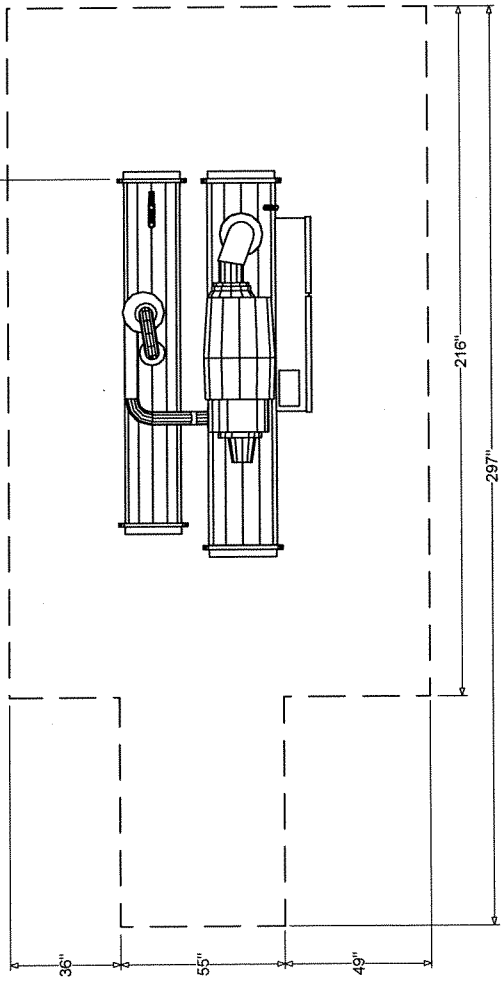
Item: A1 Qty: 1 Tag(s): CH-1



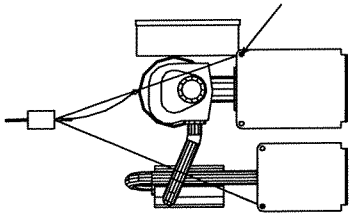
RIGHT END VIEW

FRONT VIEW

Lifting Weight lb	Operating Weight With Water lb
10000	10700



PLAN VIEW



LEFT END VIEW

NOTES:

1. DO NOT USE CABLES (CHAINS OR SLINGS) EXCEPT AS SHOWN. OTHER LIFTING ARRANGEMENTS MAY CAUSE EQUIPMENT DAMAGE OR SERIOUS PERSONAL INJURY.
2. EACH OF THE CABLES (CHAINS OR SLINGS) USED TO LIFT UNIT MUST BE CAPABLE OF SUPPORTING THE ENTIRE WEIGHT OF THE UNIT.
3. LIFTING CABLES (CHAINS OR SLINGS) MAY NOT BE THE SAME LENGTH. ADJUST AS NECESSARY FOR EVEN LEVEL LIFT.
4. ADJUST AS NECESSARY USING SINGLE POINT LIFT. TO PREVENT UNIT FROM ROLLING, ATTACH CABLE (CHAIN OR SLING) WITHOUT ANY TENSION AS SHOWN.
5. DO NOT USE FORKLIFT UNIT TO MOVE OR LIFT.
6. IF UNIT IS DISASSEMBLED, SEE SERVICE BULLETIN RTHC-SB-2 FOR LIFTING AND RIGGING OF COMPONENTS.

NOTE:

ALLOW 36 OF CLEARANCE ABOVE THE STARTER ELECTRICAL CONNECTION DOOR.

Trane Standard New Equipment Terms and Conditions

Acceptance and Prices – These terms and conditions are an integral part of Trane, a division of American Standard, Inc. ("Seller")'s firm offer and form the basis of any agreement resulting from Seller's proposal. The proposal is subject to acceptance within thirty days from its date, and after that the prices are subject to change without notice prior to acceptance by the party to whom this offer is made, or its authorized agent ("Buyer"). Following acceptance without addition of any other terms and conditions of sale or any other modification by Buyer, the prices stated are firm provided that notification of release for immediate production and shipment is received at Seller's factory not later than five months from order receipt. If such release is received later than five months from order receipt date, prices will be increased a straight 1% (not compounded) for each one-month period (or part thereof) beyond the five-month firm price period up to the date of receipt of such release. If such release is not received within eight months after the date of order receipt, at Seller's option, the order may be cancelled. Any delay in shipment caused by Buyer's actions will subject prices to increase equal to the percentage increase in list prices during that period of delay. In no event will prices be decreased.

Acceptance will have occurred if Buyer: signs Seller's proposal; issues written order pursuant to submission of proposal; or permits or accepts performance; or other commercially reasonable manner. If Buyer's order is an acceptance of Seller's proposal, Seller's return of such order with these terms and conditions attached serves as an acknowledgement and confirmation of receipt of order. If order is expressly conditioned upon Seller's acceptance or assent to terms other than those expressed herein, return of order by Seller with these terms and conditions attached serves as notice of objection to such terms and a counter-offer to provide equipment in accordance with scope and terms of the original proposal. If Buyer does not reject or object within ten days, counter-offer will be deemed accepted. If Buyer permits or accepts performance, such terms will be deemed accepted. In order for Seller's acknowledgement of order to be valid it must be made at the corporate level.

Performance - Seller shall be obligated to furnish only the goods described in Seller's proposal, and submittal data (if such data is issued in connection with this order), and Seller may rely on the acceptance of proposal and submittal data as acceptance of the suitability of the equipment for the particular project. Seller's duty to perform under any order and the price thereof is dependent upon Seller's corporate approval of the order and Seller shall not be responsible for delays in contract formation caused by inclusion of new or different terms by Buyer, or delays in credit approval due to delayed or incomplete credit information by Buyer. Seller's duty to perform is contingent upon strikes, accidents, delays in transit, fires, the inability to procure materials from the usual sources of supply, the requirements of the United States Government in any manner that diverts either the material or the finished product to the direct or indirect benefit of the Government, or upon any other cause beyond the reasonable control of Seller. If the order is not approved at the corporate level, or upon occurrence of any of the foregoing events, Seller may elect to delay performance or to renegotiate with Buyer. If Seller and Buyer are unable to agree on revised prices or terms, the order may be canceled without any liability.

Taxes - To the prices and terms quoted, add any manufacturer's gross receipts, sales, or use tax, either Federal, State, or Local, payable on the transaction under any applicable statute, code, or regulation.

Warranty and Liability - Seller's warranty obligation is limited to the following: Seller warrants for a period of 12 months from initial start-up or 18 months from date of shipment, whichever is less, that products manufactured by Seller covered by Buyer's order (1) are free from defects in material and manufacture and (2) have the capacities and ratings set forth in Seller's catalogs and bulletins ("Warranty"). Exclusions from this Warranty include damage or failure arising from: wear and tear; corrosion, erosion, deterioration; Buyer's failure to follow the Seller-provided maintenance plan; modifications made by others to Seller's equipment. Seller shall not be obligated to pay for the cost of lost refrigerant. Seller's obligations and liabilities under this Warranty are limited to furnishing replacement equipment or parts, at its option, f.o.b. factory or warehouse at Seller-designated shipping point, freight-allowed to Seller's warranty agent's stock location, for all non-conforming Seller-manufactured products which have been returned by Buyer to Seller. Returns must have prior written approval by Seller and are subject to restocking charge where applicable. **SELLER MAKES NO REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, REGARDING PREVENTION OF MOLD, FUNGUS, BACTERIA, MICROBIAL GROWTH, OR ANY OTHER CONTAMINATES.**

No liability whatever shall attach to Seller until products have been paid for and Seller's liability under this Warranty shall be limited to the purchase price of the equipment shown to be defective. This Warranty is voidable in the event of non-payment. Further warranty protection is available on an extra-cost basis. Any further warranty must be in writing and agreed to by an authorized signatory of the Seller.

Warranty Disclaimer - This warranty is given in lieu of all other warranties, express or implied, including IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE and/or others arising from course of dealing or trade.

Indemnity. Buyer and Seller shall mutually, in proportion to their respective degree of fault, indemnify, defend and hold each other harmless from any and all claims, actions, costs, expenses, damages and liabilities, including reasonable attorneys' fees, resulting from death or bodily injury or damage to real or tangible personal property, to the extent caused by the negligence or misconduct of the indemnifying party, and/or its respective employees or agents. With respect to any claims based on facts or conditions that occurred prior to expiration or termination of this agreement the duty to indemnify will continue in full force and effect notwithstanding expiration or early termination.

Insurance. Seller agrees to maintain the following insurance during the term of the contract with limits not less than shown below and will, upon request from Buyer, provide a Certificate of Insurance evidencing this coverage:

Commercial General Liability	$2,000,000 per occurrence
Automobile Liability	$2,000,000 CSL
Workers Compensation	Statutory Limits

In the event Seller agrees to name Buyer or others as an additional insured, Seller will do so but only under its primary Commercial General Liability policies to the extent of the indemnity obligation assumed herein. In no event does Seller waive its right of subrogation.

Liability Disclaimer - In no event shall Seller be liable for any incidental, consequential, or punitive damages. This exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other legal theory. Should Seller nevertheless be found liable for any damages they shall be limited to the purchase price of the equipment under the order. **SELLER DISCLAIMS ANY LIABILITY FOR DAMAGES OF ANY KIND ARISING FROM MOLD, FUNGUS, BACTERIA, MICROBIAL GROWTH, OR ANY OTHER CONTAMINATES.**

Patent Indemnity - The Seller shall protect and indemnify the Buyer from and against all claims, damages, judgments and loss arising from infringement or alleged infringement of any United States patent by any of the articles or material delivered hereunder, provided that in the event of suit or threat of suit for patent infringement, Seller shall promptly be notified and given full opportunity to negotiate a settlement. Seller does not warrant against infringement by reason of Buyer's design of the articles or the use thereof in combination with other materials or in the operation of any process. In the event of litigation Buyer agrees to reasonably cooperate with Seller. In connection with any proceeding under the provisions of this Article all parties concerned shall be entitled to be represented by counsel at their own expense.

Shipment Dates - Shipment dates are estimates only. No valid contract may be made to ship within or at a specified time unless in writing, signed by an authorized signatory of Seller. Shipments shall be f.o.b. factory or warehouse at named shipping point with title and risk of loss passing to Buyer upon delivery to the carrier.

Cancellation - If, following acceptance of proposal by Buyer, all or any portion of the resulting order is canceled by Buyer without default on the part of Seller or without Seller's written consent, Buyer shall be liable to Seller for cancellation charges including but not limited to Seller's incurred costs and such profit as would have been realized by Seller from the transaction had the agreement not been breached by Buyer.

Payment - Payment terms are 100% net 30 days of shipment unless otherwise expressly agreed to in writing by Seller. Seller reserves the right to add to any account outstanding for more than 30 days a service charge the lesser of 1-1/2% of the principal amount due at the end of each month, or the maximum allowable legal interest rate. To the maximum extent permitted by applicable law, Customer shall pay Trane $25 for any check or other item returned unpaid to Trane. Buyer shall be liable to Seller for all collection expenses, including reasonable attorney's fees and court costs, incurred by Seller in attempting to collect any amounts due from Buyer. If requested, Seller will provide appropriate lien waivers upon receipt of payment. Seller reserves the right to suspend or terminate performance in the event of Buyer's non-payment.

Returns - Products may be returned only with permission of Seller and may be subject to discount.

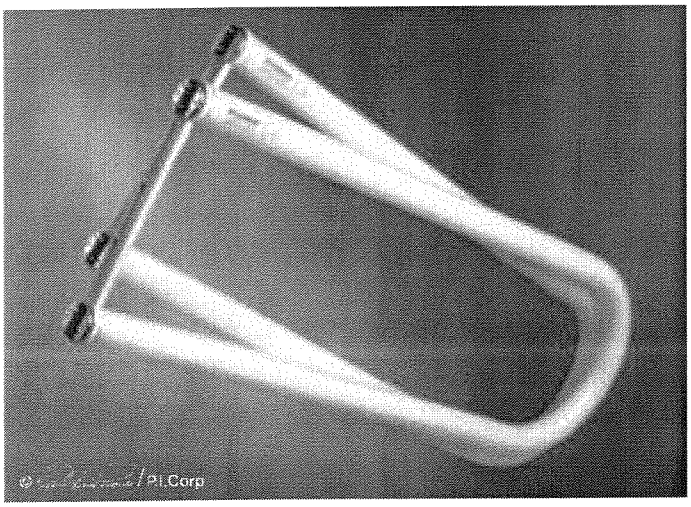
Applicable Law - Any agreement resulting from Seller's proposal will be governed and construed according to Wisconsin law.

Trane
A Division of American Standard Inc.
1-26.130-4--(03-05)

Product Information Bulletin

OCTRON® CURVALUME® XP™ SUPERSAVER® ECO®

Fluorescent Lamps



SYLVANIA 30 Watt OCTRON FBO30 CURVALUME XP SUPERSAVER ECO lamps operate on standard T8 instant start systems and provide 6% energy savings over standard 32W OCTRON CURVALUME lamps. At $.10 per kWh and 4000 hours of operation per year, the 6% energy savings translates to a savings of $1.40 per fixture per year using a normal ballast factor, instant start ballast. With 2800 initial lumen output and 94% lumen maintenance, the OCTRON FBO30 CURVALUME XP SUPERSAVER ECO lamp delivers 6% higher mean system lumens and 20% longer lamp life in addition to the 6% energy savings compared to standard 700 Series OCTRON lamps.

When paired with the QUICKTRONIC Professional PROStart PSX ballasts, the system has the lowest QUICKTRONIC system input wattage (44W/43W) while delivering similar light levels compared to T12 energy saving, magnetic systems and OCTRON 700 Series lamps operated by low ballast factor (.77), instant start systems. In both cases lamp life is longer: 33% longer than T12 and 60% longer than OCTRON 700 Series on instant start ballasts.

These ECO lamps pass the Federal TCLP test criteria for classification as non-hazardous waste in most states.

When paired with QUICKTRONIC® high frequency electronic ballasts, they provide an energy efficient, environmentally friendly system for 2X2 luminaires.

- OCTRON 30W U-Shaped T8 SUPERSAVER energy saving lamps with 6" leg spacing
- Retrofit lamp for existing 6" U-Shaped T8 instant start systems
  - 6% energy savings compared to standard 32W U-Shaped T8 lamp on instant start ballasts
  - 18,000 hour average rated life @ 3 hours per start
- Approved on OSRAM SYLVANIA QUICKTRONIC® Professional PROStart® PSX and PSN ballasts
  - 24,000 hour average rated life @ 3 hours per start
  - Up to 16% energy savings vs. normal ballast factor, instant start ballasts when using PSX ballast
- ECOLOGIC – Designed to pass Federal TCLP[1] test
- Initial Lumens – 2800
  - 94% Lumen Maintenance at 8000 hours, 93% at 9600 hours
- 3000K, 3500K & 4100K
- 85 CRI
- Minimum starting temperature: 60° F
- Not dimmable
- QUICK 60+® system warranty when operated by QUICKTRONIC ballasts

SYLVANIA OCTRON T8 ECOLOGIC fluorescent lamps are designed to pass the Federal Toxic Characteristic Leaching Procedure (TCLP) criteria for classification as non-hazardous waste in most states[2].

ECOLOGIC

[1] TCLP test results are based on NEMA LL Series standards and are available on request.

[2] Lamp disposal regulations may vary; check your local & state regulations.

Product Availability

Lamp	Wattage	Color Temperature	CRI
FBO30/830XP/6/SS/ECO	30	3000K	85
FBO30/835XP/6/SS/ECO	30	3500K	85
FBO30/841XP/6/SS/ECO	30	4100K	85

Application Information

Applications

Offices
Schools
Retail
General Lighting
Hospitals

Application Notes

1. Recommended to be used on T8 Instant Start circuit with minimum starting voltage of 550V RMS.
2. Not recommended to be used: (1) with Rapid Start circuits unless the open circuit voltage is greater than 550V, (2) at lamp ambient temperatures below 60° F or in drafty locations, (3) on low power factor ballasts, (4) dimming ballasts or (5) on inverter operated emergency lighting systems unless any of the above equipment is specifically listed for use with 30W T8 lamps. Any of the above situations could result in lamp starting and stabilization problems.
3. Can operate on QUICKTRONIC® PSX and PSN ballasts; 24,000 hours average rated life at 3 hours per start.

Sample Specification
Lamp(s) shall be OCTRON FBO30 CURVALUME XP SUPERSAVER ECO lamps with 6-inch leg spacing. Lamp(s) shall be designed to pass the Federal TCLP test criteria. Lamps(s) shall have a color temperature of (3000K, 3500K, or 4100K and a CRI of 85. Lamp(s) shall have an average rated life of 18,000 hours when operated 3 hours/start on instant start, or 24,000 hours when operated 3 hours/start on QUICKTRONIC Professional PSX electronic ballasts. Both lamp(s) and ballast(s) shall be covered by the Quick 60+ warranty program.

Warranty Information
QUICK 60+® warranty for SYLVANIA lamp and ballast combinations.
Limited 36 month lamp warranty and 5 year ballast warranty is available if both lamps and ballasts are provided by OSRAM SYLVANIA. See the QUICK 60+ warranty for details and restrictions.

OSRAM SYLVANIA
National Customer
Service and Sales Center
18725 N. Union Street
Westfield, IN 46074

Industrial & Commercial
Phone: 1-800-255-5042
Fax: 1-800-255-5043

National Accounts
Phone: 1-800-562-4671
Fax: 1-800-562-4674

OEM/Specialty Markets
Phone: 1-800-762-7191
Fax: 1-800-762-7192

Photo-Optic
Phone: 1-888-677-2627
Fax: 1-800-762-7192

OSRAM SYLVANIA
Ballast Division
800 N. Church Street
Lake Zurich, IL 60047

Phone: 1-800-654-0089
Fax: 1-847-726-6424

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OSRAM SYLVANIA LTD.
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Mississauga, ON L5S 1S4

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Fax: 1-800-667-6772

Special Markets
Phone: 1-800-265-2852
Fax: 1-800-667-6772

Visit our website: www.sylvania.com

System Comparison

Lamp Type	Ballast	System Wattage	Ballast Factor	Initial System Lumens	Mean System Lumens	% Relative Mean Light Output	% Energy Savings	% Life
System Comparison 1								
FBO32/741/6/ECO	QT2X32/ISL	51	.77	4235	3812	100%	0%	100%
FBO30/841XP/6/SS/ECO	QT2X32/ISL	48	.77	4312	4053	106%	6%	120%
FBO30/841XP/6/SS/ECO	QTP2X32/PSX	44/43	.71	3976	3737	98%	14% / 16%	160%
System Comparison 2								
FB34/CW/6/SS	E.S. Magnetic	72	.88	4576	3935	100%	0%	100%
FB34/D41/6/SS	E.S. Magnetic	72	.88	4805	4325	110%	0%	100%
FBO32/741/6/ECO	QT2X32/ISL	51	.77	4235	3812	97%	29%	83%
FBO30/841XP/6/SS/ECO	QT2X32/ISL	48	.77	4312	4053	103%	33%	100%
FBO30/841XP/6/SS/ECO	QTP2X32/PSX	44/43	.71	3976	3737	95%	39%/40%	133%

Ordering and Specification Information

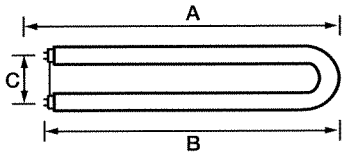
Item Number	Ordering Abbreviation	Watts	Bulb	Base	Leg Spacing	Avg. Rated Life (hrs.)[1]	Initial Lumens[2]	Mean Lumens[3]	CCT	CRI
22170	FBO30/830XP/6/SS/ECO	30	T8	Medium bi-pin	6"	18,000	2800	2632	3000K	85
22171	FBO30/835XP/6/SS/ECO	30	T8	Medium bi-pin	6"	18,000	2800	2632	3500K	85
22172	FBO30/841XP/6/SS/ECO	30	T8	Medium bi-pin	6"	18,000	2800	2632	4100K	85

1. Lamp Life base on operation at 3 hours per start on instant start ballast.
2. Initial lumens measured at 100 hours of operation.
3. Mean lumens measured at 40% of rated life.

Ordering Guide

FBO	30	/	8	35	XP	/	6	/	SS	/	ECO
Fluorescent Bent OCTRON	Wattage: 30 Watts		CRI = 85	30 = 3000K 35 = 3500K 41 = 4100K	EXtended Performance		6" leg spacing		SUPER-SAVER		ECOLOGIC

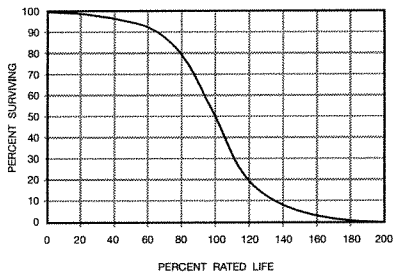
Dimensions



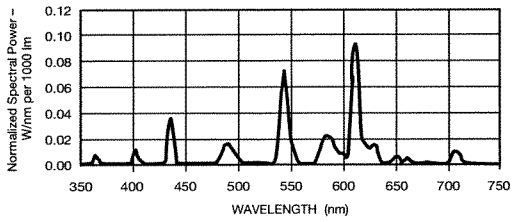
Lamp Type	(A) Maximum Overall Length (in.)	(B) Max. Base to Top of Lamp (in.)	(C) Leg Spacing Pin to Opposite Pin (in.)
FBO30	23	22.6	6.0

Technical Information

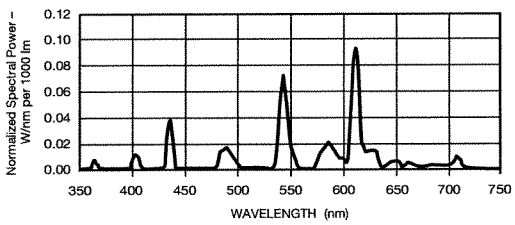
Typical Fluorescent Lamp Mortality



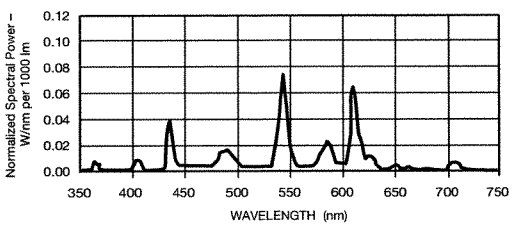
FBO30/830XP/6/SS/ECO



FBO30/835XP/6/SS/ECO



FBO30/841XP/6/SS/ECO



<10% THD Electronic T5 Fluorescent Programmed Rapid Start Systems

QUICKTRONIC® PROStart® T5 UNIVERSAL

Professional Series

Normal Light Output

Lamp/Ballast Guide

28W T5 - PENTRON®
1 or 2-lamp*
QTP2x28T5/UNV PSN

Primary Lamp Type:
FP28

Also operates:
FP14, FP21, FP35

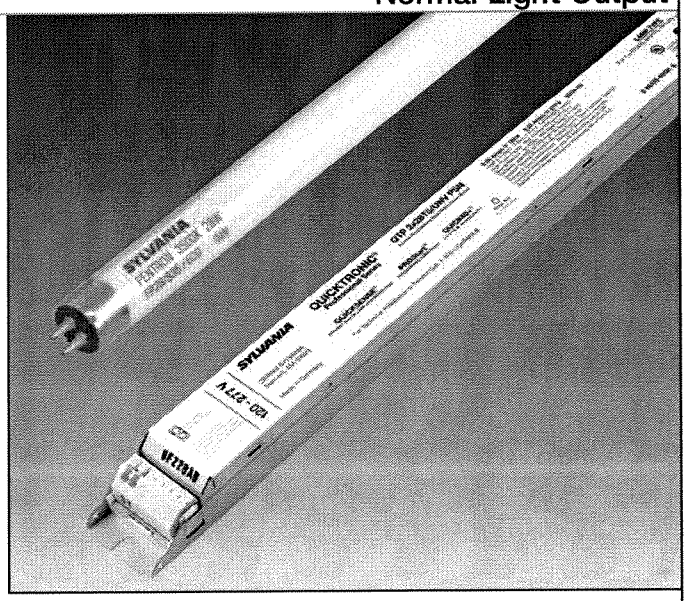
*Two lamp model can be wired for one lamp operation.

SYLVANIA QUICKTRONIC PS operates PENTRON T5 lamps with full lumen output and optimal system performance.

SYSTEM PS ballasts contain QUICKSENSE ballast technology, a patented circuitry designed to shut down the system reliably and safely when lamps reach end-of-life.

Setting the standard for quality, SYSTEM PS is also covered by our QUICK 60+® warranty, the first and most comprehensive system warranty in the industry.

SYSTEM PS is available as a two lamp model which can be wired for one lamp operation to cover a wide range of applications.



Key System Features

- Universal voltage (120-277)
- Low-profile (0.86" High)
- QUICKSENSE® ballast technology (end-of-lamp-life sensing)
- PROStart programmed start
- Occupancy sensor applications
- UL type CC rated
- 0°F Starting
- Operates at >40 Khz to reduce potential interference with infrared control systems
- High power factor
- Low harmonic distortion
- Lightweight
- UL, CSA, FCC

Application Information

SYLVANIA QUICKTRONIC PHO is ideally suited for:

- Commercial
- Retail
- Hospitality
- Institutional
- New Construction
- Direct Lighting
- Indirect Lighting
- Surface Mount
- Cove Lighting

System Information

SYSTEM PS operates from 120V through 277V, 50 or 60Hz, eliminating "wrong voltage" wiring errors and reducing the number of models in inventory by half.

PROStart ballasts provide optimum starting conditions to provide up to 100,000 switching cycles for use on occupancy sensors and building control systems.

QUICKSENSE ballast technology helps to protect against overheated bases and sockets, as well as cracking of the glass wall, and uses dynamic end-of-lamp-life sensing to avoid false shutdowns caused by some static sensing methods. QUICKSENSE ballast technology will auto reset when the end-of-life lamps are replaced with new ones.

The two lamp unit can be wired for one lamp operation, allowing for an additional 50% reduction in inventory model numbers.

System Type (2-lamp)	Input Wattage	Initial Lumens	System LPW
F40T12 - Standard Magnetic	96	5795	60
Energy Saver Magnetic	86	5795	67
F34T12 - Energy Saver Magnetic	72	4750	66
QT2x32IS - F032/800	59	5310	90
QTP2x28T5/UNV PSN - FP28/800	65/63	5800	89/92

SYSTEM PS comes in a 0.86"H x 1.18"W profile, and PENTRON lamps are designed to provide peak performance at 35°C fixture ambient, allowing for smaller and more innovative fixtures.

A complete OSRAM SYLVANIA System Performance Guide showing performance characteristics of lamps and ballasts is available upon request.

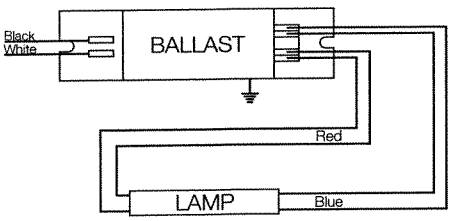
PROStart® T5 UNV
Normal Ballast Factor

<10% THD Electronic T5 Fluorescent Systems

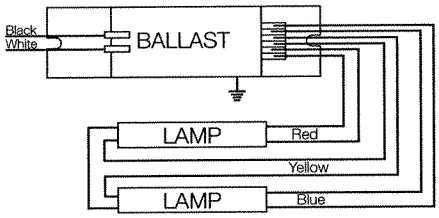
Performance Guide

Item Number	Description	Input Voltage (VAC)	Input Current (AMPS)	Lamp[1] Type	Rated[2,3] Lumens (lm)	No. of Lamps	Ballast[3] Factor (BF)	System[3] Lumens	Input[3] Power (Watts)	System Efficacy (lm/W)
49181	QTP 2x28T5/UNV PSN	120-277	0.55/0.23	FP28T5	2900	2	1.00	5800	65/63	89/92
*(49180)**						1	1.00	2900	32	90

1 Also compatible with other manufacturer's equivalent lamp types that meet ANSI standards.
2 Rated lamp lumens and performance data based on PENTRON® lamps.
3 At 35°C lamp ambient temperature.
(49180) QTP 2x28T5/UNV PSN: same as 49181, with leads.



1 LAMP



2 LAMP

Specifications[4]

Starting Method: Programmed Start
Ballast Factor: 1.00
Circuit Type: Series
Lamp Frequency: > 40 KHz
Lamp CCF: Less than 1.6
Starting Temp: 0°F minimum[5]
Input Frequency: 50/60 Hz
Low THD: < 10%
Power Factor: > 98%
Voltage Range: +/–10% of Rated Input

UL Listed Class P, Type 1, Outdoor, Type CC
CSA Certified
70°C Max Case Temperature
FCC 47CFR Part 18 Non-Consumer Class A Sound Rating
ANSI C62.41 Cat. A Transient Protection
Dynamic End-of-Lamp-Life Sensing
Remote Mounting up to 18 feet.[5]

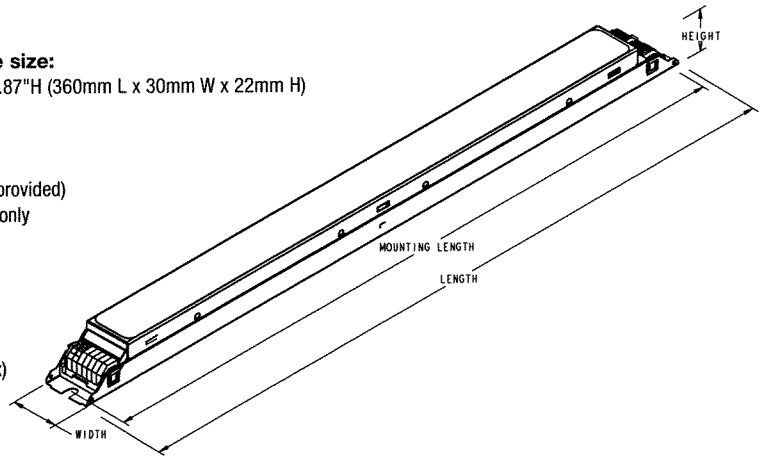
4 Data based on PENTRON 28W lamp types for primary ballast application. See the SYLVANIA QUICKTRONIC® Electronic Ballast Technology and Specification Guide (ECS-ELECTRONIC) for other PENTRON combinations.

5 Operation below 50°F may affect light output or lamp operation – see "Low Temp. Starting" definition. Remote red leads up to 18 feet. Keep blue leads <10 feet.

Dimensions:
2 lamp model enclosure size:
Overall: 14.17"L x 1.18"W x 0.87"H (360mm L x 30mm W x 22mm H)
Mounting: 13.74" (349mm)

Wiring:
Push-in connectors (no leads provided)
Use 18AWG solid copper wire only

Packaging:
Quantity: 20 (non-leaded)
10 (leaded)
Weight: 0.88 lbs
(0.40 kg) each (approx)



System Life / Warranty

QUICKTRONIC products are covered by our QUICK 60+® warranty, a comprehensive lamp and ballast system warranty. For additional details, refer to our QUICK 60+ warranty bulletin.

Ordering Guide

Specifications subject to change without notice.

Item Number — **49181 QTP 2 x 28 T5/UNV PSN** — Starting/Ballast Factor
QUICKTRONIC PROFESSIONAL — Line Voltage (120-277V)
Number of Lamps (1, 2) — Primary Lamp Wattage

QUICKTRONIC® T8 Instant Start UNIVERSAL VOLTAGE

High Efficiency Series — *Normal Ballast Factor*

Lamp/Ballast Guide

32W T8 - OCTRON®
QHE ISN SC Models
1-lamp QHE1x32T8/UNV
2-lamp QHE2x32T8/UNV
3-lamp QHE3x32T8/UNV
4-lamp QHE4x32T8/UNV

Also operates:
FBO32, FBO31, FO25, FBO24, FO17, FBO16, FO30/SS, FBO30/SS (30W), FBO29/SS & FO28/SS (28W)

F40T8 operation:
1 lamp on 2L ballast
2 lamps on 3L ballast
3 lamps on 4L ballast

Note: FO40T8 0°F Starting Temp.

Key System Features

- High Efficiency Systems over 90% efficient
- Over 100 LPW (lumens/watt) with OCTRON SUPERSAVER® lamps
- Lowest power T8 I.S. Systems
- Universal voltage (120-277)
- Small Can enclosure size
- 30-50% Energy savings
- -20°F (-29°C) min. starting temp. for OCTRON lamps
- 60°F (16°C) min. starting temperature with OCTRON SUPERSAVER lamps
- <10% THD
- Virtually eliminates lamp flicker

Application Information

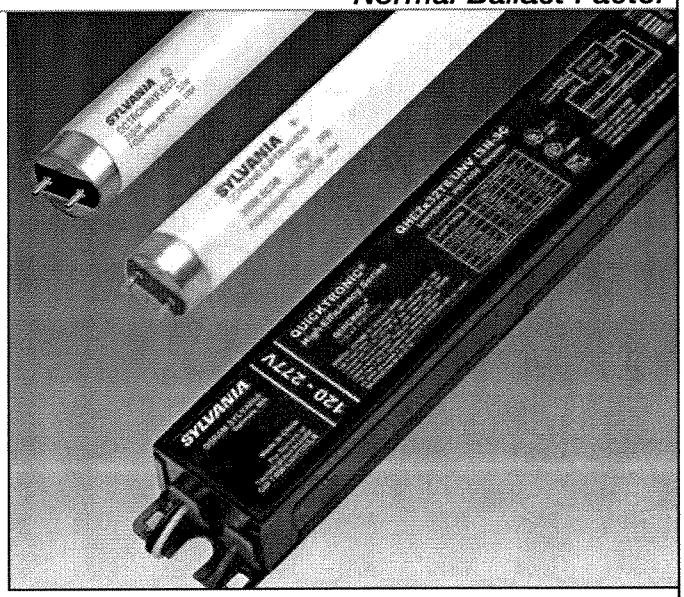
SYLVANIA QUICKTRONIC High Efficiency
is ideally suited for:

- Any applications where the lowest power T8 systems are needed for **maximum energy savings**
- Energy Retrofits
- Commercial & Retail
- Hospitality & Institutional
- New Construction

SYLVANIA QUICKTRONIC High Efficiency (QHE) energy-saving electronic T8 ballasts save up to 6% over standard electronic ballasts without compromising light output or lamp life. The added energy savings also provides for a quicker payback. QHE ballasts also meet the most demanding utility rebate standards.

SYLVANIA QUICKTRONIC High Efficiency (QHE) operates OCTRON T8 lamps with maximum efficacy and high lumen output, and provides **30-44% energy savings** when compared to F40T12 magnetic systems.

Small can enclosure allows for low profile fixture design. Small size also provides transportation, inventory and ergonomic benefits.



SYLVANIA QUICKTRONIC High Efficiency (QHE) is also covered by our QUICK 60+® warranty, the first and most comprehensive lamp & ballast system warranty in the industry. Parallel circuitry is utilized to keep the remaining lamps lit if one or more should go out.

System Information

SYLVANIA QUICKTRONIC High Efficiency (QHE) operates from 120V through 277V, eliminating "wrong voltage" wiring errors and reducing the number of models in inventory by half.

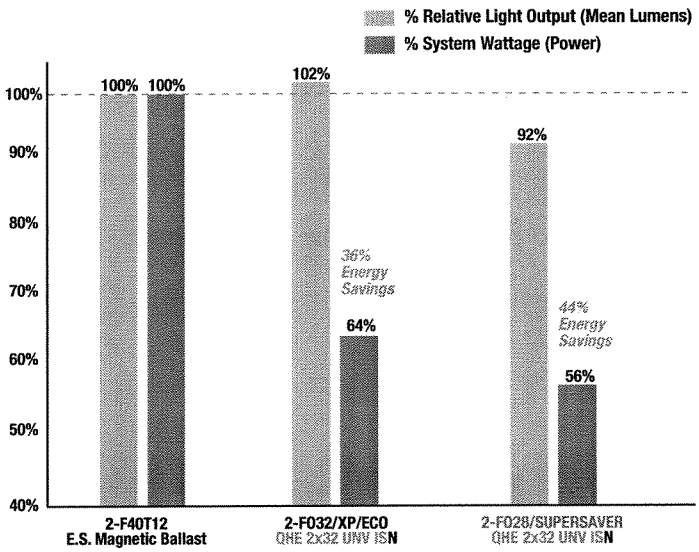
SYLVANIA QUICKTRONIC High Efficiency (QHE) uses instant start operation to provide the highest system efficacy and to assure low temperature starting capability. Instant start also provides for maximum remote wiring distances.

SYLVANIA QUICKTRONIC High Efficiency (QHE) electronic ballasts have very low harmonic distortion (<10% THD) for high system performance.

Ballast operates at >42kHz to reduce potential interference with infrared control systems.

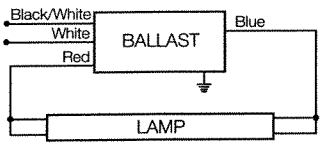
A complete OSRAM SYLVANIA System Performance Guide showing performance characteristics for all combinations of lamps and ballasts is available upon request.

System Type (2-lamp)	Input Wattage	Initial Lumens	System LPW	Mean Lumens	Energy Savings
F40T12 - E.S. Magnetic Ballast	86	5795	67	4930	Baseline
F34T12 - E.S. Magnetic Ballast	72	4660	65	3960	16%
FO32/XP - QHE2x32T8/UNV ISN-SC	**55**	**5280**	**96**	**5015**	36%
FO28/SS - QHE2x32T8/UNV ISN-SC	**48**	**4800**	**100**	**4560**	44%

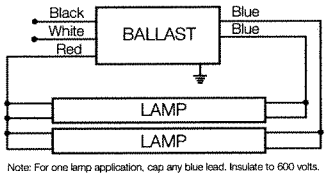


<10% THD High Efficiency Electronic T8 Fluorescent Systems (Normal Ballast Factor)

Item Number	OSRAM SYLVANIA Description	Input Voltage (VAC)	Input Current (AMPS)	Lamp Type	Rated Lumens (lm)	No. of Lamps	Ballast Factor (BF)	System Lumens	Input Wattage (W)	System Efficacy (lm/W)
49851	QHE 1X32T8/UNV ISN-SC	120-277	0.25/0.11	F032/XP	3000	1	0.88	2640	28	94
			0.22/0.09	F030/SS	2850	1	0.88	2510	26	97
			0.21/0.09	**F028/SS**	**2725**	**1**	**0.88**	**2400**	**25**	**96**
49853	QHE 2X32T8/UNV ISN-SC	120-277	0.47/0.20	F032/XP	3000	2	0.88	5280	55	96
			0.44/0.19	F030/SS	2850	2	0.88	5015	52	96
			0.40/0.18	**F028/SS**	**2725**	**2**	**0.88**	**4800**	**48**	**100**
49855	QHE 3X32T8/UNV ISN-SC	120-277	0.69/0.30	F032/XP	3000	3	0.88	7920	83/82	95/97
			0.66/0.28	F030/SS	2850	3	0.88	7525	78/77	96/98
			0.61/0.26	**F028/SS**	**2725**	**3**	**0.88**	**7195**	**72**	**100**
49857	QHE 4X32T8/UNV ISN-SC	120-277	0.91/0.39	F032/XP	3000	4	0.88	10560	108/107	98/99
			0.86/0.37	F030/SS	2850	4	0.88	10030	102/101	98/99
			0.80/0.35	**F028/SS**	**2725**	**4**	**0.88**	**9590**	**95**	**101**

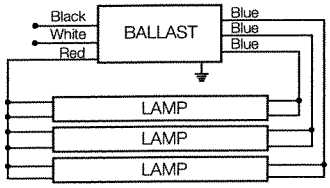


QUICKTRONIC 1x32



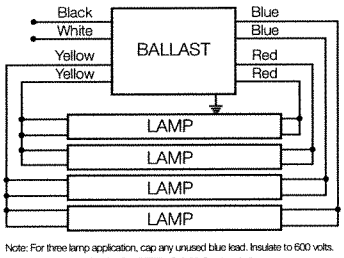
Note: For one lamp application, cap any blue lead. Insulate to 600 volts.

QUICKTRONIC 2x32



Note: For two lamp application, cap any blue lead. Insulate to 600 volts.

QUICKTRONIC 3x32



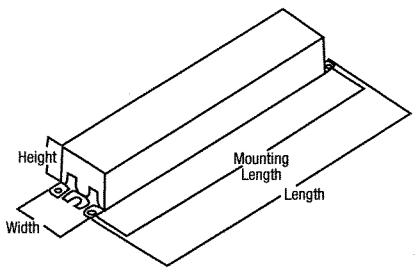
Note: For three lamp application, cap any unused blue lead. Insulate to 600 volts.

QUICKTRONIC 4x32

Dimensions:
Overall: 9.5" L x 1.68" W x 1.18" H
Mounting: 8.90"

Packaging:
Quantity: 10 pieces/840 pieces
Weight: 1.6 lbs each (approx)

Wiring:
Leads only (no connectors provided)



Item Number — **49855 QHE 3 x 32T8 / UNV ISN-SC** — Case Size
QUICKTRONIC High Efficiency — Starting/Ballast Factor
Number of Lamps — Line Voltage (120-277V)
Primary Lamp Wattage

Performance Guide

Data based upon SYLVANIA OCTRON® XP™ lamps shown. QUICKTRONIC QHE Instant Start ballasts are also compatible with other lamp manufacturers equivalent lamp types that meet ANSI specifications.

QHE Instant Start ballasts will operate F17, F25 and F32 (and the U-Bend equivalent) T8 lamps. Complete performance data is available in the QUICKSYSTEMS section of the SYLVANIA Electronic Ballast Catalog.

Specifications[1]

Starting Method: Instant Start
Ballast Factor: 0.88
Circuit Type: Parallel
Lamp Frequency: > 40KHz
Lamp CCF: Less than 1.7
Starting Temp:[1]
-20°F for OCTRON T8 lamps;
60°F for SUPERSAVER® T8 lamps
0°F for FO40T8
Input Frequency: 50/60 Hz
Low THD: < 10%
Power Factor: > 98%
Voltage Range: 108-305V

UL Listed Class P, Type 1 Outdoor
CSA Certified (where applicable)
70°C Max Case Temperature
FCC 47CFR Part 18 Non-Consumer
Class A Sound Rating
ANSI C62.41 Cat. A Transient Protection
Remote Mounting up to 20 feet[1]

[1] Operation below 50°F may affect light output or lamp operation – see "Low Temp. Starting" definition.

System Life / Warranty

QUICKTRONIC products are covered by our QUICK 60+® warranty, a comprehensive lamp and ballast system warranty. For additional details, refer to our QUICK 60+ warranty bulletin.

Ordering Guide

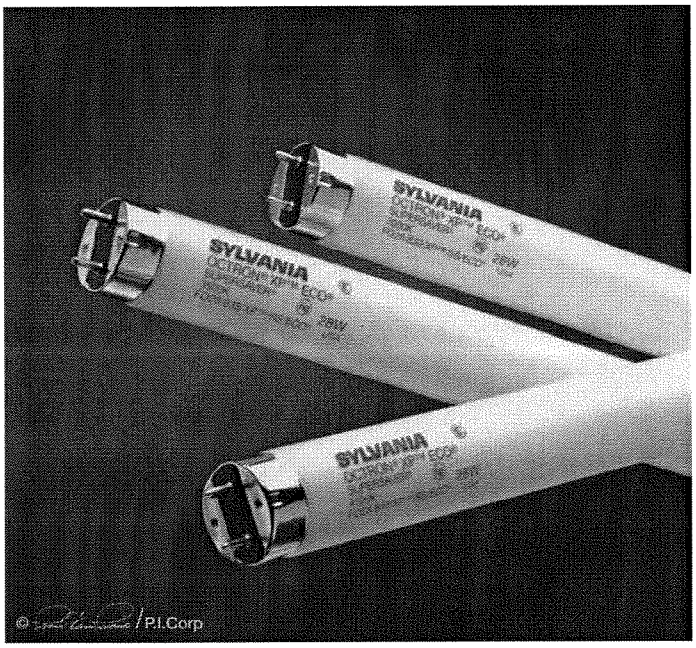
Specifications subject to change without notice.

Pallet Packs (840 pcs.)
49852 QHE 1x32T8/UNV ISN-SC-PAL
49854 QHE 2x32T8/UNV ISN-SC-PAL
49856 QHE 3x32T8/UNV ISN-SC-PAL
49858 QHE 4x32T8/UNV ISN-SC-PAL

Product Information Bulletin

OCTRON® Four Foot FO28 XP® SUPERSAVER® ECO®

Fluorescent Lamps



SYLVANIA 28 Watt OCTRON FO28 XP SUPERSAVER ECOLOGIC lamps operate on standard T8 instant start systems and provide 12.5% energy savings over standard 32 Watt OCTRON lamps. At $.10/kWh and 4000 hours of operation per year, the 12.5% savings translates to a savings of $5.70 per fixture per year for a 4-lamp fixture with a normal ballast factor, instant start ballast. The 94% lumen maintenance of the OCTRON FO28/800XP/SS/ECO lamp assures that light levels are maintained while energy is saved. These lamps pass the Federal TCLP test, classifying them as non-hazardous waste in most states. Group relamp to realize the benefits of these OCTRON lamps in your facility.

- 28 Watt, 4-foot, SUPERSAVER energy saving, T8 lamp
- 12.5% energy savings compared to standard 32W T8 lamp
- ECOLOGIC – Designed to pass TCLP[1]
- Initial lumens – 2725
- 94% lumen maintenance at 9600 hours
- 3000K, 3500K & 4100K
- 85 CRI
- Retrofit lamp for existing T8 instant start systems
  - 18,000 hours average rated life @ 3 hrs per start
  - 26,000 hours average rated life @ 12 hrs per start
- Approved on OSRAM SYLVANIA QUICKTRONIC® PSX and PSN ballasts.
  - 24,000 hours average rated life @ 3 hrs per start
  - 30,000 hours average rated life @ 12 hrs per start
- Minimum starting temperature: 60°F
- Not dimmable

SYLVANIA OCTRON T8 ECOLOGIC fluorescent lamps are designed to pass the Federal Toxicity Characteristic Leaching Procedure (TCLP) criteria for classification as non-hazardous waste in most states[2]

ECOLOGIC™

1. TCLP test results are based on NEMA LL Series standards and are available on request.
2. Lamp disposal regulations may vary; check your local & state regulations.

Product Availability

Lamp Type	Wattage	Color Temperature	CRI
FO28/830XP/SS/ECO	28	3000K	85
FO28/835XP/SS/ECO	28	3500K	85
FO28/841XP/SS/ECO	28	4100K	85

Application Information

Applications

Retail
Office
Schools
Hospitals
Industrial
Many applications with T8 instant start ballasts currently using 32W T8 lamps

Fixtures

Contact your local fixture agent for available fixtures.

Ballast Information

Contact your OSRAM SYLVANIA representative for a list of compatible electronic operating systems.

Application Notes

1. Recommended to be used on T8 F32 Instant Start circuit with minimum starting voltage of 550V rms.

Application Notes (continued)

2. Not recommended to be used: (1) with Rapid Start circuits unless the open circuit voltage is greater than 550V, (2) at lamp ambient temperatures below 60°F or in drafty locations, (3) on low power factor ballasts, (4) dimming ballasts, or (5) inverter-operated emergency lighting systems unless any of the above equipment is specifically listed for 28 watt lamps. Any of the above situations could result in lamp starting and stabilization problems, or system compatibility issues.
3. Can operate on QUICKTRONIC® PSX and PSN ballasts. 24,000 hours average rated life at 3hrs per start, 30,000 hours average rated life at 12hrs per start.
4. Fixture must conform to ANSI C78.1 – 1991 requirements for luminaire design.

Sample Specification
Lamp(s) shall be OCTRON® FO28 XP® SUPERSAVER ECOLOGIC 4-foot lamp(s) having medium bi-pin bases. Lamp(s) shall be designed to pass the Federal TCLP test in force at the time of manufacture. Lamp(s) shall have an average rated life of 18,000 hours at 3 hours per start when operated on T8 instant start ballasts, 2725 initial lumens, 94% lumen maintenance at 9600 hours, a correlated color temperature of (3000K, 3500K or 4100K) and a CRI of 85. The OCTRON SUPERSAVER ECOLOGIC lamp(s) shall be operated on QUICKTRONIC electronic, high frequency ballasts with complete system warranty from the manufacturer covering lamps and ballast.

Warranty Information
QUICK 60+® warranty for OSRAM SYLVANIA lamp and ballast combination
Limited 36 month lamp warranty and a five year ballast warranty is possible if both lamps and ballast are provided by OSRAM SYLVANIA. See the QUICK 60+ warranty for details and restrictions.

System Comparison

4-Lamp Instant Start Systems: FO28/800XP/SS/ECO vs FO32/700/ECO

Lamp Type	Initial Lumens	Average Rated Life (hrs.)	Ballast	Ballast Factor	System Watts	System Lumens @ 8000 hrs.	Relative Lumens	Relative Lamp Life	% Energy Savings	LPW
FO32/741/ECO	2800	15,000	4-lamp IS	.90	114	9070	100%	100%	–	80
FO28/841XP/SS/ECO	2725	18,000	4-lamp IS	.90	100	9319	103%	120%	12.5	93
FO32/741/ECO	2800	15,000	4-lamp IS-L	.77	98	7761	100%	100%	–	79
FO28/841XP/SS/ECO	2725	18,000	4-lamp IS-L	.77	86	7973	103%	120%	12.5	93
FO28/841XP/SS/ECO	2725	24,000	4-lamp PSX	.71	82/80[1]	7352	95%	160%	17/19[1]	90/92[1]

1. Ballast is universal input, data is presented 120V/277V

Ordering and Specification Information

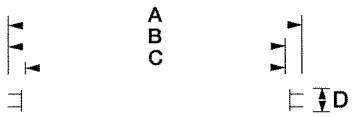
Item Number	Ordering Abbreviation	Watts	Bulb	Base	Initial Lumens	Mean Lumens[1]	Avg. Rated Life (hrs.)[2]	CCT	CRI
22177	FO28/830XP/SS/ECO	28	T8	Medium bi-pin	2725	2562	18,000	3000K	85
22178	FO28/835XP/SS/ECO	28	T8	Medium bi-pin	2725	2562	18,000	3500K	85
22179	FO28/841XP/SS/ECO	28	T8	Medium bi-pin	2725	2562	18,000	4100K	85

1. Measured @ 9600 hours, 95% of initial lumens @ 8000 hours.
2. Based on 3 hours/start on instant start ballasts. At 12 hours/start, average rated life = 26,000 hours on instant start ballasts.

Ordering Guide

FO	28	/	8	35	XP	/	SS	/	ECO
Fluorescent OCTRON	Wattage = 28		CRI = 85	Color Temperature 30 = 3000K 35 = 3500K 41 = 4100K	EXtended Performance		SUPERSAVER		ECOLOGIC

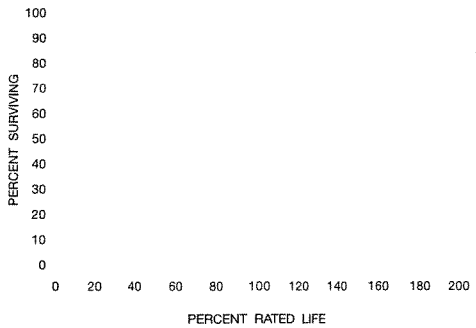
Dimensions



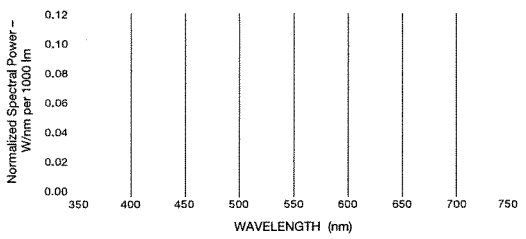
	(A) Maximum Overall Length (in.)	(B) Base Face to Opposite Pin (in.)	(C) Max. Base Face to Base Face (in.)	(D) Max. Outside Diameter (in.)
FO28	47.78"	Min. 47.41" Max. 47.50"	47.22"	1.1"

Technical Information

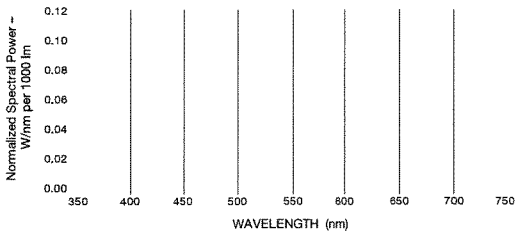
Typical Fluorescent Lamp Mortality



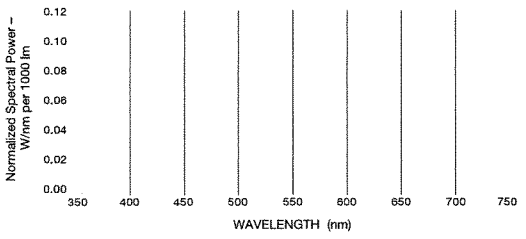
OCTRON 830



OCTRON 835



OCTRON 841



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Fax: 1-800-562-4674

OEM/Specialty Markets
Phone: 1-800-762-7191
Fax: 1-800-762-7192

Photo-Optic
Phone: 1-888-677-2627
Fax: 1-800-762-7192

In Canada
OSRAM SYLVANIA LTD.
Headquarters
2001 Drew Road
Mississauga, ON L5S 1S4

Industrial & Commercial
Phone: 1-800-263-2852
Fax: 1-800-667-6772

Special Markets
Phone: 1-800-265-2852
Fax: 1-800-667-6772

Visit our website: www.sylvania.com

Up to 80% water use reduction!

COMMERCIAL "POWER SPRAY" WASHER

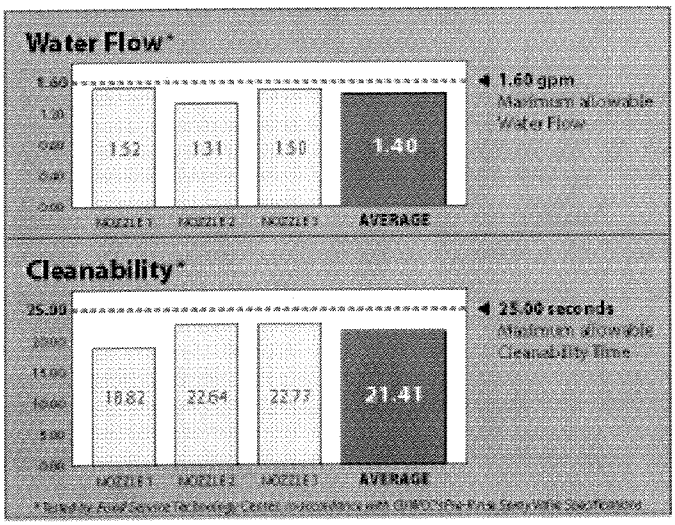
Savings up to $1,000.00 Every Year!

Features & Benefits

- The **Most Powerful Rinser Ever**
- **Pays for itself** in a few weeks
- Saving in water, energy and sewer
- **High performance** and **incredible hot water savings** using 1.6 GPM @ 80 PSI
- Anti corrosive **stainless steel nozzle**
- Solid brass, triple chrome plated sprayer body
- Insulated handle ensures comfortable grip
- Installs easily
- **Interchangeable with ALL brands**
- Any repairs are easy with standard gaskets
- Standard, protective, full surrounding dish guard bumper
- **Certified by Food Services Technology Center**
- **5 year warranty**

Part # N2180

Power Rinser Savings	Hours of Spray-valve usage	Water Savings (gallons per day)	Wastewater Savings (gallons per day)	Gas Savings (therms per day)	Annual Dollar Savings
Very Small	2 hours per day	100	100	0.7	**$300 - $400**
Small	4 hours per day	200	200	1.3	**$700 - $900**
Medium	6 hours per day	300	300	2.0	**$1000 - $1300**



Retrofit your pre-rinse units with efficient and economical Power Rinser.

You can save thousands of dollars in water & energy costs.

That's the Power of Niagara.

NIAGARA CONSERVATION

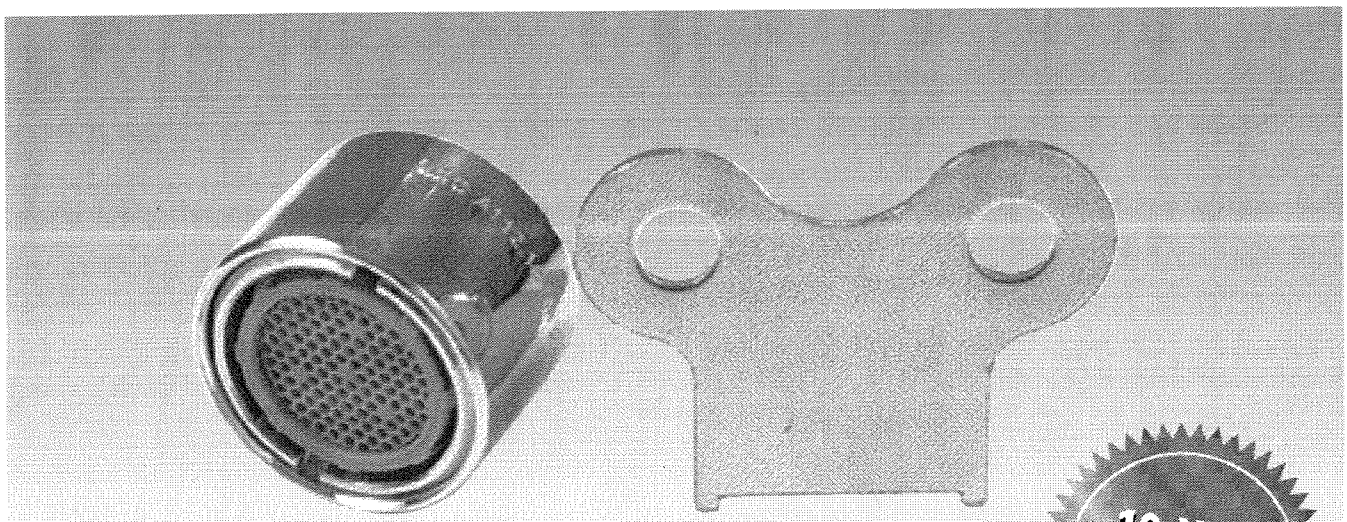
45 Horsehill Road • Cedar Knolls, New Jersey 07927

(800) 831-8383 • Fax (973) 829-1400

www.niagaraconservation.com

TAMPERPROOF AERATORS FOR COMMERCIAL APPLICATIONS

Ideal for Hotels and Commercial Use!



10-Year Warranty

Part # N3205FTP

Thread Type	Part #	Flow Rate (gpm)	Spray Pattern
Female	N3205FTP	0.5	Needle
	N3210FTP	1.0	Needle
	N3215FTP	1.5	Bubble
	N3222FTP	2.0	Bubble
Male	N3205MTP	0.5	Needle
	N3210MTP	1.0	Needle
	N3215MTP	1.5	Bubble
	N3222MTP	2.0	Bubble

Note: All aerators are packed 504/case and supplied with 5 keys per carton.

Features & Benefits

- Brass / Chrome plated
- Each case of aerators comes with locking key
- Works well on kitchen and bathroom faucets
- **Meets or exceeds ASME standards**
- **California Energy Commission Certified**

Retrofit your kitchen and bathrooms with Niagara Tamperproof Aerators.

You can save thousands of dollars in water & energy costs.

That's the Power of Niagara.

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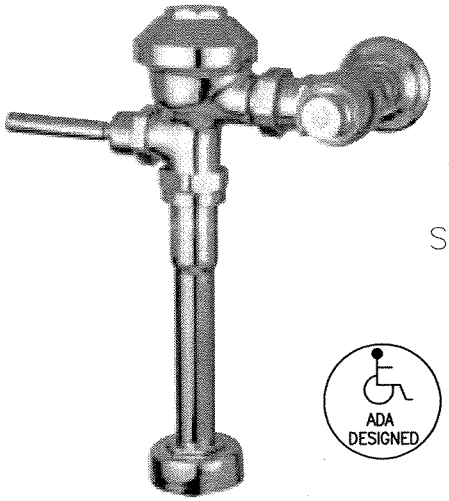
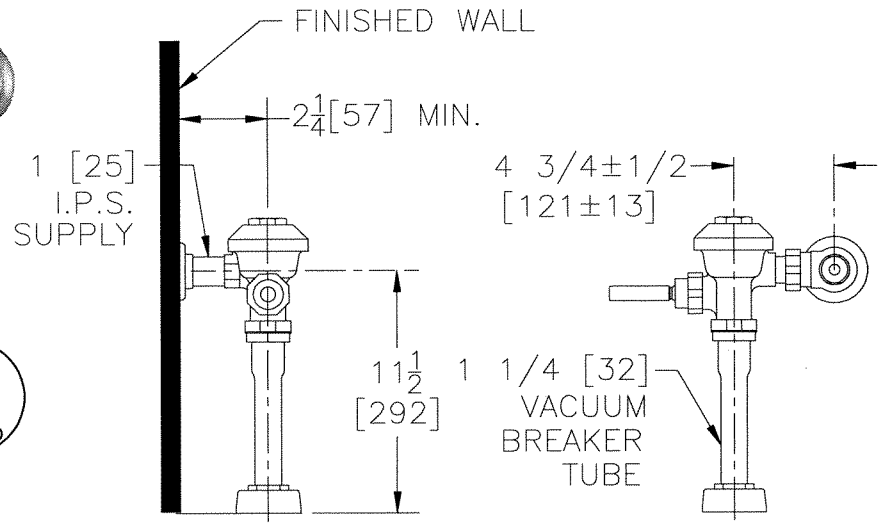
ZURN®

Aquaflush®
TAG _____

Exposed Z6001 Model
for 1-1/4" Urinals





Flow Options

☐	**-WS1**	1.0 Gal. Low Consumption
☐	**-WS**	1.5 Gal. Water Saver
☐	**Standard Flush**	3.0 Gallons Per Flush

Suffix Options (Check/Specify Appropriate Options)

_____	**-BG**	BioCare ADA Handle
_____	**-H**	Handle on Front of Flush Valve
_____	**-L**	1" [25] Metal Push Button
_____	**-L3**	3" [76] Metal Push Button
_____	**-VC**	Vandal Resistant Cover
_____	**-YB**	Sweat Solder Kit
_____	**-YC**	Cast Wall Flange
_____	**-YJ**	Split Ring Pipe Support
_____	**-YK**	Solid Ring Pipe Support
_____		Other

ENGINEERING SPECIFICATION: ZURN Z6001 Aquaflush Exposed Urinal Flush Valve -Exposed, quiet diaphragm-type, chrome plated flushometer valve with a polished exterior. Complete with a chloramine resistant, dual seal diaphragm with a clog resistant by-pass. The valve is ADA compliant with a non-hold-open and no leak handle feature, high back pressure vacuum breaker, hex coupling nut and adjustable tailpiece, spud coupling and flange for top spud connection. Control stop has internal siphon-guard protection. Internal seals are made of chloramine resistant materials.

☐ **Z6001PL - Aquaflush Plus** is furnished as specified above and includes sweat solder kit, vandal resistant stop cap, and cast wall flange.

This space is for Architectural/engineering Approval

ZURN INDUSTRIES, INC. ♦ COMMERCIAL BRASS OPERATION ♦ 5900 ELWIN BUCHANAN DRIVE ♦ SANFORD NC 27330
Phone: 1-800-997-3876 ♦ Fax: 919-775-3541 ♦ World Wide Web: www.zurn.com
In Canada: ZURN INDUSTRIES LIMITED ♦ 3544 Nashua Drive ♦ Mississauga, Ontario L4V1L2 ♦ Phone: 905-405-8272 Fax: 905-405-1292

Rev. I
Dwg. No. 55937
Date: 5/27/03
Product No. Z6001

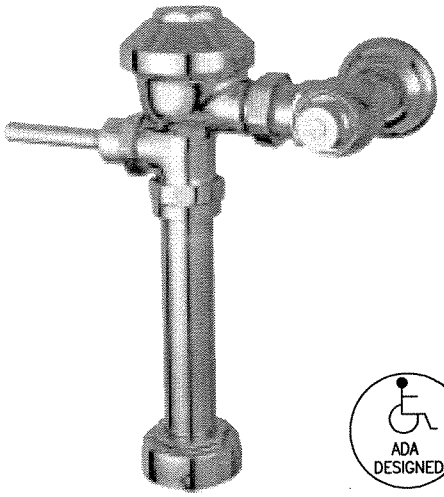
ZURN®

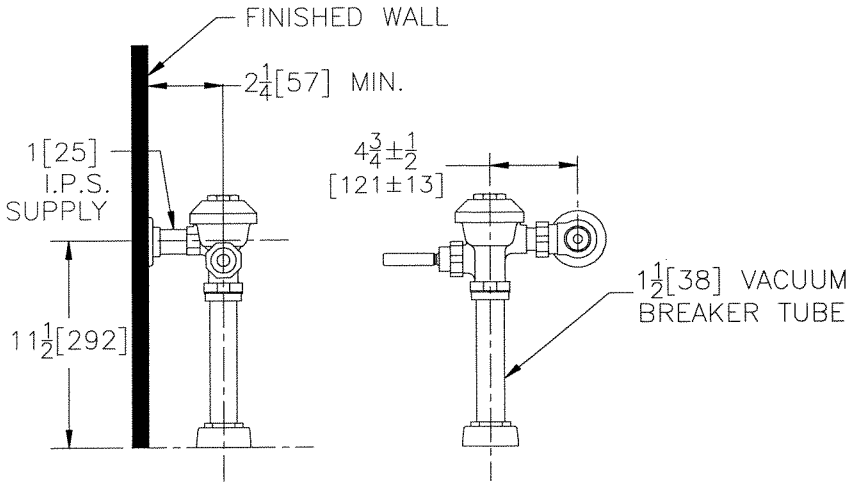
Aquaflush®

TAG _____

Exposed Z6000 Model

for Water Closets





Flow Options

☐	**-WS1**	1.6 Gal. Low Consumption Flush
☐	**-FF**	4.5 Gal. Full Flush
☐	**Standard Flush**	3.5 Gallons Per Flush

Suffix Options (Check/Specify Appropriate Options)

_____	**-BG**	BioCare ADA Handle
_____	**-H**	Handle on Front of Flush Valve
_____	**-L**	1" [25] Metal Push Button
_____	**-L3**	3" [76] Metal Push Button
_____	**-VC**	Vandal Resistant Stop Cover
_____	**-YB**	Sweat Solder Kit
_____	**-YC**	Cast Wall Flange
_____	**-YJ**	Split Ring Pipe Support
_____	**-YK**	Solid Ring Pipe Support
_____	**-YO**	Bumper on Angle Stop
_____		Other

ENGINEERING SPECIFICATION: ZURN Z6000 Aquaflush Exposed Closet Flush Valve - Exposed, quiet diaphragm-type, chrome plated flushometer valve with a polished exterior. Complete with a chloramine resistant, dual seal diaphragm with a clog resistant by-pass. The valve is ADA compliant with a non-hold-open and no leak handle feature, high back pressure vacuum breaker, one piece hex coupling nut, adjustable tailpiece, spud coupling and flange for top spud connection. Control stop has internal siphon-guard protection. Internal seals are made of chloramine resistant materials.

☐ **Z6000PL - Aquaflush Plus** is furnished as specified above and includes sweat solder kit, vandal resistant stop cap, and cast wall flange with set screw. ***Complete with a chloramine resistant, dual seal diaphragm with a clog resistant by-pass.***

This space is for Architectural/engineering Approval

ZURN INDUSTRIES, INC. ♦ COMMERCIAL BRASS OPERATION ♦ 5900 ELWIN BUCHANAN DRIVE ♦ SANFORD NC 27330
Phone: 1-800-997-3876 ♦ Fax: 919-775-3541 ♦ World Wide Web: www.zurn.com
In Canada: ZURN INDUSTRIES LIMITED ♦ 3544 Nashua Drive ♦ Mississauga, Ontario L4V1L2 ♦ Phone: 905-405-8272 Fax: 905-405-1292

Rev. I
Dwg. No. 55936
Date: 7/10/03
Product No. Z6000

KOHLER.

KINGSTON™

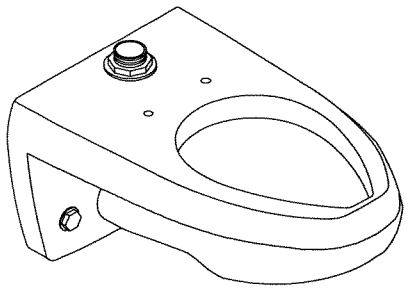
BOWL

K-4330

ADA

FEATURES

- *1-1/2" top spud*
- *Vitreous china*
- *12-3/8" x 11-3/8" water area*
- *Elongated bowl*
- *Wall-mount*
- *1.6 gpf*
- *ADA compliant when installed at required height of 17"-19" from floor to top of seat*
- *With bedpan lugs (-L)*



CODES/STANDARDS APPLICABLE

Specified model meets or exceeds the following:

- *ADA*
- *ASME/ANSI A112.19.2M*
- *ASME/ANSI A112.19.6M*
- *CABO/ANSI A117.1*
- *Energy Policy Act of 1992 (EPACT)*
- *IAPMO/UPC*
- *Canadian Standards Association (CSA)*
- *States of Massachusetts, New York, & Texas*
- *Cities of Los Angeles, CA*

COLORS/FINISHES

- 0 White
- Other Refer to Fixtures Price Book for additional colors

Accessories:

- 0 White
- Other Refer to Fixtures Price Book for additional colors

SPECIFIED MODEL:

Model	Description	Colors/Finishes	
K-4330	Elongated bowl toilet	☐0 White	☐Other_____
K-4330-L	Elongated bowl toilet with bedpan lugs	☐0 White	☐Other_____
Recommended Accessories			
K-4670-C	Lustra™ open front seat	☐0 White	☐Other_____
K-4670-CA	Lustra™ open front seat (with anti-microbial agent)	☐0 White	

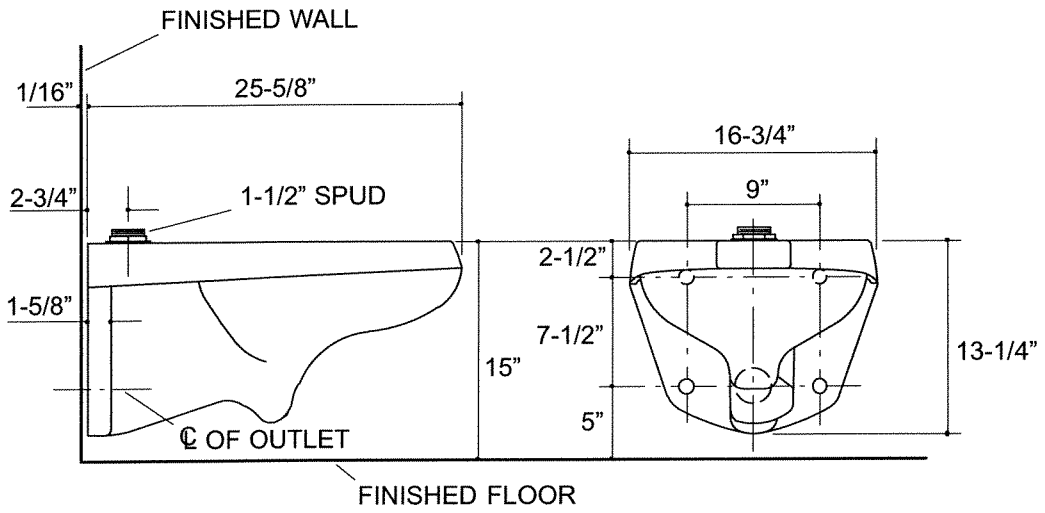
PRODUCT SPECIFICATION:

The elongated bowl shall be wall-mount with a 1-1/2" top spud. Bowl shall be made of vitreous china. Bowl shall have 12-3/8" x 11-3/8" water area. Bowl shall be 1.6 gpf. Bowl shall be ADA compliant when installed at required height of 17"-19" from floor to top of seat. Bowl shall have bedpan lugs (-L). Bowl shall be Kohler Model K-4330-_____-_____.

KINGSTON™

PRODUCT INFORMATION

ADA compliant	
Fixture:	
Configuration	Top spud, elongated
Gallons per flush	1.6 gallons*
Spud size	1-1/2"
Passageway	2-1/4"
Water area	12-3/8" x 11-3/8"
Water depth from rim	5-1/4"
Seat post hole centers	5-1/2"
* Designed to flush with 1.6 gallons of water when installed with a 1.6 gpf flush valve.	
Included Components:	
Spud	18357
Flush valve requirements: Refer to manufacturer and local codes.	



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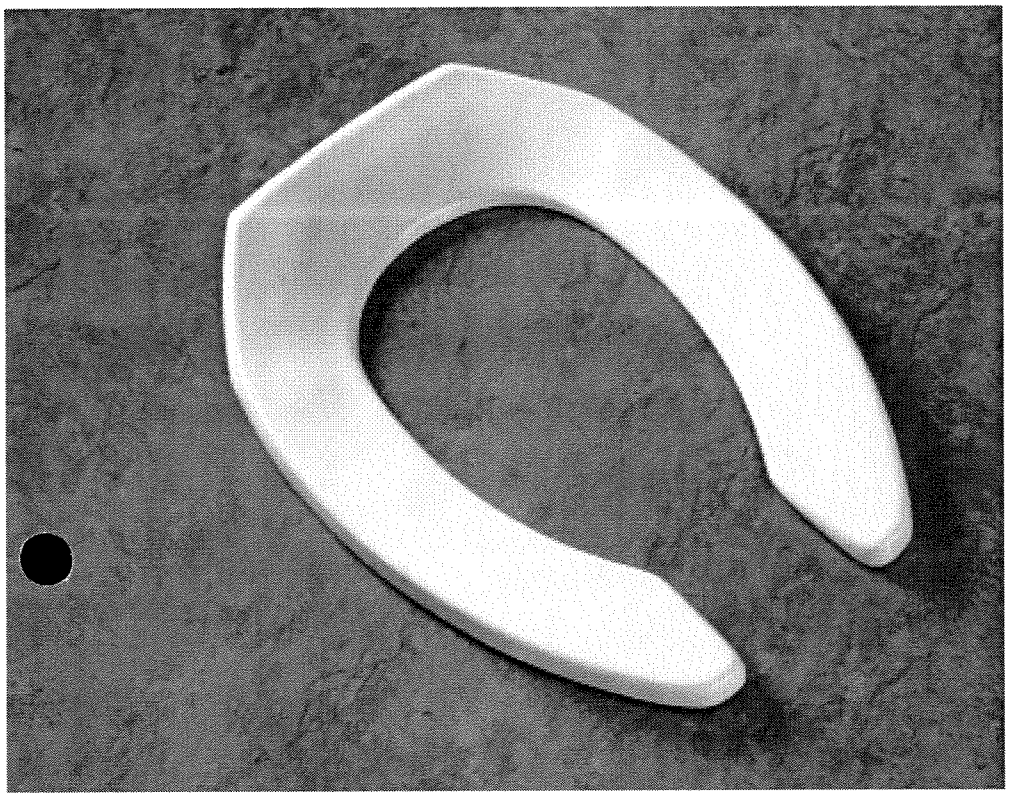
PRODUCT DIAGRAM

BEMIS

COMMERCIAL PLASTIC SEATS

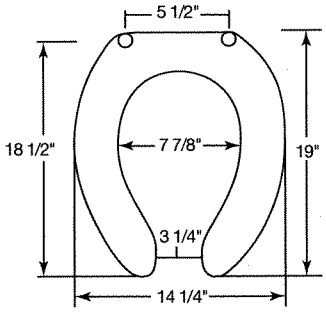


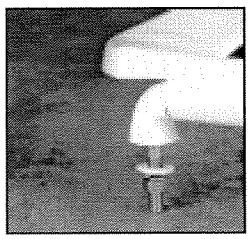
1955CFR

Seats shall be No. 1955CFR as manufactured by Bemis Manufacturing Co. Seats shall contain DuraGuard®, an antimicrobial agent. Seats shall conrtain FirePro™, a fire retardant material to meet UL-94VO flammability rating. Seats shall be heavy weight and injection molded of solid plastic. Seats shall be open front less cover for elongated bowl and feature large molded-in bumpers. External check hinges to feature 300 Series stainless steel posts that stop seat 11 degrees beyond vertical. Uses 300 Series stainless steel hardware.Color to be white. Hinges shall be_____.

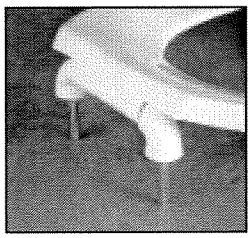
❑ **1955CFR** Open front seat less cover/external check hinge stops seat 11° beyond vertical.

❑ **1955SSFR** Open front seat less cover/ stainless steel, self-sustaining and external check hinge holds seat in any raised position up to 11° beyond vertical.





EXTERNAL CHECK HINGES WITH 300 SERIES STAINLESS STEEL POST



EXTERNAL CHECK HINGE

Ring thickness is 13/16"
Ring thickness including the bumper is 1"

Bemis Manufacturing Co., Sheboygan Falls, WI 53085
www.bemisseats.com

Phone: 920-467-4621 800-558-7651 Fax: 920-467-8573

KOHLER.

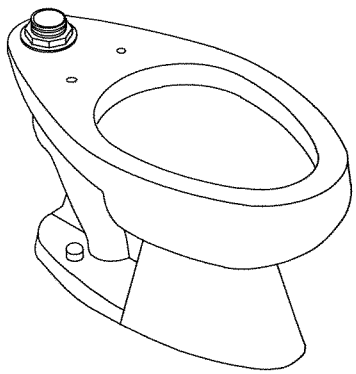
WELLCOMME™

BOWL

K-4350

FEATURES

- *10" or 12" rough-in*
- *1-1/2" top spud*
- *Vitreous china*
- *Elongated bowl*
- *2-1/4" passageway*
- *11-3/8" x 10-3/8" water area*
- *1.6 gpf*
- *With bedpan lugs (-L)*



CODES/STANDARDS APPLICABLE

Specified model meets or exceeds the following:

- *ASME/ANSI A112.19.2M*
- *ASME/ANSI A112.19.6M*
- *Energy Policy Act of 1992 (EPACT)*
- *IAPMO/UPC*
- *CSA International B45*
- *States of Connecticut, Massachusetts, New York, & Texas*
- *Cities of Los Angeles, CA; and New York, N.Y.*

COLORS/FINISHES

- 0 White
- Other Refer to Fixtures Price Book for additional colors

Accessories:

- 0 White
- Other Refer to Fixtures Price Book for additional colors

SPECIFIED MODEL:

Model	Description	Colors/Finishes	
K-4350	Elongated bowl toilet	☐0 White	☐Other_____
K-4350-L	Elongated bowl toilet with bedpan lugs	☐0 White	☐Other_____

Recommended Accessories			
K-4670-C	Lustra™ open front seat	☐0 White	☐Other_____
K-4670-CA	Lustra™ open front seat (with anti-microbial agent)	☐0 White	

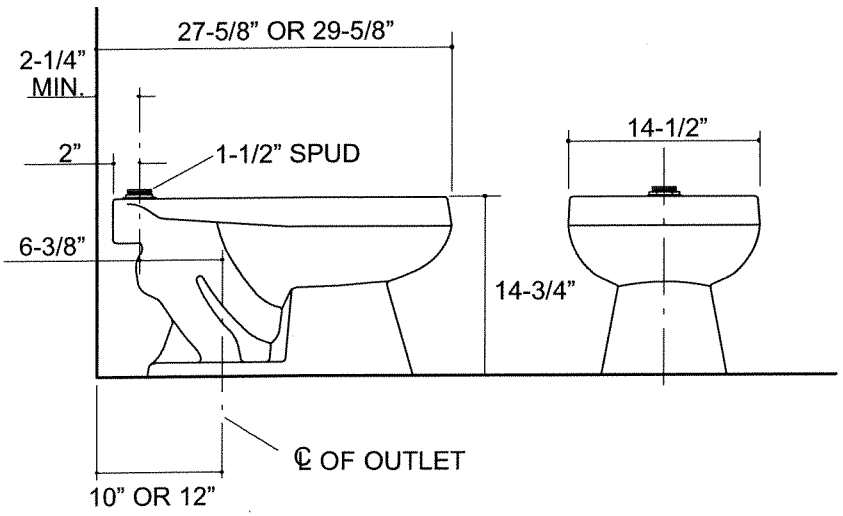
PRODUCT SPECIFICATION:

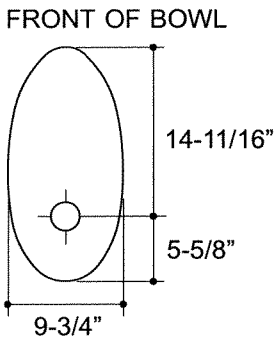
The elongated bowl shall be capable of either 10" or 12" rough-in with 1-1/2" top spud. Bowl shall be made of vitreous china. Bowl shall be 1.6 gpf. Bowl shall have 2-1/4" passageway. Bowl shall have 11-3/8" x 10-3/8" water area. Bowl shall have bedpan lugs (-L). Bowl shall be Kohler Model K-4350-_____-_____.

WELLCOMME™

PRODUCT INFORMATION

Fixture:	
Configuration	Top spud, elongated
Gallons per flush	1.6 gallons*
Spud size	1-1/2"
Passageway	2-1/4"
Water area	11-3/8" x 10-3/8"
Water depth from rim	6"
Seat post hole centers	5-1/2"
* Designed to flush with 1.6 gallons of water when installed with a 1.6 gallon flush valve.	
Included Components:	
Spud	18357
Bolt caps (pr.)	52048
Flush valve requirements: For 12" rough-in, sweat extension nipple is required. Refer to manufacturer and local codes.	





116

PRODUCT DIAGRAM

KOHLER.

HIGHCLIFF™

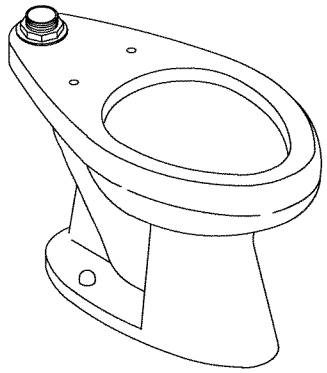
BOWL

K-4368

ADA

FEATURES

- *10" or 12" rough-in*
- *1-1/2" top spud*
- *Vitreous china*
- *Elongated bowl*
- *1.6 gpf*
- *2-1/4" passageway*
- *11-3/8" x 10-3/8" water area*
- *17-1/2" high bowl is ADA compliant*
- *With bedpan lugs (-L)*



CODES/STANDARDS APPLICABLE

Specified model meets or exceeds the following:

- *ADA*
- *ASME/ANSI A112.19.2M*
- *ASME/ANSI A112.19.6M*
- *CABO/ANSI A117.1*
- *Energy Policy Act of 1992 (EPACT)*
- *CSA International B45*
- *IAPMO/UPC*
- *States of Massachusetts, New York, & Texas*
- *City of Los Angeles, CA.*

COLORS/FINISHES

- 0 White
- Other Refer to Fixtures Price Book for additional colors

Accessories:

- 0 White
- Other Refer to Fixtures Price Book for additional colors

SPECIFIED MODEL:

Model	Description	Colors/Finishes	
K-4368	Elongated bowl toilet	☐0 White	☐Other_____
K-4368-L	Elongated bowl toilet with bedpan lugs	☐0 White	☐Other_____
Recommended Accessories			
K-4670-C	Lustra™ open front seat	☐0 White	☐Other_____
K-4654	Lustra™ open front seat with support arms and cover	☐0 White	
K-4670-CA	Lustra™ open front seat (with anti-microbial agent)	☐0 White	
K-4654-A	Lustra™ open front seat with support arms and cover (with anti-microbial agent)	☐0 White	

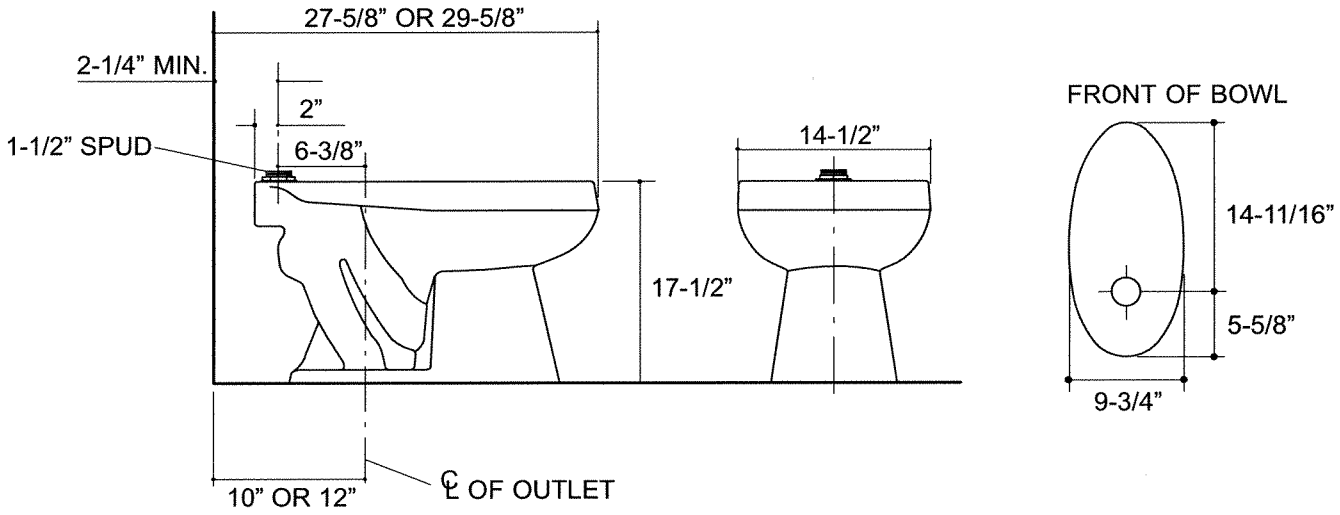
PRODUCT SPECIFICATION:

The elongated bowl shall be 10" or 12" rough-in with 1-1/2" top spud. Bowl shall be made of vitreous china. Bowl shall be 1.6 gpf. Bowl shall have 11-3/8" x 10-3/8" water area. Bowl shall have 2-1/4" passageway. Bowl shall be ADA compliant with 17-1/2" high bowl. Bowl shall have bedpan lugs (-L). Toilet shall be Kohler Model K-4368-_____-_____.

HIGHCLIFF™

PRODUCT INFORMATION

ADA compliant.	
Fixture:	
Configuration	Top spud, elongated
Gallons per flush	1.6 gallons*
Spud size	1-1/2"
Passageway	2-1/4"
Water area	11-3/8" x 10-3/8"
Water depth from rim	6"
Seat post hole centers	5-1/2"
* Designed to flush with 1.6 gallons of water when installed with a 1.6 gpf flush valve.	
Included Components:	
Spud	18357
Bolt cap accessory pack	52048
Flush valve requirements: For 12" rough-in, sweat extension nipple is required. Refer to manufacturer and local codes.	

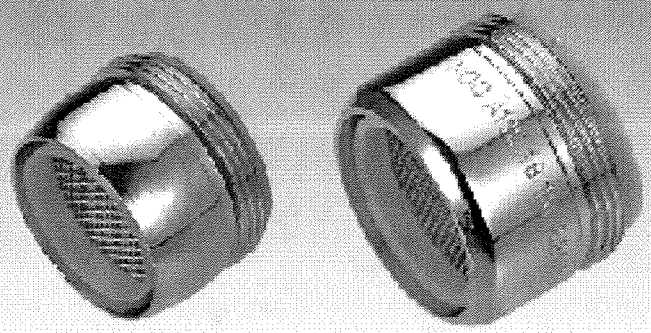


116

PRODUCT DIAGRAM

AERATOR

Faucet Sink Aerator



- Chrome-plated Brass Aerator
- Flow Control
- Stainless Steel Screen
- Provides an even spray pattern
- Innovative Dual-Thread System
- Accommodates both Female and Male Applications
- Flow rate at 80 PSI maximum
- 10-Year Guarantee

NIAGARA CONSERVATION

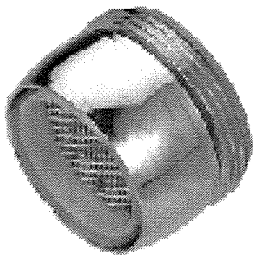
45 Horsehill Road
Cedar Knolls, NJ 07927
(800) 831-6383
Fax: (973) 829-1400
www.niagaraconservation.com

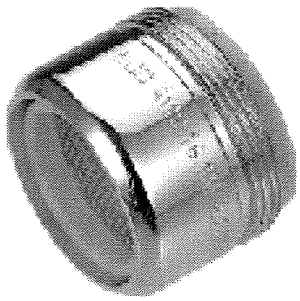
AERATORS

Faucet Sink Aerators

Features

- Housing constructed of solid brass with highly polished chrome finish
- Includes housing, flow control, stainless steel screen and all other parts necessary for proper installation and operation
- Internally and externally threaded with 15/16 x 27 threads outside and 55/64 x 27 threads inside
- Does not contain any unplated brass components
- Provides an even spray pattern
- No damage by use of 150 dynamic PSI at 160°F
- Flow control constructed of long lasting Celcon Plastic (no substitute).
- Flow rate at 80 PSI maximum
- Meets and exceeds ASME Standards
- CEC certified
- Life expectancy of approximately 10 years





Aerator Washer

1 Santoprene® Grade 241-73
Grade 241-73 is listed by NSF International for contact with potable water under NSF standard 61, drinking water system components-health effects, for use as joining and sealing material, protective (barrier) material, and others.

NIAGARA CONSERVATION

45 Horsehill Road
Cedar Knolls, NJ 07927
(800) 831-8383
Fax: (973) 829-1400
www.niagaraconservation.com

Product #	Description	Additional Certification	Quantity	Total Quantity/Case
N3100T-2.2	2.2 GPM Dual-Thread	CSA Certified	[10-pack sleeve]	[500/case]
N3102	2.2 GPM Dual-Thread Swivel Spray	CSA Certified	[10-pack sleeve]	[500/case]
N3104T	1.5 GPM Dual-Thread	CSA Certified	[10-pack sleeve]	[500/case]
N3210T	1.0 GPM Dual-Thread		[10-pack sleeve]	[500/case]
N3205T	0.5 GPM Dual-Thread		[10-pack sleeve]	[500/case]
N3105	2.2 GPM Small-Thread Male		[10-pack sleeve]	[500/case]
N3107	2.2 GPM Small-Thread Female		[10-pack sleeve]	[500/case]

T&S BRASS AND BRONZE WORKS, INC.
2 SADDLEBACK COVE / P.O. BOX 1088 / TRAVELERS REST, SC 29690
PHONE 800-476-4103 FAX 864- 834-3518

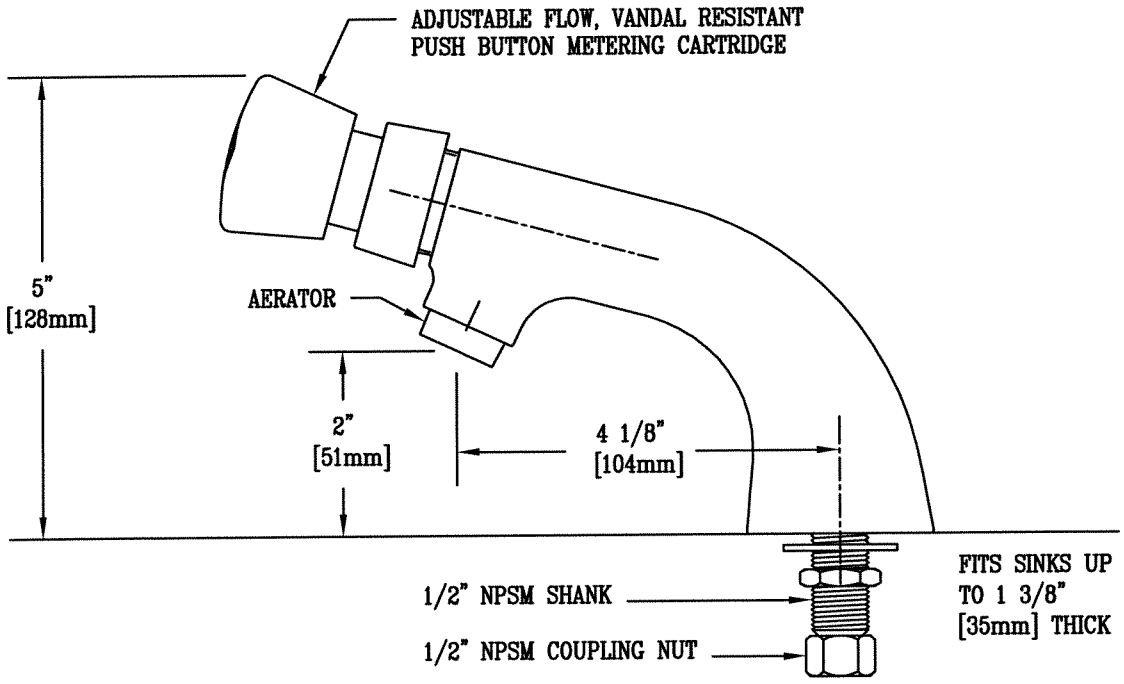
REG. #A2601
ISO #9002

Model No.
B-0805
Item No.:

Job Name:	Architect/Engineer Approval:

Notes:

ADA COMPLIANT



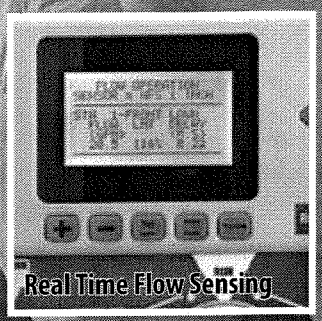
Product Description:	Drawn:	Checked	Scale:
PUSH BUTTON METERING FAUCET WITH 1/2" NPT THREADED SHANK, AERATOR OUTLET, ADJUSTABLE FLOW, & VANDAL RESISTANT BONNETS	TEH	JKD	1:2
	Approved		Date:
	MVW		8-6-04

Hunter®

The Irrigation Innovators

ACC

Hunter's most powerful controller for command of large and sophisticated sites

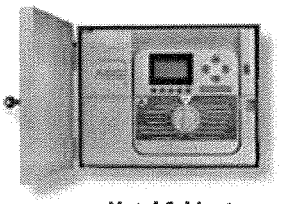


Real Time Flow Sensing

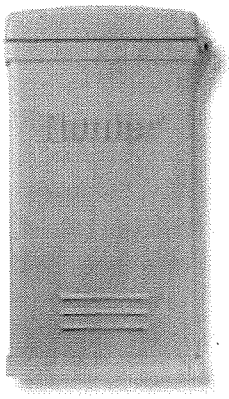
Optional ET Module

Remote Compatible

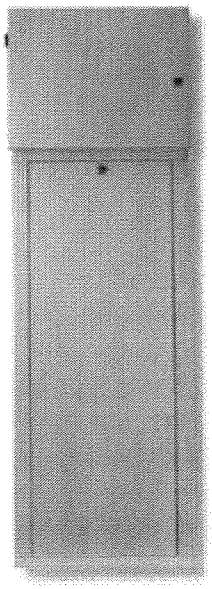
The ACC brings the convenience and versatility of modularity to the most advanced controller the company has ever created. The adaptable modular design not only allows configuration to the number of stations you desire, it also makes it easy to upgrade to true 2-way communication with a Hunter central control system. Customize your controller in the field with the features you need: plug-in modules add stations and add central control communication capability. But what truly sets the ACC apart are its many features, most notably real-time flow sensing. This feature allows the controller to dynamically respond to flow changes by station and track system water use. The ACC also boasts a total of 6 independent and 4 custom programs and the unique ability to assist the water manager in conforming to "watering windows." Plus, the ACC's large backlit LCD display offers the user a convenient means to personalize on-screen station and program names.



Metal Cabinet

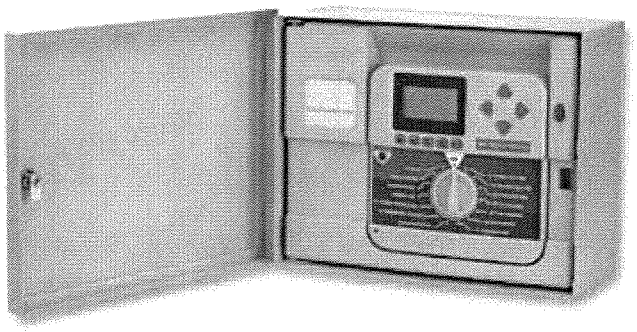


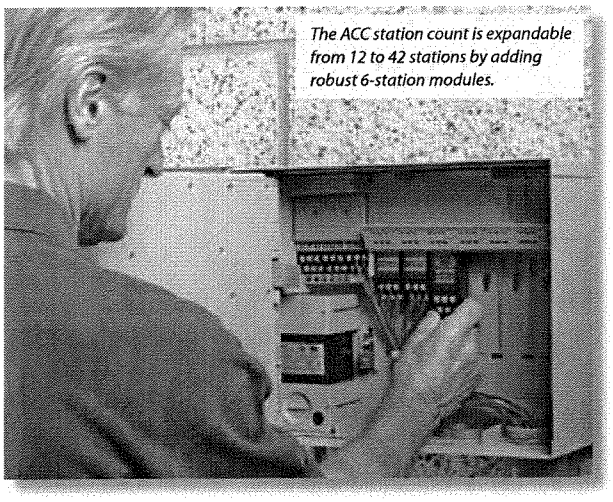
Plastic Pedestal



Metal Pedestal

Features & Benefits





The ACC station count is expandable from 12 to 42 stations by adding robust 6-station modules.

Real-time flow sensing in standalone mode

Learns flow by station and automatically responds to incorrect flow

Stations expand with plug-in modules

Provides easy addition of more stations and simplified inventory management

Easy modular upgrade to 2-way communication with central control

Simple plug-in modules upgrade ACC to hardwire, modem, or radio control

6 fully-independent programs (plus 4 custom programs)

Automatic programs each have separate day cycles and 10 start times, offering total flexibility for complex landscapes

Independent day schedule options for each program

Maximum scheduling choices (select days of the week, true odd/even days, skip days up to 31 days)

Non-volatile 100-year memory

Program data is retained during power outages, no battery required

Cycle and Soak capability by station

Allows run times to be divided into repeat cycles to minimize runoff

Remote control ready

Pre-wired to directly accept Hunter ICR remote control—plug and go!

Watering Window Manager™

User defines hours and days of week when no watering is allowed; will override any user-set programs that enter that time frame

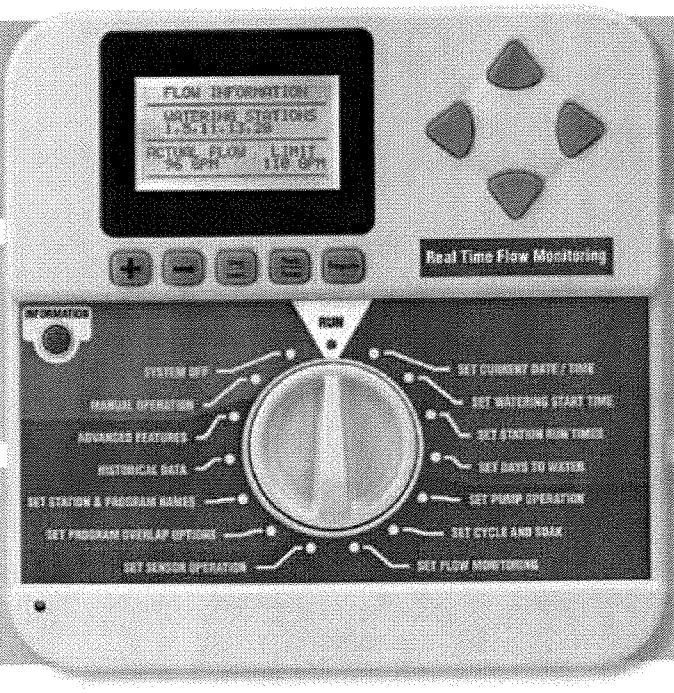
Multiple sensor capability

Accommodate devices for weather and flow to provide automatic system shutoff in abnormal conditions

Large Backlit LCD
For easy viewing of readouts whether in dim conditions or bright sunlight.

Information Button
Provides programming help and unlocks hidden features.

Ability to Name Programs and Stations
Makes field identification of programs and stations easy.



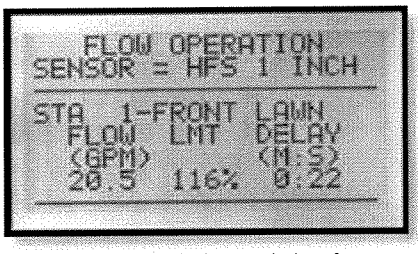
Pause/Resume Feature
Allows the user to suspend watering, and then resume where it left off (no missed irrigation).

Two Programmable Master Valve/ Pump Circuits
Can either be normally closed or normally on.

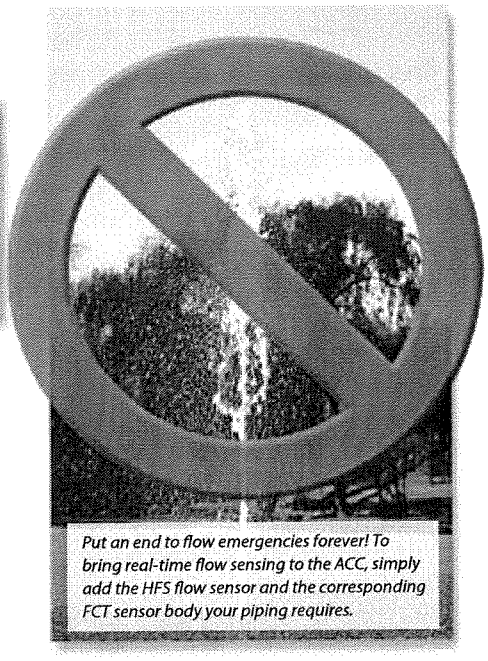
Cycle and Soak
Minimizes run-off with tight soils or slopes.

Real-Time Flow Sensing: Immediate Response to Abnormal Flows

Never before has a standalone version of a top-level controller offered real-time flow sensing as an economical option. With the ACC, Hunter brings this feature once considered elite to even small projects with limited budgets. Real-time flow sensing will identify a system's low flow or overflow conditions instantaneously, before resulting damage (to either the system or surrounding landscape) can occur. The user determines the threshold for what will be recognized as a "highest flow rate" and "lowest flow rate" by station. In turn, the controller will calibrate itself to automatically identify any flow below or above these pre-determined limits to be an incorrect flow condition. When the limits are exceeded, the ACC shuts off that part of the system. To bring real-time flow sensing to the ACC, simply add the HFS flow sensor and the corresponding FCT sensor body your piping requires.



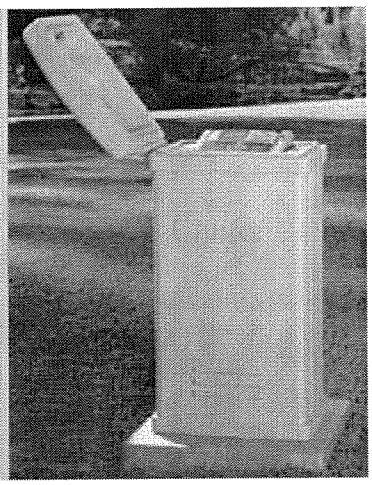
The large backlit LCD display provides lots of information and easily steps the user through the programming process.

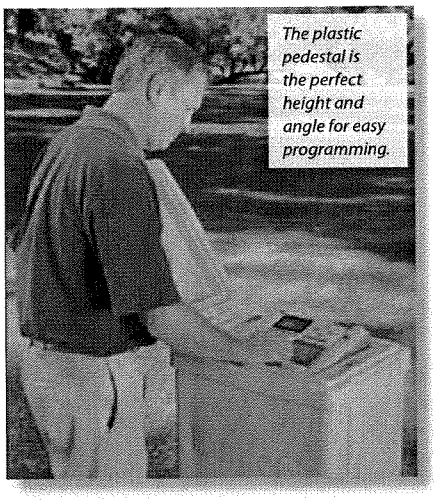


Put an end to flow emergencies forever! To bring real-time flow sensing to the ACC, simply add the HFS flow sensor and the corresponding FCT sensor body your piping requires.

ACC Pedestal Models

Featuring the highest-grade construction, the ACC plastic pedestal can stand up to the harshest conditions Mother Nature (and humans) can dish out. The plastic pedestal is rustproof, weather-resistant, and UV-tested to prevent fading...plus, it won't dent. In addition, you won't believe the amount of space in its interior. There's ample room to accommodate all of your field wiring and central control wiring needs, and it's even possible to permanently install the receiver for an ICR remote control.





The plastic pedestal is the perfect height and angle for easy programming.

Models*

ACC-1200 – 12-station controller, metal cabinet, 42-station capacity

ACC-1200-PP – 12 station controller, plastic pedestal, 42-station capacity

ACC-99D – 2-Wire decoder controller with 99 station capacity, metal cabinet

ACC-99DPP – 2-Wire decoder controller with 99 station capacity, plastic pedestal

ACM-600 – 6-station module for use with any ACC

AGM-600 – 6-station module with extreme service surge protection

HFS – Hunter flow sensor, requires the use of an FCT-xxx

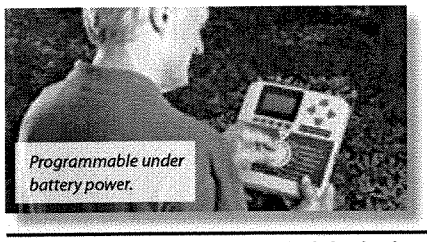
ACC-PED – Metal pedestal for use with ACC-1200

Dimensions

- ACC Cabinet: 12 ⅜" H x 15½" W x 6 7/16" D (31.37 cm H x 39.37 cm W x 16.38 cm D)
- ACC Metal Pedestal: 36⅛" H x 15½" W x 5" D (91.45 cm H x 39.37 cm W x 12.7 cm D)
- ACC Plastic Pedestal: 38⅜" H x 21 9/16" W x 15⅞" D (97.47 cm H x 54.61 cm W x 40.32 cm D)

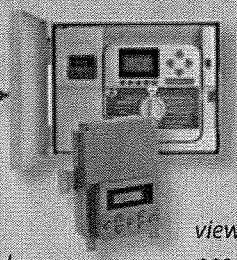
Specifications and Features

- Transformer input: 120/230VAC, 50/60Hz; 2A at 120VAC, 1A at 230VAC
- Transformer output: 24VAC, 4A, 120VA
- Station output: 24VAC, 0.56A (2 valves)
- Maximum total output: 24VAC, 4A (14 valves), includes master valve circuits
- Two master valve outputs: 24VAC, 0.3A each
- Rain sensor override compatible with most brands utilizing a normally closed micro switch
- Seasonal adjustment: 0 to 300% in 1% increments
- All programs can run simultaneously or stack, selectable
- Self-diagnostic circuit breaker: skips shorted stations and continues watering
- Station run times: up to 6 hours
- Programmable delay between stations of up to 6 hours
- Programmable rain delay up to 31 days
- UL listed
- 365 day calendar (including leap year)
- Hunter Quick Check™ helps troubleshoot field wiring problems
- Test program feature allows for quick system checks
- Central control compatible with Hunter IMMS™ system
- Upgrade to ET capability (April 2006)



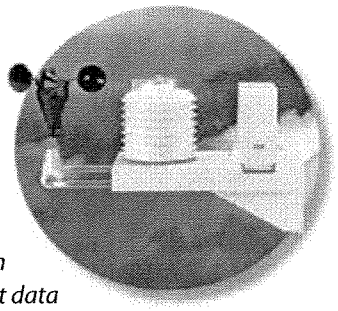
Programmable under battery power.

Integrates Seamlessly with Hunter Irrigation Management and Monitoring System™



The ACC controller has been designed specifically to accommodate the IMMS™, Hunter's affordable water management tool that can monitor and control a network of irrigation systems from a single location. For the ACC to access the virtues of the IMMS, just plug in a convenient module. No external boxes, hook-ups, or messy wiring is necessary. The module features a separate LCD readout and program buttons for simple viewing. And, everything you need fits neatly into the cabinet or pedestal, including your radio or modem connections, if needed.

Add ET Capabilities to the ACC



Simply put, evapotranspiration (ET) is the amount of water that your plants need to be replaced either through rainfall or irrigation. By calculating ET, it is possible to more accurately adjust the watering requirements of your landscape as climatic conditions change. However, typical ET systems commonly depend upon data received from the nearest official weather station. Quite often, that data is not representative of your particular site, since slight differences in elevation or terrain can create individual microclimates whose temperature and precipitation can vary substantially from the general "climate" of an area. As part of the ACC, the Hunter ET System provides you with essential weather data that is collected on site. In addition to being able to shut off watering in the event of rain, the ET System also takes into account such variables as soil type, plant type, slope, and sun exposure, enabling the ACC to automatically adjust its programs to accommodate more subtle changes in your weather, not the weather somewhere else.

ACC Quick Reference Chart

Desired Station Configuration	Order Base Unit	Plus Number of modules	Specify as:
12 Zone	one ACC-1200	no module needed	ACC-1200
18 Zone	one ACC-1200	one ACM-600	ACC-1800
24 Zone	one ACC-1200	two ACM-600	ACC-2400
30 Zone	one ACC-1200	three ACM-600	ACC-3000
36 Zone	one ACC-1200	four ACM-600	ACC-3600
42 Zone	one ACC-1200	five ACM-600	ACC-4200

SPECIFICATION GUIDE

EXAMPLE: **ACC - 1200 - PED**

MODEL	FEATURES	OPTIONS USER INSTALLED
ACC	**1200** = 12-Station Base Unit Controller, Metal Cabinet, Expands to 42 Stations **1200PP** = 12-Station Base Unit Controller, Plastic Pedestal, Expands to 42 Stations **99D** = 2-Wire Decoder Controller with 99 Station Capacity, Metal Cabinet* **99DPP** = 2-Wire Decoder Controller with 99 Station Capacity, Plastic Pedestal*	**PED** = Optional Metal Pedestal
ACM	**600** = 6-Station Plug-in Module for use with any ACC Controller Model	
HFS	Hunter Flow Sensor, requires the use of an FCT-xxx	
ACC-COM**	**HWR** = Hardwire Connection Communication Module for "Satellite" Installations **POTS** = Regular Dial-up Telephone (RJ-11) Connection Communication Module for "Satellite" Installations **GSM** = Cellular Connection Communication Module (Cell Phone & Antenna Included) for "Satellite" Installations	
ACC-HWIM	Terminal for Hardwire Connections (In- and Outbound Wire)	
RAD3	UHF Radio Communications Module (Antenna not Included)	

* See ACC–99D Brochure (LIT-394) for detailed information.

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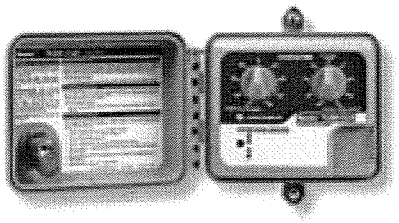
P/N 701009 LIT-387 3/06

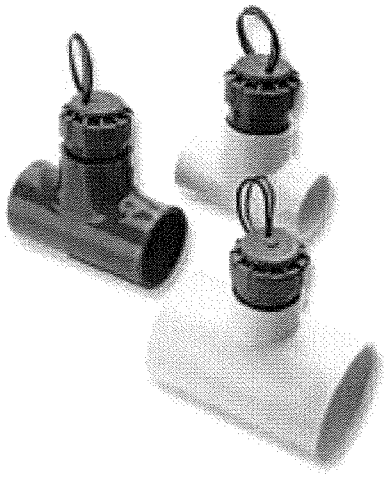
Hunter®
The Irrigation Innovators

Flow-Clik™

Automatically shuts down irrigation system if an overflow condition occurs



Flow-Clik Inteface Panel



Flow-Clik Sensor and Body

The hazards of an over-flow situation know no economic boundaries. A high flow and the damage that can occur could just as easily take place on a simple residential system as it could on a top-of-the-line commercial system comprised of institutional-grade components. That's why Hunter has developed the Flow-Clik, an economical way to monitor and shut off the flow of any system–existing or new, large or small. A ruptured pipe or broken sprinkler that is left undetected can result in a substantial amount of damage. Plants and groundcover can be flooded, a slope can be eroded, even solid surfaces such as sidewalks or driveways can be undercut. The installation of a Flow-Clik will ensure that such a break will be identified before any damage can occur. The Flow-Clik is user-set to activate at a specified level of flow; once that level is exceeded, the electrical circuit is broken and the valves are shut off. As a result, the amount of water loss in the event of high external leakage would be substantially reduced. For liability reduction, erosion prevention, and an easy means of water conservation, there is no better low cost solution than the Flow-Clik.

Features & Benefits

Reduced costs for rupture-related repairs

Unanticipated budget allocations kept to a minimum

Weatherproof interface panel provides system status

"Overflow watchdog" provides constant update for any system

Compatible with all commercial and residential piping systems

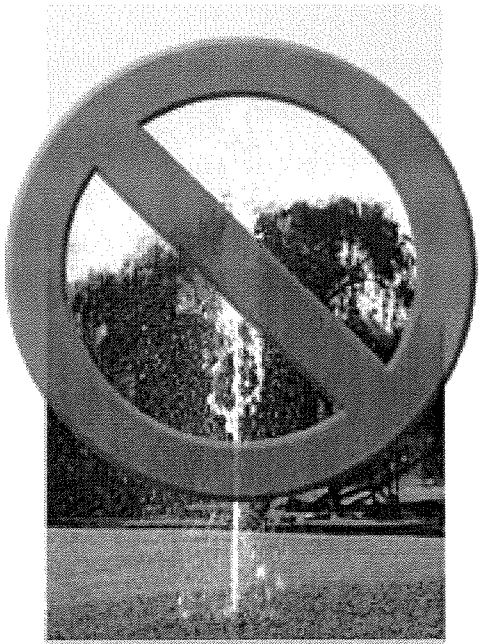
Large flow range provides complete flexibility

Customized calibration for precise system control

Every irrigation system is set individually with a single push button

Multi-color LED provides system status

Displays if power is applied and whether flow is acceptable



Put an end to flow emergencies forever! To bring flow sensing to standard Hunter controllers or to the IMMS™ Central Control, simply add the Flow-Clik flow sensor with the appropriate FCT sensor bodies for your installation's piping.

Models

FLOW-CLIK - Includes sensor and interface panel, works with all standard 24 volt controllers (order FCT sensor bodies separately)

FLOW-CLIK-IMMS - Sensor (interface panel not required), for IMMS™ central control (order FCT sensor bodies separately)

FCT 100 - 1" Schedule 40 Sensor Body

FCT 150 - ½" Schedule 40 Sensor Body

FCT 158 - 1½" Schedule 80 Sensor Body

FCT 200 - 2" Schedule 40 Sensor Body

FCT 208 - 2" Schedule 80 Sensor Body

FCT 300 - 3" Schedule 40 Sensor Body

FCT 308 - 3" Schedule 80 Sensor Body

FCT 400 - 4" Schedule 40 Sensor Body

Dimensions

Flow-Clik Sensor Body:

FCT 100 - 4.8" H x 2.3" W x 4.5" L

FCT 150 - 5.4" H x 2.3" W x 4.6" L

FCT 158 - 5.4" H x 2.3" W x 5.1" L

FCT 200 - 5.9" H x 2.7" W x 4.7" L

FCT 208 - 6.0" H x 2.9" W x 5.4" L

FCT 300 - 7.0" H x 4.0" W x 6.2" L

FCT 308 - 7.0" H x 4.2" W x 6.4" L

FCT 400 - 6.5" H x 5" W x 6.5" L

Interface Panel: 4.5" H x 5.5" W x 1.5" D (Not required for Flow-Clik IMMS)

Operating Specifications

- Temperature: 0-150 degrees F
- Pressures: up to 200 PSI
- Humidity: up to 100%

Flow-Clik Interface Panel

- 36" leads provided for easy wiring to controller (2 wires to controller 24VAC terminals and 2 wires to sensor and terminals)

Electrical Specifications

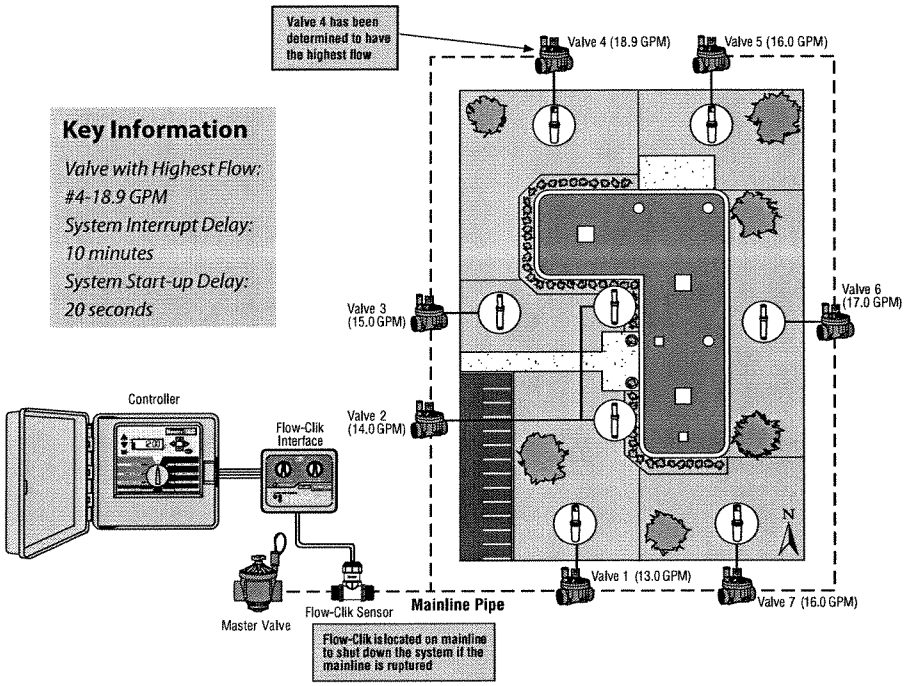
- Current draw: @24VAC .025 Amps
- Switching current: 2.0 Amps
- Maximum distance between interface panel and sensor = 1000 ft. (18 gauge minimum wire size) 2 wires required for Flow-Clik Sensor, 4 wires required for Flow-Clik IMMS Sensor to IMMS Interface

Additional features

- Programmable start up delay (0 to 300 Seconds)
- Programmable interrupt period (2 to 60 Minutes)
- System status indicator light
- One button system calibration to highest flow zone

How Flow-Clik Works: An Example

At a small commercial site, the Flow-Clik sensor is connected to the mainline pipe that provides water to the system control valves. The user determines which valve has the highest flow rate and calibrates the flow sensor to automatically identify any flow in excess of this pre-determined amount, in this case, 21 gallons per minute (GPM) to be a "high flow" condition. The user also sets the desired setting for the system interrupt and start-up delay. If flow should exceed 21 GPM, a signal would be sent to the controller to interrupt the system for a prescribed period of time.



Lateral Line Break: *If a break should occur on zone #3, the Flow-Clik would sense a "high flow" condition (>21 GPM) and would shut down the system for the prescribed interrupt period.*

Mainline Rupture: *The Flow-Clik would identify a "high flow" condition approximately 20 seconds after the first valve is activated based on the irrigation schedule and the master valve would shut down.*

FLOW RANGE

FLOW SENSOR DIAMETER	OPERATING RANGE (GPM)		
	MINIMUM*	SUGGESTED MAXIMUM**	MAXIMUM (for sensor)
1"	6	17	50
1½"	13	35	100
2"	20	55	200
3"	40	120	300
4"	60	200	400

* *Minimum recommended flow for the highest flow zone for your system.*

** *Good design practice dictates the maximum flow not to exceed 5ft/sec. Suggested maximum flow is based upon Class 200 IPS plastic pipe.*

Note: *Highest flow zone within irrigation system should not be more than 75% maximum available system flow.*

SPECIFICATION GUIDE

EXAMPLE: **FLOW-CLIK**

MODEL	FEATURES
FLOW-CLIK	= Standard Version for all 24VAC Controllers (includes sensor and interface panel)
FLOW-CLIK IMMS	= Version for use with IMMS Central Control (includes sensor only–interface panel not required for IMMS™)
FCT	**100** = 1" Schedule 40 Sensor Body **150** = 1½" Schedule 40 Sensor Body **158** = 1½" Schedule 80 Sensor Body **200** = 2" Schedule 40 Sensor Body **208** = 2" Schedule 80 Sensor Body **300** = 3" Schedule 40 Sensor Body **308** = 3" Schedule 80 Sensor Body **400** = 4" Schedule 40 Sensor Body

Note: Order Flow-Clik Sensor Bodies separately (FCT series).

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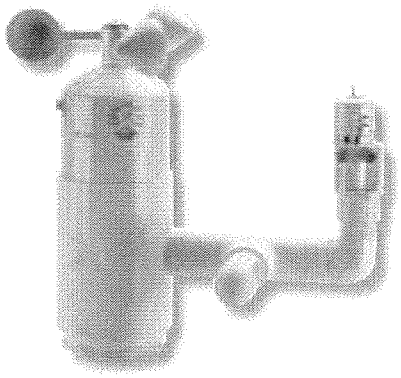


Mini-Weather Station
(With Optional Freeze Sensor)

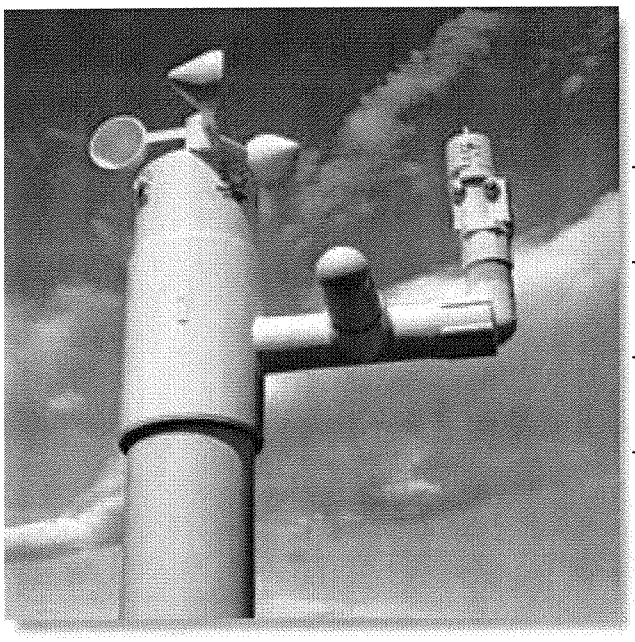
Mini-Weather Station

Control irrigation system operation with sensors for wind, rain, and temperature

Having a climate like a smorgasbord can make for some tricky business when it concerns your irrigation system. Of course, you can simply look out the window and decide whether to turn on the sprinklers manually each day, but that defeats the purpose of an automatic system. What you really need is an automatic device that can make the decision whether there is too much rain, too much wind, or too much cold to do the watering. With the Hunter Mini-Weather Station you get each of Hunter's three different sensor devices in one single convenient unit. The Mini-Clik® rain sensor shuts sprinklers off in a storm and keeps them off, automatically compensating for the amount of rainfall that occurred. The Freeze-Clik® prevents system activation by automatically stopping the flow of water when outdoor temperatures drop near freezing. The Wind-Clik® shuts off systems during periods of high wind, then automatically resets the system when conditions are more favorable. Easy to mount (it attaches to your controller with just two wires) and easy to use, the Mini-Weather Station takes all the guesswork out of when you shouldn't water.

PROVEN WATER SAVER

Features & Benefits



Easily installs on automatic irrigation system
Versatile enough to meet your particular needs

Shuts system off in rainy conditions
Sets from ⅛" to 1" based on your local conditions

Sets to shut down system from 12 to 35 mph winds
Choose the wind speed most effective for your area

Shuts off water at 37˚F
Eliminates ice on landscapes, walkways, roadways

Models

MWS – Mini-Weather Station with wind and rain sensors

MWS-FR – Mini-Weather Station with wind, rain, and freeze sensors

Specifications

- Electrical rating: 120VAC, 5 amps max
- Mini-Clik-C:

  Adjustable settings: measure rainfall in quantities of ⅛" to 1"
- Wind-Clik:

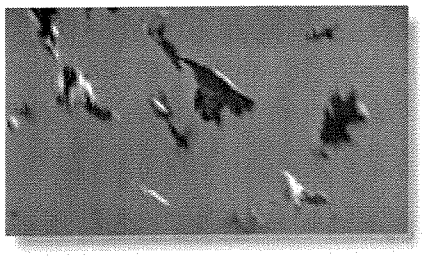
  Wind vane diameter: 5 inches

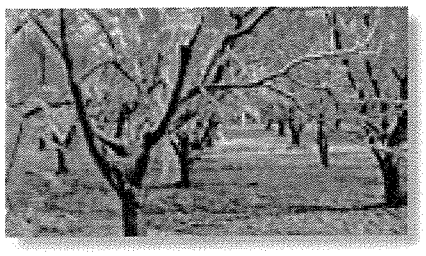
  Wind speed adjustments:
  Actuation: 12 to 35 mph
  Reset: 8 to 24
- Freeze-Clik:

  Temperature set point: 37˚F (3˚C) +/- 2˚C

  Temperature differential: +/- 1˚C

  Sensor element: Double epoxy sealed, weatherproof





SPECIFICATION GUIDE

EXAMPLE: **MWS - FR**

MODEL
MWS = Wind and Rain Sensors

OPTIONS
FR = Combines Wind, Rain and Freeze Sensors

Note: To add Bypass Switch Box to any non-Hunter controller installation, specify BPSW with sensor. Bypass switch function is standard in all Hunter controllers.

The Mini-Weather Station Combines Hunter's Reliable Weather Sensors in a Single Convenient Unit

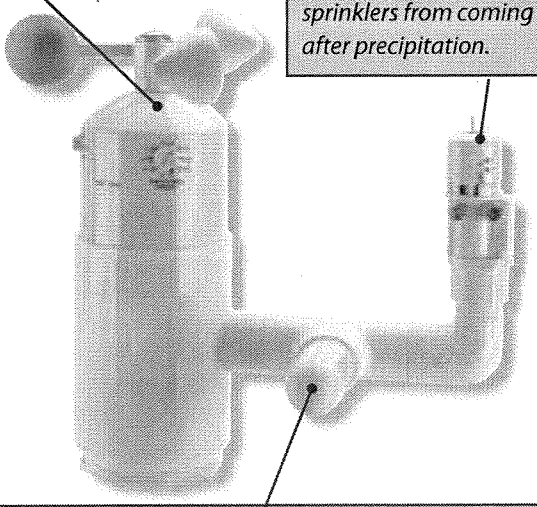
Connect two wires to the controller and your irrigation system will shut down when there is too much rain, too much wind or, when the temperature reaches freezing.

Wind-Clik®

With Wind-Clik you'll save water, worry, and money as your system will only be operating at the times when you can be sure that the water intended for your landscape will reach its destination. Reduce liability issues by turning off wind-blown sprinklers that soak pedestrian paths or roadways with passing cars.

Mini-Clik®

There's nothing more embarrassing–or more wasteful or costly–than an irrigation system that runs when it doesn't have to…in the rain. Mini-Clik® provides the simplest, most effective way to prevent sprinklers from coming on during or after precipitation.

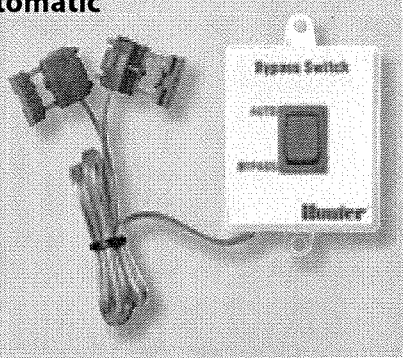


Freeze-Clik®

A freeze sets in overnight...you arise to see a landscape frozen over, with ice on adjoining driveways, sidewalks, and even roadways. In some areas, where temperature swings like this are all too common, the results are not only hazardous to the life of your lawn and plants, it can also be hazardous to those who walk or drive nearby. The Freeze-Clik automatically stops irrigation systems from activating when the outdoor temperature drops to a near freezing level.

Bypass Switch Box: Give Any Automatic Controller's Remote Sensors the Capability to Bypass

It's the easy way to put a system in the manual mode as would be needed during servicing and troubleshooting operations. Featuring a compact, heavy-duty switch mechanism, the Bypass Switch Box mounts quickly and easily with its no-strip wire connectors and supplied adhesive tape.



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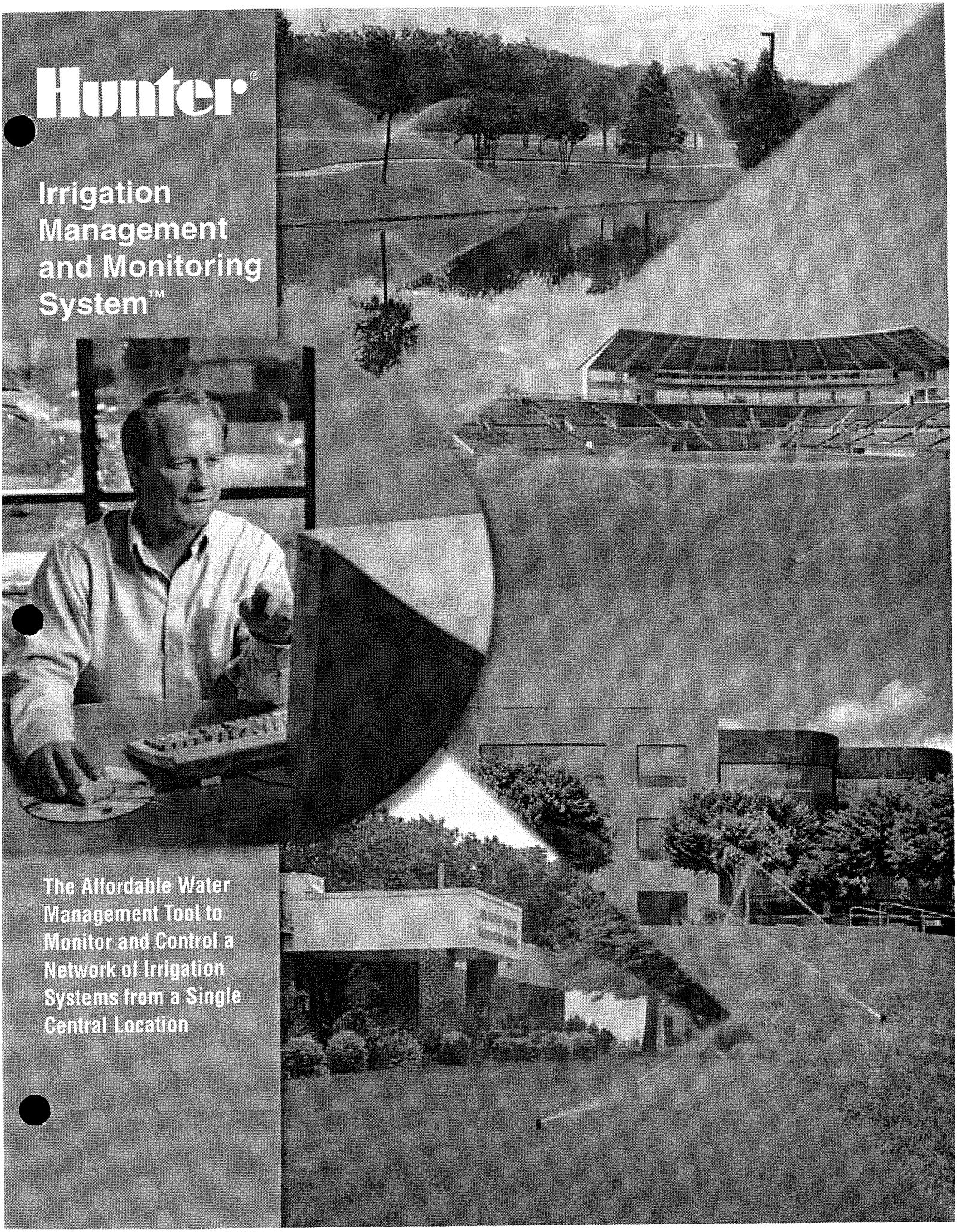
LIT-279 11/05

Hunter®

Irrigation Management and Monitoring System™



The Affordable Water Management Tool to Monitor and Control a Network of Irrigation Systems from a Single Central Location

IMMS™: Save Time, Manage Water, Save Money

IMMS Saves Time

Managing a network of irrigation controllers – on a single site or multiple sites – requires time-consuming work. Setting up and synchronizing controller operations can take hours of time. Plus, every time a program change needs to be made, or a system needs to be shut down for a special event, you have to physically travel to the controller.

With the Irrigation Management and Monitoring System (IMMS), these hassles are removed, since the entire system can be monitored and controlled from the comfort of your office. Additionally, by communicating with localized sensors, the system can alert you to potential service problems such as a ruptured pipe or sprinklers that have been broken by vandals.

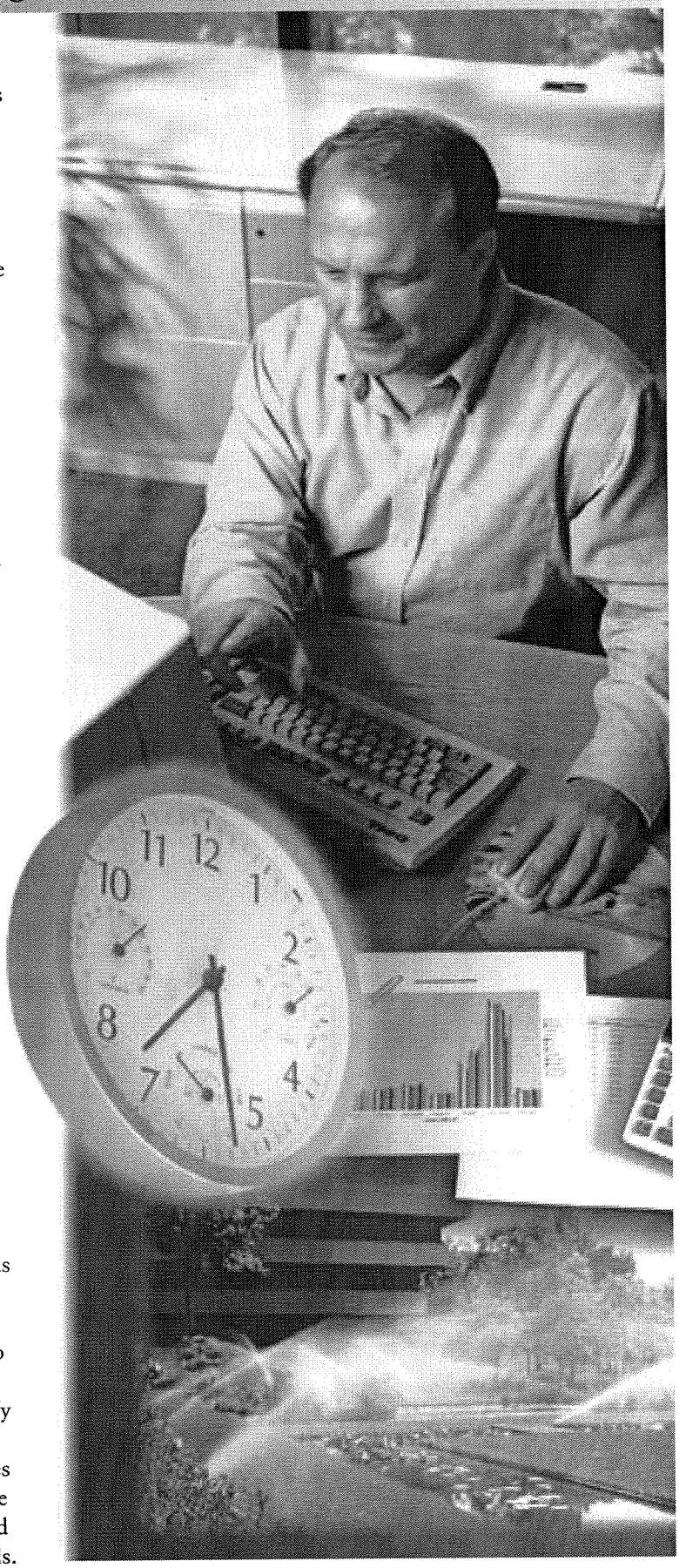
IMMS Manages Water

The centralized control of your irrigation controller network allows you to take advantage of the latest water saving benefits. Modify controller schedules in real-time, taking into account daily and seasonal weather conditions and weather forecasts...shut down all systems during rain automatically or with just a few keystrokes...increase watering for thirsty annuals during hot days. Any and all changes can be made to each controller's program in a matter of seconds.

In addition, the program's reporting module allows you to monitor your estimated water usage over time, both in total gallons used and estimated water costs. This will allow you to plan ahead for future needs and identify areas for improvement.

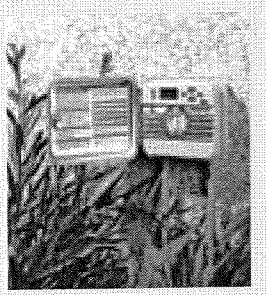
IMMS Saves Money

Saving time and saving water ultimately adds up to an even greater savings: that of your irrigation budget. The IMMS reduces your labor expenses, including the time it takes to travel from site to site and the time it takes to program and update controllers and verify system operations. Not to mention the fact that the IMMS is priced at a level that makes it affordable and not a luxury item. With the IMMS, you possess a powerful tool designed to manage and monitor your irrigation needs.



The Irrigation Management and Monitoring System™: How to be All Over Town and Never Leave Your Desk

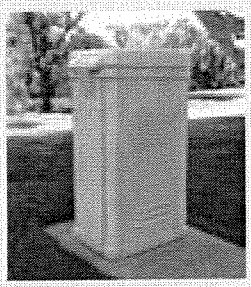
With the Irrigation Management and Monitoring System (IMMS™), automatic irrigation systems at multiple sites can be programmed for functions that would typically be handled directly at each site's controller. Scheduling of days to water, run times, start times, cycle and soak operations, seasonal adjustments, and more can now be done from a single computer at a desk miles away from the actual installation.



The IMMS works with standard Hunter Controllers.

In addition, scheduled operation of non-irrigation components also in use at these sites – e.g., lighting systems at athletic fields, fountains at shopping centers – as well as pump output and sensors can also be programmed and monitored from a single central location.

A key function of the IMMS is its ability to monitor changing conditions. With the aid of such options as flow-limit sensors, rain sensors and other weather-sensing devices, the IMMS can receive reports on the current condition at every site it is linked with, and respond with pre-programmed shutdowns should any of those conditions go beyond the user-defined limits.



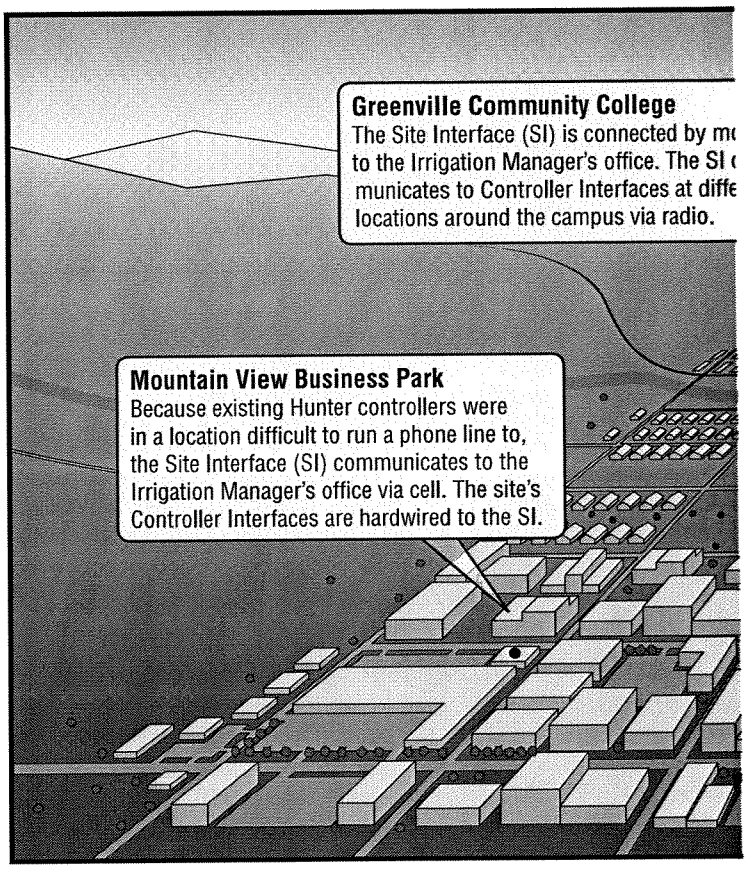
Quickly reprogram controllers across multiple projects for changes in weather conditions or maintenance events without visiting the site.

No system available today is more cost-effective than the Hunter IMMS. It's inexpensively priced and contains the most essential features needed for water management. It's able to team with most of Hunter's standard automatic controllers including the SRC, the Pro-C and the ICC. Plus, it's easy and affordable to upgrade, making it possible to accommodate an expanding network of controllers.

Projects that can benefit from Hunter's Irrigation Management and Monitoring System™

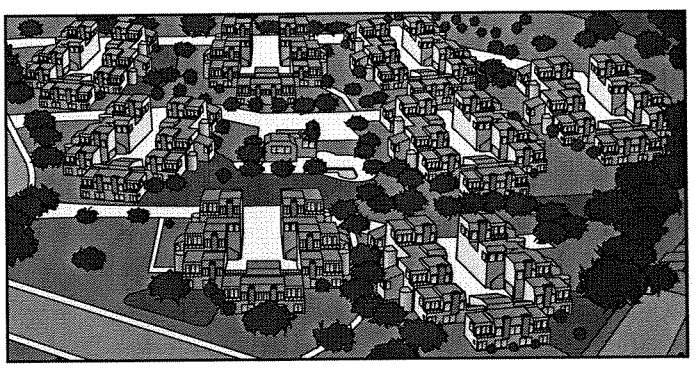
- School and Industrial Campuses
- Parks
- Town Centers and Urban Plazas
- Businesses with Branch Locations
- Shopping Malls
- Apartment Buildings
- Condominiums
- Homeowner Associations
- Large Residential Estates
- Sports Field Complexes
- Cemeteries

Sample Applications for the Irri

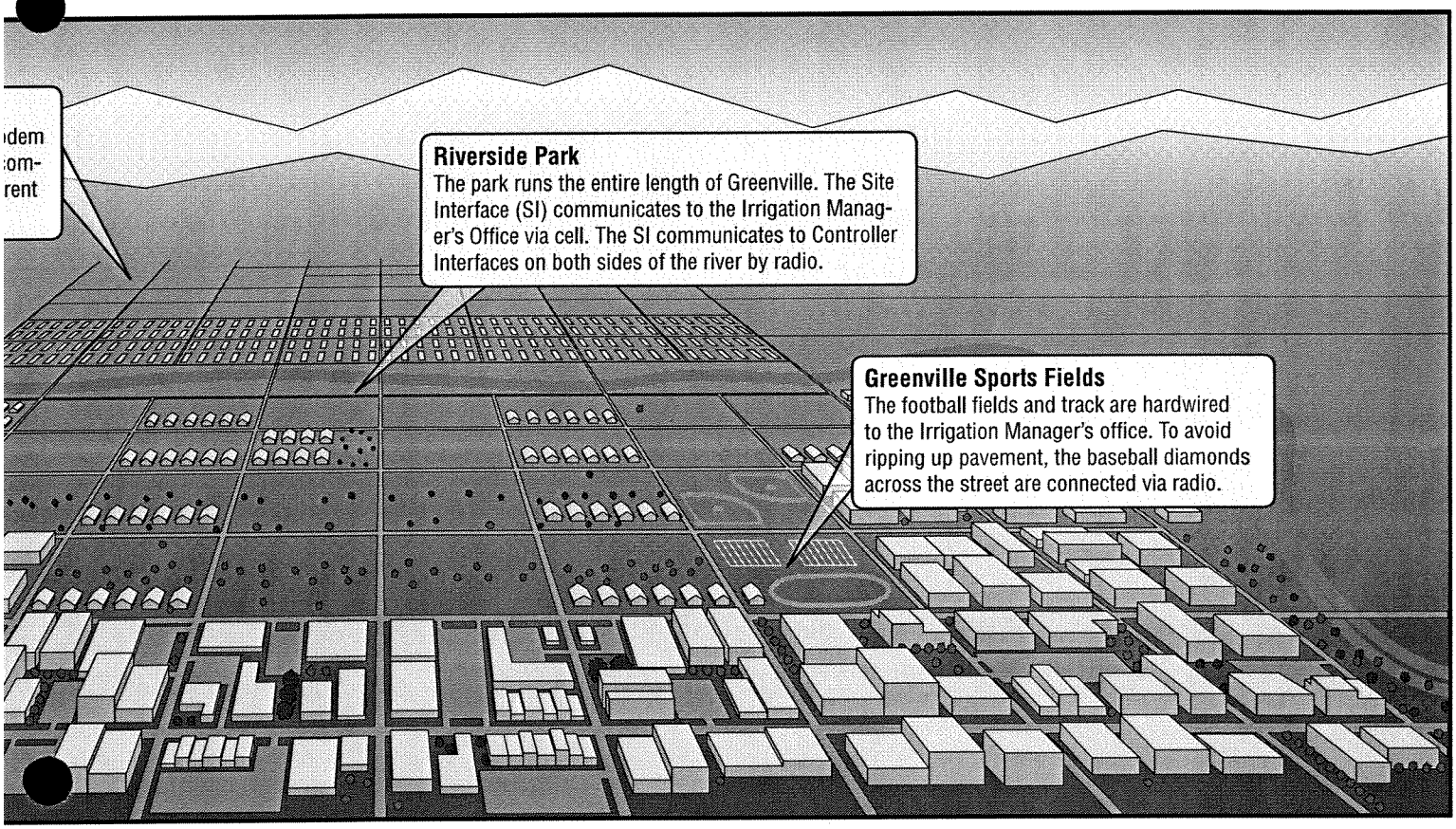


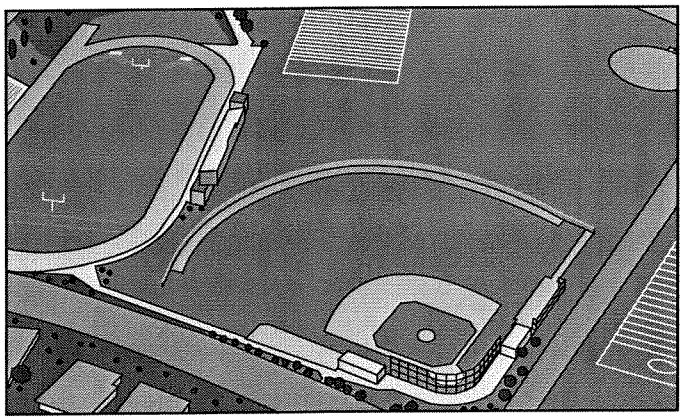
Apartments, Condominiums, and Homeowner Associations

An irrigation manager can maintain positive "curb appeal" while reducing water use at multi-family residential sites. Local maintenance personnel and/or an off-site contractor can schedule and re-schedule irrigation to adjust to changing weather conditions while also meeting specialized requirements for specific watering windows and skip days. Water usage can be carefully monitored for potential savings, and optional sensors provide feedback on areas of potential concern.



gation Management and Monitoring System™



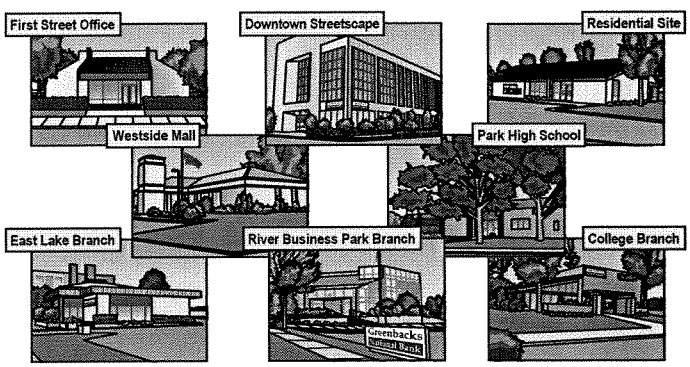


Athletic Fields and Facilities

The IMMS is the ideal choice for the sophisticated management needs of athletic fields, whether at a single location or at multiple locations around a city. The software allows the user to globally manage watering days, event days and maintenance plans, providing precise use of resources for fields of all types. From a central location the user can assure superior turf playability without the hassles of regular site visits.

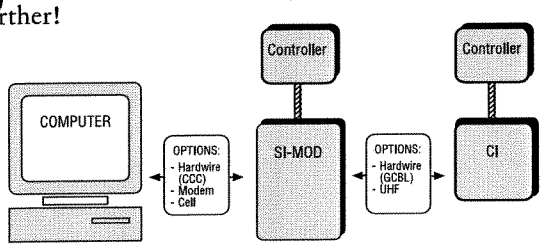
Multiple Location Commercial or Park Sites

Centralized control of irrigation systems at multiple-site locations like office buildings, branch banks and more can be easily achieved at a low cost with the IMMS. Each site's water needs can be carefully programmed and monitored from a central location. The program's sophisticated reporting module allows the tracking of water usage data. Additionally, sensor interfaces provide feedback on alarm conditions such as no flow (system did not run) or overflow (broken line or vandalism) before they become a property damage or liability concern.



Communication Options

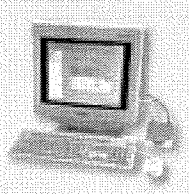
IMMS offers more communications options than ever before, to stretch your control, and your savings even further!



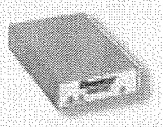
1. **Hardwire:** Simple low-cost central control when central PC is on same site as the controllers.
   - Easy, affordable color-coded wiring (Hunter GCBL). Use IMMS-CCC next to the computer to insert signals onto long-haul cable.
   - Signal resistant to electrical noise and surge.
   - Proven technology with no fees and no license.
2. **Modem (Telephone):** Affordable wide-area communications using dial up modems for 1 to 100 Site Interfaces (dedicated analog line only).
   - Uses technology you already own (computer's modem, connected to public telephone system).
   - Lowest cost alternative for many, with no distance limitation (telephone charges may apply).
   - Automatic dialing of all sites at programmable intervals.
3. **Cellular/GSM:** Modems for long-range, wireless communications to remote sites.
   - Wireless communications can eliminate costly telephone line drops to remote locations (local cellular charges may apply).
   - Control your irrigation where land-based telephone services are unavailable.
4. **UHF Radio (450-470 MHz):** Narrowband radios broadcast IMMS control signals around individual sites, for the ultimate in installation convenience and long-term reliability.

   UHF radio is an option to any version of either SI or CI for local area communications only. The SI can have radio and/or hardwire for local area, and hardwire, modem or cellular for wide-area connection to the computer.
   - Available for either Site Interface (SI) or Controller Interface (CI).
   - ½ to 2 mile range (depending on local terrain and antenna placement). IMMS-R is designed for on-site communications and is not to connect the central computer to a Site Interface...combine on-site radio with modem or cellular SI for maximum flexibility.
   - FCC/Industry Canada license required. International customers may purchase mounting kit (IMMS-R-KIT) and source radio module locally.

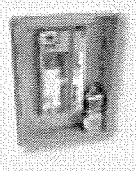
What Components Comprise the Irrigation Management and Monitoring System™?



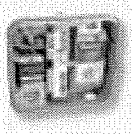
Central Software – Installed in a PC with the Windows® 2000 or Windows® XP operating systems, the IMMS software is the brain of the entire water management operation. IMMS is compatible with most other common office software applications.



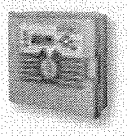
Central Computer Communication Unit – Located at the irrigation manager's office. Enables communication between the manager's office and the field through hardwire cable. This device is not needed for modem installations.



Site Interface (SI) – A Site is a single controller, or a group of controllers, connected to the central computer via hardwire, dial-up, or cellular telephone connection, up to 100 sites per system! One SI is required per Site, to manage communications from the controller location to the central computer. A SI may control one controller directly, and up to 99 more through controller interfaces.



Controller Interface (CI) – At sites where multiple controllers are used to handle irrigation tasks, a controller interface is needed for each controller except the first controller (connected to the SI). Each of these units is wired to its own controller, and also connected to the site interface (via hardwire cable or UHF radio) to communicate with the central controller.



Irrigation Controller – A standard Hunter ICC, Pro-C, or SRC controller. Can be wall or pedestal mounted, plastic or metal cabinets. No upgrade required for central compatibility.

Rain Sensor

Flow-Clik IMMS™ Sensor

Sensors – Changes in weather conditions (rain, wind, freeze) and excessive flow rates can be monitored by sensors that automatically identify conditions that exceed the prescribed optimum. Immediate automatic responses take place when alarms occur, and alarms are then reported to the central computer on the next synchronization. These pre-programmed responses to local conditions can save substantial amounts of water.

IMMS Models

IMMS-CD – Central Control Software

IMMS-SI-HW – Site Interface Unit, Hardwire

IMMS-SI-MOD – Site Interface Unit, Standard Phone Modem

IMMS-CI-HW – Controller Interface Unit, Hardwire

IMMS-CCC – Central Computer Communication Unit, Hardwire

Dimensions

IMMS-SI-HW – 16" H x 11.5" W x 4.25"D

IMMS-SI-MOD – 16" H x 11.5" W x 4.25"D

IMMS-CI-HW – 8.9" H x 9.9" W x 4.3"D

Electrical Specifications

- U.S.A. version 110 VAC
- Australia version 240 VAC
- Europe version 230 VAC

ICC-SAT Models

ICC-800-SAT-SI-HW – 8-station controller, IMMS site interface unit, hardwire, plastic pedestal, 48-station capacity

ICC-800-SAT-SI-MOD – 8-station controller, IMMS site interface unit, phone modem, plastic pedestal, 48-station capacity

ICC-800-SAT-CI-HW – 8-station controller, IMMS controller interface unit, hardwire plastic pedestal, 48-station capacity

Dimensions

- Plastic Pedestal: 38.2" H x 20.5" W x 15.1" D (97 cm H x 52 cm W x 38 cm D)

Control Capabilities

- Manage irrigation systems at up to 100 different sites from a single centralized computer.
- Each site managed can have up to 100 controllers networked into the site interface. The IMMS™ system can network with Hunter ICC, Pro-C, and SRC controllers.
- Manage all controller programming data from the central computer.
- Manual functions: activate, deactivate manual or automatic waterings from the central computer.
- Initiate rain-off or rain-delay features by controller or globally.
- Manage "no water days" up to 365 days in advance globally, by site, or by controller. This allows an irrigation manager to set specific days for maintenance, events, etc.
- Easily program cycle and soak waterings for efficient watering (ICC only).
- Manages watering windows and no-water days with global and site-specific settings.

Monitoring Capabilities

Configure rain, wind and freeze sensors for real-time responses to weather conditions, and monitor their status remotely. Sensor data can be implemented locally with individual controllers or shared across an entire site.

React to system flow conditions through optional Flow-Clik IMMS flow sensors. This will shut controllers down automatically during over-flow conditions (line breaks, broken sprinklers), saving water and reducing liability concerns.

Communications Capabilities

IMMS can operate as an on-site hardwired central system, directly connected to a network of up to 100 irrigation controllers via the site and controller interfaces. IMMS can also operate as a wide-area network via telephone or cellular modem to multiple sites (up to 100), each with multiple controllers (up to 100 controllers per site!) On-site communications may be any combination of hardwire and radio interfaces.

Central Computer Software and Requirements

- Windows® 2000 or Windows® XP operating system with minimum Intel® Pentium® III processor, 366 MHz or higher. At least 128 Mb of RAM, 30 Mb of hard disk space, and CD-ROM drive required. SVGA monitor with resolution of at least 800 x 600. Internal modem (if using modem or cellular connections) and at least one Serial Port if CCC is to be used. Mouse or other pointing device.
- Easy-to-use software with icon based navigation provides fast program set-up and ongoing management.
- Locations, controllers and stations can be user-assigned actual names and site descriptions for easy reference.
- Built-in calendar program allows for scheduling of maintenance events (mowing, fertilizing, etc.).
- Extensive reporting section generates tables and graphs showing estimated water usage and dollar costs. Data can be viewed for current and historic time periods to ascertain trends.

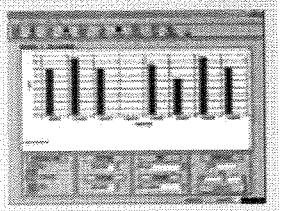
Site Interface Specifications

Rugged, key-lockable cabinets can be installed indoors or out (within 6 ft/ 2m of associated controller), with internal primary AC power connections. Each interface has an internal 24 VAC (UL, CE) transformer.

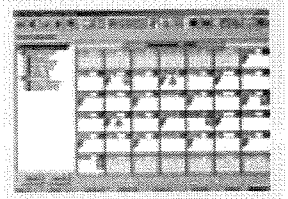
Wiring Specifications

Devices	Wire Type	Distance
PC to Central Computer Communication unit (CCC*)	Standard serial cable (DB9)	6 ft./2m
CCC* to Site Interface (SI)	Hunter Model GCBL (18/4, two twisted pair, shielded)	10,000 ft./3km
SI to additional Controller Interface (CI) and then to each subsequent CI	Hunter Model GCBL (18/4, two twisted pair, shielded)	10,000 ft./3km
Interface (SI or CI) to local controller	18/5 wire (Paige P7138 or equivalent)	6 ft./2m
PC to Modem-equipped Site Interface (IMMS-SI-MOD)	Public Telephone network	No limit
All telephone modem connections	Standard RJ11 telephone wire	25 ft./8m

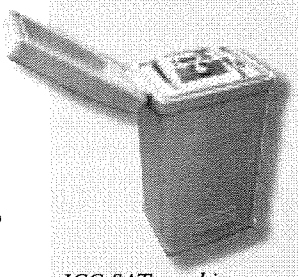
**Not required for telephone modem systems.*



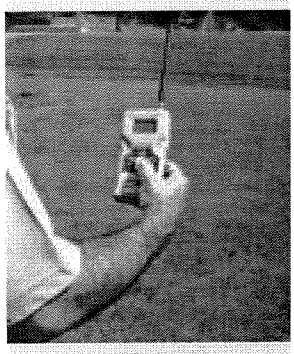
Reporting module tracks activity, alarms and water use in simple graphical formats.



Calendar program offers advance planning for events and scheduling of maintenance activities.



ICC-SAT combine the modular ICC and your choice of IMMS interfaces, pre-wired into a rugged, attractive pedestal.



Interfaces with Hunter's ICR remote for on-site maintenance checks.

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P/N 700907 LIT-349 6/04

ARTHUR ASHE MIDDLE SCHOOL

Existing Conditions

Arthur Ashe Middle School

History

Arthur Ashe Middle School is located in Broward County, Florida. The School was originally built in 2003 and is located at 1701 NW 23rd Ave., Fort Lauderdale, FL.

School Facility's Envelope

Arthur Ashe Middle School is a multi-level, concrete block and stucco middle school. There are approximately 157,770 square feet (sq.ft.) of usable area according to SBBC.

Enrollment consists of approximately 1,029 regular students and the school operational occupancy is from 9:00a.m. - 3:30p.m., Monday through Friday during the academic year.

The campus consists of two buildings: Building 1 and Building 2. Building 1 is shared with an adjacent elementary school while Building 2 is completely dedicated to middle school usage. This elementary school, Rock Island Elementary, shares a common kitchen and the central chilled water plant which includes chillers, pumps, and cooling towers.

Building 1 is a two story structure that houses the cafeteria, gymnasium, and chilled water plant. Structurally, mechanically and electrically this building is in excellent condition. One exception to this overall evaluation is the condition of the electrical transformers located adjacent to room 190 within Building 1. Recently an electrical fire severely damaged these transformers leading to the installation of temporary transformers as permanent repairs are completed.

Building 2 houses classrooms, a media center, and administration spaces.

This two story structure is also well equipped and in overall excellent condition.

Energy Using System

Broward County Public Schools

Lighting

Most interior lighting is provided by fluorescents fixtures with T-8 lamps and electronic ballast. Lighting levels and quality within the hallways, classrooms and administrative spaces are adequate. Maintenance personnel report no difficulty with the lighting fixtures, lamps or ballast.

Many classrooms have occupancy sensor controls. Note that several of these sensors were found defected or misadjusted and were not controlling the lights properly. Due to the recent construction of the school current technology was used throughout the facility to minimize lighting system energy requirements. No recommendations for system improvement are offered at this time.

Water

An inspection of the water system at Arthur Ashe Middle School indicated that the plumbing fixtures - including toilets, urinals and faucets – used valves that had properly sized flow rates. There are approximately 60 toilets, 20 urinals and 36 faucets which operate at 1.6 gal per flush, 1.0 gal per flush and .5 gal per minute respectively. No changes would be recommended to these fixtures due to their existing conditions.

Irrigation

Arthur Ashe Middle School was built adjacent to an existing school, Rock Island Elementary. Due to the common grounds surrounding these two schools one irrigation system was installed to service both facilities. This irrigation system has two 20-hp pumps, one small (approximately 2-hp) pump and a control system. Model ESP-40MC with "cycle + soak" controls delivery of the well water to 58 zones. Based on a handwritten schedule within the cover of the control system each zone is watered for 20 to 45 minutes on an "even day" schedule.

All equipment, including pumps, valves, and the control system appears to be in excellent condition. Access to the control system, pumps and valves should be secured with a fence or lock since no physical barriers prevent vandalism.

One irrigation controller runs from the city water system. It was analyzed that this controller runs 58 irrigation zones five days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20

minutes on each zone.

Cooling

Two 485-ton, water-cooled, centrifugal Trane chillers provide chilled water for air handling units located throughout the facility. According to plant personnel chiller number two is currently disabled due to a "motor problem" that is scheduled to be repaired shortly. Despite the use of only one chiller both the middle school and the elementary school are able to obtain enough chilled water to maintain a comfortable temperature. Normally both chillers are required during the academic year due to the increased heat load, infiltration, and make-up air requirements.

These chillers are cooled using two large, stainless steel evaporative cooling towers constructed by Evapco. Although the cooling towers show signs of algae growth they are structurally in excellent condition and appear to be properly sized (neither nameplate nor print data available). The make-up water line has a meter installed to permit the reduction of the wastewater treatment component of the water bill.

Three new condensing water pumps supply the cooling tower water to the chillers. These 40 horsepower US Electric pumps are rated at 90.2 percent efficiency. Five chilled water Marathon pumps provide service to both the elementary and middle schools. These pumps, ranging in size from 20 to 50 horsepower have rated efficiencies of 91.0 percent. Although one pump is temporarily disabled for repairs overall all pumps are in excellent condition and have sufficiently high efficiency ratings.

Building 1 also has one split system that services a small area. Both the condenser and the evaporator appear to be new, well-maintained and in excellent condition.

The following information summarizes the equipment in the common chiller plant:

Chiller 1 & 2	CH-1, CH-2
Manufacturer:	Trane
Model:	CVHF485
Serial:	L02G12478 & L02G12193
Type:	Centrifugal, water-cooled
Capacity:	485 tons
Refrigerant:	R-22
Compressor Qty:	1
Age:	July 02
Condition:	Good
CHWS / CHWR temperature:	45 F / 54 F

Original / Current Efficiency: 1.2 kW/ton / 1.25 kW/ton
Pumps: 5 CHW pumps, 20 – 50 hp

Air Distribution

A total of 14 Trane air handling units service the campus.
Building 1 has three large Trane air handling units for the conditioning and distribute of air. These units are located in dedicated mechanical rooms and have clean, well-sealed and apparently properly designed distribution systems. The fan speed in each unit is controlled with a variable frequency drive while an Andover control system coordinates overall operation.

Building 2 has eleven large Trane air handling units to condition and distribute air throughout the facility. These units are also controlled via variable frequency drives and the Andover system. Overall the air handling units and distribution systems in both buildings are in excellent condition reflecting good workmanship and maintenance practices.

The following information summarizes the air distribution equipment.

Equipment	Location Served	Fan Motor HP
AHU-9	187	15
AHU-10	187	10
AHU-11	189	10
AHU-12	210	10
AHU-13	210	7.5
AHU-14	219	5
AHU-15	219	5
AHU-16	225	10
AHU-17	231	10
AHU-18	292	10
AHU-19	240	10
AHU-20	248	5
AHU-21	255	5
AHU-22	268	5
OAU-2	268	5

Domestic Hot Water and Miscellaneous Loads

Two gas water heaters provided hot water for the elementary and middle schools. It appears that one heater is dedicated to the elementary and one heater is dedicated to the middle school, but, due to lack of drawings at the schools, these systems may be interconnected to provide improved reliability. Both water heaters are new and in excellent condition.

EMS

An Andover system controls all start and stop operation of major HVAC equipment within Arthur Ashe Middle School. Each air handling unit and chiller is further controlled with a variable frequency drive. All control equipment is new and in excellent condition with no reported failures or operational difficulties.

Electric Service:

Electric service is currently provided by FPL at the GSLD-1 rate. One electric meter serves the entire facility. According to utility bills, this school facility consumes 4,006,400 kWh/yr for a total cost of $376,742.36 (July 2005 / May 2006).

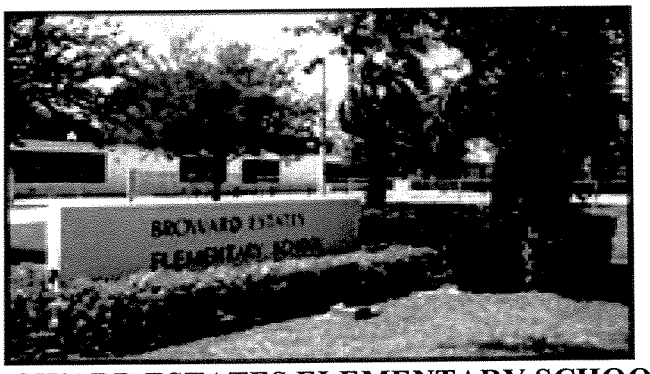
The existing school facility resulting electricity energy use index (EUI) is 25.39 kWh/sq.ft. and the energy cost index (ECI) is $ 2.38/sq.ft.

Occupancy and Equipment Schedules

Primary occupancy for the students is between 9:00a.m. - 3:30p.m., Monday through Friday. During previous years an academic camp (i.e., additional tutoring) has operated until approximately 5:00p.m. during the academic year. Due to reassignment of the principal it is unknown at this time if this academic camp will continue. Typically maintenance personnel continue to work until approximately 10:00p.m. during the academic year and approximately 5:00pm during summer.

BROWARD ESTATES ELEMENTARY SCHOOL

Existing Conditions



BROWARD ESTATES ELEMENTARY SCHOOL

History

Broward Estates Elementary School is located in Broward County, Florida. The school was originally built in 1959 and is located at 441 NW 35th Ave., Ft. Lauderdale 33311.

School Facility's Envelope

Broward Estates Elementary School is a multi-building facility built in 1959, with exception of the newly built Cafeteria.

There is approximately 87,198 square feet (sq.ft.) of usable area according to SBBC.

Enrollment consists of approximately 720 regular students and the school operational occupancy is from 8:00a.m. - 2:00p.m, Monday through Friday.

The Campus consists of 12 buildings and 7 portables. Buildings 1 – 7 houses general classrooms, building 8 is the original cafeteria, building 10 is administration and media and building 12 houses Kindergarten.

According to SBBC, there are plans for major renovations to the existing facility. Buildings 1-7 are to be demolished and replaced with a single two-story building housing several classrooms in addition to a new cafeteria.

Energy Using System

Broward County Public Schools

Lighting

Lighting, with the exception of the new Cafeteria, is provided primarily by 2-lamp x 4' and 4-lamp x 4' fluorescent fixtures with energy saving magnetic ballasts and 34-watt T-12 bulbs. There are also several incandescent lamps and high pressure sodium HID fixtures. Mercury vapor fixtures were found in the library. The existing exit signs are LED.

A detailed count and description of all existing fixtures is available in the Appendix. The lights typically operate from approximately 6:00 a.m. until 9:00 p.m. as needed by school personnel, on regular school days. Note that at the time of the analysis, the new cafeteria was under construction and this has not been included in the analysis. The fixtures identified to be installed in the new cafeteria are reportedly T-8 fixtures.

Water

An inspection of the water system at Broward Estates Elementary School indicated that the plumbing fixtures - including toilets, urinals and faucets. There are approximately 41 toilets, 4 urinals and 14 faucets which operate at 3.5 gal per flush, 1.5 gal per flush and 2.5 gal per minute respectively. In addition there is a small quantity of low flow plumbing fixtures.

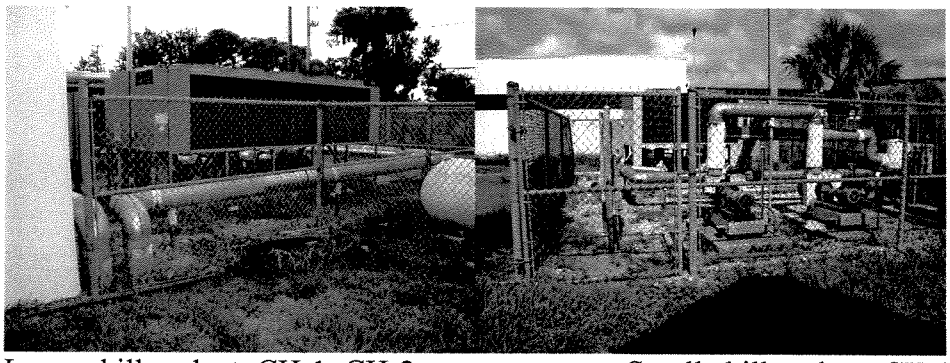
Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 2 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

Irrigation

Irrigation usage is on 1 well water system. One irrigation controller runs from the well water system. It was analyzed that this controller runs 16 irrigation zones four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

Two chiller plants provide cooling for the majority of the campus, with the exception of the 700 Building. The large chiller plant consists of chiller 1 (CH-1) and chiller 2 (CH-2) which serve Buildings 1-8 and the new Cafeteria. The small chiller plant consists of chiller 3 (CH-3) which serves the Administration and Media Building. Each chiller plant is connected to a single loop, single pump (with backup) constant volume chilled water system. Building 700 has eight (8) classrooms which contain dedicated, DX package air-conditioning units (PTACs). Each unit contains an enthalpy heat recovery wheel.



Large chiller plant: CH-1, CH-2 Small chiller plant: CH-3

The following information summarizes the equipment in the large chiller plant.

Chiller 1 & 2	**CH-1, CH-2**
Manufacturer:	Trane
Model:	RTAA1304X001A300B
Serial:	U98J03129
Type:	Air Cooled, screw compressors
Capacity:	130 tons
Refrigerant:	R-22
Compressor Qty:	2
Age:	Less than 5 years
Condition:	Good
CHWS / CHWR temperature:	45 F / 54 F
Original / Current Efficiency:	1.2 kW/ton / 1.25 kW/ton
Pumps:	(2) CHWPs w/ 30 hp motors

The following information summarizes the equipment in the small chiller plant.

Chiller 3	**CH-3**
Manufacturer:	McQuay
Model:	AGZ060AS27-ER10
Serial:	STNU001000123
Type:	Air cooled, scroll compressors
Capacity:	60 tons
Refrigerant:	R-22
Compressor Qty:	4
Age:	Compressors recently replaced
Condition	Good
CHWS / CHWR temperature:	45 F/ 54 F
Original / Current Efficiency:	1.2 kW/ton / 1.2 kW/ton
Pumps:	(2) CHWPs w/ 5 hp motors

PTAC

The following information summarizes the PTAC units serving the 700 Building.

Building 700	PTAC Units
Manufacturer:	Scholar
Model:	VAI40ACC10HGII-2000BI
Type:	DX package unit
Capacity:	3 tons
Refrigerant:	R-22
Quantity:	(8) – one per classroom
Condition	Fair
Original / Current Efficiency	1.3 kW/ton / 1.4 kw/ton

Air Distribution

The air distribution system with the exception of the 700 Building consists of constant volume (CV) air handling units (AHUs), variable air volume (VAV) AHUs and fan coil units (FCUs). Each classroom contains a FCU. The Administration Building and Old Cafeteria are served by CV chilled water AHUs, and the New Cafeteria is served by a combination of CV and VAV chilled water AHUs. All CV AHUs are equipped with F&B dampers with pneumatic actuators. Individual thermostats control each AHU and are scheduled remotely by a central energy management system (EMS). Standard low efficiency filters appear to be used throughout the facility. Heating is provided by electric strip heaters. Exhaust fans are located throughout the facility and operate on the same schedule as the AHUs. With the exception of the New Cafeteria units, the existing AHUs are over 10 years old but are in relatively good operating condition and are not recommended for replacement due to economic feasibility.

The following information summarizes the air distribution equipment.

Equipment	Location Served	Fan Motor HP
AHU-1	Old Cafeteria	15
AHU-2	Kindergarten	5
AHU-3	Media	5
AHU-4	Building 1	5
AHU-5	Administration	5
AHU-6	New Kitchen	5
AHU-7	New Cafeteria	15
(5) FCUs	Building 1 – Classrooms	1/3 hp each
(4) FCUs	Building 2 – Classrooms	1/3 hp each
(4) FCUs	Building 3 – Classrooms	1/3 hp each
(4) FCUs	Building 4 – Classrooms	1/3 hp each

(4) FCUs	Building 5 – Classrooms	1/3 hp each
(3) FCUs	Building 6 - Classrooms	1/3 hp each

Domestic Hot water and Miscellaneous Loads

Hot water for the kitchen is provided by an electric hot-water heater with a 100-gallon storage tank. Domestic hot water for the rest of the school is supplied by multiple small electric hot-water heaters. All of the water heating equipment is in good condition and appears to be operating efficiently. With the exception of the kitchen, hot water usage at the facility is minimal.

Miscellaneous electrical equipment consists of computers, office equipment, teaching equipment, kitchen cooking equipment, water coolers, etc.

EMS

The existing energy management system (EMS) consists of several types of manufactures. Multiple vendors have installed EMS equipment throughout the school's history including Siebe, Honeywell, Johnson Controls, and Andover. The current operating system is provided by Andover. The Andover system operates all HVAC equipment with the exception of the 700 Building. The 700 Building equipment is controlled by individual programmable thermostats (T-Stats). The Andover EMS currently schedules the HVAC equipment to operate from approximately 6:00 a.m. 9:30 p.m. Monday through Friday.

Electric Service

Electric service is currently provided by FPL at the GSLD-1 and GSD-1 rate. Two electric meters serves the entire facility; one for the main campus and one for the portable classrooms. According to utility bills, this school facility consumes 2,142,074 kWh/yr for a total cost of $188,685 (June 2005 / May 2006).

The existing facility resulting electricity energy use index (EUI) is 24.56 kWh /sq.ft. and the energy cost index (ECI) is $2.27/sq.ft.

Occupancy and Equipment Schedules

Primary occupancy for the students is between 7:30 a.m. and 2:30 p.m. Teachers work from approximately 7:10 a.m. until 2:40 p.m., while the administration staff works from approximately 6:30 a.m. until 6:00 p.m. Custodians/operators are present from 6:00 a.m. until 9:30 p.m.

FLORANADA ELEMENTARY SCHOOL

Existing Conditions

FLORANADA ELEMENTARY SCHOOL

History

Floranada Elementary School is located in Broward County Florida. The school was built in 2000 to replace another elementary school at the same location. The campus is located at 5251 NE 14th Way, Fort Lauderdale.

School Facility's Envelope

This two-story, brick facility is structurally in good condition. Although technically this campus has two buildings in effect a single, two-story building contains the bulk of classrooms and administration spaces. The second building is a single-story structure containing a physical education office and storage area. According to the SBBC approximately 106,937 square feet (sqft) of usable space is available at Floranada Elementary.

Enrollment consists of 813 elementary students and normal hours of operation are from 8:00 a.m. to 2:00 p.m., Monday through Friday. An after school program runs from 2:00 p.m. to 6:00 p.m. and custodian staff hours are from 6:00 a.m. to 10:00 p.m. Monday through Friday.

Energy Using System

Broward County Public Schools

Lighting

Nearly all the lighting in the school utilizes T8 fixtures with electronic ballasts. During the lighting survey school personnel noted that they are experiencing significant failure in lamps and ballasts. This failure rate may be due to incompatibility of the lamps and ballasts with frequent switching cycles caused by the occupancy sensors. Existing exit signs use LED technology.

Since the only economic payback associated with replacement of the electronic ballast may be uncertain operational savings related to

reduction of the frequent ballast failure SIEMENS is not suggesting any changes to the ballast at this time. We do recommend, however, that all existing T8 lamps be replaced with more efficient FO28/841/XP/ECO lamps. Siemens cannot meet the economic criteria of the district for this project to include replacing the ballasts at this school to correct this problem.

Water

An inspection of the water system at Arthur Ashe Middle School indicated that the plumbing fixtures - including toilets, urinals and faucets all used valves that had properly sized flow rates There are approximately 60 toilets, 2 urinals and 32 faucets which operate at 1.6 gal per flush, 1.0 gal per flush and 0.5 gal per minute respectively.

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 3 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

Irrigation

Irrigation usage is divided by 1 city water system and well system. The majority of irrigation is well water. One irrigation controller runs from the city water system. It was analyzed that this controller runs 6 irrigation zones five days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

One irrigation controller runs from the well water system. It was analyzed that this controller runs 40 irrigation zones five days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

The larger of the two buildings, Building number one, is primarily cooled through the use of one rotary Trane air-cooled chillers. This 300 ton chiller uses three compressors and is in fairly good condition. Two 20 horsepower chilled water pumps provide circulation for the chilled water system and, due to a more exposed position, are in good to moderate good condition.

Information about the chillers follows:

Chiller 1	**CH-1**
Manufacturer:	Trane
Model:	RTAA3004XT01A3008FG
Serial:	U99H00342
Type:	air-cooled rotary

Capacity:	300 tons
Refrigerant:	R-22
Compressor Qty:	2
Age:	Approx 6 years
Condition:	Good
CHWS / CHWR temperature:	45 F / 54 F
Original / Current Efficiency:	1.0 kW/ton / 1.1 kW/ton
Pumps:	2 CHW pumps, 20 hp

Building one also has four relatively new condensing units located on the roof. These units are part of the split systems that service several isolated areas within the facility. All the condensing units are new and in excellent condition.

Equipment	Manufacturer	Model	Capacity	Condition
RTU	Trane	THCO72A3RCADYBOA	6 Tons	Good
RTU	Rheem	RRCF075CK	7.5 Tons	Moderate
RTU	Trane	TCH181C300BA	18 Tons	Excellent
RTU	Trane	TCH181C300BA	18 Tons	Excellent
RTU	Trane	THC120ASEOA1Y	12 Tons	Excellent

Although the cooling equipment in the physical education building was not physically examined due access difficulty in the storage area it is reported to be small, serviced by the chilled water and in good condition.

Air Distribution

A total of eighteen air handling units use chilled water to cool the facilities. Many of these units are located in exterior mechanical rooms that service both first and second floor areas. Several other units are located within interior mechanical rooms. All of these units are in either good or excellent condition.

The air duct system also appears to be in excellent condition. Those ducts which transit exterior mechanical rooms are well-insulated and appear to be well sealed.

The following information summarizes the air distribution equipment:

Equipment	Location Served	Fan Motor HP
AHU 1-1	163	3
AHU 1-2	154	3
AHU 1-3	166	3
AHU 1-4	145	3

AHU 1-5	132	5
AHU 1-6	128	3
AHU 1-7	166	5
AHU 1-8	147	5
AHU 1-9	147	1.5
AHU 1-10	125	2
AHU 1-11	125	2
AHU 1-12	125	5
AHU 1-13	163	5
AHU 1-14	154	3
AHU 1-15	147	5
AHU 1-16	145	7.5
AHU 1-17	132	7.5
AHU 1-18	128	7.5
CU-1	Roof	1/6
CU-2	Roof	1/6
CU-3	Roof	1/6
CU-4	Roof	¼

Domestic Hot water and Miscellaneous Loads

Most domestic hot water is provided by a distributed system of electric hot water heaters. Cooking requirements for hot water are satisfied by a propane hot water heater located adjacent to the kitchen. All hot water heaters are in good condition.

EMS

All air handling units and the chiller operation are centrally controlled with an Andover system. This digital control system is reported to work well and appears to be in excellent condition.

Electric Service

Electric service is currently provided by FPL at the GSLD-1 and OL-1 rate. Two electric meters serves the entire facility. According to utility bills, this school facility consumes 1,572,072 kWh/yr for a total cost of $161,908 (June 2005 / May 2006).

The existing school facility resulting electricity energy use index (EUI) is 14.70 kWh/sqft and the energy cost index (ECI) is $1.51/sqft.

Occupancy and Equipment Schedules

Enrollment consists of 813 elementary students and normal hours of operation are from 8:00 a.m. to 2:00 p.m., Monday through Friday. An after school program runs from 2:00 p.m. to 6:00 p.m. and custodian staff hours are from 6:00 a.m. to 10:00 p.m. Monday through Friday.

JAMES RICKARDS MIDDLE SCHOOL

EXISTING CONDITIONS

History

James Rickard Middle School is located in Broward County Florida. The school is located at 6000 NE Ninth Ave., Oakland Park, FL 33334.

School Facility's Envelope

James Rickard Middle School has a two-story building and a modular building as part of its campus. The two-story building houses the administration, the classrooms, cafeteria and the gymnasium. The modular buildings are used mainly for classrooms. There is approximately 156,823 square feet of usable area with an enrollment of 994 according to the latest SBBC information.

Energy Using System

Broward County Public Schools

Lighting

This school has a combination of T8/Electronic fixtures and T12/Magnetic fixtures, with some fixtures controlled by occupancy sensors. The exit signs are predominantly compact fluorescent technology although some incandescent exit signs remain. All public places must have exit signs and they are usually red. They are located high on the wall and direct you to an exit. Incandescent fixtures have high wattage lamps that have a relatively short life and require replacement several times each year.

SIEMENS proposes to replace the existing lighting systems with high efficient lighting. The existing T8 and T12 fixture types will be retrofitted with Sylvania FO28/841/XP/ECO lamps and QHE (High Efficiency) Low Power ballasts, tandem wiring where applicable. Fixtures currently controlled by motion sensors will utilize a Sylvania Extreme programmed start ballast designed for frequent switching cycles. 2x2' U-bend fixtures will be retrofit with a reflector socket kit to accommodate 3-FO17/841XP/ECO (2'linear) lamps and QHE Low Power ballast. Incandescent exit signs will be replaced with new LED

battery backup exit signs. 1000W metal halide gym fixtures will be replaced on a two-for-one basis with a 4 lamp Pentron T5HO fixture, complete with lens and wire guard. 300W incandescent gym fixtures will be replaced on a one-for-one basis with a 2 lamp Pentron T5HO fixture, complete with lens and wire guard.

Water

An inspection of the water system at James Rickards Middle School indicated that the plumbing fixtures - including toilets, urinals and faucets. There are approximately 57 toilets, 29 urinals and 64 faucets which operate at 3.5 gal per flush, 1.5 gal per flush and 2.5 gal per minute respectively. In addition, there are a small number of low flow plumbing fixtures.

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 3 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

Irrigation

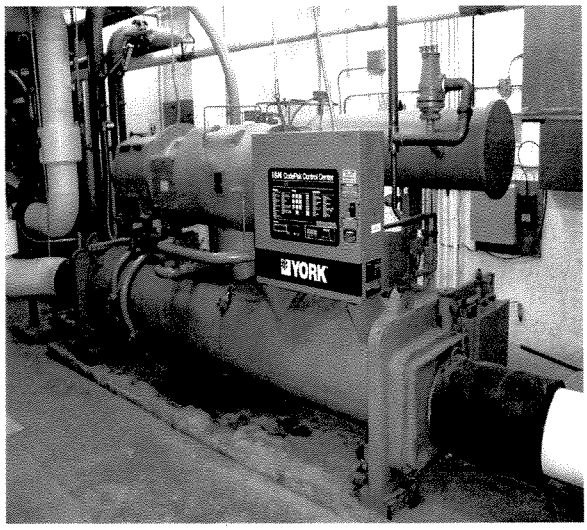
Irrigation usage is divided between one system with city water and another on Well.

One irrigation controller runs from the city water system. It was analyzed that this controller runs 12 irrigation zones seven days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

One irrigation controller runs from the well water system. It was analyzed that this controller runs 12 irrigation zones seven days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

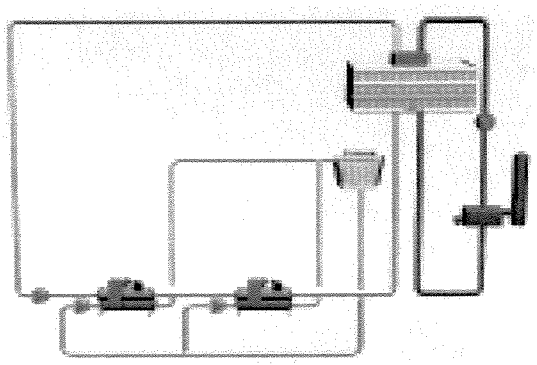
Cooling

There are two water-cooled chillers and a cooling tower at James Rickard Middle School.



York Chiller in Series with a Carrier Chiller at James Rickards

These chillers provide cooling for the entire school building. One chiller is a 200-ton Carrier and the other is a York chiller whose model number is YSBBBS1-CHB. These chillers use R-22 as the refrigerant. The two chillers are in series.



Typical Series Chiller Arrangement

The chillers are in series to optimize their performance for the specific design conditions of the application. Series chillers have single pass evaporator arrangements, which can lead to higher evaporator pressure drops. The total chilled water system pressure drop for series chillers is determined by adding the chiller pressure drops, usually resulting in a higher pressure drop than a parallel arrangement.

The condensers are piped in series counter flow to the chilled water. This arrangement enhances the chiller performance by "cascading" the chillers. The Carrier chiller has a smaller lift because it sees the return chilled water. The York chiller has a higher lift because it cools the water to 42 °F. Since both chillers have the same discharge pressure requirements (dictated by using 85 °F - 95 °F condenser water) the chiller

lifts are different.

Main Chiller Plant	**CH-1**
Manufacturer:	York
Model:	YSBBBS1-CHB
Serial:	
Type:	Water cooled
Capacity:	200 tons
Refrigerant:	R-22
Compressor Qty:	1
Age:	Median
Condition:	Fair
CHWS / CHWR temperature:	44 F / 54 F
Original / Current Efficiency:	0.6 kW/ton / 0.65 kW/ton
Primary CHWP motor	10 hp motors

Main Chiller Plant	**CH-2**
Manufacturer:	Carrier
Model:	23XL1011EC40
Serial:	
Type:	Water cooled
Capacity:	200 tons
Refrigerant:	R22
Compressor Qty:	1
Age:	Old
Condition:	Fair
CHWS / CHWR temperature:	44 F / 54 F
Original / Current Efficiency:	0.7 kW/ton / 0.9 kW/ton
Primary CHWP motor	10 hp motors

The cooling towers are made by Evapco and are located outside behind the gym. The cooling towers have no VFDs. The modular buildings have wall-mounted heat pumps manufactured by BARD that condition them. These wall units have occupancy sensors.

Air Distribution

Several chilled water air handling units are located in the mechanical room and some are located in the gym.

Location	Facility Use	Tag	Manufacturer	Model Number	Comment	Controls
Mechanical Rm		AHU-1	Thermal Engineering Corp.	CP312-7	Good condition	Andover Controls
Mechanical Rm		AHU-2	Thermal Engineering Corp.	CP312-7	Good condition	Andover Controls
Mechanical Rm		AHU-3	Thermal Engineering Corp.	CP312-7	Good condition	Andover Controls
Mechanical Rm		AHU-4	Thermal Engineering Corp.	CB322-7	Good condition	Andover Controls
Mechanical Rm		AHU-5	Thermal Engineering Corp.	CP-212-V	Good condition	Andover Controls
Mechanical Rm	Administartion	AHU-6	Thermal Engineering Corp.	CP312-7	Good condition	Andover Controls
Mechanical Rm	Media Ctr. /Back Office	AHU-7	Thermal Engineering Corp.	CP312-7	Good condition	Andover Controls
Mechanical Rm		AHU-8	Thermal Engineering Corp.	CP-212-V	Good condition	Andover Controls
Mechanical Rm	Cafeteria/ Assembly	AHU-9	Thermal Engineering Corp.	CP312-7	Good condition	Andover Controls
Mechanical Rm	Home Economics	AHU-10	Thermal Engineering Corp.	CP-411-H	Good condition	Andover Controls
Mechanical Rm		AHU-11	Thermal Engineering Corp.	CP312-7	Good condition	Andover Controls
Gym	Gym	AHU-12	Thermal Engineering Corp.	CP-212-V	Good condition	Andover Controls
Gym	Gym	AHU-13	Thermal Engineering Corp.	CP-212-V	Good condition	Andover Controls
Mechanical Rm	Kitchen	AHU-14	Dunham-Bush	VCS10LF3437703	Good condition	

These AHUs are all constant volume and of varying sizes. With the exception of the Gym AHUs, all the other air-handlers are located in the mechanical room. All CV AHUs are equipped with dampers with pneumatic actuators. Individual thermostats control each AHU and are scheduled remotely by a central energy management system (EMS).

Domestic Hot water and Miscellaneous Loads

The propane-fired Superior boiler is used for hot-water only. This boiler has a capacity of 6,107 Btuh. Most of the equipment is in a fairly good condition. There are many computers throughout the school and other office electric equipment which are used regularly, thereby adding a lot of electric load. The transformers are standard distribution dry-type transformers which are located in the mechanical rooms. These transformers are not "K-rated" transformers.

EMS

The EMS in this building is Andover Controls. This provides scheduling for all the mechanical equipment including exhaust fans.

Electric Service:

Electric service is currently provided by FPL at the GSLD-1 and GSD-1 rate. Two electric meters serves the entire facility. According to utility bills from July 2005 to June 2006, this school facility consumes 2,703,830 kWh per year for a total cost of $252,541. The existing school facility resulting electricity energy use index (EUI) is 17.24 kWh per square feet and the energy cost index (ECI) is $1.61 per square feet.

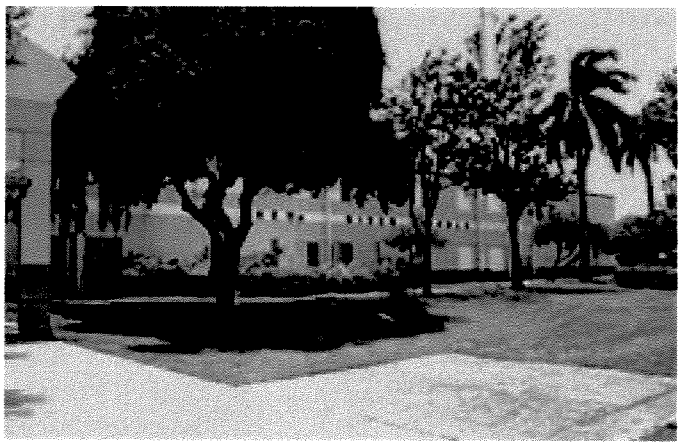
Occupancy and Equipment Schedules

Primary occupancy and equipment schedules are as shown below:

Function	Weekdays	Start/Stop Times
Students	M - F	9:15 am – 3:45 pm
HVAC	M - F	5:00 am – 10:00 pm

Exhaust Fans	M - F	8:00 am – 6:00 pm
OA Dampers	M - F	8:00 am – 6:00 pm

NEW RIVER MIDDLE SCHOOL



New River Middle School

Existing Conditions

History

New River Middle School is located in Broward county, Florida. In 1960-61 New River Middle School students moved into their new school to 3100 Riverland Rd., Ft. Lauderdale, FL 33312.

School Facility's Envelope

New River Middle school is composed of three buildings. There are two, 2-story buildings and one, 1-story building. The one-story building houses the cafeteria and the gymnasium. All the classrooms, the library and the administration offices are the two, 2-story buildings. There is approximately 198,558 square feet of usable area according to SBBC.

Enrollment consists of approximately 1486 regular students and the school operational occupancy is from 9:15a.m. - 3:45p.m., Monday through Friday.

Energy Using System

Broward County Public Schools

Lighting

Existing lighting systems utilizes T8 lamps and Electronic Ballast. In addition, compact fluorescent lamps and HID fixtures are in operation. Lighting systems were found to be in good working order and providing sufficient illumination.

The proposed system will include the retrofit of all T8 lamps to Sylvania's 28w T8 lamp and QHE series Electronic Ballast. Compact Fluorescent and HID systems will remain as is. HID fixtures located in the Gym will be replaced with Fluorescent High Bay fixtures.

Water

An inspection of the water system at New River Middle School indicated that the plumbing fixtures - including toilets, urinals and faucets – used valves that had properly sized flow rates. There are approximately 70 toilets, 20 urinals and 70 faucets which operate at 1.6 gal per flush, 1.0 gal per flush and .5 gal per minute respectively.

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 2 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

In a cooling tower, water is lost through the evaporative cooling process. To replace lost water and maintain cooling function, makeup water must be added to the cooling tower system. The makeup meter tracks the amount of water that passes through the meter as it goes to the cooling tower. The blow-down meter tracks the amount of water leaving the cooling tower before it actually enters the City's wastewater system. These meters allow facilities to save money by allowing the customer to pay only for the wastewater that reaches the wastewater system.

The cooling tower at New river middle school does not currently have the capability to separately meter the make up or blow down water consumption.

Irrigation

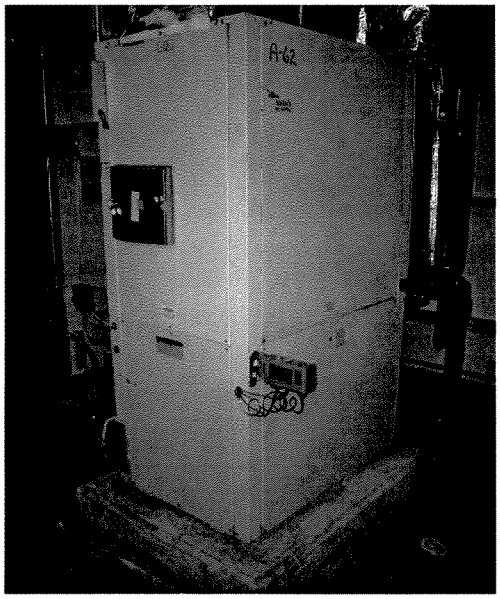
Irrigation usage is divided between one system with city water and another on Well. One irrigation controller runs from the city water system. It was analyzed that this controller runs 20 irrigation zones four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

One irrigation controller runs from the well water system. It was analyzed that this controller runs 12 irrigation zones four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

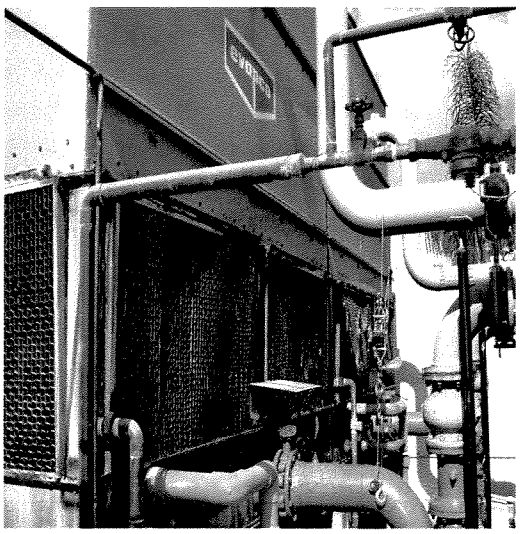
New River Middle School has thirty-seven (37) water source heat pumps throughout the facility. The heat pumps range from 94,000 Btuh to 260,000 Btuh with EER ratings ranging from 19 to 25. The water source heat pump systems are for boiler/tower (water loop) applications. Water Source Heat Pump (WSHP) systems are one of the most efficient, environmentally friendly ways to heat and cool buildings because of their

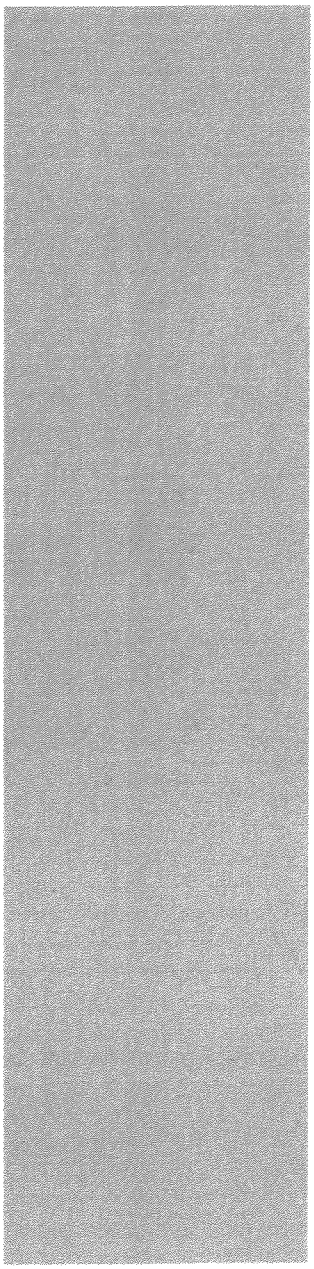
ability to move energy from where it is not needed to where it is needed.



Typical Water-Source Heat Pump at New River Middle

High-efficiency, self-contained Climate Master WSHP units have been placed in virtually any location within the building and connected via a water loop. Heat is added and rejected from the loop using a boiler and a cooling tower. Each unit responds only to the heating or cooling load of the individual zone it serves. The cooling tower is an Evapco whose nominal capacity is 696.4 tons. The cooling tower is located outside Building 3 which houses the cafeteria and gym. The coils on this cooling tower have been heavily corroded. The condenser water pumps have been rebuilt recently.





New River Middle School Cooling Tower

Below is a Table showing the various heat pumps at New River Middle.

Tag	Manufacturer	Model Number	Description	Cooling (btuh)	Tons	EER
HP-1	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-2	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-3	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-4	Climate Master	MV260FSD	Water Source	260,000	22	19
HP-5	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-6	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-7	Climate Master	MV094FSD	Water Source	94,000	8	25
HP-8	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-9	Climate Master	MV122FSD	Water Source	122,000	10	25
HP-10	Climate Master	MV122FSD	Water Source	122,000	10	25
HP-11	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-12	Climate Master	MV180FSD	Water Source	180,000	15	25
HP-13	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-14	Climate Master	MV260FSD	Water Source	260,000	22	19
HP-15	Climate Master	MV180FSD	Water Source	180,000	15	25
HP-16	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-17	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-18	Climate Master	MV260FSD	Water Source	260,000	22	19
HP-19	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-20	Climate Master	MV180FSD	Water Source	180,000	15	25
HP-21	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-22	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-23	Climate Master	MV260FSD	Water Source	260,000	22	19
HP-24	Climate Master	MV220FSD	Water Source	220,000	18	20
HP-25	Climate Master	MV220XSD	Water Source	220,000	18	20
HP-26	Climate Master	MV220XSD	Water Source	220,000	18	20
HP-27	Climate Master	MV122XSD	Water Source	122,000	10	25
HP-28	Climate Master	MV220XSD	Water Source	220,000	18	20
HP-29	Climate Master	MV180XSD	Water Source	180,000	15	25
HP-30	Climate Master	MV260XSD	Water Source	260,000	22	19
HP-31	Climate Master	MV260XSD	Water Source	260,000	22	19
HP-32	Climate Master	MV260XSD	Water Source	260,000	22	19
HP-33	Climate Master	MV260XSD	Water Source	260,000	22	19
HP-34	Climate Master	MV220XSD	Water Source	220,000	18	20
HP-35	Climate Master	MV220XSD	Water Source	220,000	18	20
HP-36	Climate Master	MV260XSD	Water Source	260,000	22	19
HP-37	Climate Master	MV220FSD	Water Source	220,000	18	20
					660	

Air Distribution

The air distribution system consists of constant volume (CV) AHUs. All the AHUs are in the ceiling which made it difficult to access them to obtain equipment data. All CV AHUs are equipped with dampers with pneumatic actuators.

Domestic Hot water and Miscellaneous Loads

There are two natural gas boilers used for heating and domestic hot water. The boilers are both made by Jarco. One boiler has a capacity of 970,000 Btuh and the other has a capacity of 1,200,000 Btuh. A Lochnivar 118-gallon electric hot-water heater also provides domestic hot water for New River Middle School.

There are many computers throughout the school and other office electric equipment which are used regularly, thereby adding a lot of electric load. The transformers are standard distribution dry-type transformers which are located in the mechanical rooms. These transformers are not "K-rated" transformers. A DMT emergency generator provides up-to 200

kW.

EMS

Individual thermostats control each AHU and are scheduled remotely by a central energy management system (EMS). Standard low efficiency filters appear to be used throughout the facility.

Electric Service:

Electric service is currently provided by FPL and the rate is GSLD-1. One electric meter serves the entire facility. According to utility bills from July 2005 to June 2006, this school facility consumes 3,818,760 kWh per year for a total cost of $343,066.

The existing school facility resulting electricity energy use index (EUI) is 19.23 kWh per square feet and the energy cost index (ECI) is $1.72 per square feet.

Occupancy and Equipment Schedules

Primary occupancy for the students is between 9:15 a.m. - 3:45 p.m., Monday through Friday.

Primary occupancy and equipment schedules are as shown below:

Function	Weekdays	Start/Stop Times
Students	M - F	9:15 am – 3:45 pm
HVAC	M - F	5:30 am – 10:00 pm
Exhaust Fans	M - F	7:00 am – 4:00 pm
OA Dampers	M - F	6:45 am – 4:30 pm

NORTHEAST HIGH SCHOOL

Northeast High School

EXISTING CONDITIONS

History

Northeast High School is located in Broward County, Florida. The school was built in 1971 and is located at 700 NE 56th St., Oakland Park, FL 33334.

School Facility's Envelope

Northeast High School is multi-building facility including some modular buildings and portables. The modular buildings are new additions to the school. Northeast High school has an Olympic size pool and a football & baseball field. Most of the classrooms provide technical training in woodwork, automotive, music, HVAC and other trades.

There is approximately 271,906 square feet (sq.ft.) of usable area according to SBBC. Enrollment consists of approximately 2,016 regular students and the school operational occupancy is from 7:40a.m. - 2:40p.m, Monday through Friday.

Energy Using System

Broward County Public Schools

Lighting

Existing lighting systems utilizes T12 lamps and Magnetic Ballast, however some T8 lamps and electronic ballast were identified. In addition, compact fluorescent, incandescent and HID fixtures were identified. Emergency lighting systems was identified by school staff as trouble-some as it remain on 24/7. This system utilizes compact fluorescent lamps either mounted inside existing fixtures or in stand alone units. Many fixtures were found to be in poor condition.

Water

An inspection of the water system at Northeast High School indicated that the plumbing fixtures - including toilets, urinals and faucets. There are approximately 101 toilets, 58 urinals and 97 faucets which operate at 3.5 gal per flush, 1.5 gal per flush and 2.5 gal per minute respectively.

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 2 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

Water consumption charges are based on meter readings placed at an entry point to the site. The utility calculates sewer charges from these same meter readings based on the assumption that water entering a site will exit the site through the sewer. Although these cooling towers consume large amounts of water for operation, only about 10% of the water returns to the sewer system while the remaining 90% evaporates from the towers. This breakdown equates to a 10:1 reduction of water consumed versus water entering the sewer system.

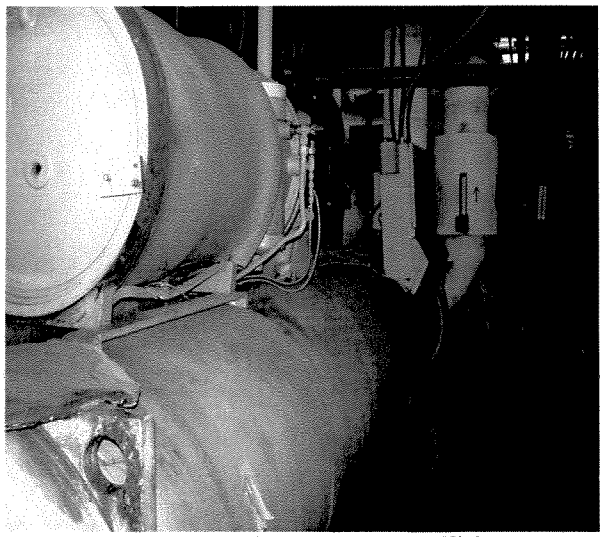
No separate meter currently exists to document the amount of water evaporating. As a result, several charges are being assessed to the full amount of water consumed by the tower. The installation of a separate meter will result in saving these sewer charges.

Irrigation

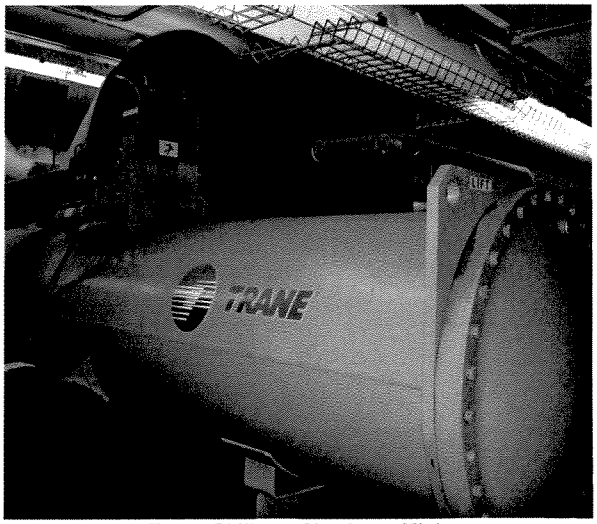
Irrigation usage has 4 systems all supplied by Well.
One irrigation controller runs from the city water system. It was analyzed that this controller runs 44 irrigation zones four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

About seventy-five percent of the campus is conditioned by a chiller and heating plant located in the mechanical room in the building that houses the cafeteria. There are two chillers, one 500-ton Trane water cooled chiller and a 350-ton water cooled Westinghouse chiller. The Trane chiller looks new and has a VFD whereas the Westinghouse chiller is obsolete and uses R-11 as its refrigerant. The Trane chiller is able to provide cooling for the stated area of the campus, whereas the Westinghouse chiller alone cannot provide enough cooling for the same area.



Westinghouse Chiller at Northeast High



Trane Chiller at Northeast High

The Table below shows the specifications for the two chillers at Northeast High school.

Main Chiller Plant	**CH-1**
Manufacturer:	Trane
Model:	CVHF485
Serial:	
Type:	Water cooled
Capacity:	500 tons
Refrigerant:	R-123
Compressor Qty:	1
Age:	3 or 4 yrs
Condition:	Good
CHWS / CHWR temperature:	44 F / 54 F

Original / Current Efficiency:	0.47 kW/ton / 0.49 kW/ton
Primary CHWP motor	50 hp motors

Main Chiller Plant	**CH-2**
Manufacturer:	Westinghouse
Model:	No nameplate
Serial:	
Type:	Water cooled
Capacity:	Approximately 350 tons
Refrigerant:	R22
Compressor Qty:	1
Age:	Old
Condition:	Very Bad
CHWS / CHWR temperature:	44 F / 54 F
Original / Current Efficiency:	0.7 kW/ton / 0.9 kW/ton
Primary CHWP motor	25 hp motors

Building 85 has wall mounted heat pumps manufactured by BARD. They are all 3.5 ton units with a standard barometric fresh air damper. These units also have occupancy sensors. Below is a list of these BARD units.

Location	Facility Use	Quantity	Make	Model No.	Tons	Voltage	Phase
Bldg 85	Classroom Portables	10	BARD	WA424DA	3.5	230	1

Building 3 has packaged rooftop DX units. These units only cool a third of the building as the other two-thirds is cooled by the main chiller plant. Two of the three units are fairly new with a manufacturing date of year 2002. The Carrier unit is the oldest and has reached its end of useful life. Below is a table showing the specifications of these units.

Location	Facility Use	Tag	Manufacturer	Model Number	V/P/F	Mfg Date	Capacity (tons)	Cooling Capacity (Btu/hr)	EER	Nominal CFM
Bldg 3	Classrooms	RTU 3-1	Trane	TSC090A3RO	208/3/60	Mar-2002	7.5	95,000	10.1	3,000
Bldg 3	Classrooms	RTU 3-2	Carrier	39ER11	208/3/60	Obselete	10	120,000	8	4,600
Bldg 3	Classrooms	RTU 3-3	Trane	TSC090A3RO	208/3/60	Mar-2002	7.5	95,000	10.1	3,000
							25			

The cooling towers are metered and have variable frequency drives (VFDs). The modular buildings have wall-mounted air-conditioning units and the portables as well.

Air Distribution

Various buildings' air-handling units have VFDs on the supply and return fans. Below is a list of all the air-handling units at Northeast High.

Location	Facility Use	Tag	Manufacturer	Model Number	Description	Comment	Capacity (Btuh)	Controls
Bldg 1	Admin & Class	AHU 1-1	York	CS217SHMP	On ABB VFDs	Good Condition	217,000	Barber Colman
Bldg 1	Admin & Class	AHU 1-2	York	CS2174SHMP	On ABB VFDs	Good Condition	217,400	Barber Colman
Bldg 1	Admin & Class	AHU 1-3	York	CS113FOCB	On ABB VFDs	Good Condition	113,000	Barber Colman
Bldg 1	Admin & Class	AHU 1-4	York	CS2217SHMP	On ABB VFDs	Good Condition	221,700	Barber Colman
Bldg 1	Admin & Class	AHU 1-5	York	CS156SVLP		Good Condition	156,000	
Bldg 1	Admin & Class	AHU 1-6	York	CS32SVLP		Good Condition	32,000	
Bldg 1	Admin & Class	AHU 1-7	York	CS270SHMP	On ABB VFDs	Good Condition	270,000	Barber Colman
Bldg 1	Admin & Class	AHU 1-8	York	CS217SHMP	On ABB VFDs	Good Condition	217,000	Barber Colman
Bldg 2	Café/Kitchen/	AHU 2-1	York			Could not access		
Bldg 2	Café/Kitchen/	AHU 2-2	York	CS217SHMP		Good Condition	217,000	
Bldg 2	Café/Kitchen/	AHU 2-3	York			Could not access		
Bldg 2	Café/Kitchen/	AHU 2-4	York	CS74SVLB		Good Condition	74,000	
Bldg 2	Café/Kitchen/	AHU 2-5	York	CS50SVFCLP		Good Condition	50,000	
Bldg 2	Café/Kitchen/	AHU 2-6	York	CS50SVFCLP		Good Condition	50,000	
Bldg 2	Café/Kitchen/	AHU 2-7	York	CS50SVFCLP		Good Condition	50,000	
Bldg 2	Café/Kitchen/	AHU 2-8	York	CS50SVFCLP		Good Condition	50,000	
Bldg 3	Classrooms	AHU 3-1	York	CS113SBMP	On ABB VFDs	Good Condition	113,000	Barber Colman
Bldg 3	Classrooms	AHU 3-2	York	CS113SBMP	On ABB VFDs	Good Condition	113,000	Barber Colman
Bldg 3	Classrooms	AHU 3-3	York			Good Condition		
Bldg 3	Classrooms	AHU 3-4	York			Good Condition		
Bldg 4	Auditorium	AHU 4-1	York	CS113SVFCLP	On ABB VFDs	Good Condition	113,000	Barber Colman
Bldg 4	Auditorium	AHU 4-2	York	CS74SVFCLP	On ABB VFDs	Good Condition	74,000	Barber Colman
Bldg 4	Auditorium	AHU 4-3	York	CS74FOFCLP	On ABB VFDs	Good Condition	74,000	Barber Colman
Bldg 4	Auditorium	AHU 4-4	York	CS113SHFCLP	On ABB VFDs	Good Condition	113,000	Barber Colman
Bldg 5	Band Rooms	AHU 5-1	York	CS113FOFCLP		Good Condition	113,000	
Bldg 5	Band Rooms	AHU 5-2	York	CS74FOFCLP		Good Condition	74,000	
Bldg 5	Band Rooms	AHU 5-3	York	CS32SVFCLP		Good Condition	32,000	
Bldg 5	Band Rooms	AHU 5-4	Trane	CCDB10S30M		Good Condition	10,000	
Bldg 6	Gym	AHU 6-1	Bohn			Could not access		
Bldg 6	Gym	AHU 6-2	Bohn			Could not access		
Bldg 8	Weights/Maine	AHU 8-1				No nameplate		
Bldg 8	Weights/Maine	AHU 8-2				No nameplate		
Bldg 9	Classrooms	AHU 9-1	York	CS32SHFCLP	On ABB VFDs	Good Condition	32,000	Barber Colman
Bldg 9	Classrooms	AHU 9-2	York	CS50FOFCLP	On ABB VFDs	Good Condition	50,000	Barber Colman
Bldg 9	Classrooms	AHU 9-3	York	CS74SHFCLP	On ABB VFDs	Good Condition	74,000	Barber Colman
Bldg 10	Classrooms	AHU 10-1	York	CS156SVMP	On ABB VFDs	Good Condition	156,000	Barber Colman
Bldg 10	Classrooms	AHU 10-2	York	CS217SHMP	On ABB VFDs	Good Condition	217,000	Barber Colman
Bldg 10	Classrooms	AHU 10-3	York	CS217SHMP	On ABB VFDs	Good Condition	217,000	Barber Colman
Bldg 10	Classrooms	AHU 10-4	York	CS113SVMP	On ABB VFDs	Good Condition	113,000	Barber Colman
Bldg 10	Classrooms	AHU 10-5	York	CS113SVMP	On ABB VFDs	Good Condition	113,000	Barber Colman
Bldg 11	Classrooms	AHU 11-1	York	CS156SVMP	On ABB VFDs	Good Condition	156,000	Barber Colman
Bldg 11	Classrooms	AHU 11-2	York			No nameplate		
Bldg 17	Media Ctr/Libr	AHU 17-1	Trane	CC21530M	On ABB VFDs	Good Condition	215,300	Barber Colman
Bldg 17	Media Ctr/Libr	AHU 17-2	Trane	CCDB12530M	On ABB VFDs	Good Condition	125,300	Barber Colman
Bldg 17	Media Ctr/Libr	AHU 17-3	Trane	CCDB12530M		Good Condition	125,300	
Bldg 20	Press Box	AHU 20-1	Trane	MCCA003GA40B		Good Condition	3,000	

VFDs operate by converting the incoming AC power to a DC signal and then re-transmitting the power signal to the motor at varying frequencies and voltages. VFDs can operate rotating equipment at speeds ranging from nearly 0 RPM to as high as 150 percent of the rated speed for the motor. The use of a frequency drive requires installing high-efficiency Class F insulated motors that can withstand the variations in voltage and current flux. These VFDs are primarily being used to control air supply to multiple zones and isolation dampers in zones with different occupancy and operating schedules. Below is a schematic of VFD installation.

$$W2=W1\times(Q2/Q1)^3$$

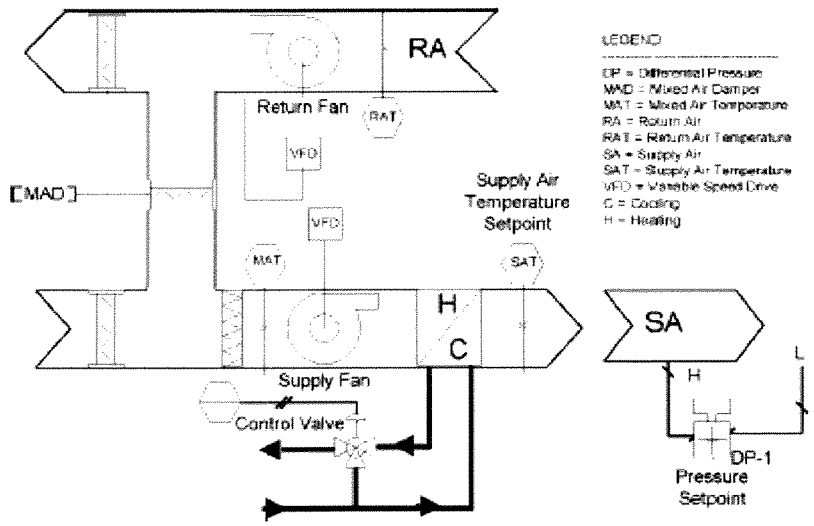


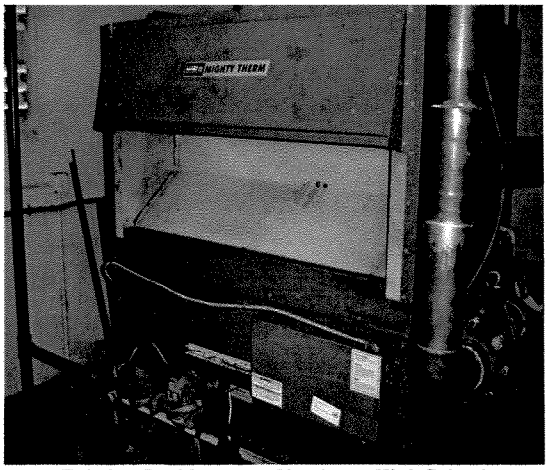
Figure 2 – Schematic of VFD Installation

Domestic Hot water and Miscellaneous Loads

There are different boilers throughout the campus. The boilers in the mechanical room are used for providing hot water to the kitchen. Others are electrical water heaters that provide hot water to the locker rooms and other hot water needs of various buildings. Below is a list of the boilers at Northeast High.

Location	Facility Use	Manufacturer	Model No.	Capacity	Gallons	Mfg Date
Bldg 2	Café/Kitchen/M	Fulton	TCS-20	840,000		1998
Bldg 2	Café/Kitchen/M	JARCO	AJH35	350,000		1994
Bldg 8	Classrooms	AO Smith	BTP150-400	400,000	150	

The pool has propane-fired boilers used for heating. Northeast High also has an outdoor pool which 83 ft by 75 ft. This pool is used all year round. The pool is heated by Laars Mighty Therm propane-fueled boiler with an output of about 1,639,918 Btu/hr and a maximum water temperature of 240°F.



Existing Pool heater at Northeast High School

There are many computers throughout the school and other office electric equipment which are used regularly, thereby adding a lot of electric load. The transformers are standard distribution dry-type transformers which are located in the mechanical rooms. These transformers are not "K-rated" transformers.

EMS

Most of the buildings on campus have Barber-Coleman EMS controls. This EMS is used to schedule most of the mechanical systems including exhaust fans.

Electric Service:

Electric service is currently provided by FPL and the rate is GSLD-1 and GSD-1. Two electric meters serves the entire facility. According to utility bills from July 2005 to June 2006, this school facility consumes 4,204,204 kWh per year for a total cost of $410,672.

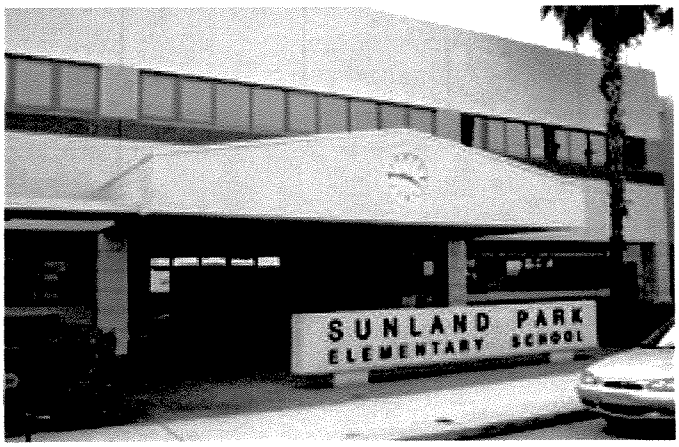
The existing school facility resulting electricity energy use index (EUI) is 15.46 kWh per square feet and the energy cost index (ECI) is $1.51 per square feet.

Occupancy and Equipment Schedules

Primary occupancy and equipment schedules are as shown below:

Function	Weekdays	Start/Stop Times
Students	M - F	7:40 am – 2:40 pm
HVAC	M - F	5:30 am – 11:00 pm
Exhaust Fans	M - F	Unknown
OA Dampers	M - F	Unknown

SUNLAND PARK ELEMENTARY SCHOOL



EXISTING CONDITIONS

History

Sunland Park Elementary School is located in Broward County, Florida at 919 NW 13th Terrace, Ft. Lauderdale 33311.

School Facility's Envelope

Sunland Park Elementary School is a single two-story facility originally built in 1991. The facility houses classrooms, offices, a media center, and a cafeteria. There is approximately 75,000 square feet (sq.ft.) of usable area according to SBBC.

Enrollment consists of approximately 445 regular students and the school operational occupancy is from 8:00 a.m. - 2:00 p.m.., Monday through Friday.

Energy Using System

Broward County Public Schools

Lighting

Lighting is provided primarily by 1-lamp x 4', 2-lamp x 4', 3-lamp x 4', and 4-lamp x 4' fluorescent fixtures with energy saving magnetic ballasts and 34-watt T-12 bulbs. The existing exit signs are all compact fluorescent fixtures. A detailed count and description of all existing fixtures is available in the Appendix. The lights typically operate from approximately 6:00 a.m. until 10:00 p.m. as needed by school personnel, on regular school days. .

Water

An inspection of the water system at Sunland Park Elementary School

indicated that the plumbing fixtures - including toilets, urinals and faucets. There are approximately 30 toilets, 1 urinals and 30 faucets which operate at 3.5 gal per flush, 1.5 gal per flush and 2.5 gal per minute respectively.

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 1 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

In a cooling tower, water is lost through the evaporative cooling process. To replace lost water and maintain cooling function, makeup water must be added to the cooling tower system. The makeup meter tracks the amount of water that passes through the meter as it goes to the cooling tower. The blow-down meter tracks the amount of water leaving the cooling tower before it actually enters the City's wastewater system. These meters allow facilities to save money by allowing the customer to pay only for the wastewater that reaches the wastewater system.

The cooling tower at New river middle school does not currently have the capability to separately meter the make up or blow down water consumption.

Irrigation

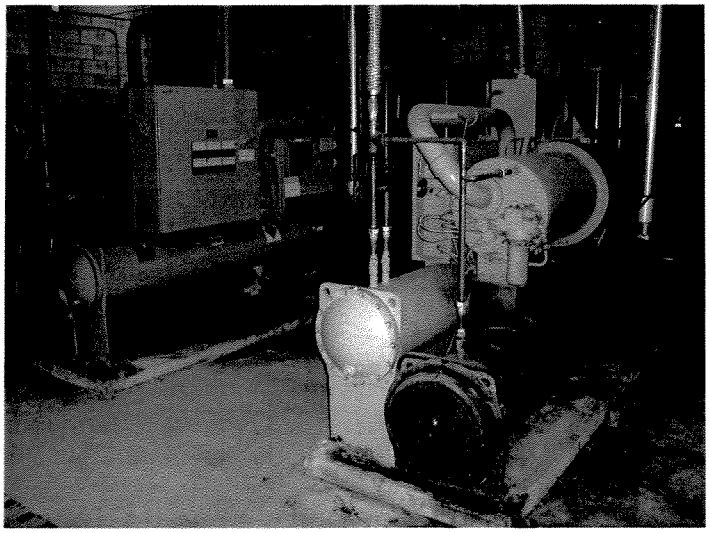
Irrigation usage is on 1 Well System. One irrigation controller runs from the well water system. It was analyzed that this controller runs 12 irrigation zones four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

One chiller plant provides cooling for the entire campus. The chiller plant consists of two water cooled Trane chillers. Both chillers were installed in 1991, but have been properly maintained and are in good operating condition. One chiller can satisfy the load of the entire building only during the cooler months of the year. A second chiller operates as needed the remainder of the year.

There are two chilled water (CHW) pumps each with a 15-hp motor. One (CHW) pump serves as a backup. A single chilled water loop supplies the entire campus. Each chiller operates based on factory mounted controls which are enabled by a central energy management

system (EMS).



Sunland Park chiller plant.

The following information summarizes the Sunland Park Elementary chiller plant.

Main Chiller Plant	**CH-1, CH-2**
Manufacturer:	Trane
Model:	RTHA130FCU0CDU
Serial:	U92K01054
Type:	Water cooled, screw compressors
Capacity:	130 tons
Compressor Qty:	1
Age:	15 yrs
Condition:	Good
CHWS / CHWR temperature:	44 F / 54 F
Original / Current Efficiency:	0.69 kW/ton / 0.8 kW/ton
CHWP motor	(2) 15 hp motors

Cooling Towers

There are two (2) single-cell TS Tower Supply cooling towers. Both cooling towers are approximately 14 years old and nearing the end of their useful life. Each tower has a single 5-hp fan. There are two condenser water (CW) pumps with 7.5-hp motors. One CW pump serves as a backup.

Air Distribution

The air distribution system consists of a several constant volume (CV), chilled water air handling units (AHUs). All of the AHUs have a face/bypass configuration with an automated damper and a two position, 3-way chilled water valve. Individual thermostats control each AHU and are scheduled remotely by a central energy management system (EMS). Standard low efficiency filters appear to be used throughout the facility. Heating is provided by electric strip heaters. Exhaust fans are located throughout the facility and operate on the same schedule as the AHUs. All of the AHUs appear to have been properly maintained and are in good operating condition.

The following information summarizes the air distribution equipment.

Equipment	Location Served	Fan Motor HP
AHU-1	Multi-P, Stage	7.5
AHU-2	Cafeteria	5
AHU-3	Kitchen	5
AHU-4	Music	5
AHU-5	Administration	7.5
AHU-6	Media	5
AHU-7	Media	5
AHU-8	North Classrooms	7.5
AHU-9	South Classrooms	5
AHU-10	Guidance	10
AHU-11	East Classrooms	5
AHU-12	East Classrooms	5
AHU-13	West Classrooms	7.5
AHU-14	West Classrooms	5
AHU-15	West Classrooms	5

Domestic Hot water and Miscellaneous Loads

Hot water for the kitchen is provided by an electric hot-water heater with a 100-gallon storage tank. Domestic hot water for the rest of the school is supplied by multiple small electric hot-water heaters. All of the water heating equipment is in good condition and appears to be operating efficiently. With the exception of the kitchen, hot water usage at the facility is minimal.

Miscellaneous electrical equipment consists of computers, office

equipment, teaching equipment, kitchen cooking equipment, water coolers, etc.

EMS

The existing energy management system (EMS) consists of several types of manufactures. Multiple vendors have installed EMS equipment throughout the school's history including Siebe, Honeywell, Johnson Controls, and Andover. The current operating system is provided by Andover. The Andover system operates all major HVAC equipment throughout the campus. The EMS currently schedules the HVAC equipment to operate from approximately 5:00 a.m. 10:00 p.m. Monday through Friday.

Electric Service

Electric service is currently provided by FPL at the GSD-1. One electric meter serves the entire facility. According to utility bills, this school facility consumes 1,609,200 kWh/yr for a total cost of $147,578 (June 2005 / May 2006).

The existing school facility resulting electricity energy use index (EUI) is 21.46 kWh sqft and the energy cost index (ECI) is $1.97 /sq.ft.

Occupancy and Equipment Schedules

Primary occupancy for the students is between 7:30 a.m. and 2:30 p.m. Teachers work from approximately 7:00 a.m. until 3:00 p.m., while the administration staff works from approximately 6:30 a.m. until 6:00 p.m. Several after school programs take place in multiple buildings throughout the year and typically last until 6:00 p.m. Custodians/operators are present from 6:00 a.m. until 10:00 p.m.

SUNRISE MIDDLE SCHOOL

Existing Conditions

History

Sunrise Middle School is located in Broward County, Florida. The school was originally built in 1992 and is located at 1750 NE 14th St., Ft. Lauderdale 33304.

School Facility's Envelope

Sunrise Middle School is a multi-building facility. In addition, there are eight (8) portable classrooms. There is approximately 156,274 square feet (sq.ft.) of usable area according to SBBC.

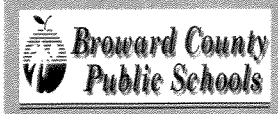
Enrollment consists of approximately 1,326 regular students and the school operational occupancy is from 9:00 a.m. - 3:30 p.m.., Monday through Friday.

The Campus consists of 13 buildings and 8 portables. Below is a description and summary of the buildings (Bldg):

Building	Description
➢ Bldg 100	Administration
➢ Bldg 200	Media Center
➢ Bldg 300	Science Labs
➢ Bldg 400	Business
➢ Bldg 500	Exceptional Education
➢ Bldg 600	General Classrooms
➢ Bldg 700	General Classrooms
➢ Bldg 800	Computer Labs
➢ Bldg 900	Art
➢ Bldg 1000	Gymnasium
➢ Bldg 1100	Industrial
➢ Bldg 1200	Kitchen
➢ Bldg 1300	Music, Cafeteria

Sunrise Middle School also has an outdoor swimming pool. The pool is approximately 75' x 65' with an average depth of 4 feet. The pool is currently heated by a natural gas water heater. A small locker room facility is located adjacent to the pool.

Energy Using System



Lighting

Lighting is provided primarily by 2-lamp x 4' and 3-lamp x 4' fluorescent fixtures with standard magnetic ballasts and 34-watt T-12 bulbs. The existing exit signs are all incandescent fixtures. A detailed count and description of all existing fixtures is available in the Appendix. The lights typically operate from approximately 6:00 a.m. until 10:00 p.m. as needed by school personnel, on regular school days.

Water

An inspection of the water system at Sunrise Middle School indicated that the plumbing fixtures - including toilets, urinals and faucets that have opportunity for improvements. There are approximately 59 toilets, 18 urinals and 27 faucets which operate at 3.5 gal per flush, 1.5 gal per flush and 2.5 gal per minute respectively. In addition, there are a small quantity of low flow plumbing fixtures.

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 3 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

Irrigation

Irrigation usage is divided between one system with city water and another on Well.

One irrigation controller runs from the city water system. It was analyzed that this controller runs 24 irrigation zones five days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

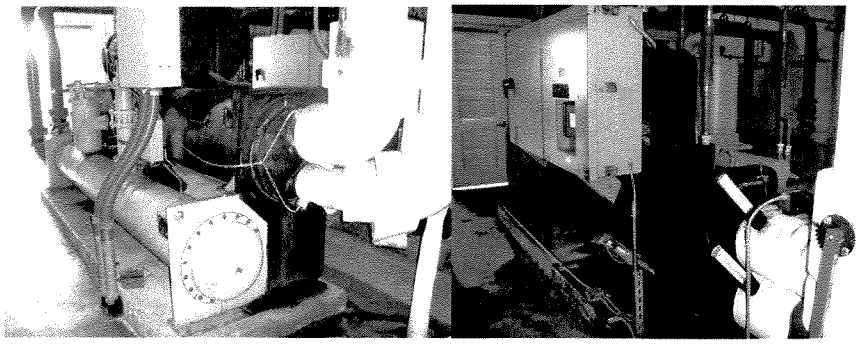
One irrigation controller runs from the city water system. It was analyzed that this controller runs 18 irrigation zones five days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

One chiller plant provides cooling for the entire campus, with exception of the swimming pool locker room. The small locker room facility next to the swimming pool is cooled by a dedicated split DX system, which was not functional at the time of the audit. SBBC personal report this unit will be repaired so it is not included in the scope of this project.

The chiller plant consists of two water cooled chillers. The Trane chiller is relatively new and in good condition. The McQuay chiller was installed in 1992 and is beginning to near the end of its useful life. One chiller can satisfy the load of the entire building only during the cooler months of the year. A second chiller operates as needed the remainder of the year.

The chilled water system consists of a primary and a secondary loop. Two dedicated pumps with 7.5-hp motors circulate chilled water through the primary loop. Two pumps with 30-hp motors circulate chilled water through the secondary loop serving the campus. One of the secondary chilled water (CHW) pumps serves as a backup. Both secondary CHW pump motors are equipped with ABB variable frequency drives (VFDs). Each chiller operates based on factory mounted controls which are enabled by a central energy management system (EMS). The older McQuay chiller has been used as the primary chiller according to school staff.



Sunrise chiller plant: CH-1 (McQuay), CH-2 (Trane)

The following information summarizes the older McQuay chiller.

Main Chiller Plant	CH-1
Manufacturer:	McQuay
Model:	PEH063
Serial:	5WC0101000
Type:	Water cooled, screw compressors
Capacity:	200 tons
Refrigerant:	R-12
Compressor Qty:	1
Age:	15 yrs
Condition:	Fair
CHWS / CHWR temperature:	44 F / 54 F
Original / Current Efficiency:	0.7 kW/ton / 0.9 kW/ton
Primary CHWP motor	10 hp motors

The following information summarizes the newer Trane chiller.

Main Chiller Plant	CH-2
Manufacturer:	Trane
Model:	RTHD UB2FXBOU AC2A
Serial:	U04M09050
Type:	Water cooled, screw compressors
Capacity:	200 tons
Refrigerant:	R134a
Compressor Qty:	1
Age:	2 yrs
Condition:	Good
CHWS / CHWR temperature:	44 F / 54 F
Original / Current Efficiency:	0.6 kW/ton / 0.65 kW/ton
Primary CHWP motor	10 hp motors

Cooling Towers

The existing cooling towers are approximately 14 years old and near the end of their useful life. There are currently (2) single-cell towers, each with a single fans. Each fan motor is equipped with an ABB VFD. There are two condenser water (CW) pumps with 15-hp motors. One CW pump serves as a backup.

Two new Evapco cooling towers have been delivered to the school and are scheduled for installation in the near future. (Under a separate Project)

Air Distribution

The air distribution system consists of a combination of constant volume (CV) air handling units and fan coil units (FCUs). All of the CV AHUs have a face/bypass configuration with an automated damper and a two position, 3-way chilled water valve. Individual thermostats control each AHU and FCU and are scheduled remotely by a central energy management system (EMS). Standard low efficiency filters appear to be used throughout the facility. Heating is provided by electric strip heaters. Exhaust fans are located throughout the facility and operate on the same schedule as the AHUs. All of the AHUs appear to have been properly maintained and are in good operating condition.

The following information summarizes the air distribution equipment.

Equipment	Location Served	Fan Motor HP
AHU-1	Administration	10
AHU-2	Media	5
AHU-4	Business	1
AHU-4a	Home Econ.	1
AHU-4b	Health Lab	1
AHU-5	PE Multi CR	1
AHU-7	Comp. lab	2
AHU-8	Comp. skills	2
AHU-9	Teacher Planning	5
AHU-9a	Art	3
AHU-10	Gym – East	5
AHU-10a	Boys locker	5
AHU-10(2)	Gym – West	5
AHU-10a(2)	Girls locker	5
AHU-11	Amer. Ind.	5
AHU-11a	Graphics	2
AHU-12	Cafeteria	10
AHU-12a	Teacher lounge	1
AHU-12b	Kitchen	5
AHU-13	Music	7.5
(5) FCUs	400 wing	2.5 – total
(10) FCUs	500 wing	5 – total
(10) FCUs	600 wing	5 – total
(4) FCUs	700 wing	2 – total
(9) FCUs	800 wing	4.5 – total
(9) FCUs	900 wing	4.5 – total

Domestic Hot water and Miscellaneous Loads

Hot water for the kitchen is provided by an electric hot-water heater with a 100-gallon storage tank. Domestic hot water for the rest of the school is supplied by multiple small electric hot-water heaters. All of the water heating equipment is in good condition and appears to be operating efficiently. With the exception of the kitchen, hot water usage at the facility is minimal.

Miscellaneous electrical equipment consists of computers, office equipment, teaching equipment, kitchen cooking equipment, water coolers, etc.

EMS

The existing energy management system (EMS) consists of several types of manufactures. Multiple vendors have installed EMS equipment throughout the school's history including Siebe, Honeywell, Johnson Controls, and Andover. The current operating system is provided by Andover. The Andover system operates all major HVAC equipment throughout the campus. The EMS currently schedules the HVAC equipment to operate from approximately 5:00 a.m. 9:00 p.m. Monday through Friday.

Electric Service

Electric service is currently provided by FPL at the GS-1, GSLD-1 and GSD-1. Four electric meters serves the entire facility. According to utility bills, this school facility consumes 2,891,234 kWh/yr for a total cost of $279,300 (June 2005 / May 2006).

Infinite Energy provides natural gas; the natural gas consumption is 20,233 therms/yr at a cost of $12,841/yr.

The existing school facility resulting electricity energy use index (EUI) is 18.50 kWh/sqft and the energy cost index (ECI) is $1.78 /sqft.

Occupancy and Equipment Schedules

Primary occupancy for the students is between 7:30 a.m. and 2:30 p.m. Teachers work from approximately 7:00 a.m. until 3:00 p.m., while the administration staff works from approximately 6:30 a.m. until 5:00 p.m. Several after school programs take place in multiple buildings throughout the year and typically last until 6:00 p.m. Custodians/operators are present from 6:00 a.m. until 9:30 p.m.

VIRGINIA YOUNG ELEMENTARY SCHOOL

Existing Conditions

History

Virginia Young is located in Broward County, Florida. The school was originally built in 1993 and, according to school personnel, opened in 1994. The facility is located at 101 NE 11th Ave., Ft. Lauderdale 33301.

Although currently undergoing renovations no significant equipment or facility upgrade has been completed since the facility was opened.

School Facility's Envelope

The envelope of this slab foundation, concrete block and stucco building appears to be in excellent condition. Built with two courtyards all classrooms open into interior open spaces. This design has very few interior hallways and therefore minimizes the requirement for cooling and heating. There is approximately 77,043 square feet (sqft) of usable area according to the SBBC.

Enrollment consists of approximately 758 regular students during the academic year. No students are enrolled in any programs during the summer. Normal classroom operational hours are between 9:00 a.m. and 3:00 p.m. A pre-school and after-school program extends these hours, however, from 7:00 a.m. to 6:00 p.m.

Energy Using System

Lighting

The majority of the existing lighting systems utilize T12 lamps with Magnetic Ballast. Some T8 lamps with electronic ballast, however, were identified within the facility. In addition, compact fluorescent, incandescent and HID fixtures were also found throughout the school.

Broward County Public Schools

Lighting systems were found to be in fairly good working order and providing sufficient Illumination.

The proposed system will include the retrofit of all T12 and T8 lamps to Sylvania's 28w T8 lamp and QHE series Electronic Ballast. Covered walkway will be replaced with new vandal resistant fixtures. Compact Fluorescent and HID systems will remain as is.

Water

An inspection of the water system at Virginia Young Elementary School indicated that the plumbing fixtures - including toilets, urinals and faucets have opportunities for improvement. There are approximately 53 toilets, 0 urinals and 53 faucets which operate at 3.5 gal per flush, 1.5 gal per flush and 2 gal per minute respectively

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 1 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

Irrigation

During the audit of the irrigation practices at Virginia Young we determined that the current system does not adjust watering schedules to account for rain and wind. This inability to monitor environmental conditions leads to excessive use of water during irrigation. Furthermore, the current system does not monitor for flow and therefore cannot detect excess water usage caused by pipe leaks and valve failures.

To address these issues and ultimately to reduce the quantity of water required for irrigation SIEMENS proposes the installation of an automated irrigation and flow sensor system at the school. Our proposal includes two Hunter Pro-C 12 station digital controllers (PCM-300), a mini weather station, a sub meter and associated equipment. Once installed the benefits will include reduced water consumption, pumping costs and chemical costs.

One irrigation controller runs from the city water system. It was analyzed that this controller runs 7 irrigation zones four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

One irrigation controller runs from the well water system. It was analyzed that this controller runs 12 irrigation zones four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

Two air-cooled, rotary Trane chillers provide chilled water for nearly all cooling within the facility. Both these 125 ton units, as well as all associated equipment such as chilled water pumps, are in excellent condition. Although nine medium-sized air handling units provide cooling to common areas such as the cafeteria, media center, and administration spaces the majority of the air handling units are small Carrier units (37 in total) serving the classrooms.

Information about the chillers follows:

Chiller 1 & 2	**CH-1 & 2**
Manufacturer:	Trane
Model:	RTAA 1234 XR01 A3O0 B
Serial:	U05J04228
Type:	Air-cooled rotary
Capacity:	125 tons
Refrigerant:	R-22
Compressor Qty:	2
Age:	2004
Condition:	Excellent
CHWS / CHWR temperature:	45 F / 54 F
Original / Current Efficiency:	1.0 kW/ton / 1.1 kW/ton
Pumps:	2 CHW pumps, 30 hp

Two of the medium-sized air handling units (AHU's 7 and 8) are split systems. These R-22 units have condensers on the roof and are independent of the chilled water system.

Equipment	Manufacturer	Model	Capacity	Condition
Split System Condenser	Carrier	38AKS016—E71610	16 Tons	Excellent
Split System Condenser	Carrier	38ARZ008—E601BA	8 Tons	Excellent

Overall the chillers and cooling towers are new, well-maintained and adequately sized.

Air Distribution

Each of the 37 classrooms has a small Carrier air handling unit located within an attached mechanical room. In addition to the normal supply and return air ducts a small make-up air duct discharges into this mechanical room. The room, therefore, functions as a plenum permitting the mixture of the return air with the make-up air before the air passes

through the air handling unit.

One feature of this arrangement is that the outside air fan and duct dampers are controlled by an occupancy sensor located within the classroom. Once the occupancy sensor detects movement within the room the make-up fan is energized and the duct is opened. Multiple control companies are used to control the sequence of operation of the air handling unit, the occupancy sensor, and the outside air make-up systems.

As previously stated two of the larger air handling units are split systems which are independent of the chilled water system. These units serve the administrative and media center areas. Since no students are on campus during the summer it is possible, therefore, to secure the chillers and continue to cool both of these areas with the independent systems.

Nearly all air handling units on campus are well-maintained and in good operating condition.

The following information summarizes the air distribution equipment:

Equipment	Location Served	Fan Motor HP
AHU-1	Kitchen	2
AHU-2	Kitchen	2
AHU-3	Cafeteria	2
AHU-4	Band Room	2
AHU-6	Guidance Center	2
AHU-7	Main Office	2
AHU-8	Media Center	3
AHU-9	Art Room	2
AHU (37)	Classrooms	1/2

Domestic Hot water and Miscellaneous Loads

Hot water is provided through the use of distributed electric hot water heaters. Most of these Lochinvar water heaters have 30-gallons capacities while several have capacities of 52-gallons. Although one water heater was disabled and scheduled for replacement all other water heaters were in good condition and operable.

EMS

Individual air handling units and exhaust fans are controlled with start / stop commands from a central Andover control system. The small Carrier air handling units which serve individual class rooms are primarily controlled with start / stop commands from the Andover system and partially controlled with Johnson and Honeywell controllers. The Johnson Controls work with a class room mounted occupancy sensor to

open a make-up air damper and start a make-up air fan when the class is occupied. The final component of the system is a Honeywell controller which operates chilled water valves and supplemental heat as determined by the controllers' setpoints.

Electric Service:

Electric service is currently provided by FPL at the GSLD-1 schedule. One electric meter serves the entire facility. According to utility bills, this school facility consumes 1,481,280 kWh/yr for a total cost of $149,925 (June 2005 / May 2006).

The existing school facility resulting electricity energy use index (EUI) is 19.22 kWh/sqft and the energy cost index (ECI) is $1.95 /sqft.

Occupancy and Equipment Schedules

Primary occupancy for the students is between 9:00 a.m. - 3:00 p.m., Monday through Friday. Pre-school and after-school programs extend these hours from 7:00 a.m. to 6:00 p.m. Neither weekends nor summer months have any additional programs requiring facility usage.

WILTON MANORS ELEMENTARY SCHOOL

Wilton Manors Elementary School

Existing Conditions

History

Wilton Manors Elementary School is located in Broward County Florida. According to school personnel the facility was originally build in 1996 but was only partially occupied (buildings 2, 3, and 5) at that time due to an ongoing problem with the construction company. In December of 1999 the remaining buildings (1 and 4) were occupied. The school is located at 2401 NW 3rd Avenue, Ft. Lauderdale.

School Facility's Envelope

This campus has five buildings that are centrally arranged around a large courtyard. Two of these buildings, Buildings 2 and 4, are two story structures while the remaining three buildings are single story. Nearly all classrooms and specialty areas (i.e., the media center and cafeteria) open to the interior courtyard. This architectural design minimizes air conditioning requirements for spaces such as hallways and other common areas. The campus has approximately 77,531 square feet (sqft) of usable area according to the SBBC.

Enrollment consists of approximately 624 regular students and the school operational occupancy is from 8:30 a.m. - 3:00 p.m., Monday through Friday. School staff are on site from approximately 7:00 a.m. to 10:00 p.m.

Energy Using System

Broward County Public Schools

Lighting

The school currently utilizes T8 lamps with electronic ballasts. The electronic ballasts are not the commonly installed instant start but instead are rapid start versions. Since the rapid start version cannot be relamped with the improved T8 (FO28/841/XP/ECO) lamps a complete retrofit would be necessary in order to improve efficiency.

The energy reduction from this T-8 to T-8 retrofit would be significantly

small enough to be difficult to demonstrate on a whole building analysis of electric bills. In addition the cost to retrofit for this site would be cost prohibitive. Therefore we are not recommending any changes.

1. All T8 fixtures that are not controlled by sensors will be retrofit with Sylvania FO28/841/XP/ECO lamps and QHE (High Efficiency) Low Power ballasts, tandem wiring where applicable.
2. Fixtures currently controlled by motion sensors will utilize a Sylvania Xtreme programmed start ballast designed for frequent switching cycles.
3. 2x2' U-bend fixtures will be retrofit with a reflector socket kit to accommodate 3-FO17/841XP/ECO (2'linear) lamps and QHE Low Power ballast.
4. All T8/electronic fixtures will be relamped with FO28/841/XP/ECO lamps.
5. Incandescent exit signs will be replaced with new LED battery backup exit signs.
6. 1000W metal halide gym fixtures will be replaced on a two-for-one basis with a 4 lamp Pentron T5HO fixture, complete with lens and wire guard.
7. 300W incandescent gym fixtures will be replaced on a one-for-one basis with a 2 lamp Pentron T5HO fixture, complete with lens and wire guard.

Water

An inspection of the water system at Wilton Manor Elementary School indicated that the plumbing fixtures - including toilets, urinals and faucets – used valves that had properly sized flow rates. There are approximately 50 toilets, 2 urinals and 60 faucets which operate at 1.6 gal per flush, 1.0 gal per flush and .5 gal per minute respectively.

Kitchen personnel were interviewed to gather a consensus of 120 minutes (2 hours) per day for dishwashing. There were 2 kitchen dishwashing sprayers found at this location measured 4.0 gallons per minute.

Irrigation

During the audit of the irrigation practices at Wilton Manor we determined that the current system does not adjust watering schedules to account for rain and wind. This inability to monitor environmental conditions leads to excessive use of water during irrigation. Furthermore, the current system does not monitor for flow and therefore cannot detect excess water usage caused by pipe leaks and valve failures.

To address these issues and ultimately to reduce the quantity of water required for irrigation SIEMENS proposes the installation of an

automated irrigation and flow sensor system at the school. Our proposal includes a Hunter Pro-C 12 station digital controller (PCM-300), a mini weather station, a sub meter and associated equipment. Once installed the benefits will include reduced water consumption, pumping costs and chemical costs.

One irrigation controller runs from the city water system. It was analyzed that this controller runs 19 of the 24 irrigation zones 20 min four days a week. Each zone has 6 irrigation spray nozzles that run 3.5 gallons per minute (design specification) and the system was programmed to run for 20 minutes on each zone.

Cooling

Two 100-ton, water-cooled, rotary Trane chillers provided chilled water to seven large air handling units located throughout the facility as well as two small air handling units within the media center. The large units are manufactured by Trane and McQuay and the smaller units are Lennox models. All air handling units are approximately 10 years old but are in good condition.

The two Quadraflow Marley cooling towers that provide condensing water for the chillers are in good condition with some evidence of algae growth. Slight improvements in cooling tower efficiency may be available through improvement of the cooling tower chemical controls.

Energy savings technologies currently employed at the school include variable frequency drives controlling air handling units and cooling tower fans as well as the use of heat wheels to pre-cool make-up air using the exhaust air streams.

The building's envelope, as well as the condition of the equipment and the use of proper controls, indicates that overall maintenance is sufficient and little opportunity for energy savings exists at this facility.

Information about the chillers follows:

Chiller 1 & 2	**CH-1 & 2**
Manufacturer:	Trane
Model:	RTWA1004YA01D1DOWN
Serial:	U96D03685
Type:	water-cooled rotary
Capacity:	100 tons
Refrigerant:	R-22
Compressor Qty:	2
Age:	1996
Condition:	Excellent

CHWS / CHWR temperature: 45 F / 54 F
Original / Current Efficiency: 1.0 kW/ton / 1.1 kW/ton
Pumps: 2 CHW pumps, 7.5 hp

The following information summarizes the air distribution equipment:

Equipment	Location Served	Fan Motor HP
AHU-1A	125	5
AHU-2B	223	7.5
AHU-2B	204	7.5
AHU-3A	Cafeteria	1
AHU-3C	Cafeteria	3
AHU-4B	423	7.5
AHU-5	406	7.5
Lennox-1	Media Center	1
Lennox-2	Media Center	1

EMS

Wilton Manors uses an Andover controller for start / stop operation of the air handling units. The Trane units have additional Trane controllers and all units use variable frequency drives. No reported control problems and the system components appear to be in excellent condition.

Domestic Hot water and Miscellaneous Loads

A distributed hot water system using small, electric hot water heaters for bathrooms along with a large electric hot water heater for the kitchen minimizes domestic hot water energy losses. All hot water heaters appear to be in good condition.

Electric Service:

Electric service is currently provided by FPL at the GSD-1 schedule. Two electric meters serve the entire facility. According to utility bills, this school facility consumes 1,702,080 kWh/yr for a total cost of $9,252 (June 2005 / May 2006).

The existing school facility resulting electricity energy use index (EUI) is 21.95 kWh/sqft and the energy cost index (ECI) is $2.18/sqft.

Occupancy and Equipment Schedules

Primary occupancy for the students is between 8:30 a.m. - 3:00 p.m., Monday through Friday. School staff and maintenance personnel are on site from approximately 7:00 a.m. to 10:00 p.m.

SIEMENS

Schedule D
Energy Savings Guarantee
Phase III Summary

Sep-2006

YEAR	1	2	3	4	5	6	7	8	9	10	TOTAL
PROGRAM SAVINGS											
Arthur Ashe Middle	$ 3,255	$ 3,418	$ 3,589	$ 3,768	$ 3,957	$ 4,155	$ 4,362	$ 4,581	$ 4,810	$ 5,050	$ 40,945
Broward Estates Elementary	$ 22,473	$ 22,948	$ 23,438	$ 23,947	$ 24,472	$ 25,016	$ 25,579	$ 26,163	$ 26,768	$ 27,395	$ 248,199
Floranada Elementary	$ 3,585	$ 3,764	$ 3,952	$ 4,150	$ 4,357	$ 4,575	$ 4,804	$ 5,044	$ 5,296	$ 5,561	$ 45,088
James Rickards Middle	$ 35,242	$ 36,031	$ 36,850	$ 37,698	$ 38,577	$ 39,489	$ 40,435	$ 41,416	$ 42,435	$ 43,492	$ 391,667
New River Middle	$ 38,271	$ 39,292	$ 40,351	$ 41,452	$ 42,596	$ 43,786	$ 45,022	$ 46,308	$ 47,646	$ 49,037	$ 433,763
Northeast High	$ 79,096	$ 80,692	$ 82,340	$ 84,044	$ 85,806	$ 87,629	$ 89,516	$ 91,469	$ 93,490	$ 95,584	$ 869,668
Sunland Park Elementary	$ 25,210	$ 25,831	$ 26,474	$ 27,142	$ 27,835	$ 28,555	$ 29,302	$ 30,079	$ 30,886	$ 31,724	$ 283,038
Sunrise Middle	$ 83,736	$ 85,297	$ 86,905	$ 88,562	$ 90,271	$ 92,033	$ 93,850	$ 95,725	$ 97,659	$ 99,657	$ 913,696
Virginia Young Elementary	$ 25,432	$ 26,084	$ 26,762	$ 27,466	$ 28,199	$ 28,958	$ 29,747	$ 30,570	$ 31,425	$ 32,315	$ 286,958
Wilton Manors Elementary	$ 7,340	$ 7,707	$ 8,092	$ 8,497	$ 8,922	$ 9,368	$ 9,836	$ 10,328	$ 10,844	$ 11,387	$ 92,320
Annual Gross Savings	**$ 323,640**	**$ 331,063**	**$ 338,755**	**$ 346,727**	**$ 354,992**	**$ 363,564**	**$ 372,456**	**$ 381,683**	**$ 391,260**	**$ 401,202**	**$ 3,605,342**
Cumulative Savings	*$ 323,640*	*$ 654,703*	*$ 993,458*	*$ 1,340,185*	*$ 1,695,177*	*$ 2,058,742*	*$ 2,431,197*	*$ 2,812,880*	*$ 3,204,140*	*$ 3,605,342*	

SCHEDULE E
Compensation to ESCO

Energy Conservation Measure	Arthur Ashe Middle	Broward Estates Elementa	Floranada Elementary	James Rickards Middle	New River Middle	Northeast High	Sunland Park Elementary	Sunrise Middle	Virginia Young Elementary	Wilton Manors Elementary	Grand Total
Automated Irrigation & Flow Sensors											
Water Conservation											
Lighting Retrofit & Upgrade											
Chiller Replacement											
Total by School	$ 29,705.00	$ 156,791.00	$ 25,221.00	$ 214,005.00	$ 268,131.00	$ 529,350.00	$ 164,423.00	$ 532,832.00	$ 174,163.00	$ 17,740.00	$ 2,112,361.00

Service/Maintenance/Guarantee Mgmt. Fee											
Year 1	$ 812	$4,983	$894	$8,011	$7,960	$18,045	$5,443	$17,988	$5,606	$1,831	71,571
Year 2	$ 852	$5,232	$939	$8,412	$8,358	$18,947	$5,715	$18,887	$5,886	$1,923	75,151
Year 3	$ 895	$5,494	$986	$8,832	$8,776	$19,895	$6,001	$19,832	$6,181	$2,019	78,909
Year 4	$ 939	$5,768	$1,035	$9,274	$9,215	$20,889	$6,301	$20,823	$6,490	$2,120	82,854
Year 5	$ 986	$6,057	$1,087	$9,737	$9,675	$21,934	$6,616	$21,865	$6,814	$2,226	86,997
Year 6	$ 1,036	$6,360	$1,141	$10,224	$10,159	$23,031	$6,947	$22,958	$7,155	$2,337	91,347
Year 7	$ 1,087	$6,678	$1,198	$10,736	$10,667	$24,182	$7,294	$24,106	$7,513	$2,454	95,914
Year 8	$ 1,142	$7,012	$1,258	$11,272	$11,201	$25,391	$7,659	$25,311	$7,888	$2,576	100,710
Year 9	$ 1,199	$7,362	$1,321	$11,836	$11,761	$26,661	$8,042	$26,576	$8,283	$2,705	105,745
Year 10	$ 1,259	$7,730	$1,387	$12,428	$12,349	$27,994	$8,444	$27,905	$8,698	$2,831	111,024
Total Annual fees	$ 10,207	$ 62,675	$ 11,245	$ 100,761	$ 100,120	$ 226,968	$ 68,462	$ 226,251	$ 70,513	23,020	900,221

Total - Installation and Annual Fees	**$3,012,582.08**

Note: Does not include 4% finance costs.

BASELINE ENERGY CONSUMPTION

ESTABLISHMENT AND ADJUSTMENT OF THE BASELINE

1. CALCULATION OF TOTAL SAVINGS

Siemens Building Technologies will calculate the Calculated Savings as the sum of the energy savings plus the operational costs avoided.

2. MONTHLY CALCULATION OF ENERGY SAVINGS

(a) General. Except as otherwise provided, energy savings will be calculated for each month of each Annual Savings Period as the product of (i) the excess, if any, of the Customer's usage of energy in such month of the base period as set forth in the Exhibit titled "Base Period Energy usage," adjusted for the weather conditions, occupancy and configuration during such month of such Annual Savings Period, over the Customer's actual usage of energy in such month of such Annual Savings Period, adjusted as described below, or zero if there is no such excess, multiplied by (ii) the effective unit cost of energy for such month of such Annual Savings Period, adjusted as described below.

(b) Sources of Data. For each month of the base year and each month of the term of the contract, data shall be obtained as follows:

(1) Weather - weather data shall be obtained from the National Weather Service, NOAA or Accuweather for the nearest weather station to the Facility. This weather data also may be provided by the company which produces the energy accounting software.

(2) Energy Use - Electricity usage data shall be obtained from the electric utility bills. Since meters are not usually read on the same day each month, monthly usage shall be determined by (a) apportioning billed usage assuming a constant daily usage between meter reading or (b) actual daily usage data provided by the facility. Usage for most months will, therefore, be derived from two bills. The predominant month of energy tracking will be the month in which the utility was consumed. Demand (kW) will not be apportioned and will read from the predominant bill.

Costs used for savings calculations will be based on the rate in effect for the predominant bill or the rate in effect for the corresponding period in the base year, whichever is greater. The rate in effect during the base year will be designated the floor price. If the Facility is on a time-of-use rate, the on-peak, mid-peak, and off-peak usage components shall be treated as three separate energy sources, if possible. Natural gas, oil, water, and other purchased utilities usage's shall be determined by the method described above for electricity, unless agreed to otherwise by the parties (e.g., stipulated savings).

(c) Determination of Base Period Data. The Customer and Siemens Building Technologies have agreed on a twelve month time period whose energy consumption is representative of the Facility's energy use and cost prior to the date of this Agreement

(the "Base Year") and parameters which affect the energy usage and cost of the Facility, including, but not limited to, utility rates, local weather profile, Facility square footage, environmental conditions (e.g., Lighting, HVAC, people), and an inventory of equipment in the Facility (the "Base Period Data").

(d) Calculations. The Base Year's utility data and weather parameters will be entered into an energy accounting software program, or calculated using a substantially similar algorithm. Energy Accounting software will adjust the Base Period Data based on weather and operational conditions during the Annual Savings Period to estimate the energy and energy costs of the Facility had Siemens Building Technologies not performed the Work (the "Adjusted Baseline").

Siemens Building Technologies will adjust energy savings for variations in energy consumption due to (1) local weather conditions, (2) occupancy level changes, hours of operation, (3) structural modifications, modifications to energy consuming equipment, (4) damaged or malfunctioning equipment (except as is the responsibility of Siemens Building Technologies), and (5) any variances from the proposed operating schedules, strategies and conditions upon which the calculated savings are based as described in the Technical Audit, or which could affect energy usage. There may be changes in the Facility's usage and operation for which a calculated adjustment is necessary. Either the Customer or Siemens Building Technologies may propose an adjustment procedure based upon acceptable engineering practices to account for any such changes.

The Adjusted Baseline for each month of the Annual Savings Period for each energy type (excluding Kw demand adjustments) will be calculated s follows:

$$AB = ((d \times nC) + (r \times dd)) \times Ko \times Ka + Ca$$

where:

AB	=	adjusted baseline.
d	=	days in current month.
nC	=	daily non-temperature sensitive consumption factor from baseline data as determined from Metrix analysis.
r	=	ratio of weather sensitive consumption per heating or cooling degree day as determined from Metrix analysis.
dd	=	total heating or cooling degree days for current month based upon balance point temperature for Facility as determined from Metrix analysis.
Ko	=	occupancy/schedule adjustment factor (e.g., current operating hours/agreed upon operating hours, Schedule 5 & 6).
Ka	=	space utilization adjustment factor (current conditioned square footage/baseline conditioned square footage).
Ca	=	calculated adjustments (e.g., added load from the Equipment).

Note: Ko, Ka, and Ca must be documented.

The Adjusted Baseline for each month of the Annual Savings Period for each energy type for kW demand adjustments will be calculated as follows:

$$kWa = kWb \times Ka + Ca$$

Where:

kWa = adjusted demand
kWb = demand from baseline period
Ca = calculated adjustments (e.g., added Measure loads)

Monthly energy savings will be calculated as follows:

S = AB - AU and kWs = kWa - kWU

Where:

S = monthly unit energy savings
AB = Adjusted Baseline
AU = post retrofit monthly energy usage

kWa = adjusted demand
kWs = kW demand savings
kWu = post retrofit kW demand usage

The energy costs avoided will be calculated as follows:

CS = S x uc + kWs x uc + Os

Where:

CS = monetary savings
S = monthly energy savings
uc = the greater of the floor price of energy (as defined above) and the current costs, calculated as follows:

(1) For energy sources having a unit cost that decreases with increasing usage, the marginal unit cost from the subject month's bill shall be utilized. For electricity, this marginal cost shall be determined for energy (starting with the amount paid for the last kilowatt-hour purchased including fuel adjustment cost) and demand (amount paid for the last kilowatt purchased) including, if applicable, the effect of demand on the energy cost.
(2) For energy sources having a unit cost that does not decrease with increasing usage, the average unit cost of all deliveries received during the subject month will be utilized.

Os = other related savings attributable to the conservation program. The Customer will retain any and all benefits realized from rebates, grants and similar payments and discounts resulting from the Work.

If the Work results in a change of energy source (e.g., conversion from electric to gas heat), or where the level of usage changes enough to affect the marginal cost, or where utilities have changed rate structures, Siemens Building Technologies shall modify the calculations procedure to appropriately adjust for the change.

Schedule G – Savings Measurement & Calculation Formulae;

Methodology to Adjust Baseline

Sound engineering practice and calculations based upon methods from the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), the Association of Energy Engineers (AEE), the Institute of Electrical and Electronic Engineers (IEEE), and the Illumination Engineering Society have been used to show and project all energy savings. The data for the calculations have been collected using many tools such as wattmeters, ampmeters, voltmeters, thermometers, humidistats, light meters, velometers, data loggers and computer simulation tools. Siemens' Energy Engineers utilize this data to apply the appropriate calculations associated with the particular Facility Improvement Measure (FIM).

Energy calculations from the collected data were reviewed by the engineering design team and Siemens Building Technologies' national technical support staff for accuracy, sound engineering practice and code compliance. The calculations are shown in detail via Building Modeling or spreadsheet calculations and are included in the energy audit report.

The energy savings are further reported in Siemens' "*Solutions"* software along with the FIM project costs. The Solutions software spreadsheet demonstrates how the savings are broken down by FIM and energy type. This allows SBBC to easily see savings, costs, and simple paybacks of each FIM individually and grouped with other FIMs.

The methodology and reporting of savings in the Measurement and Verification Plan by Siemens Building Technologies follows the intent of the Measurement and Verification (M&V) Guideline for Federal Energy Projects document DOE/GO-I 0096-248. The method Siemens Building Technologies is proposing for the SBBC Project is based upon federal measurement & verification method GVL-C-OI (Chapter 18) from the Measurement and Verification (M&V) Guideline for Federal Energy Projects. The Metrix software utilized by Siemens Building Technologies is a regression billing analysis as written about in Chapter 18 of the Measurement and Verification (M&V) Guideline for Federal Energy Projects.

A utility bill comparison method will be utilized for the performance guarantee. Siemens Building Technologies uses an industry standard energy accounting program, Metrix, for measurement and verification.

This method is applicable for projects in which:

- There is a high degree of interaction between various energy conservation measures at single site.
- The measurement of individual component savings would be difficult. Other approaches are more expensive or technically complicated.

The comparison approach involves the differences between consumption and demand before and after installation of FIM's. The difference indicated from the comparison is the change in energy consumption and demand due to the FIMs as well as other factors that affect energy use.

A critical factor in a comparison approach is the specification of the analysis period. The analysis period should include at least one year's worth of utility meter billing data for the baseline period as well as the post-installation period. The smallest interval of billing data is available for the site should be used in the analysis; i.e. a monthly comparison of energy consumption data.

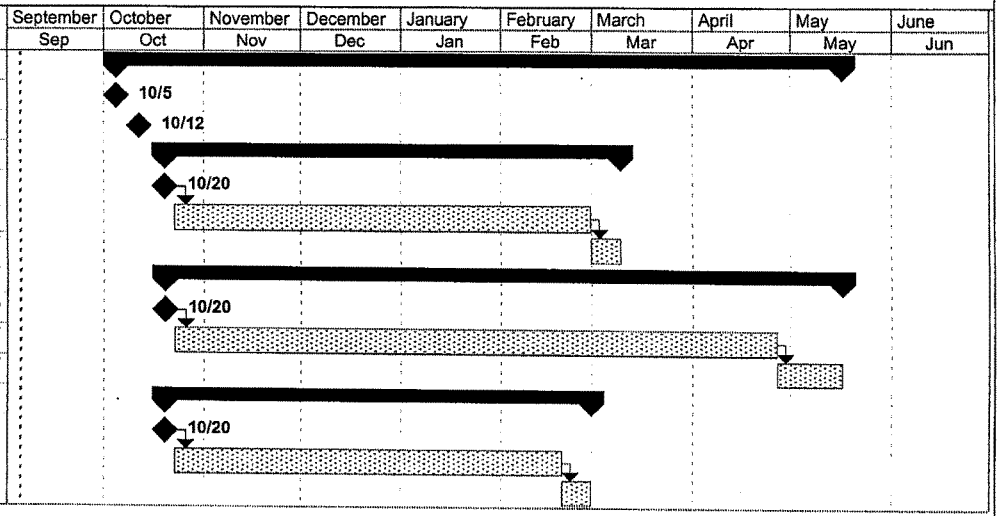
A regression model(s) will be developed that describes changes between pre-installation and post-installation energy use for the affected facility (or facilities), taking into account all explanatory variables, i.e. occupancy, new square footage. Processes to arrive at the regression model included: designation of the equation, description of independent variables, data analysis and verification for statistical soundness of the model. The savings are calculated by using the actual values of explanatory variables from the post-installation period in the final regression model(s).

The results of the comparison will be forwarded to the customer monthly. At the end of the first year of the guarantee period the monthly savings amounts will be combined to provide the total energy savings in both units and dollars.

The energy unit cost for each specific energy type is the total consumption related cost found on the respective utility bill, including charges for consumption, demand, service, power factor, fuel adjustments, etc., divided by total consumption. Late payment charges will not be included in this calculation. If the current energy unit cost is less than the base period energy unit cost, the base period energy unit cost will be used in determining the adjusted base period unit cost.

Northeast High School

ID	Task Name	Duration	Start	Finish
1	**Northeast High School**	**160 days**	**Thu 10/5/06**	**Wed 5/16/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Lighting Upgrade**	**149 days**	**Fri 10/20/06**	**Wed 5/16/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	134 days	Mon 10/23/06	Thu 4/26/07
11	Punch list	14 days	Fri 4/27/07	Wed 5/16/07
12	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
13	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
14	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
15	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: Northeast High
Date: Tue 9/5/06

Task
Split
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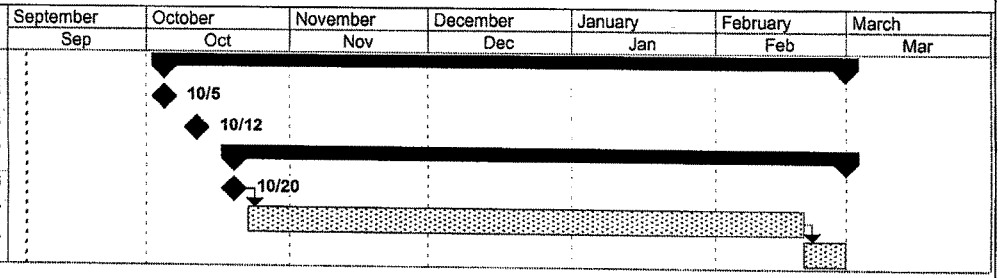
Deadline

Arthur Ashe Middle

ID	Task Name	Duration	Start	Finish
1	**Arthur Ashe Middle**	**105 days**	**Thu 10/5/06**	**Wed 2/28/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
7	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: Floranda
Date: Tue 9/5/06

Task
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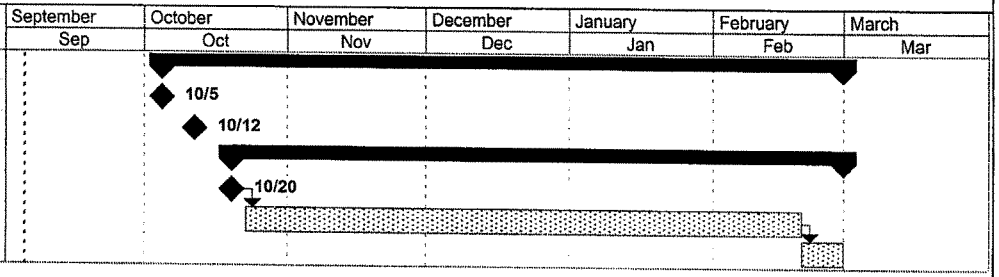
Deadline

Floranda

ID	Task Name	Duration	Start	Finish
1	**Floranda**	**105 days**	**Thu 10/5/06**	**Wed 2/28/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
7	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: Sunland Park
Date: Tue 9/5/06

Task
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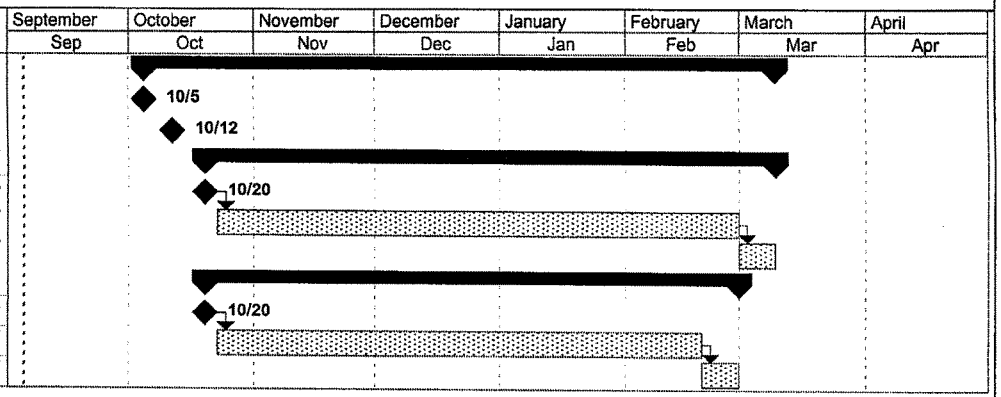
Sunland Park Elementary

ID	Task Name	Duration	Start	Finish
1	**Sunland Park Elementary**	**112 days**	**Thu 10/5/06**	**Fri 3/9/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
11	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: James Rickards
Date: Tue 9/5/06

Task
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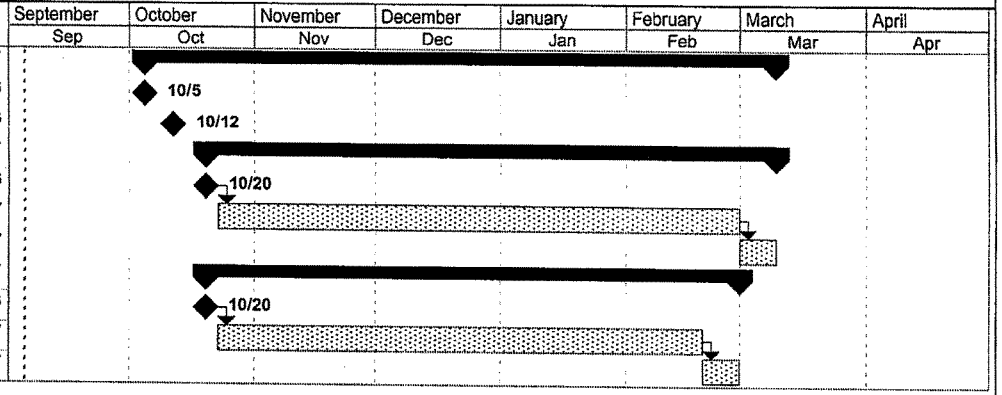
Deadline

James Rickards Middle

ID	Task Name	Duration	Start	Finish
1	**James Rickard Middle**	**112 days**	**Thu 10/5/06**	**Fri 3/9/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
11	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: Wilton Manors
Date: Tue 9/5/06

Task
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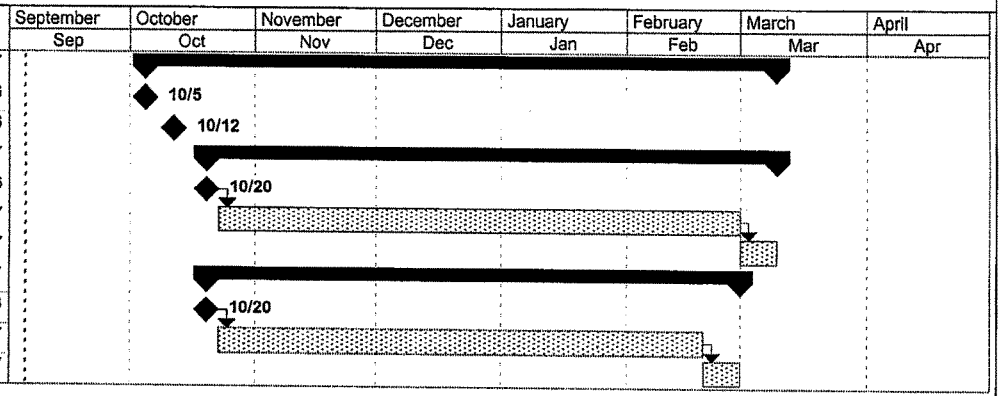
Wilton Manors

ID	Task Name	Duration	Start	Finish
1	**Wilton Manors**	**112 days**	**Thu 10/5/06**	**Fri 3/9/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
11	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: Sunrise
Date: Tue 9/5/06

Task
Split
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Milestone
Summary
Project Summary
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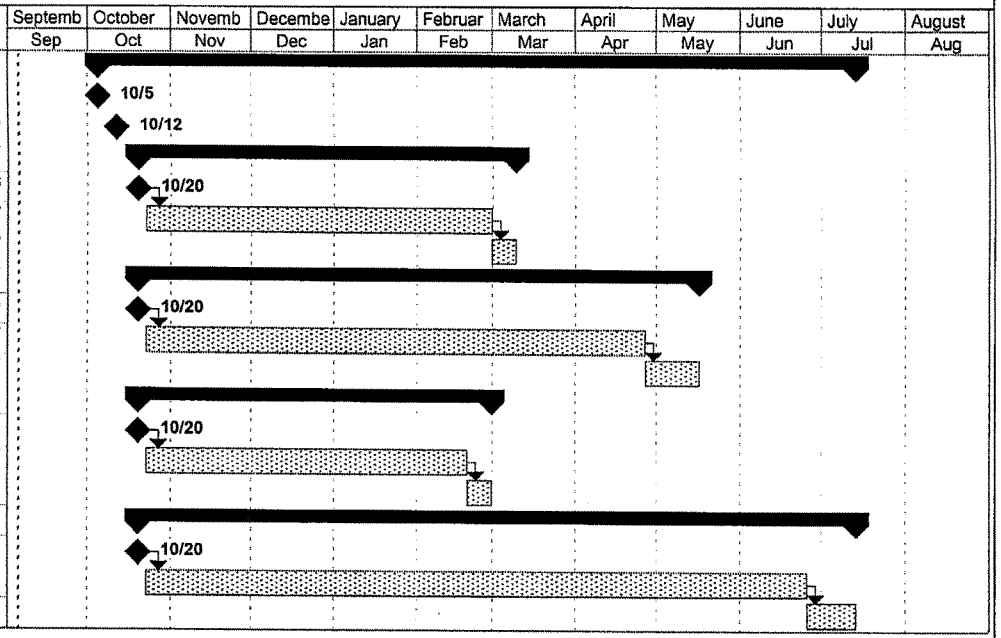
External Milestone
Deadline

Sunrise Middle

ID	Task Name	Duration	Start	Finish
1	**Sunrise Middle**	**202 days**	**Thu 10/5/06**	**Fri 7/13/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Lighting Upgrade**	**149 days**	**Fri 10/20/06**	**Wed 5/16/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	134 days	Mon 10/23/06	Thu 4/26/07
11	Punch list	14 days	Fri 4/27/07	Wed 5/16/07
12	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
13	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
14	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
15	Punch list	7 days	Tue 2/20/07	Wed 2/28/07
16	**Chiller Replacement**	**191 days**	**Fri 10/20/06**	**Fri 7/13/07**
17	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
18	System upgrade	176 days	Mon 10/23/06	Mon 6/25/07
19	Punch list	14 days	Tue 6/26/07	Fri 7/13/07



Project: Broward Estates
Date: Tue 9/5/06

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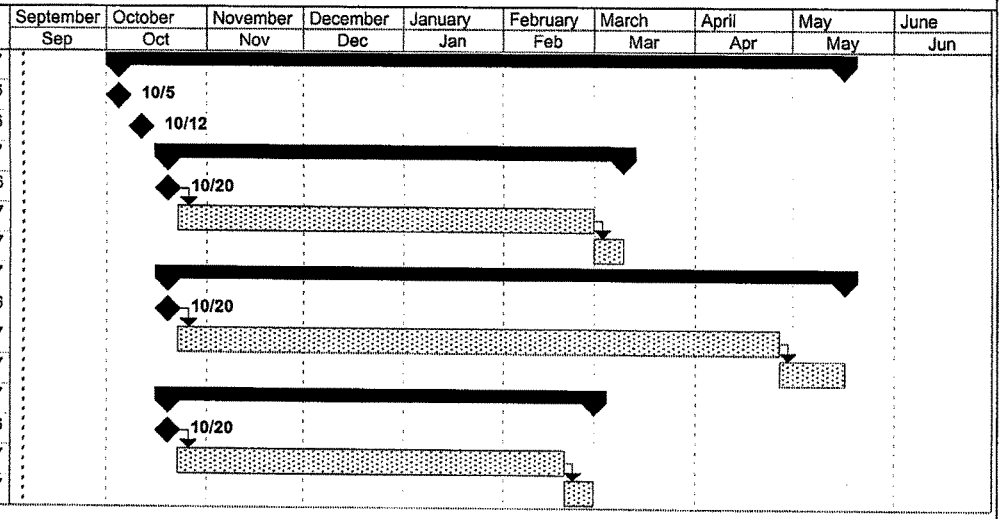
Deadline

Broward Estates Elementary

ID	Task Name	Duration	Start	Finish
1	**Broward Estates Elementary**	**160 days**	**Thu 10/5/06**	**Wed 5/16/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Lighting Upgrade**	**149 days**	**Fri 10/20/06**	**Wed 5/16/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	134 days	Mon 10/23/06	Thu 4/26/07
11	Punch list	14 days	Fri 4/27/07	Wed 5/16/07
12	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
13	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
14	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
15	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: New River
Date: Tue 9/5/06

Task
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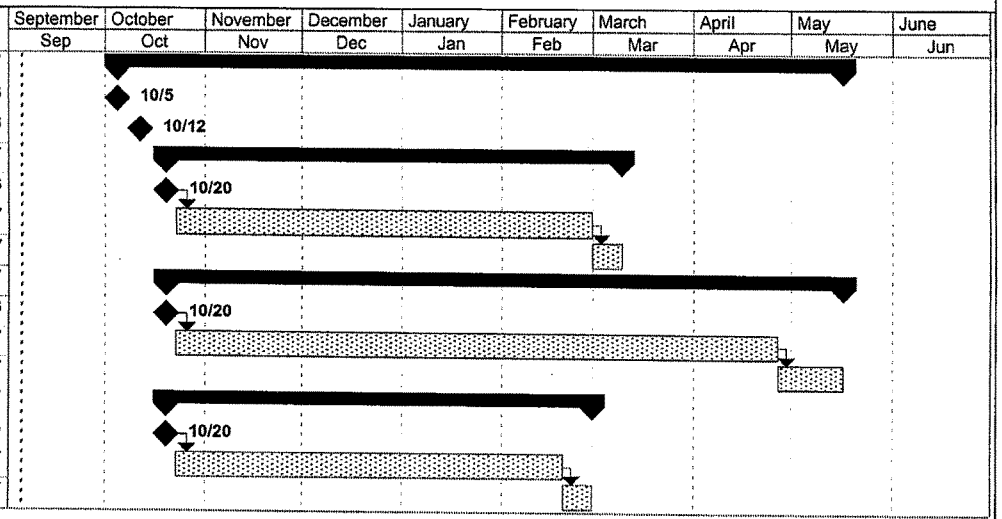
New River Middle

ID	Task Name	Duration	Start	Finish
1	**New River Middle**	**160 days**	**Thu 10/5/06**	**Wed 5/16/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Lighting Upgrade**	**149 days**	**Fri 10/20/06**	**Wed 5/16/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	134 days	Mon 10/23/06	Thu 4/26/07
11	Punch list	14 days	Fri 4/27/07	Wed 5/16/07
12	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
13	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
14	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
15	Punch list	7 days	Tue 2/20/07	Wed 2/28/07

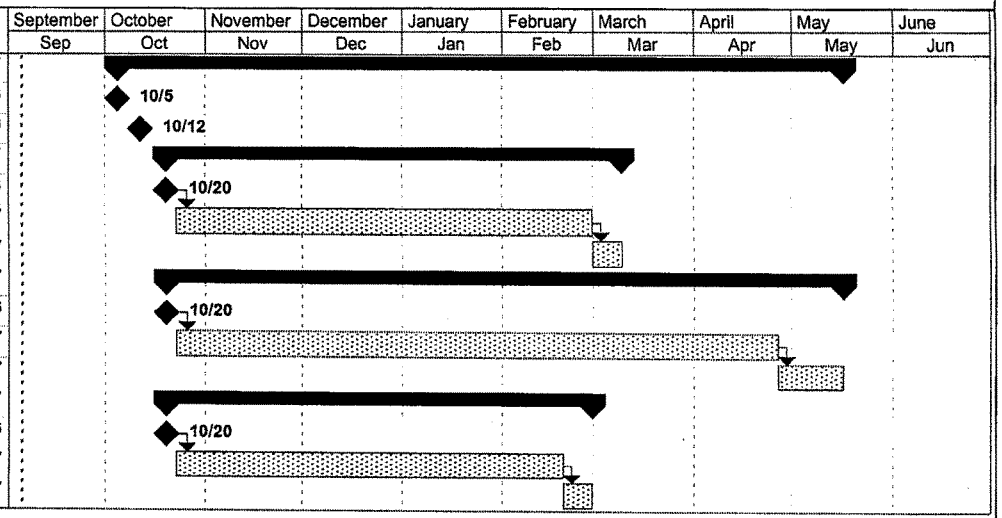


Project: Virginia Young
Date: Tue 9/5/06

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Virginia Young Elementary

ID	Task Name	Duration	Start	Finish
1	**Virginia Young Elementary**	**160 days**	**Thu 10/5/06**	**Wed 5/16/07**
2	Board Approval	1 day	Thu 10/5/06	Thu 10/5/06
3	Pre-Construction Meeting	1 day	Thu 10/12/06	Thu 10/12/06
4	**Water Conservation**	**101 days**	**Fri 10/20/06**	**Fri 3/9/07**
5	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
6	System upgrade	93 days	Mon 10/23/06	Wed 2/28/07
7	Punch list	7 days	Thu 3/1/07	Fri 3/9/07
8	**Lighting Upgrade**	**149 days**	**Fri 10/20/06**	**Wed 5/16/07**
9	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
10	System upgrade	134 days	Mon 10/23/06	Thu 4/26/07
11	Punch list	14 days	Fri 4/27/07	Wed 5/16/07
12	**Irrigation upgrade**	**94 days**	**Fri 10/20/06**	**Wed 2/28/07**
13	Site Walk-through	1 day	Fri 10/20/06	Fri 10/20/06
14	System upgrade	86 days	Mon 10/23/06	Mon 2/19/07
15	Punch list	7 days	Tue 2/20/07	Wed 2/28/07



Project: Northeast High
Date: Tue 9/5/06

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

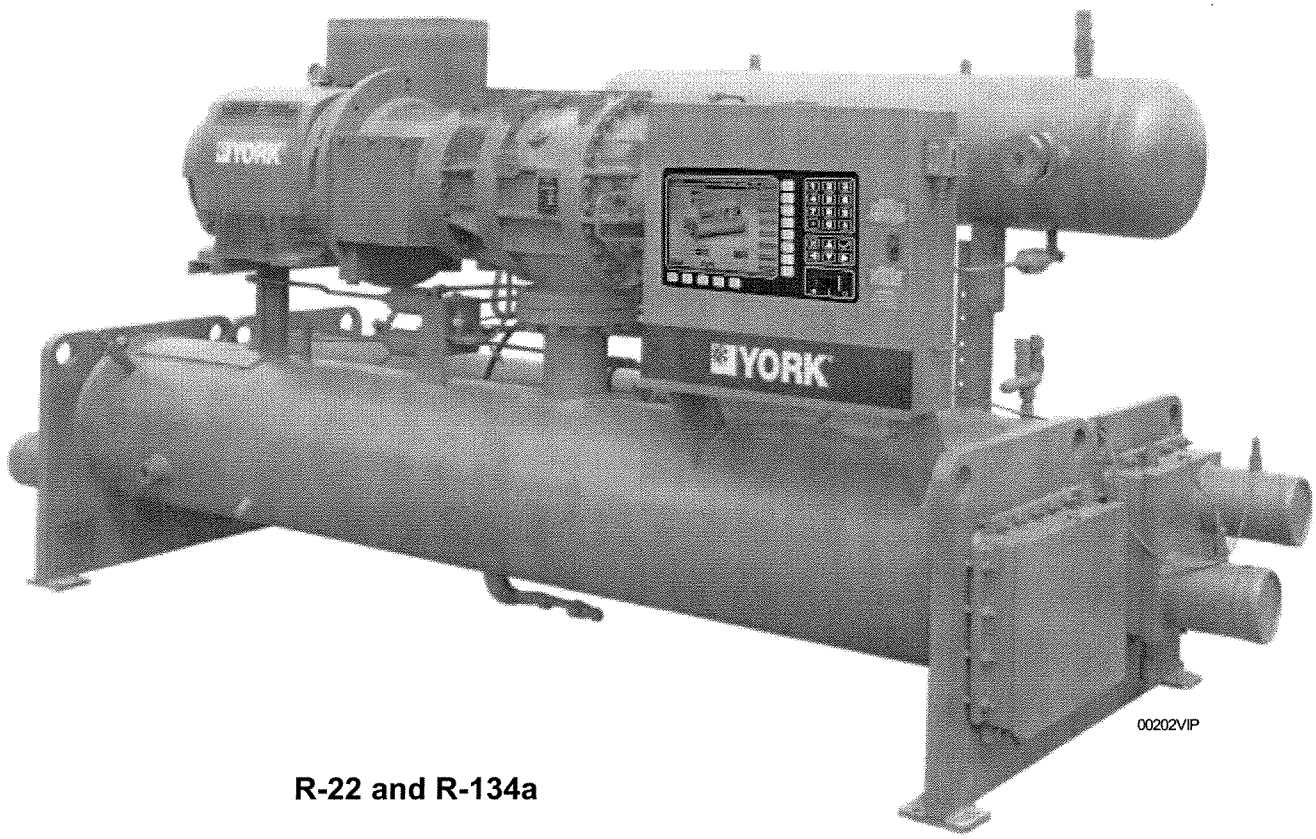
SYSTEMS START UP AND COMMISSIONING; OPERATING PARAMETERS OF INSTALLED EQUIPMENT

The following pages detail start up, commissioning, and operating instructions, processes, and parameters regarding applicable equipment to be installed at Sunrise Middle School as part of this project. Siemens Building Technologies, Inc. as well as its suppliers or subcontractors, will implement these start up and commissioning processes.

Additional detailed operating parameters are found in Schedule B of this document.

YORK®	*MILLENNIUM*™ ROTARY SCREW LIQUID CHILLERS	
INSTALLATION, OPERATION & MAINTENANCE	Supersedes: Nothing	Form 160.80-NOM1 (1199)

MODELS
YS BA BA S0 THROUGH YS FC FB S5
STYLE E



00202VIP

R-22 and R-134a

Metric Conversions

MANUFACTURER CERTIFIED TO ARI AS COMPLYING WITH ARI STANDARD 550

LLOYD'S REGISTER QUALITY COMPANY ISO9001

Manufactured in
ISO-Certified Facility

IMPORTANT!

READ BEFORE PROCEEDING!

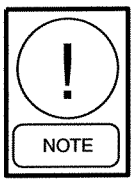
GENERAL SAFETY GUIDELINES

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, oils, 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.

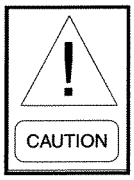
This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual possesses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual 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 areas of potential hazard:



NOTE is used to highlight additional information which may be helpful to you.



CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

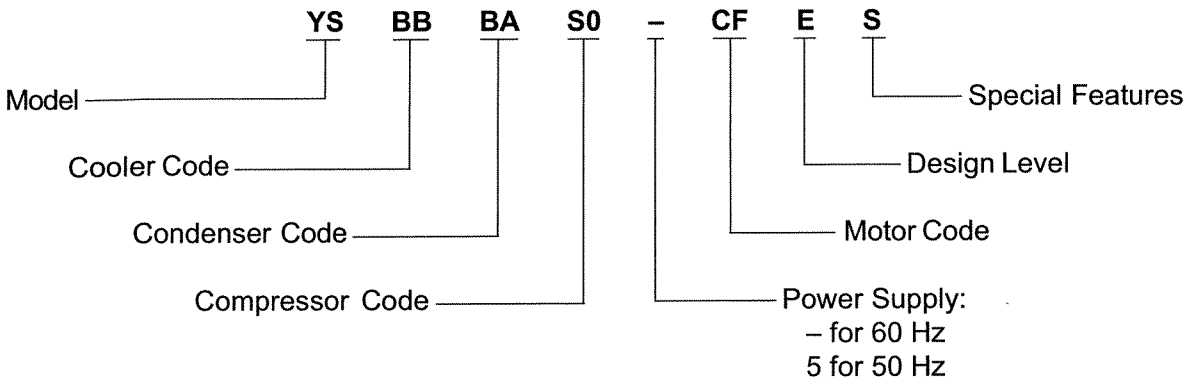
CHANGEABILITY OF THIS DOCUMENT

In complying with YORK's policy for continuous product improvement, the information contained in this document is subject to change without notice. While YORK makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest YORK Applied Systems Service office.

It is the responsibility of operating/service personnel as to the applicability of these documents to the equipment in question. If there is any question in the mind of operating/service personnel as to the applicability of these documents, then, prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current literature is available.

NOMENCLATURE

The model number denotes the following characteristics of the unit:



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SECTION 4 MAINTENANCE

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LIST OF FIGURES

SECTION 1 – INSTALLATION

GENERAL

This instruction describes the installation of a Model YS Rotary Screw Liquid Chiller. (See Figure 1.) This unit is shipped as a single factory assembled, piped, wired and nitrogen or refrigerant charged package (Form 1 shipment). This unit requires a minimum of field labor to make chilled water connections, condenser water connections, refrigerant atmospheric relief connections, and electrical power connections.

YS units can also be shipped dismantled when required by rigging conditions, but generally it is more economical to enlarge access openings to accommodate the factory assembled unit.

The YS Chiller may be ordered and shipped in the following forms:

Form 1 – Factory Assembled Unit, Complete with Motor and Refrigerant and Oil Charges as discussed in this instruction.

Form 2 – Factory Assembled (same as Form 1) except not charged with oil or refrigerant. Shipped with holding charge of nitrogen. Refrigerant shipped in 50 and 125 lb. cylinders.

Form 3 – Driveline Separate From Shells – Shipped as three major assemblies.

Form 7 – Split Shells – Shipped as four major assemblies.

NOTE

Units shipped dismantled MUST be reassembled by, or under the supervision of a YORK representative. Refer to Form 160.80-N1 for detailed instructions of Form 3 and 7 shipments.

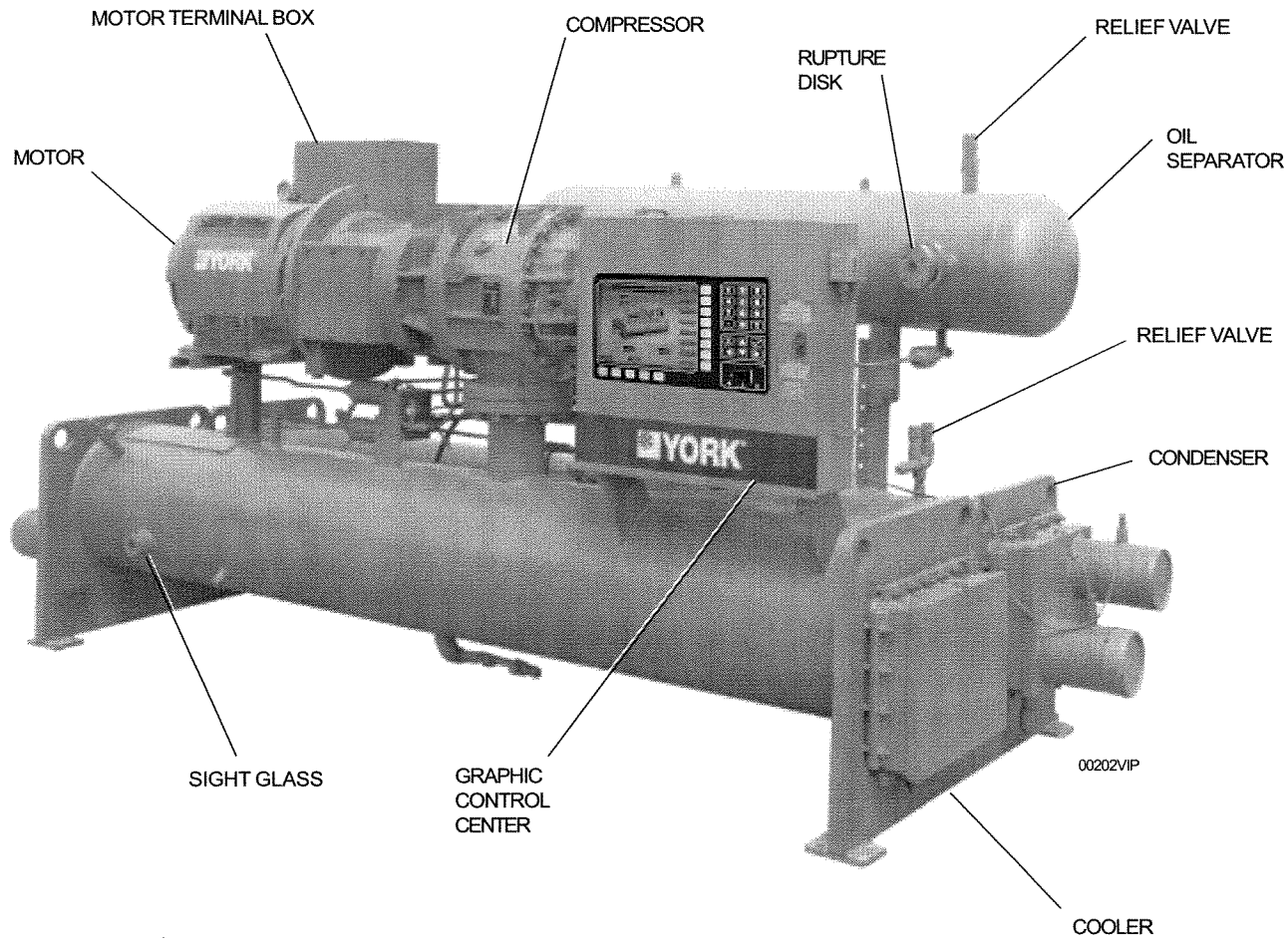


FIG. 1 – MODEL YS, STYLE E ROTARY SCREW LIQUID CHILLER

The YORK Warranty will be voided if the following restrictions are not adhered to:

1. No valves or connections should be opened under any circumstances because such action will result in loss of the factory refrigerant or nitrogen charge.

2. Do not dismantle or open the unit for any reason except under the supervision of a YORK representative.

3. When units are shipped dismantled, notify the nearest YORK office in ample time for a YORK representative to supervise rigging the unit to its operating position and the assembly of components.

4. Do not make final power supply connections to the compressor motor or control center.

5. Do not charge the system with oil.

6. Do not attempt to start the system.

7. Do not run hot water (100°F max.) or steam through the cooler or condenser at any time.

INSPECTION

The unit shipment should be checked on arrival to see that all major pieces, boxes and crates are received. Each unit should be checked on the trailer or rail car when received, before unloading, for any visible signs of damage. Any damage or signs of possible damage must be reported to the transportation company immediately for their inspection.

YORK WILL NOT BE RESPONSIBLE FOR ANY DAMAGE IN SHIPMENT OR AT JOB SITE OR LOSS OF PARTS. (Refer to Shipping Damage Claims, Form 50.15-NM.)

When received at the job site, all containers should be opened and the contents checked against the packing list. Any material shortage should be reported to YORK immediately.

DATA PLATE

A unit data plate is mounted on the control center assembly of each unit, giving unit model number; design working pressure; water passes; refrigerant charge; serial numbers; and motor power characteristics and connection diagrams. Refer to "Nomenclature" on page 3 to verify data plate markings.

LOCATION

The chiller should be located in an indoor location where temperature ranges from 40°F to 110°F (4°C to 43°C).

The units are furnished with neoprene vibration isolator mounts for basement or ground level installations. Units may be located on upper floor levels providing the floor is capable of supporting the total unit operating weight. Refer to Tables 1 and 2.

Equipment room should be ventilated to allow adequate heat removal. Check ANSI, state, local or other codes.

FOUNDATION

A level floor, mounting pad or foundation must be provided by others, capable of supporting the operating weight of the unit.

CLEARANCE

Clearances should be adhered to as follows:

Rear, Ends and Above Unit	–	2 Ft. / 610 mm
Front of Unit	–	3 Ft. / 914 mm
Tube Removal	–	See Table 1 below

TABLE 1 – CLEARANCES

COMPRESSOR	TUBE REMOVAL SPACE		ADD – MARINE WATER BOXES	
	Ft. - In.	mm	Ft. - In.	mm
S0, S1, S2, S3	10'–1"	3,073	1'–6"	457
S4, S5	12'–1"	3,683	1'–9"	533

RIGGING

The complete standard unit is shipped without skids. (When optional skids are used, it may be necessary to remove the skids so riggers skates can be used under the unit end sheets to reduce the overall height.)

Each unit has four lifting holes (two on each end) in the end sheets which should be used to lift the unit. Care should be taken at all times during rigging and handling to avoid damage to the unit and its external connections. Lift only using holes shown in Figure 2.

WARNING

Do not lift the unit with slings around motor/compressor assembly or by means of eyebolts in the tapped holes of the compressor motor assembly. Do not turn a unit on its side for rigging. Do not rig with driveline in a vertical orientation.

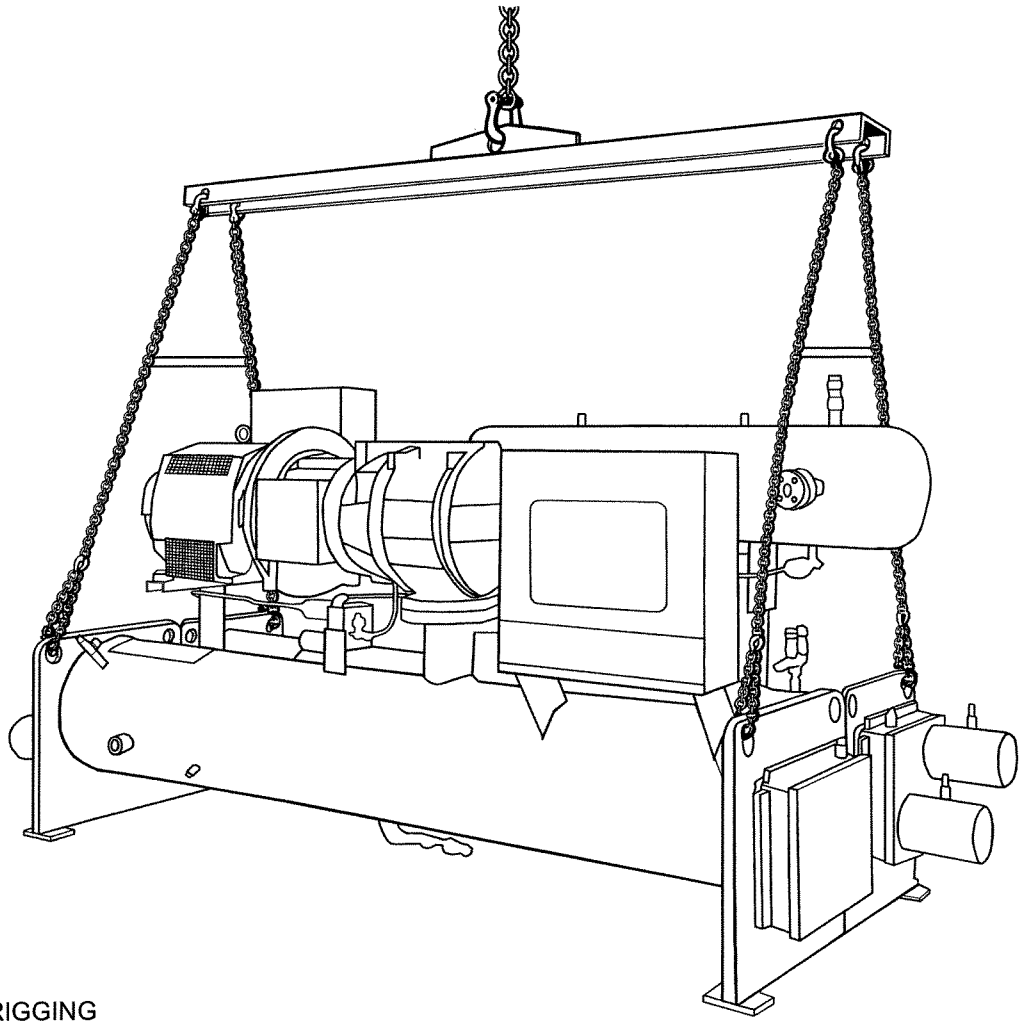
CAUTION

If necessary to rig a unit by one end to permit lifting or dropping through a vertical passageway, such as an elevator shaft, contact YORK Factory for special rigging instructions.

1

The shipping and operating weights are given in Tables 2 and 3. Overall dimensions are shown in Figures 4 thru 7. More detailed dimensions can be found in Form 160.80-PA1.

If optional shipping skids are used, remove them before lowering the unit to its mounting position. Rig the unit to its final location on the floor or mounting pad by lifting the unit (or shell assembly) with an overhead lift and lower the unit to its mounting position.



LD03588rig

FIG. 2 – RIGGING

TABLE 2 – WEIGHTS - ENGLISH, R-22 AND R-134A UNITS, 50 AND 60 HZ

SHELL CODE COOLER – COND.	COM-PRES-SOR	SHIP-PING WT. (Lbs.)	OPER-ATING WT. (Lbs.)	REFRIG-ERANT CHARGE (Lbs. R-22)	REFRIG-ERANT CHARGE (Lbs. R-134a)
BA-BA	S0	8,388	9,019	490	441
BA-BB	S0	8,538	9,235	490	441
BB-BA	S0	8,494	9,187	460	414
BB-BB	S0	8,644	9,403	460	414
BA-CA	S0	9,142	9,996	520	468
BA-CB	S0	9,416	10,388	520	468
BB-CA	S0	9,271	10,186	480	432
BB-CB	S0	9,545	10,579	480	432
CA-BA	S0	9,297	10,084	620	558
CA-BB	S0	9,448	10,299	620	558
CB-BA	S0	9,528	10,412	620	558
CB-BB	S0	9,679	10,627	620	558
CA-CA	S0	10,011	11,020	650	585
CA-CB	S0	10,285	11,413	650	585
CB-CA	S0	10,242	11,348	650	585
CB-CB	S0	10,516	11,740	650	585
BA-BA	S1	8,454	9,085	490	441
BA-BB	S1	8,608	9,301	490	441
BB-BA	S1	8,560	9,253	460	414
BB-BB	S1	8,711	9,469	460	414
BA-CA	S1	9,208	9,974	520	468
BA-CB	S1	9,482	10,454	520	468
BB-CA	S1	9,337	10,252	480	432
BB-CB	S1	9,611	10,645	480	432
CA-BA	S1	9,363	10,150	620	558
CA-BB	S1	9,513	10,365	620	558
CB-BA	S1	9,594	10,478	620	558
CB-BB	S1	9,745	10,693	620	558
CA-CA	S1	10,077	11,086	650	585
CA-CB	S1	10,351	11,479	650	585
CB-CA	S1	10,308	11,414	650	585
CB-CB	S1	10,582	11,806	650	585
BA-BA	S2	10,542	11,174	—	441
BA-BB	S2	10,693	11,390	—	441
BB-BA	S2	10,648	11,342	—	414
BB-BB	S2	10,797	11,558	—	414
BA-CA	S2	11,298	12,065	—	468
BA-CB	S2	11,571	12,547	—	468
BB-CA	S2	11,426	12,342	—	432
BB-CB	S2	11,701	12,735	—	432
CA-BA	S2	11,452	12,241	—	558
CA-BB	S2	11,604	12,457	—	558
CB-BA	S2	11,683	12,567	—	558
CB-BB	S2	11,833	12,783	—	558
CA-CA	S2	12,146	13,155	680	612
CA-CB	S2	12,419	13,547	680	612
CB-CA	S2	12,377	13,483	680	612
CB-CB	S2	12,650	13,874	680	612

SHELL CODE COOLER – COND.	COM-PRES-SOR	SHIP-PING WT. (Lbs.)	OPER-ATING WT. (Lbs.)	REFRIG-ERANT CHARGE (Lbs. R-22)	REFRIG-ERANT CHARGE (Lbs. R-134a)
CA-DA	S2	13,357	14,765	750	675
CA-DB	S2	13,874	15,506	750	675
CB-DA	S2	13,588	15,093	750	675
CB-DB	S2	14,105	15,833	750	675
DA-CA	S2	13,293	14,480	840	756
DA-CB	S2	13,577	14,872	840	756
DB-CA	S2	13,668	15,008	840	756
DB-CB	S2	13,941	15,400	840	756
DC-CA	S2	14,026	15,552	840	756
DC-CB	S2	14,299	15,943	840	756
DA-DA	S2	14,549	16,124	950	855
DA-DB	S2	15,066	16,864	950	855
DB-DA	S2	14,869	16,608	910	819
DB-DB	S2	15,386	17,348	910	819
DC-DA	S2	15,215	17,437	840	756
DC-DB	S2	15,732	16,781	840	756
CA-CA	S3	12,360	13,372	—	612
CA-CB	S3	12,633	13,764	—	612
CB-CA	S3	12,591	13,698	—	612
CB-CB	S3	12,865	14,090	—	612
CA-DA	S3	13,574	14,983	—	675
CA-DB	S3	14,090	15,726	—	675
CB-DA	S3	13,804	15,313	—	675
CB-DB	S3	14,324	16,054	—	675
DA-CA	S3	13,497	14,673	840	756
DA-CB	S3	13,770	15,065	840	756
DB-CA	S3	13,861	15,201	840	756
DB-CB	S3	14,134	15,593	840	756
DC-CA	S3	14,219	15,744	840	756
DC-CB	S3	14,491	16,135	840	756
DA-DA	S3	14,741	16,316	950	855
DA-DB	S3	15,258	17,057	950	855
DB-DA	S3	15,061	16,800	910	819
DB-DB	S3	15,578	17,541	910	819
DC-DA	S3	15,408	17,333	840	756
DC-DB	S3	15,925	18,073	840	756
DA-CA	S4	17,068	18,247	—	740
DA-CB	S4	17,341	18,639	—	740
DB-CA	S4	17,431	18,776	—	740
DB-CB	S4	17,705	19,168	—	740
DC-CA	S4	17,791	19,320	—	740
DC-CB	S4	18,064	19,710	—	740
DA-DA	S4	18,313	19,893	—	830
DA-DB	S4	18,833	20,634	—	830
DB-DA	S4	18,635	20,378	—	800
DB-DB	S4	19,153	21,119	—	800
DC-DA	S4	18,983	20,912	—	740
DC-DB	S4	19,426	21,652	—	740

TABLE 2 – WEIGHTS - ENGLISH, R-22 AND R-134A UNITS, 50 AND 60 HZ (CONT'D)

SHELL CODE COOLER – COND.	COM-PRES-SOR	SHIP-PING WT. (Lbs.)	OPER-ATING WT. (Lbs.)	REFRIG-ERANT CHARGE (Lbs. R-22)	REFRIG-ERANT CHARGE (Lbs. R-134a)
EA-EA	S4	20,460	21,890	1,400	1,260
EA-EB	S4	21,104	22,743	1,400	1,260
EB-EA	S4	20,955	22,484	1,350	1,215
EB-EB	S4	21,533	23,337	1,350	1,215
EC-EA	S4	21,362	23,139	1,300	1,170
EC-EB	S4	22,000	23,991	1,300	1,170
EA-FA	S4	23,485	25,592	1,520	1,368
EA-FB	S4	24,695	27,192	1,520	1,368
EB-FA	S4	23,914	26,180	1,520	1,368
EB-FB	S4	25,119	27,781	1,450	1,305
EC-FA	S4	24,382	26,840	1,450	1,305
EC-FB	S4	25,592	28,435	1,450	1,305
FA-EA	S4	22,922	24,998	—	1,690
FA-EB	S4	23,638	25,853	—	1,690
FB-EA	S4	23,711	25,902	—	1,690
FB-EB	S4	24,288	26,757	—	1,690
FC-EA	S4	24,171	27,076	—	1,620
FC-EB	S4	25,141	27,929	—	1,620
FA-FA	S4	25,977	28,655	2,000	1,800
FA-FB	S4	27,187	30,256	2,000	1,800
FB-FA	S4	26,626	29,552	2,000	1,800
FB-FB	S4	27,830	31,152	1,900	1,710
FC-FA	S4	27,148	30,729	1,900	1,710
FC-FB	S4	28,688	32,324	1,900	1,710

SHELL CODE COOLER – COND.	COM-PRES-SOR	SHIP-PING WT. (Lbs.)	OPER-ATING WT. (Lbs.)	REFRIG-ERANT CHARGE (Lbs. R-22)	REFRIG-ERANT CHARGE (Lbs. R-134a)
EA-EA	S5	20,777	22,210	—	1,260
EA-EB	S5	21,423	23,065	—	1,260
EB-EA	S5	21,275	22,807	—	1,215
EB-EB	S5	21,853	23,682	—	1,215
EC-EA	S5	21,681	23,462	—	1,170
EC-EB	S5	22,322	24,317	—	1,170
EA-FA	S5	23,808	25,919	—	1,368
EA-FB	S5	25,020	27,521	—	1,368
EB-FA	S5	24,240	26,508	—	1,368
EB-FB	S5	25,445	28,112	—	1,305
EC-FA	S5	24,707	27,171	—	1,305
EC-FB	S5	25,919	28,769	—	1,305
FA-EA	S5	23,274	25,280	—	1,690
FA-EB	S5	23,920	26,135	—	1,690
FB-EA	S5	23,991	26,184	—	1,690
FB-EB	S5	24,568	27,036	—	1,620
FC-EA	S5	24,453	27,356	—	1,620
FC-EB	S5	25,423	28,211	—	1,620
FA-FA	S5	26,257	28,936	2,000	1,800
FA-FB	S5	27,467	30,536	2,000	1,800
FB-FA	S5	26,906	29,832	2,000	1,800
FB-FB	S5	28,111	31,433	1,900	1,710
FC-FA	S5	27,759	31,009	1,900	1,710
FC-FB	S5	28,969	32,604	1,900	1,710

NOTES:

1. Calculate total chiller weight by adding motor weight, solid state starter weight, and marine water box weights, if applicable.
2. Shipping weight includes refrigerant and oil charge. Operating weight includes water in tubes and water boxes.
3. Weights based on standard tubes in coolers and condensers.
4. Operating weight based on R-22. Subtract difference in refrigerant charge if using R-134a.

TABLE 3 – WEIGHTS - SI, R-22 AND R-134A UNITS, 50 AND 60 HZ

SHELL CODE COOLER – COND.	COM-PRES-SOR	SHIP-PING WT. (Kgs.)	OPER-ATING WT. (Kgs.)	REFRIG-ERANT CHARGE (Kgs. R-22)	REFRIG-ERANT CHARGE (Kgs. R-134a)
BA-BA	S0	3,805	4,091	222	200
BA-BB	S0	3,873	4,189	222	200
BB-BA	S0	3,853	4,167	209	188
BB-BB	S0	3,921	4,265	209	188
BA-CA	S0	4,147	4,534	236	212
BA-CB	S0	4,271	4,712	236	212
BB-CA	S0	4,205	4,620	218	196
BB-CB	S0	4,330	4,799	218	196
CA-BA	S0	4,217	4,574	281	253
CA-BB	S0	4,286	4,672	281	253
CB-BA	S0	4,322	4,723	281	253
CB-BB	S0	4,390	4,820	281	253
CA-CA	S0	4,541	4,999	295	265
CA-CB	S0	4,665	5,177	295	265
CB-CA	S0	4,646	5,147	295	265
CB-CB	S0	4,770	5,325	295	265
BA-BA	S1	3,835	4,121	222	200
BA-BB	S1	3,905	4,219	222	200
BB-BA	S1	3,883	4,197	209	188
BB-BB	S1	3,951	4,295	209	188
BA-CA	S1	4,177	4,524	236	212
BA-CB	S1	4,301	4,742	236	212
BB-CA	S1	4,235	4,650	218	196
BB-CB	S1	4,360	4,829	218	196
CA-BA	S1	4,247	4,604	281	253
CA-BB	S1	4,315	4,702	281	253
CB-BA	S1	4,352	4,753	281	253
CB-BB	S1	4,420	4,850	281	253
CA-CA	S1	4,571	5,029	295	265
CA-CB	S1	4,695	5,207	295	265
CB-CA	S1	4,676	5,177	295	265
CB-CB	S1	4,800	5,355	295	265
BA-BA	S2	4,782	5,069	—	200
BA-BB	S2	4,850	5,167	—	200
BB-BA	S2	4,830	5,145	—	188
BB-BB	S2	4,898	5,243	—	188
BA-CA	S2	5,125	5,473	—	212
BA-CB	S2	5,249	5,691	—	212
BB-CA	S2	5,183	5,598	—	196
BB-CB	S2	5,308	5,777	—	196
CA-BA	S2	5,195	5,553	—	253
CA-BB	S2	5,264	5,650	—	253
CB-BA	S2	5,299	5,700	—	253
CB-BB	S2	5,367	5,798	—	253
CA-CA	S2	5,509	5,967	308	278
CA-CB	S2	5,633	6,145	308	278
CB-CA	S2	5,614	6,116	308	278
CB-CB	S2	5,738	6,293	308	278
CA-DA	S2	6,059	6,697	340	306
CA-DB	S2	6,293	7,034	340	306
CB-DA	S2	6,164	6,846	340	306
CB-DB	S2	6,398	7,182	340	306
DA-CA	S2	6,030	6,568	381	343
DA-CB	S2	6,159	6,746	381	343
DB-CA	S2	6,200	6,808	381	343
DB-CB	S2	6,324	6,985	381	343
DC-CA	S2	6,362	7,054	381	343
DC-CB	S2	6,486	7,232	381	343
DA-DA	S2	6,599	7,314	431	388
DA-DB	S2	6,834	7,650	431	388
DB-DA	S2	6,745	7,533	413	371
DB-DB	S2	6,979	7,869	413	371
DC-DA	S2	6,902	7,909	381	343
DC-DB	S2	7,136	7,612	381	343
CA-CA	S3	5,606	6,066	—	278
CA-CB	S3	5,730	6,243	—	278
CB-CA	S3	5,711	6,213	—	278
CB-CB	S3	5,836	6,391	—	278
CA-DA	S3	6,157	6,796	—	306
CA-DB	S3	6,391	7,133	—	306
CB-DA	S3	6,261	6,946	—	306
CB-DB	S3	6,497	7,282	—	306
DA-CA	S3	6,122	6,656	381	343
DA-CB	S3	6,246	6,833	381	343
DB-CA	S3	6,287	6,895	381	343
DB-CB	S3	6,411	7,073	381	343
DC-CA	S3	6,450	7,141	381	343
DC-CB	S3	6,573	7,319	381	343
DA-DA	S3	6,687	7,401	431	388
DA-DB	S3	6,921	7,737	431	388
DB-DA	S3	6,832	7,620	413	371
DB-DB	S3	7,066	7,957	413	371
DC-DA	S3	6,989	7,862	381	343
DC-DB	S3	7,224	8,198	381	343
DA-CA	S4	7,742	8,277	—	336
DA-CB	S4	7,866	8,455	—	336
DB-CA	S4	7,907	8,517	—	336
DB-CB	S4	8,031	8,695	—	336
DC-CA	S4	8,070	8,764	—	336
DC-CB	S4	8,194	8,940	—	336
DA-DA	S4	8,307	9,023	—	376
DA-DB	S4	8,543	9,360	—	376
DB-DA	S4	8,453	9,243	—	363
DB-DB	S4	8,688	9,580	—	363
DC-DA	S4	8,611	9,486	—	336
DC-DB	S4	8,812	9,821	—	336

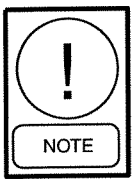
TABLE 3 – WEIGHTS - SI, R-22 AND R-134A UNITS, 50 AND 60 HZ (CONT'D)

SHELL CODE COOLER – COND.	COM-PRES-SOR	SHIP-PING WT. (Kgs.)	OPER-ATING WT. (Kgs.)	REFRIG-ERANT CHARGE (Kgs. R-22)	REFRIG-ERANT CHARGE (Kgs. R-134a)
EA-EA	S4	9,281	9,929	635	572
EA-EB	S4	9,573	10,316	635	572
EB-EA	S4	9,505	10,199	612	551
EB-EB	S4	9,767	10,586	612	551
EC-EA	S4	9,690	10,496	590	531
EC-EB	S4	9,979	10,882	590	531
EA-FA	S4	10,653	11,609	689	621
EA-FB	S4	11,202	12,334	689	621
EB-FA	S4	10,847	11,875	689	621
EB-FB	S4	11,394	12,601	658	592
EC-FA	S4	11,060	12,175	658	592
EC-FB	S4	11,609	12,898	658	592
FA-EA	S4	10,397	11,339	—	767
FA-EB	S4	10,722	11,727	—	767
FB-EA	S4	10,755	11,749	—	767
FB-EB	S4	11,017	12,137	—	767
FC-EA	S4	10,964	12,282	—	735
FC-EB	S4	11,404	12,669	—	735
FA-FA	S4	11,783	12,998	907	816
FA-FB	S4	12,332	13,724	907	816
FB-FA	S4	12,078	13,405	907	816
FB-FB	S4	12,624	14,131	862	776
FC-FA	S4	12,314	13,939	862	776
FC-FB	S4	13,013	14,662	862	776

SHELL CODE COOLER – COND.	COM-PRES-SOR	SHIP-PING WT. (Kgs.)	OPER-ATING WT. (Kgs.)	REFRIG-ERANT CHARGE (Kgs. R-22)	REFRIG-ERANT CHARGE (Kgs. R-134a)
EA-EA	S5	9,424	10,074	—	572
EA-EB	S5	9,717	10,462	—	572
EB-EA	S5	9,650	10,345	—	551
EB-EB	S5	9,913	10,742	—	551
EC-EA	S5	9,835	10,642	—	531
EC-EB	S5	10,125	11,030	—	531
EA-FA	S5	10,799	11,757	—	621
EA-FB	S5	11,349	12,484	—	621
EB-FA	S5	10,995	12,024	—	621
EB-FB	S5	11,542	12,752	—	592
EC-FA	S5	11,207	12,325	—	592
EC-FB	S5	11,757	13,050	—	592
FA-EA	S5	10,557	11,467	—	767
FA-EB	S5	10,850	11,855	—	767
FB-EA	S5	10,882	11,877	—	767
FB-EB	S5	11,144	12,264	—	735
FC-EA	S5	11,092	12,409	—	735
FC-EB	S5	11,532	12,797	—	735
FA-FA	S5	11,910	13,125	907	816
FA-FB	S5	12,459	13,851	907	816
FB-FA	S5	12,205	13,532	907	816
FB-FB	S5	12,751	14,258	862	776
FC-FA	S5	12,591	14,066	862	776
FC-FB	S5	13,140	14,789	862	776

NOTES:
1. Calculate total chiller weight by adding motor weight, solid state starter weight, and marine water box weights, if applicable.
2. Shipping weight includes refrigerant and oil charge. Operating weight includes water in tubes and water boxes.
3. Weights based on standard tubes in coolers and condensers.
4. Operating weight based on R-22. Subtract difference in refrigerant charge if using R-134a.

RIGGING (CONT'D)



Units shipped dismantled should be assembled under the supervision of a YORK representative.

If the cooler is to be field insulated, the insulation should be applied while the unit is in the lift position, before the unit is placed in position.

LOCATING AND INSTALLING ISOLATOR PADS

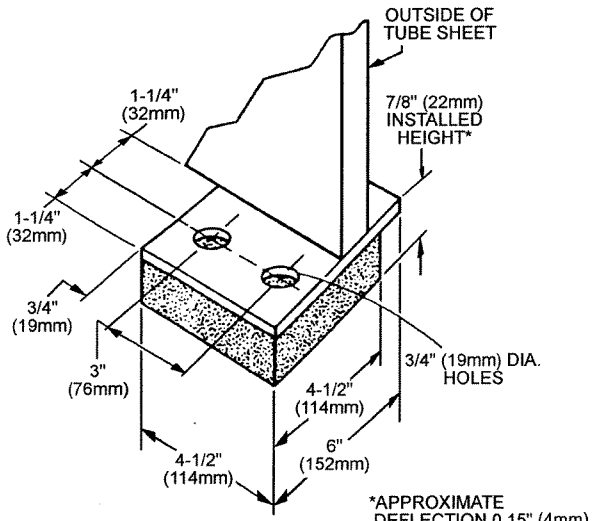
The isolator pads should be located in accordance with the floor layout of the dimensional product drawing, Form 160.47-PA1. After the isolator pads have been placed into position on the floor, lower the unit onto the pads. Make sure the pads are even with the edges of the mounting feet. When the unit is in place, remove the rigging equipment and check that the chiller is level, both longitudinally and transversely. See Figure 3.

The longitudinal alignment of the unit should be checked by placing a level on the top center of the cooler shell **under the compressor/motor assembly.** Transverse alignment should be checked by placing a level on top of the shell end sheets at each end of the unit.

The unit should be level within 1/4 inch from one end to the other end and from front to the rear. If the chiller is not level within the amount specified, lift it and place shims between the isolation pad and the tube sheets.

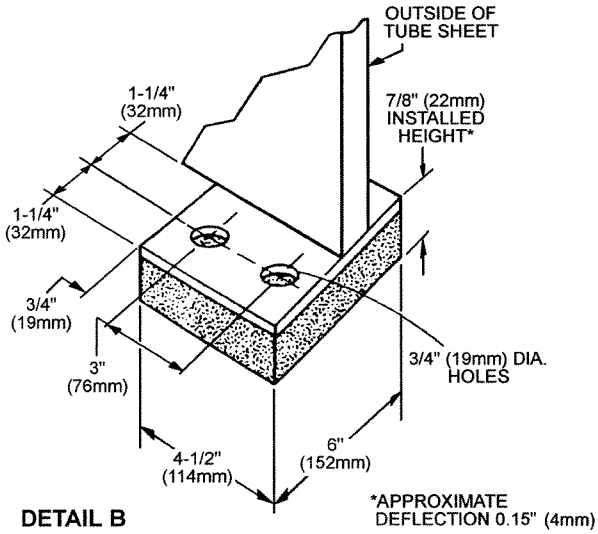
CHECKING THE ISOLATOR PAD DEFLECTION

All isolator pads should be checked for the proper deflection while checking the level of the unit. Each pad should be deflected approximately 0.15 inch (4mm). If an isolator pad is under deflected, shims should be placed between the unit tube sheet and the top of the pad to equally deflect all pads. Refer to Figure 3.



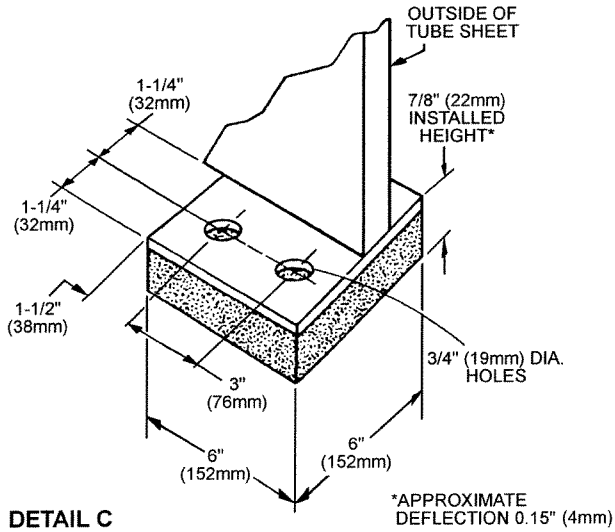
DETAIL A

LD02942



DETAIL B

LD02943

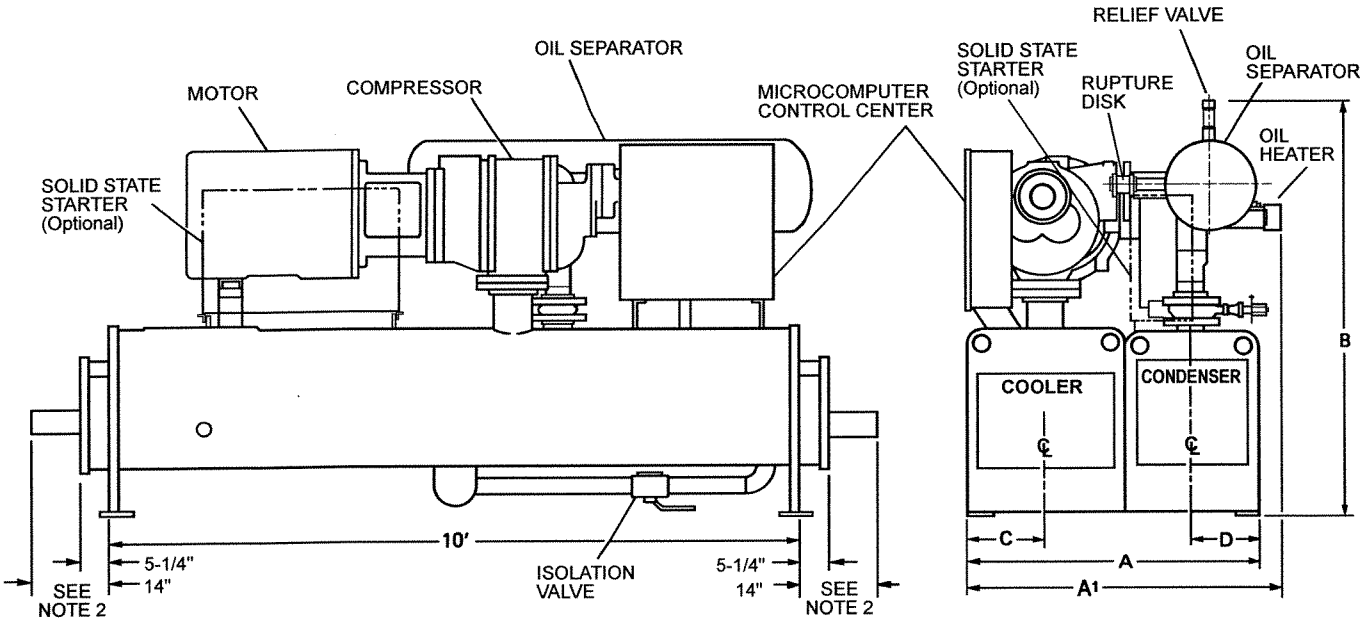


DETAIL C

LD02944

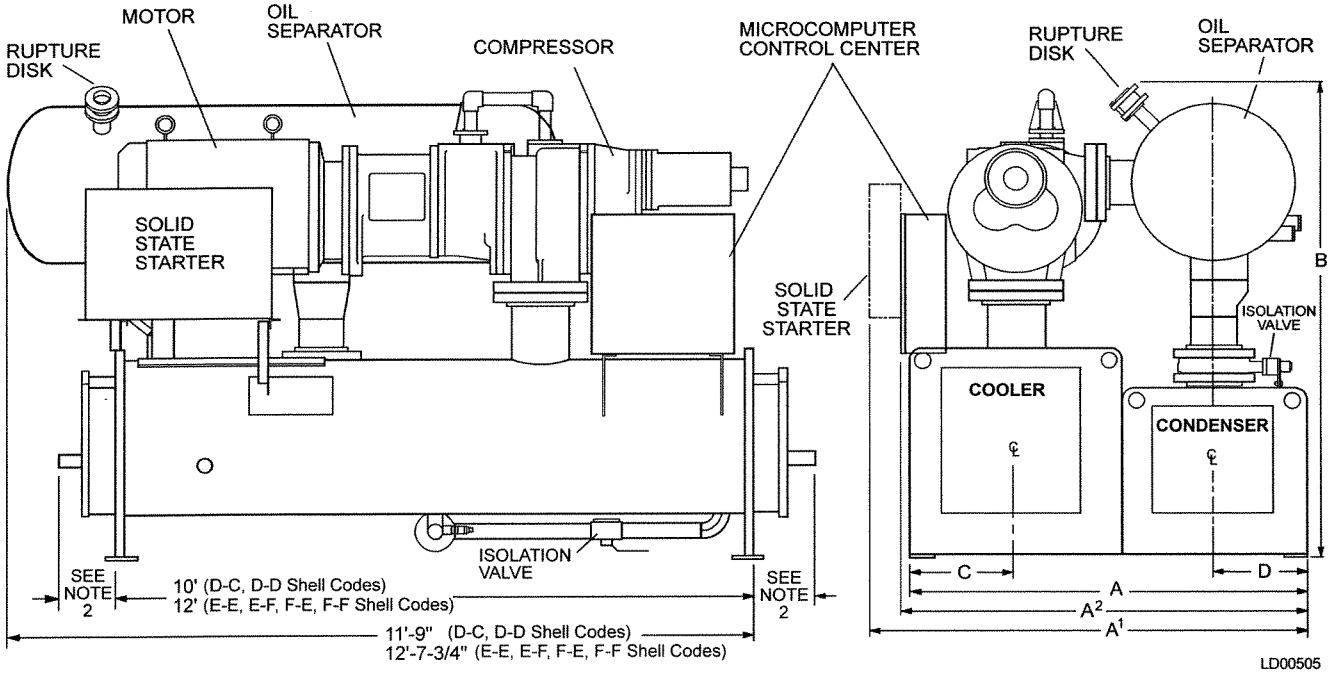
OPERATING WEIGHT (Lbs. / Kgs.)	DETAIL
UP TO 16,365 / 7,423	A
16,636 / 7,546 to 28,835 / 13,080	B
28,836 / 13,080 to 53,530 / 24,281	C

FIG. 3 – STANDARD NEOPRENE VIBRATION ISOLATOR PAD MOUNTS



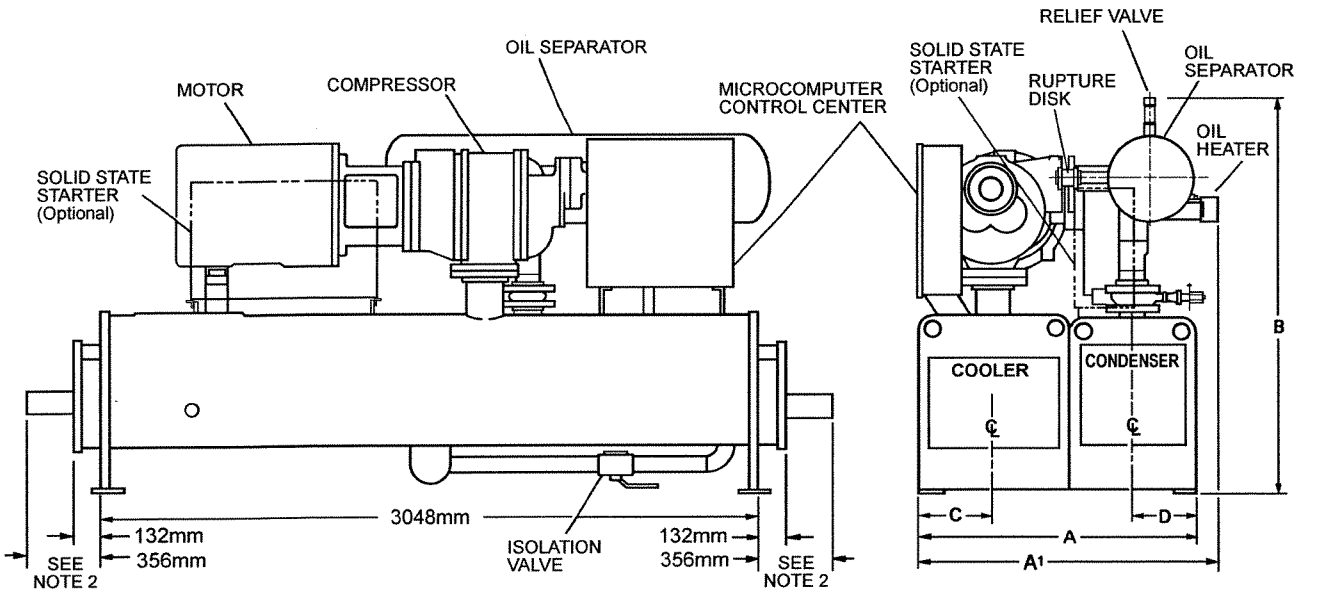
DIMENSION	S0 and S1 COMPRESSOR				S2 COMPRESSOR			S2 and S3 COMPRESSOR			
	SHELL CODES (Cooler – Condenser)										
	B-B	B-C	C-B	C-C	B-B	B-C	C-B	C-C	C-D	D-C	D-D
A – TUBE SHEET WIDTH	4'–2-7/8"				5'–2-1/2"			5'–2-1/2"			
A[1] – OVERALL WIDTH	4'–6-3/4"	4'–6-1/4"	4'-6-3/4"	4'–6-1/4"	5'–3-3/4"			5'–3-3/4"			
B – OVERALL HEIGHT[3]	5'–8-5/8"	5'–11-1/2"	5'–10-1/4"	5'–11-1/2"	5'–11-1/4"	6'–3-1/4"	6'–3-1/4"	6'–3-1/4"	6'–7-5/8"	6'–8-3/4"	6'–9-3/8"
C – COOLER C/L	1'–1-7/8"				1'–5"			1'–5"			
D – CONDENSER C/L	0'–11-5/8"				1'–2-1/4"			1'–2-1/4"			

FIG. 4 – OVERALL DIMENSIONS - ENGLISH, S0 THRU S3 COMPRESSOR



DIMENSION	S4 COMPRESSOR		S4 and S5 COMPRESSOR			
	SHELL CODES (Cooler – Condenser)					
	D-C	D-D	E-E	E-F	F-E	F-F
A TUBE SHEET WIDTH	6'–2"	6'–2"	6'–2"	6'–4-1/2"	6'–6-1/2"	6'–9"
A[1] – With SSS	6'–9-7/8"	6'–9-7/8"	6'–9-7/8"	7'–0-3/8"	7'–3-5/8"	7'–2-5/8"
A[2] – OVERALL WD. (less SSS)	6'–3-3/8"	6'–3-3/8"	6'–2"	6'–4-1/2"	6'–6-1/2"	6'–9"
B – OVERALL HEIGHT[3]	7'–9-1/8"	7'–9-1/8"	7'–9-1/8"	8'–2-1/4"	8'–2-1/4"	8'–2-1/4"
C – COOLER C/L	1'–7-3/4"	1'–7-3/4"	1'–7-3/4"	1'–7-3/4"	1'–10"	1'–10"
D – CONDENSER C/L	1'–5-1/4"	1'–5-1/4"	1'–5-1/4"	1'–6-1/2"	1'–5-1/4"	1'–6-1/2"

FIG. 5 – OVERALL DIMENSIONS - ENGLISH, S4 AND S5 COMPRESSOR



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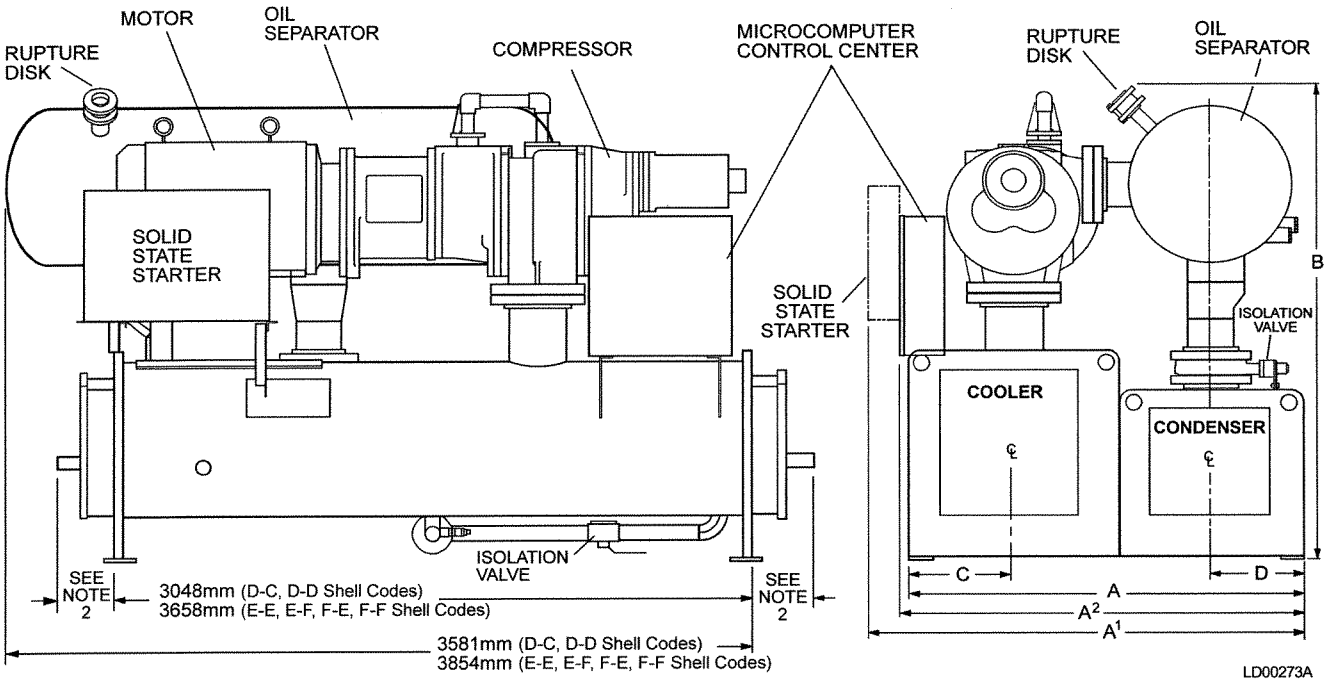
DIMENSION	S0 and S1 COMPRESSOR				S2 COMPRESSOR			S2 and S3 COMPRESSOR			
	SHELL CODES (Cooler – Condenser)										
	B-B	B-C	C-B	C-C	B-B	B-C	C-B	C-C	C-D	D-C	D-D
A – TUBE SHEET WIDTH	1,292	1,292	1,292	1,292	1,588	1,588	1,588	1,588	1,588	1,588	1,588
A[1] – OVERALL WIDTH	1,349	1,349	1,349	1,349	1,591	1,591	1,591	1,591	1,591	1,591	1,591
B – OVERALL HEIGHT[3]	1,816	1,895	1,857	1,899	1,848	1,946	1,946	1,946	2,054	2,102	2,102
C – COOLER C/L	351	351	351	351	432	432	432	432	432	432	432
D – CONDENSER C/L	295	295	295	295	362	362	362	362	362	362	362

All dimensions in mm.

FIG. 6 – OVERALL DIMENSIONS - STANDARD INTERNATIONAL, S0 THRU S3 COMPRESSOR



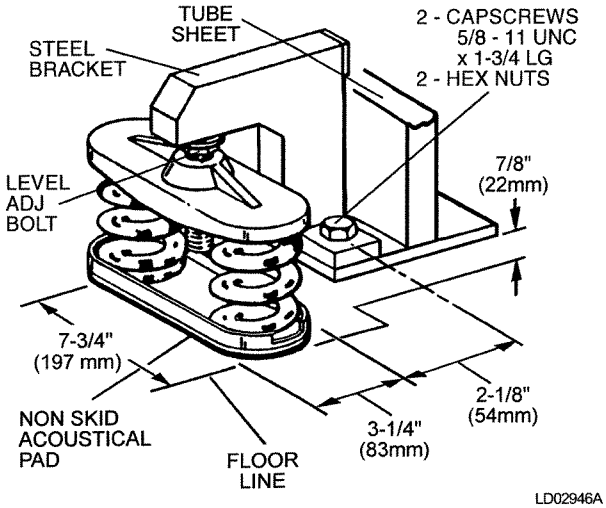
DIMENSION	S4 COMPRESSOR	S4 and S5 COMPRESSOR				
	SHELL CODES (Cooler – Condenser)					
	D-C	D-D	E-E	E-F	F-E	F-F
A – TUBE SHEET WIDTH	1,880	1,880	1,880	1,943	1,994	2,057
A[1] – WITH SOLID STATE STARTER	2,080	2,080	2,080	2,143	2,226	2,200
A[2] – OVERALL WIDTH (Less S.S.S)	1,915	1,915	1,880	1,943	1,994	2,057
B – OVERALL HEIGHT[3]	2,365	2,365	2,365	2,496	2,496	2,496
C – COOLER C/L	502	502	502	502	559	559
D – CONDENSER C/L	438	438	438	470	438	470

All dimensions in mm.

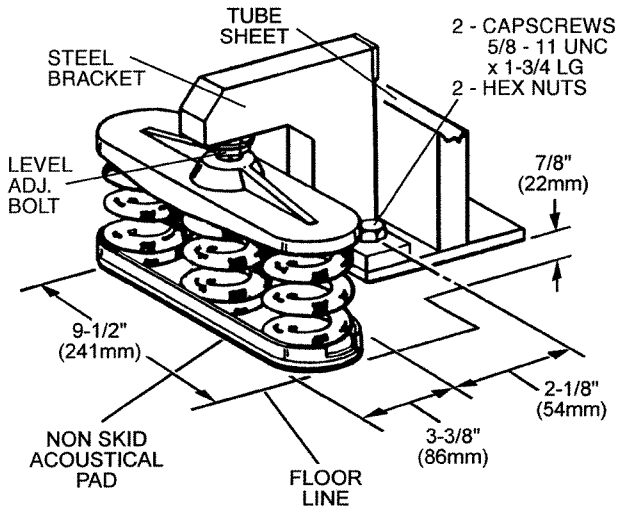
FIG. 7 – OVERALL DIMENSIONS - STANDARD INTERNATIONAL, S4 AND S5 COMPRESSOR

INSTALLING OPTIONAL SPRING ISOLATORS

To install these spring isolators, first remove the bolts and nuts from the spring isolator bracket. Bolt the isolator bracket to the unit foot support before the unit is located on the floor. Place the four spring isolators in position in accordance with the product drawing, Form 160.47-PA1. The threaded adjusting bolts in each isolator should be screwed out of the isolator until the extended head of the screw fits snugly into the isolator bracket hole. Then the unit is lowered over the adjusting bolts. Refer to Figure 8.



PART NO. 029-18479



PART NO. 029-18480

SPRING ISOLATORS (4 Per Unit) – ENGLISH

COMPRESSOR SIZE	SYSTEM OPERATING WEIGHT (Lbs.)	PART NUMBER
S0, S1, S2, S3	UP to 6,865	029-18479-001
	6,866 to 9,818	029-18479-002
	9,819 to 12,182	029-18479-003
	12,183 to 15,272	029-18479-004
	15,273 to 18,272	029-18480-001
	18,273 to 22,909	029-18480-002
S4, S5	UP to 22,909	029-18480-002
	22,910 to 26,044	029-18480-003
	26,045 to 32,101	029-18480-004

SPRING ISOLATORS (4 Per Unit) – SI

COMPRESSOR SIZE	SYSTEM OPERATING WEIGHT (kg)	PART NUMBER
S0, S1, S2, S3	UP to 3,114	029-18479-001
	3,115 to 4,453	029-18479-002
	4,454 to 5,525	029-18479-003
	5,526 to 6,927	029-18479-004
	6,928 to 8,288	029-18480-001
	8,289 to 10,392	029-18480-002
S4, S5	UP to 10,392	029-18480-002
	10,392 to 11,813	029-18480-003
	11,814 to 14,561	029-18480-004

FIG. 8 – SPRING ISOLATORS (OPTIONAL)

The adjusting bolts should now be rotated one (1) turn at a time, in sequence, until the unit end sheets are about 7/8 inch (22mm) off the floor or foundation, and the unit is level. Check the level of the unit both longitudinally and transversely. If the adjusting bolts are not long enough to level the unit due to an uneven or sloping floor or foundation, steel shims (grouted, if necessary) must be added beneath the isolator assemblies as necessary.

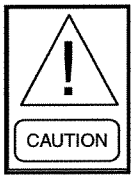
After the unit is leveled, wedge and shim under each corner to solidly support the unit in this position while piping connections are being made, pipe hangers adjusted and connections checked for alignment. Then the unit can be filled with water and checked for leaks. The adjusting bolts should now be finally adjusted and the wedges and shims can be removed. The unit should now be in correct level position, clear of the floor or foundation and without any effect from the weight of the piping. When the unit is properly supported, spring isolator deflection should be approximately 1" (25 mm).

PIPING CONNECTIONS

After the unit is leveled (and wedged in place for optional spring isolators) the piping connections may be fabricated; chilled water, condenser water and refrigerant relief. The piping should be arranged with offsets for flexibility, and adequately supported and braced independently of the unit to avoid strain on the unit and vibration transmission. Hangers must allow for alignment of pipe. Isolators (by others) in the piping and hangers are highly desirable, and may be required by specifications. This is done to effectively utilize the vibration isolation characteristics of the isolator mounts on the unit.

CHECK FOR PIPING ALIGNMENT

When piping is complete, check for alignment try opening a connection in each line, as close to the unit as possible, by removing the flange bolts or coupling. If any of the bolts are bound in their holes, or if the connection springs are out of alignment. The misalignment must be corrected by properly supporting the piping or by applying heat to anneal the pipe.



It may be necessary to weld chilled water or condenser water piping directly to the water pipe nozzles. Since chilled and condenser water temperature sensor wells are often in close proximity to these connection points, sensors in the wells may often see temperatures of several hundred degrees. We have reason to believe that some potential exists for damaging these sensors from the transferred heat. Any damage will most likely show up as error in the sensor.

It is advisable to remove the sensors from the wells during the welding process as a precautionary measure. If the sensor is removed, assure that it bottoms out when it is placed back in the well.

If the piping is annealed to relieve stress, the inside of the pipe must be cleaned of scale before it is finally bolted in place.

COOLER AND CONDENSER WATER PIPING

YS Chillers have cooler and condenser liquid heads with nozzles that are grooved for the use of victaulic couplings. The nozzles are alos suitable for welding Class 150 PSIG (1034 kPA) flanges.

The nozzles and water pass arrangements are furnished in accordance with the job requirements (see Product Drawing, Form 160.47-PA1). Standard units are designed for 150 PSIG (1034 kPa) DWP on the water side. If job requirements are for greater than 150 PSIG (1034 kPa) DWP, check the unit data plate to determine if the unit has provisions for the required DWP before applying pressure to cooler or condenser.

Chilled Water Circuit

The minimum velocity through the tubes is 3 FPS (feet per second) (0.914 MPS - meters per second), so chilled water piping designs for variable flow should be selected with higher velocities at design conditions. The rate of change should be slow, to make sure that the chiller controls can track the load.

The following is a guideline for an allowable variable flow rate of change. This may require modification based on specific design application.

The maximum allowable rate of change is 15 minutes to go from 10% to 50% of design flow, based on a minimum chilled water system turnover rate of 15 minutes. System turnover rate (STR) is a measure of the chilled water system volume as compared to the design chilled water flow rate, and is defined as:

$$\text{System Turnover Rate (STR)} = \frac{\text{Volume of chilled water system (gallons)}}{\text{Design chilled water flow rate (gpm)}}$$

As noted previously, if the STR is above 15 minutes, chilled water flow rate of change is 15 minutes. If STR goes below 15 minutes, chilled water flow rate of change must be modified as follows:

$$\text{Rate of Change from 100\% to 50\% Flow (minutes)} = 15 + 15 - \text{STR}$$

Chilled water must leave the cooler through the connection marked "Liquid Outlet". Cooling water must enter the condenser through the connection marked "Liquid Inlet". Refer to Figure 9.

Foreign objects which could lodge in, or block flow through, the cooler and condenser tubes must be kept out of the water circuit. All water piping must be cleaned or flushed before being connected to the unit, pumps, or other equipment.

Permanent strainers (by others) are required in both the cooler and condenser water circuits to protect the unit as well as the pumps, tower spray nozzles, chilled water coils and controls, etc. The strainer, meeting YORK specifications should be installed in the entering chilled water line, directly upstream of the unit.

Water piping circuits should be arranged so that the pumps discharge through the unit. The circuits should be controlled as necessary to maintain essentially constant chilled and condenser water flows through the unit at all load conditions.

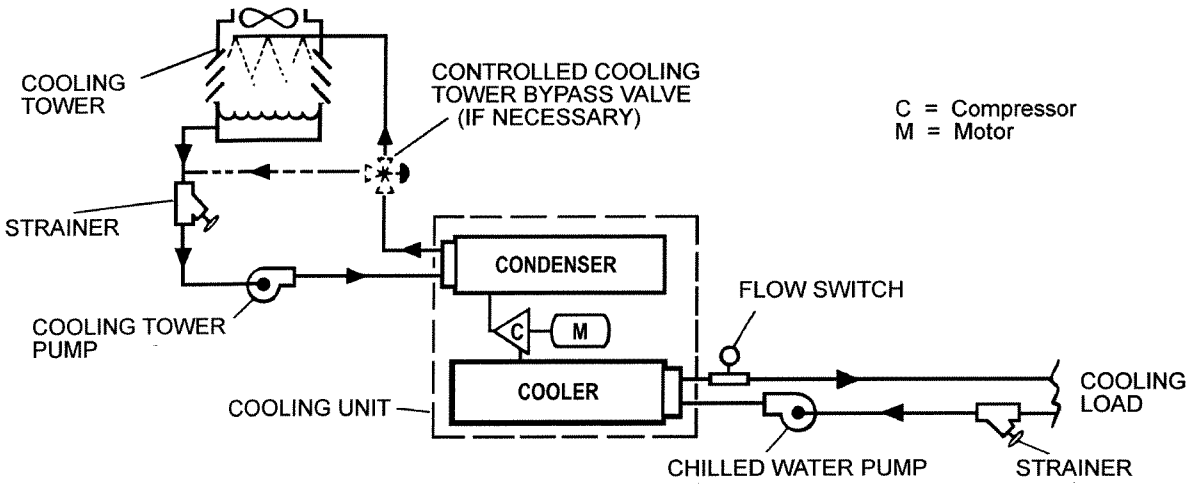


FIG. 9 – SCHEMATIC OF A TYPICAL PIPING ARRANGEMENT

LD03299

If pumps discharge through the unit, the strainer may be located upstream from the pumps to protect both pump and unit. (Piping between the strainer, pump and unit must be very carefully cleaned before start-up.) If pumps are remotely installed from the unit, strainers should be located directly upstream.

Condenser Water Circuit

For proper operation of the unit, condenser refrigerant pressure must be maintained above cooler pressure. If operating conditions will fulfill this requirement, no attempt should be made to control condenser water temperature by means of automatic valves, cycling of the cooling tower fan or other means. Refer to Fig. 9 for a typical water piping schematic. YS units are designed to function satisfactorily and efficiently, when condenser water is allowed to seek its own temperature level at reduced loads and off-peak seasons of the year. However, if entering condenser water temperature can go below the required minimum, condenser water temperature must be maintained equal to or slightly higher than the required minimum. Refer to page 37, Condensing Water Temperature, and the formula to calculate the minimum Entering Condensing Water Temperature.

Stop Valves

Stop valves may be provided (by others) in the cooler and condenser water piping, adjacent to the unit to ease maintenance. Pressure taps should be provided (by others) in the piping as close to the unit as possible, to aid in obtaining operating checks.

1

Flow Switches (Field Installed)

A flow switch or pressure differential control in the chilled water line(s), adjacent to the unit, is an accessory which can be provided by YORK for connection to the control center. If a flow switch is used, it must be directly in series with the unit and sensing only water flow through the unit. The differential switch must sense pressure drop across the unit.

Drain and Vent Valves

Drain and vent valves (by others) should be installed in the connections provided in the cooler and condenser liquid heads. These connections may be piped to drain if desired.

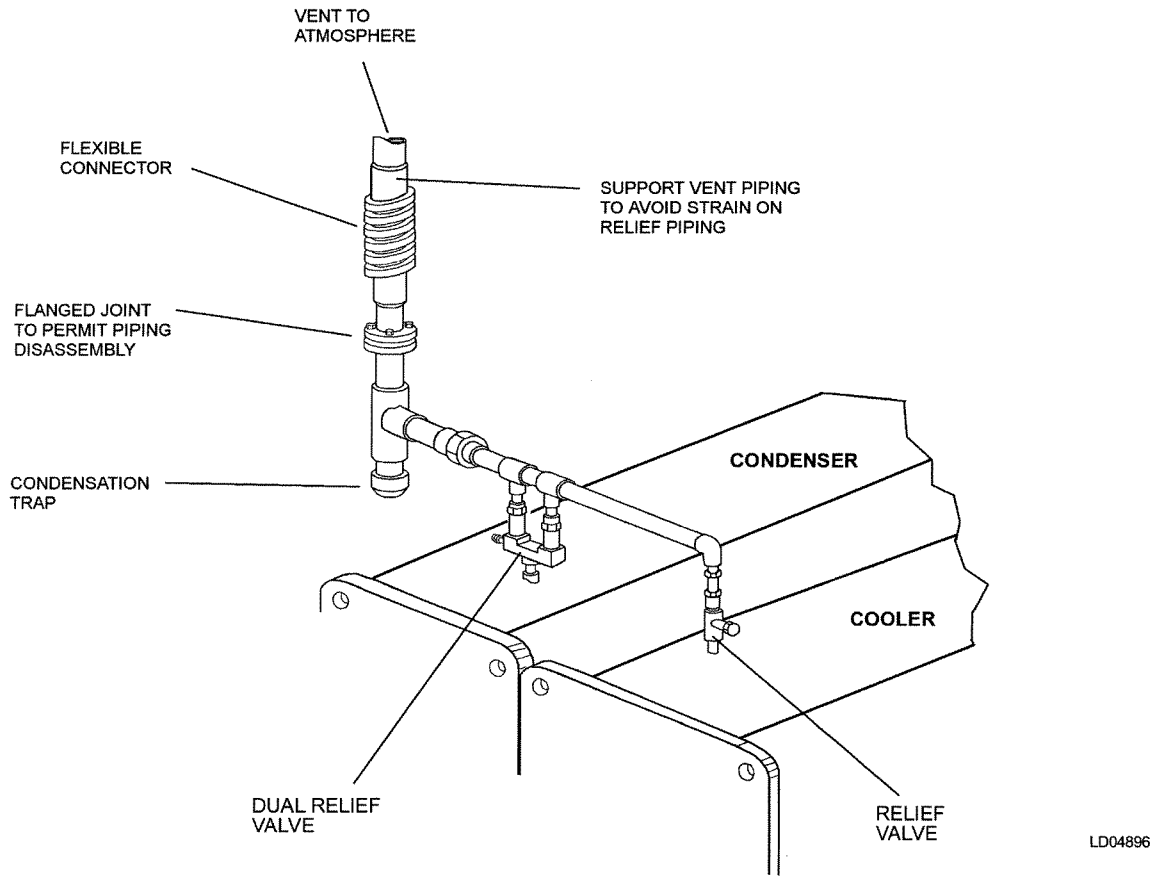


FIG. 10 – TYPICAL REFRIGERANT VENT PIPING FROM RELIEF VALVES

Checking Piping Circuits and Venting Air

After the water piping is completed, but before any water box insulation is applied, tighten and torque the nuts on the liquid head flanges (to maintain between 30 and 60 ft. lbs. / 41 and 81 nm). Gasket shrinkage and handling during transit cause nuts to loosen. If water pressure is applied before this is done, the gaskets may be damaged and have to be replaced. Fill the chilled and condenser water circuits, operate the pumps manually and carefully check the cooler and condenser water heads and piping for leaks. Repair leaks as necessary.

Before initial operation of the unit both water circuits should be thoroughly vented of all air at the high points.

REFRIGERANT RELIEF PIPING

Each unit is equipped with relief device(s) on the cooler, condenser and oil separator for the purpose of quickly relieving excess pressure of the refrigerant charge to the atmosphere in case of an emergency. The relief valve is furnished in accordance with American Society of Heating, Refrigeration and Air Conditioning Engineers Standard 15 (ASHRAE 15) and set to relieve at 300 PSIG (2069 kPa). The rupture disk on the oil separator is set at 345 PSIG (2379 kPa) and sized to accommodate the compressor pumping capacity. The relief valve is furnished in accordance with ASHRAE-15 and is set to relieve at 300 PSIG (2060 kPa).

Refrigerant relief vent piping (by others), from the relief valves to the outside of the building, is required by code and should be installed on all units. Refer to Figures 10, 11 and Table 4. For additional information on relief valve discharge line sizing, refer to Form 160.47-AD2 (Application Data).

CAUTION

1. Piping should be properly supported to prevent any strain on bursting disk mounting.

2. Be careful not to puncture bursting disk when thread protector is removed.

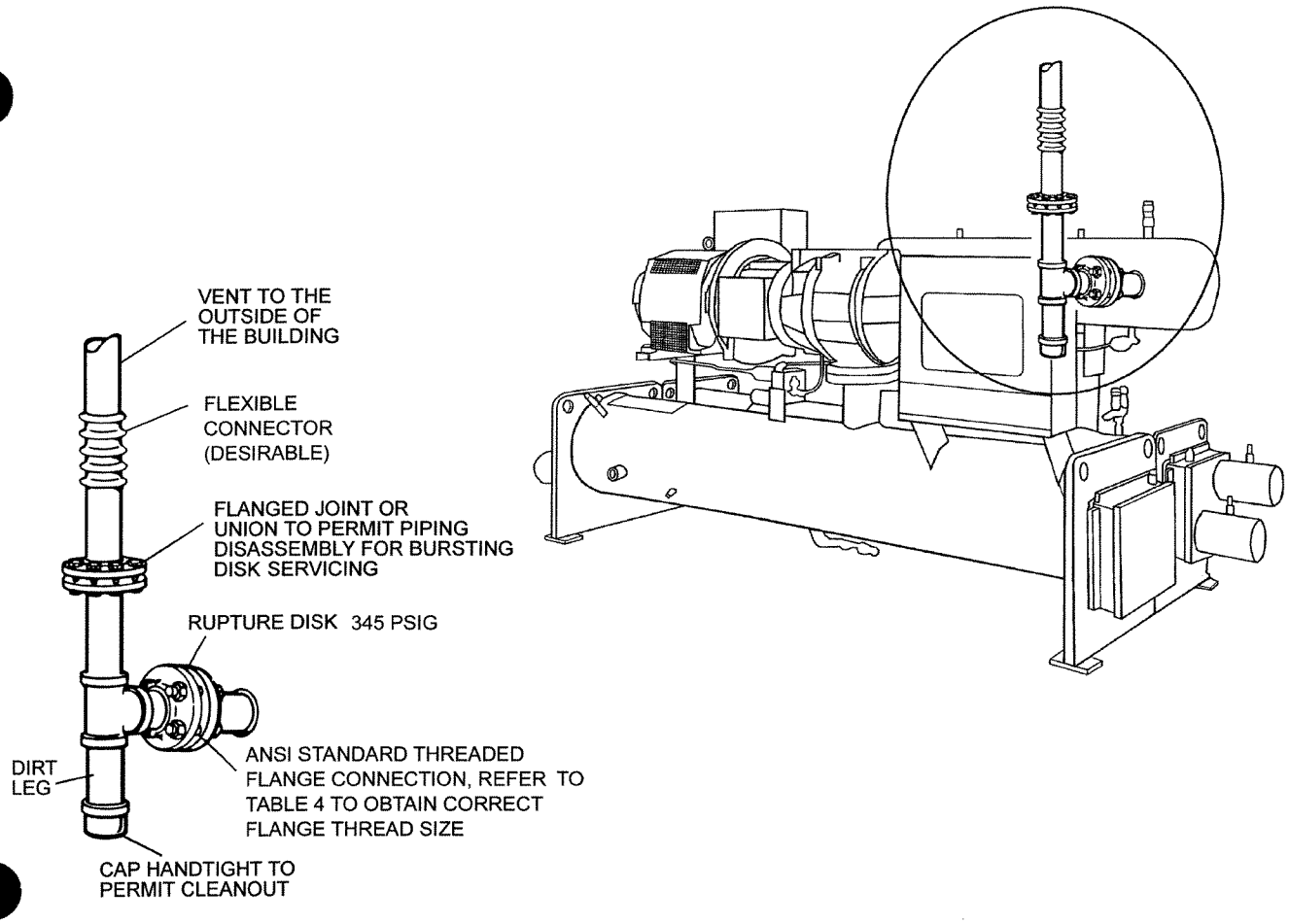


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FIG. 11 – TYPICAL REFRIGERANT VENT PIPING FROM RUPTURE DISK

TABLE 4 – REFRIGERANT RELIEF CHARACTERISTICS

OIL SEPARATOR (R-22)					
COMPRESSOR CODE		RELIEF VALVE		RUPTURE DISK	
	C	Cr	DUAL (1)	CR	SINGLE
	LBS. AIR PER MIN.		OUTLET NPT	#AIR/MIN.	OUTLET NPT
S0, S1 (2)	24.0	35.9	*3/4"	511.0	2"
S2, S3 (2)	28.3	35.9	3/4"	764.0	2"
S4 (2)	33.3	63.8	1"	1008.0	2-1/2"
S5 (2)	33.3	63.8	1"	1275.0	2-1/2"

OIL SEPARATOR (R-134a)					
COMPRESSOR CODE		RELIEF VALVE		RUPTURE DISK	
	C	Cr	DUAL (1)	CR	SINGLE
	LBS. AIR PER MIN.		OUTLET NPT	#AIR/MIN.	OUTLET NPT
S0, S1 (2)	24.0	35.9	*3/4"	511.0	2"
S2, S3 (2)	28.3	35.9	3/4"	511.0	2"
S4 (2)	33.3	63.8	1"	764.0	2-1/2"
S5 (2)	33.3	63.8	1"	1008.0	2-1/2"

* Single relief valve

COOLER			
SHELL	C	SINGLE RELIEF VALVE	
		Cr	OUTLET
	LBS. AIR PER MIN.		NPT
B	26.3	35.9	3/4"
C	31.7	35.9	3/4"
D	39.7	63.8	1"
E	51.2	63.8	1"
F	62.4	63.8	1"

CONDENSER			
SHELL	C	DUAL RELIEF VALVE (1)	
		Cr	OUTLET
	LBS. AIR PER MIN.		NPT
B	24.0	35.9	3/4"
C	28.3	35.9	3/4"
D	34.3	35.9	3/4"
E	41.2	63.8	1"
F	53.6	63.8	1"

Where:

C = Min. required discharge capacity

Cr = Rated capacity of YORK supplied relief valve @ 300 PSIG or rupture disk at 345 PSIG

Relief valve set pressure - 300 PSIG (2,069 kPa).

Rupture disk set pressure - 345 PSIG (2,379 kPa).

NOTES:

1. Dual relief valve consists of one three-way shut off valve and two single relief valves. The valve configuration will not allow both valves to be shut off at the same time, and valves are sized such that each relief valve has sufficient discharge capacity when used alone. This permits safe removal of either relief valve for repair or replacement, while maintaining vessel protection.
2. ASHRAE 15-1994 Section 9.8 and Appendix F describes relief requirements for positive displacement compressors. Summarized, the unit must be equipped with a relief device suitable for relieving the entire compressor capacity. YORK YS mod E (S0 - S5 compressor) units utilize a 2" rupture disk venting to atmosphere set at 345 PSIG (Refer to Table 4 for proper connection size).

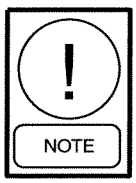
UNIT PIPING

Compressor lubricant piping and system refrigerant piping are factory installed on all units shipped assembled. On units shipped dismantled, the following piping should be completed under the supervision of the YORK representative; the lubricant piping; system oil return using material furnished. See Form 160.80-N1.

CONTROL WIRING

After installation of the control center on units shipped disassembled, the control wiring must be completed between unit components and control center or solid state starter when used, using the wiring harness furnished.

Field wiring connections for commonly encountered control modifications (by others), if required, are shown on Wiring Diagram, Form 160.47-PW5.



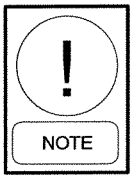
No deviations in unit wiring from that shown on drawings furnished shall be made without prior approval of the YORK Representative.

POWER WIRING

Unit With Electro-Mechanical Starter

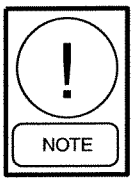
A 115 volt – single-phase – 60 or 50 Hertz power supply of 15 amperes must be furnished to the control center, from the control transformer (1-1/2 kVa required) included with the compressor-motor starter. DO NOT make final power connections to control center until approved by YORK Representative. Refer to Form 160.80-PW3, *Power Wiring*. YORK recommends that all connections to the unit be flexible. Consult with and confrom to all local regulatory requirements.

POWER WIRING (CONT'D)

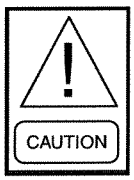


Remote Electro-Mechanical starters for the YS Unit must be furnished in accordance with YORK Standard R-1079.

Each YS unit is furnished for a specific electrical power supply as stamped on the unit data plate, which also details the motor connection diagrams.



To insure proper motor rotation, the starter power input and starter to motor connections must be checked with a phase sequence indicator in the presence of the YORK Representative.



IMPORTANT: DO NOT cut wires to final length or make final connections to motor terminals or starter power input terminals until approved by the YORK Representative.

Figure 12 shows the power wiring hook-up for YS Motor Connections. (Refer to Wiring Labels in Motor Terminal Box for hook-up to suit motor voltage and amperage.)

Motor leads are furnished with a crimp-type connection having a clearance hole for a 3/8 inch bolt, motor terminal lugs are not furnished.

Unit With Solid State Starter (Optional)

A YS unit equipped with a Solid State Starter, does not require wiring to the compressor-motor. The motor power wiring is factory connected to the Solid State Starter (or an optional factory installed disconnect switch). All wiring to the control panel is completed by the factory. A control transformer is furnished with the Solid State Starter. Refer to Form 160.80-PW1.

INSULATION

Insulation of the type specified for the job, or minimum thickness to prevent sweating of 30°F surfaces (water chill application), should be furnished (by others) and applied to the cooler shell, end sheets, liquid feed line to flow chamber, compressor suction connection, and cooler liquid heads and connections. The liquid head flange insulation must be removable to allow head removal for tube maintenance. Details of areas to be insulated are given in Product Drawing, Form 160.47-PA1.

Units can be furnished, factory anti-sweat insulated, on order at additional cost. This includes all low temperature surfaces except the two cooler liquid heads.

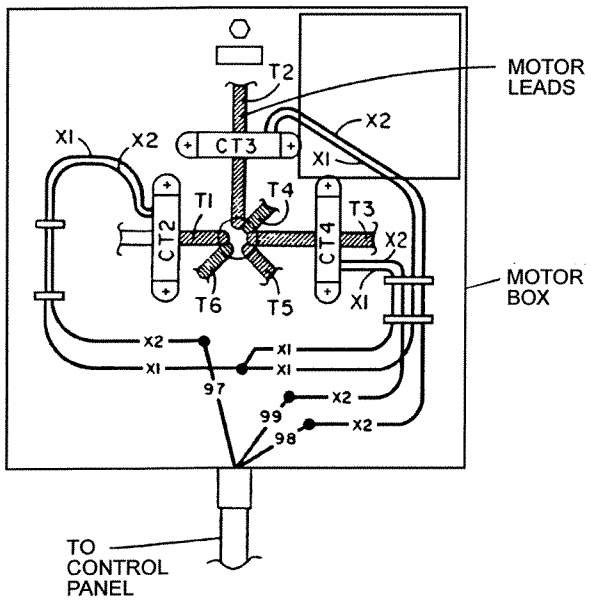
IMPORTANT: DO NOT field insulate until the unit has been leak tested under the supervision of the YORK Representative.

INSTALLATION CHECK – REQUEST FOR START-UP SERVICE

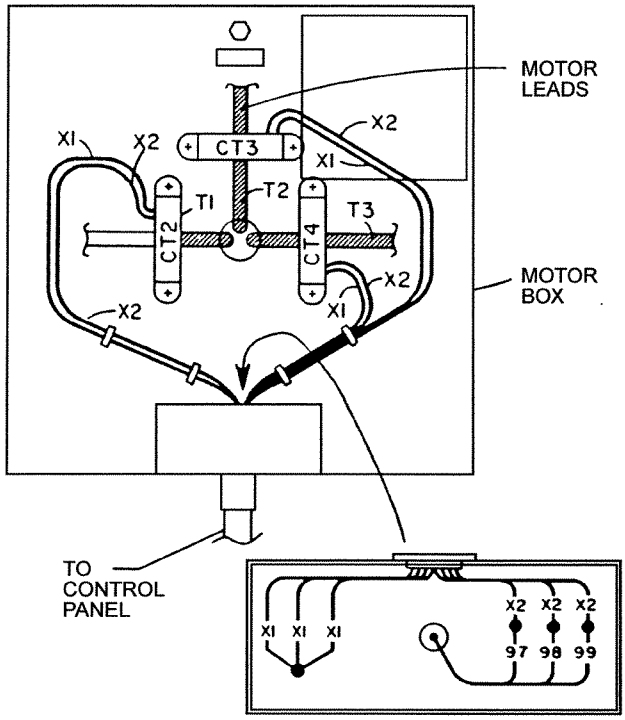
After the unit is installed, piped and wired as described in this Instruction, but before any attempt is made to start the unit, the YORK District Office should be advised so that the start-up service, included in the contract price, can be scheduled. Notification to the YORK Office should be by means of Installation Check List and Request, Form 160.47-CL1, in triplicate. (See Figure 13.)

The services of a YORK Representative will be furnished to check the installation and supervise the initial start-up and operation on all YS units installed within the Continental United States.

1



LOW VOLTAGE (6 LEAD MOTOR)
(200V – 600V)



HIGH VOLTAGE (3 LEAD MOTOR)
(2300V – 4160V)

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FIG. 12 – YS MOTOR CONNECTIONS (ELECTRO-MECHANICAL STARTER APPLICATION)

SUPERSEDES: 160.47-CL1 (390) FORM 160.47-CL1 (790)

MODEL YS YORK MILLENNIUM™

INSTALLATION CHECK LIST AND REQUEST FOR AUTHORIZED START-UP ENGINEER

*TO: _____ JOB NAME: _____
_____ LOCATION: _____
_____ CUSTOMER ORDER NO. _____
YORK TEL. NO. _____ YORK ORDER NO. _____ YORK CONTRACT NO. _____

CHILLER
MODEL NO. _____ 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

A. YORK CHILLER

1. Unit assembled (if shipped dismantled) and refrigerant piping installed under YORK Supervision ☐
2. Vibration isolator mounts so the unit is level, and isolators equally deflected ☐

B. WATER PIPING

1. Condenser water piping installed between condenser, pumps and cooling tower ☐
2. Chilled water piping installed between cooler, pumps and cooling coils ☐
3. Make-up and fill lines installed to cooling tower and chilled water system ☐
4. All water piping checked for strain – Piping should not spring when connections are broken at unit ☐
5. Water piping leak tested and flushed, and water strainers cleaned after flushing. Piping systems filled with water and trapped air vented ☐
6. Chilled and condenser water flow available to meet unit design requirements ☐

C. REFRIGERANT RELIEF PIPING (when required)

1. Refrigerant relief piping (with flexible connection) installed from unit to atmosphere (per ASHRAE-15) ☐

D. ELECTRICAL WIRING

1. Electro-mechanical starter ☐
   a. Main and control power supply available ☐
   b. Compressor motor starter furnished in accordance with YORK Standard R-1079 – Form 160.47-PA5.1 ☐
   c. Wiring completed from main power supply to starter – but not cut to length or connected to starter ☐
   d. Wiring completed from starter to compressor motor – but not cut to length or connected to motor ☐
   e. 115 volt service completed to Control Center – but not connected ☐
2. Solid state starter ☐
   a. Main and control power supply available ☐
   b. Wiring completed from main power supply to solid state starter – but not cut to length or connected to starter. ☐
3. Control center
   a. Jumper wire not installed between terminal 24 and 25 located on the control center terminal strip ☐
   b. External control wiring completed from the control center to chilled water flow switches on interlocks in accordance with the YORK Wiring Diagram ☐
   c. Power available and wiring completed to the following starters and motors, and rotation of each checked ☐
      NOTE – Do not check compressor motor rotation
      (1.) Chilled water pump(s) ☐
      (2.) Condenser water pump(s) ☐
      (3.) Cooling tower fan ☐
   d. Meg ohm meter available for checking motor windings ☐

E. TESTING, EVACUATION AND CHARGING (Under York Supervision if Unit Shipped Less Refrigerant or Dismantled)

1. R-22 available for testing ☐
2. Dry Nitrogen available for testing ☐
3. A high vacuum pump available for evacuation and dehydration of system ☐
4. Refrigerant-22 (Supplied by YORK available for charging) ☐
5. Unit (ready to be) (has been) pressure tested, evacuated, dehydrated and charged ☐

F. CONDITIONS

1. YORK oil for compressor on job ☐
2. Cooling load available for testing and operating unit ☐
3. Personnel available for final wiring connections ☐
4. Personnel available for start-up and testing ☐
5. Owners operating personnel available for instruction ☐

Names: _____
_____
_____

With reference to the terms of the above contract, we are requesting the presence of your Authorized Representative at the job site on ____/____/____ (Month / Day / Year) to start the system and instruct operating personnel HAVE HIM CONTACT _____ (Names)

We understand that the services of the YORK Authorized Representative will be furnished in accordance with the contract for a period of not more than _____ consecutive normal working hours, and we agree that a charge of _____ per diem plus travel expenses will be paid to YORK if services are required for longer than _____ consecutive normal hours or if repeated calls are required.

Signed: _____
Title: _____

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FIG. 13 – INSTALLATION CHECK LIST AND REQUEST FOR AUTHORIZED START-UP ENGINEER

SECTION 2 – START-UP

YS CHILLER COMMISSIONING CHECKLIST

This checklist is provided as a guide to the service technician to ensure the YS Chiller is properly commissioned.

❖ This symbol indicates that the feature described is programmable or selectable from Graphic Control Center. Refer to Operational Form 160.80-O1 and the Service Manual Form 160.80-M1 for more information concerning the Graphic Control Center. The specific Graphic Control Center screen is listed in bold capital text, followed by the setpoints or operating parameters that can be configured in that screen.

* An asterisk following one of the Graphic Control Center programmable or selectable features indicates that the default value has been pre-programmed into Graphics Control center at one of the YORK factories.

YS CHILLERS PRE-STARTUP CHECKLIST

Installation

❄ Check all utility interconnections to the chiller: water piping, electrical and control wiring to the chiller.

❄ Verify that the chiller is level.

❄ Check the mounting spring isolators or vibration isolators for equal loading.

❄ Check the relief valve piping for excessive load on the relief devices.

Form 2, Form 3 and Form 7 Shipments

❄ A Vacuum Dehydration Unit is required for all field re-assembled YS Chillers; Form 3 and Form 7. In addition, Form 2 YS Chillers shipped without refrigerant require a Vacuum Dehydration procedure prior to commissioning. Refer to the Vacuum Dehydration procedure detailed in YORK Form 160.80-N1, *Field Re-Assembly for Form 3 & Form 7 Shipments (Style E).*

Evaporator and Condenser Flow Rates

❄ Check for properly installed and clean strainers in the water supply lines to the evaporator and condenser. Clean and properly installed water strainers is a YORK warranty requirement.

❖ Refer to the **Sales Order** screen for the Evaporator and Condenser design flow rates and pressure drops. Use the pressure drops to establish the correct flow rates.

EVAPORATOR SCREEN

Enter the following setpoints:

❖ Leaving Chilled Liquid Temperature (except ISN Remote Mode)

❖ Remote Leaving Chilled Liquid Temperature Setpoint Range (except ISN Remote mode)

❖ Low Chilled Liquid Temperature, Cycling Shutdown Temperature

❖ Low Chilled Liquid Temperature, Cycling Shutdown Restart Temperature

❖ Leaving Chilled Liquid Temperature Control Sensitivity

❖ Brine Low Evaporator Pressure Cutout Threshold*

❖ Ice Storage Mode ON/OFF

❖ Smart Freeze Protection ON/OFF

❖ Refrigerant Temperature Sensor ENABLE/DISABLE

CONDENSER SCREEN

Enter the following setpoints:

❖ Enter the High Pressure Limit/Warning Threshold setpoint.

❖ Freeze Warning (standby chiller freeze protection) ENABLE/DISABLE

❖ Freeze Warning time delay

Flow Safety Devices

❄ Locate the flow safety devices and confirm their interconnection to the Graphic Control center.

❄ Verify the operation of the flow safety devices. Simulate the low flow condition and make certain the switch is opening under the low flow condition. Removing a wire connection will simulate only the electrical connection, not the functional operation of the flow safety device.

Low Temperature Brine Chillers

- ❄ Verify the freeze point of the brine in the evaporator. Use a hand-held optical refractometer or a hydrometer.
- ❄ Make certain the Brine Low Evaporator Pressure Cutout Threshold* Setpoint (**EVAPORATOR** screen) is set above the brine freeze point.

High Pressure Safety Switch

- ❄ Verify the setpoint of the high-pressure safety switch. Reconfirm the High Pressure Limit/Warning threshold setpoint (**CONDENSER** screen).

Compressor

- ❄ Make certain the incoming electrical power disconnect is in the open position.
- ❄ Remove one of the access cover plates located on the D-Flange Motor-Compressor spacer casting. Check the coupling bolts to make certain they are tight. Check the Allen head set screws in the coupling hubs to make certain they are tightened.
- ❄ Rotate the compressor several revolutions by hand.

COMPRESSOR SCREEN

Maximum Load

- ❖ Maximum Load Temperature
- ❖ Maximum Load FLA
- ❖ Select Minimum Load Control Source (Slide Valve Position or % Motor FLA)
  - ❖ If Motor FLA selected, enter Minimum Load FLA

SLIDE VALVE CALIBRATE SCREEN

- ❖ Perform Slide Valve Calibration

Note the slide valve can be calibrated with the chiller off or while it is running. To perform the slide valve calibration while the chiller is off, it is necessary to use a hand pump to pump oil into the slide valve cylinder to move the slide valve from 0% to 100%. The slide valve can also be calibrated with the chiller running; however, there must be enough available load for the chiller to be loaded to 100% capacity. Refer to Service Manual 160.80-M1, *Graphic Control Center*, for more information.

Motor

- ❄ Check the voltage supply to make certain it is the same as the Motor Nameplate Data.
- ❄ Megohm the motor. Follow the instructions for Motor Megohm Check on page 52.
- ❄ Lubricate the motor bearings. Follow the motor manufacturer instructions.
- ❄ Check motor rotor rotation. All YS Chillers rotate clockwise when viewed facing the compressor shaft.

MOTOR SCREEN

Program the following setpoints:

- ❖ Local Motor Current Limit
- ❖ Pulldown Demand Limit
- ❖ Pulldown Demand Time

Motor Starter

For YORK Solid State Starter, Mod "B", program the following setpoints:

- ❖ Full Load Amps*
- ❖ Start Current*
- ❖ Supply Voltage Range*
- ❖ Enable Open SCR Detection
- ❖ KWH Reset

For YORK Solid State Starter, Mod "A", program the following setpoints:

- ❖ Full Load Amps*
- ❖ Supply Voltage Range*
- ❖ Current Unbalance Check ENABLE/DISABLE

Logic Board:

- ❖ Verify location of 300V/600V Jumper*
- ❖ Verify Start Current Calibration*
- ❖ Verify 105% FLA Calibration

For YORK Electro-Mechanical Starter Applications:
Current Module:

- ❖ Verify Switch S1 (Wye-Delta 57% or all others) Setting
- ❖ Verify Pot R16 (LRA/FLA ratio) Setting*
- ❖ Verify Slide Bar Resistor "RES" Setting*
- ❖ Verify 105% FLA Calibration*
- ❖ Verify 100% FLA Calibration*

Refrigerant Leak Check

- ❄ Thoroughly leak check the entire chiller for leaks prior to starting. Make certain to include relief valves. This may require removing field-installed relief valve piping.

Compressor Oil

- ❄ Check the compressor oil level. Oil should be visible in the top sight glass on the side of the oil separator.
- ❄ Make certain that the oil heater has been energized at least 24 hours prior to starting the chiller. Oil temperature should be at least 15°F above saturated refrigerant temperature.

OIL SEPARATOR SCREEN

Enter the following setpoints:

- ❖ Auto Zero ENABLE/DISABLE
- ❖ Seal Oil Pressure Transducer ENABLE/ DISABLE

Cooling Tower

- ❄ Verify that the cooling tower is operational and the fans and controls are ready for the chiller to be started.

Water Treatment

- ❄ Make certain the water treatment is in place and operational.

Wiring

- ❄ Check and verify all interconnecting wiring with the wiring diagram.
- ❄ Make certain all wire terminals are tight and plugs are properly secured.

GRAPHIC CONTROL CENTER PROGRAMMABLE FUNCTIONS

PROGRAM JUMPERS / SWITCHES

- ❖ Verify Micro Board Program Jumpers and Program Switches are configured appropriately.

VARIABLE ORIFICE CONTROL SCREEN

- ❖ Enter the Delta P setpoint.

HOT GAS BYPASS SCREEN

If the chiller is equipped with optional Hot Gas Bypass control, enable operation on the **OPERATIONS** screen and enter the following setpoints:

- ❖ ON Setpoint
- ❖ OFF Setpoint

SETPOINTS SCREEN

The setpoints listed on the **SETPOINTS** screen have already been programmed on previous screens. The values shown reflect the previously programmed values. However, the setpoints listed here can be changed on this screen if desired. This screen is used primarily as a central location from which most setpoints can be programmed. If it is not desired to change any of the listed setpoints, proceed to the **SETUP** screen.

SETUP SCREEN

- ❖ Enable Clock
- ❖ Enter Clock Time and Date
- ❖ Select 12 or 24 hour display mode
- ❖ The states of Program Jumpers/Switches that affect Chiller Operation are shown on the **SETUP** screen. These were configured in set 1, above. Refer to Tables 1 and 2 of Service Manual 160.80-M1 if it is desired to change them.

SCHEDULE SCREEN

- ❖ Enable or Disable Daily Start/Stop schedule as required
- ❖ Enter chiller START/STOP schedule, if required.

USER SCREEN

- ❖ Select desired Display Language
- ❖ Select desired Display units; English or Metric
- ❖ If desired, establish custom User IDs and Passwords.

COMMS SCREEN

If Modem or Printer is connected to the Micro Board Serial Data Ports, enter the following parameters as required for each device connected:

- ❖ Baud Rate
- ❖ Number of Data Bits
- ❖ Number of Stop Bits
- ❖ Parity

Enter appropriate number for Modem, Printer or ISN Remote Application:

- Chiller ID (identification)

PRINTER SCREEN

If printer is connected to Micro Board Serial Ports, enter the following:

- Automatic Print Logging ENABLE/DISABLE
- Automatic Printer Logging Start Time
- Automatic Print Logging Interval
- Printer Type
- Report Type (Status, Setpoints, Schedule or Sales Order)

SALES ORDER SCREEN

- Enter Chiller commissioning date

  IMPORTANT: Print a copy of the Sales Order screen and maintain a copy on file in the local YORK Service Office.

OPERATIONS SCREEN

- Select desired Control Source (Operating Mode); Local, ISN Remote, Digital Remote, or Analog Remote
- Hot Gas Bypass Control (optional) ENABLE/DISABLE

The following can be changed if desired:

- Chiller Start Counter
- Chiller Operating Hours Counter

YS CHILLER START-UP

Start

- Start the chiller and operate the chiller at design conditions or at the maximum load conditions available.

Graphic Control Center

- Recheck the setpoints and programmable functions of the Graphic Control Center. Change as necessary to match the operating conditions.

Print

- Use the Graphic Control Center print feature to print a copy of all operating data.
- Print a copy of the Sales Order Screen.

  Important: Save the hard copies of the operating data and the Sales Order screen. Maintain a file in the local YORK Service Office.

Leak Check

- Thoroughly check all fittings and connections for oil and refrigerant leaks.

CUSTOMER (OPERATING PERSONNEL) INSTRUCTION

Operation

- Instruct the customer or operating personnel on the location of all controls and the operation of the Graphic Control Center.

Maintenance

- Review the maintenance schedule with the customer.
- Review the preventative maintenance schedule with the operating personnel and make certain that it is thoroughly understood, including the required oil filter element change after the first 200 hours of operation.
- Start-up is an excellent time to log baseline data from vibration analysis, oil analysis and eddy current testing.

SECTION 3 – OPERATION

BASIC DESCRIPTION

The YORK YS Chiller package uses a refrigerant-flooded evaporator and a liquid-cooled condenser. The compressor is a heavy-duty, industrial-rated rotary screw compressor. The YS package consists of four major components - Driveline, Oil Separator, Condenser, and Evaporator. Refer to the Chiller Package Component drawing, Figure 14.

COMPONENTS

Driveline

The driveline is made up of the compressor and a 2-pole industrial induction motor. The motor is mounted to the compressor with a "D"-flange spacer. The "D"-flange eliminates the necessity to align the motor and compressor.

The compressor is a positive displacement, variable volume, direct drive, twin helical rotary screw compressor. The male rotor is a direct drive by the motor; the female rotor is an idler that is driven by the male rotor. The rotors do not touch each other or the compressor housing. The rotors are separated by a hydraulic oil seal, which prevents high pressure gas from leaking into low pressure areas.

Evaporator pressure gas is drawn into the compressor and compressed by the male and female rotors as they rotate together and reduce the volume of gas.

The compressor bearings are industrial duty rated, anti-friction rolling element bearings. No sleeve bearings are used. Oil is injected into the compressor by differential pressure to lubricate the bearings, seal the rotors and remove the heat of compression. The oil that is injected into the compressor mixes with the compressed gas and is separated from the refrigerant gas in the oil separator.

A slide valve is positioned between the male and female rotors, that moves axially to match the compressor capacity to that of the evaporator refrigeration load. The slide valve is moved by differential pressure. As the slide valve moves toward the unloaded position, less suction gas is pumped through the compressor. The control panel automatically positions the slide valve to match the load requirements. The slide valve can be operated manually.

When the compressor is shut off, a spring returns the slide valve to unloaded position. The compressor starts with the slide valve in the unloaded position.

Oil Separator

The oil separator removes the oil that was injected into the compressor. The oil separator is a three stage design. Most of the oil separates by a reduction in velocity in the first stage. The discharge gas is then directed through a high surface area that collects more of the oil. The final stage is a coalescer element(s) that removes the fine aerosol particles of oil.

The oil separator is very efficient and removes nearly 100% of the oil. The very small amount of oil that does pass through the oil separator is returned to the compressor through a filter drier.

The oil separator is also a reservoir for the oil. A temperature controlled immersion heater is installed in the oil reservoir. The oil heater is interlocked with a low oil level safety switch.

Condenser

Oil free refrigerant gas leaving the oil separator flows into the condenser. Water flowing through the condenser tubes removes the evaporator heat load, the heat of compression and condenses the refrigerant gas into refrigerant liquid.

The liquid refrigerant then flows through the integral liquid sub-cooler located in the bottom of the condenser. The sub-cooled liquid refrigerant flows into the evaporator by deferential pressure.

Evaporator

Condensing pressure refrigerant flows out of the liquid sub-cooler into the liquid line where the liquid refrigerant is metered into the evaporator by an orifice. The liquid refrigerant begins to flash (and cool) after flowing through the orifice plate. The refrigerant is distributed in the bottom of the evaporator. Liquid refrigerant floods the evaporator and the heat is exchanged from the chilled liquid, flowing on the inside of the evaporator tubes, to the liquid refrigerant on the outside of the tubes.

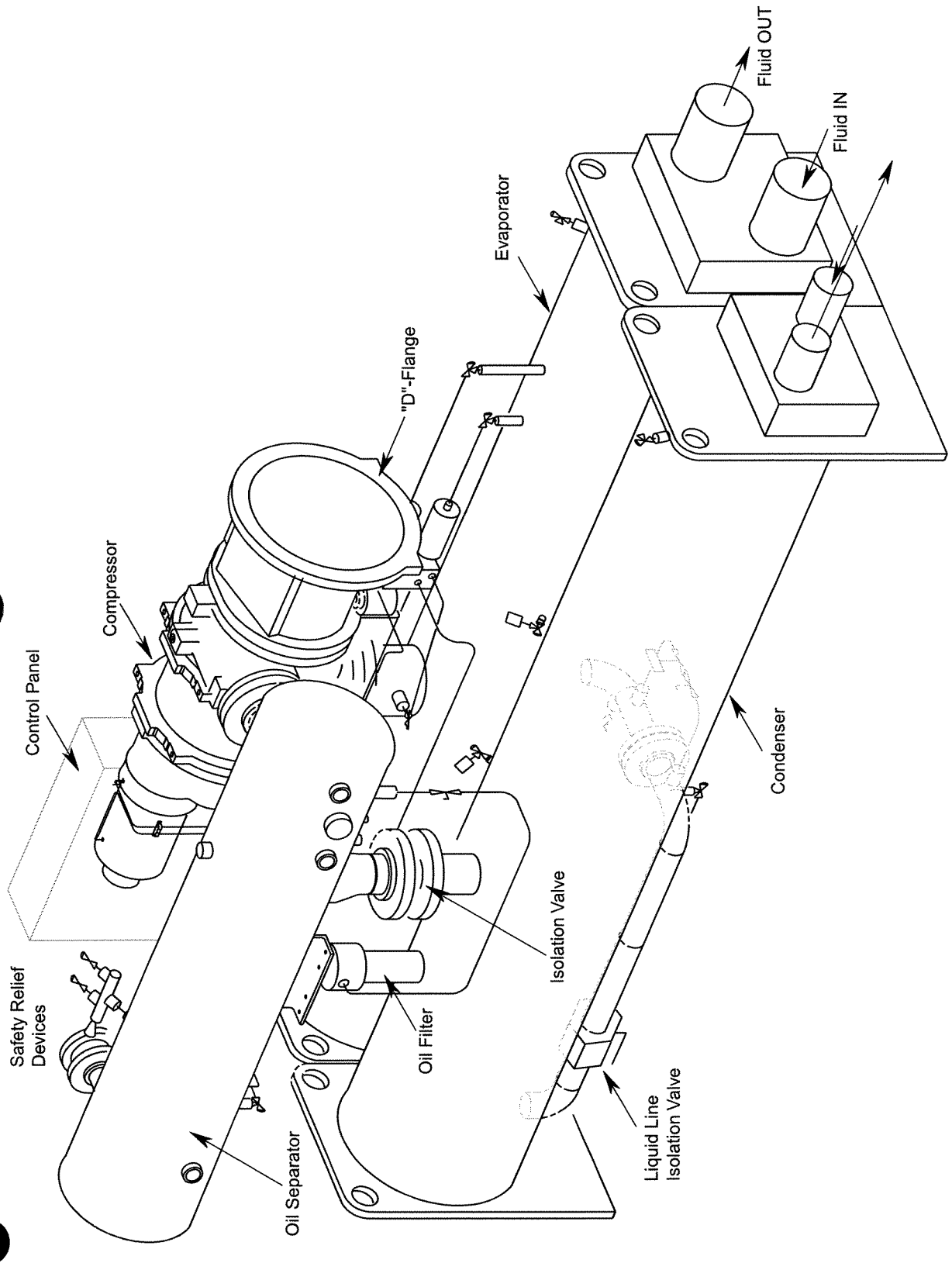


FIG. 14 – YS SCREW CHILLER COMPONENT LAYOUT DRAWING – DESIGN LEVEL "E"

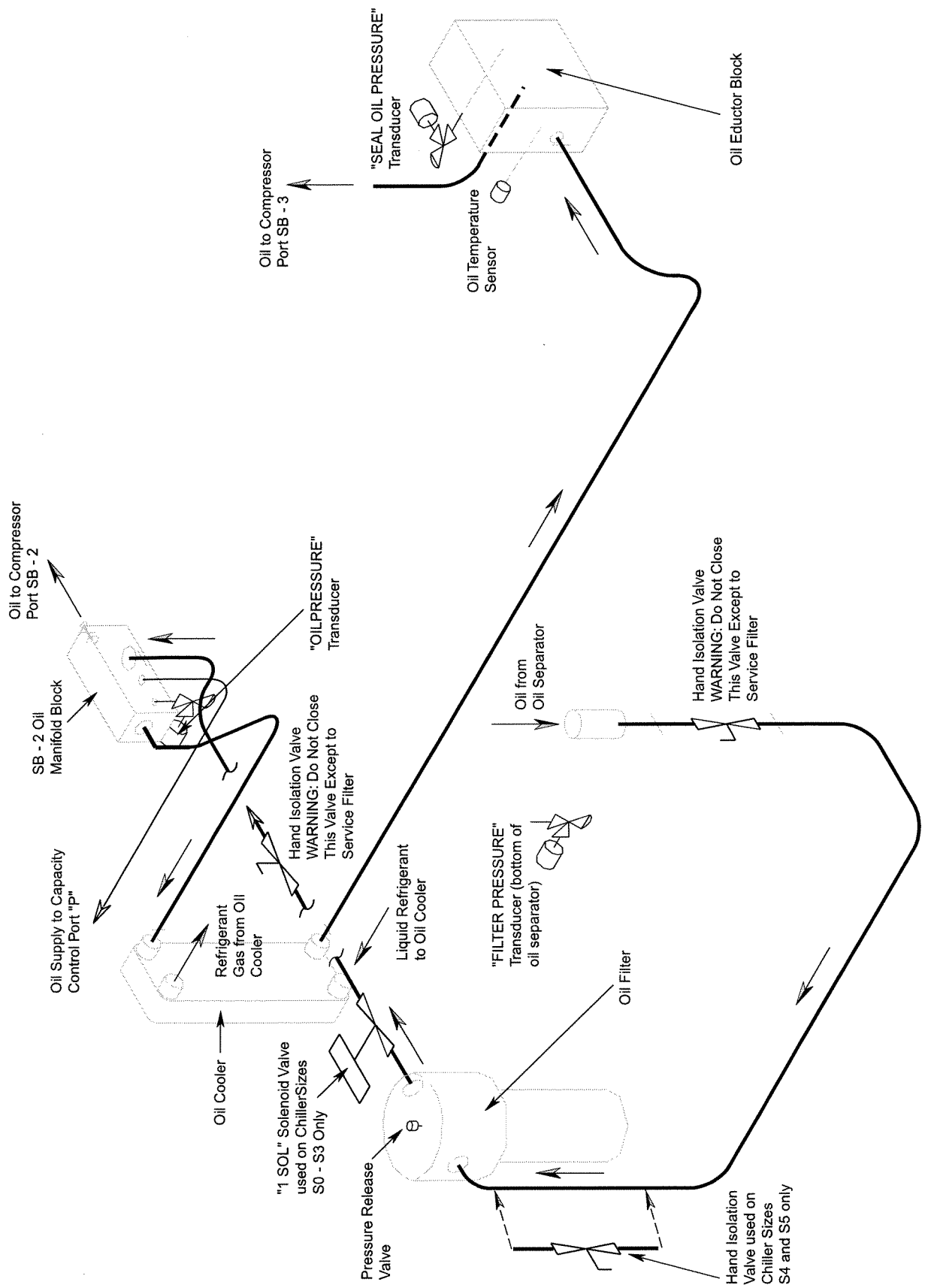


FIG. 15 – YS SCREW CHILLER OIL PIPING SCHEMATIC – DESIGN LEVEL "E"

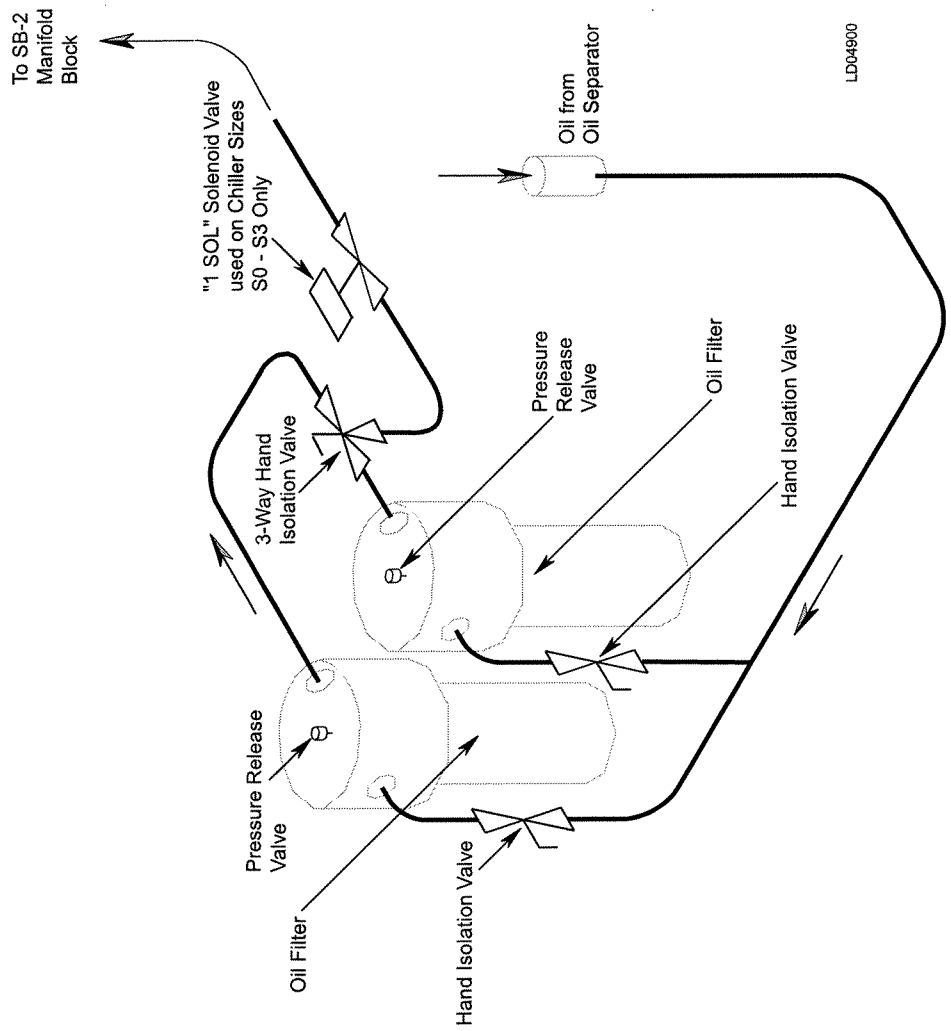


FIG. 16 – YS SCREW CHILLER OPTIONAL DUAL OIL FILTERS PIPING SCHEMATIC – DESIGN LEVEL "E"

A baffle is welded into the top of the evaporator to collect oil that falls from the compressor, preventing oil from mixing with the refrigerant charge. The baffle prevents liquid refrigerant from damaging the compressor.

CONDENSING WATER TEMPERATURE

YS Chillers can be operated with entering condensing water temperature that is less than design conditions. The following formula is used to calculate the minimum entering condensing water temperature. Note the minimum entering condensing water temperature is dependant upon the operating load condition.

R-22 Refrigerant

ECW minimum =

$$LCWT+11+\frac{[(\%\text{of load})(15-\text{design condenser deltaT})]}{100}$$

R-134a REFRIGERANT

ECW minimum =

$$LCWT+16+\frac{[(\%\text{of load})(10-\text{design condenser deltaT})]}{100}$$

Where:

ECW minimum =
Minimum Entering Condensing Water Temperature °F

LCWT =
Leaving Chilled Water Temperature °F

Operating below the minimum entering condensing water will not provide energy savings and will result in oil management problems.

Special entering condensing water temperature controls may be required when long condensing water circuits are used and the chiller is being started with minimum load available.

OIL SYSTEM

Refer to the Oil Piping Schematic Drawing, Figure 15 and the Oil Separator Drawing, Figure 20.

3

Oil flows from the oil separator into the compressor by differential pressure. The oil flows from the oil separator through a 3 micron oil filter (or optional dual oil filters). Filtered oil then flows to a oil manifold that is located at compressor port SB-2, see Figure 15.

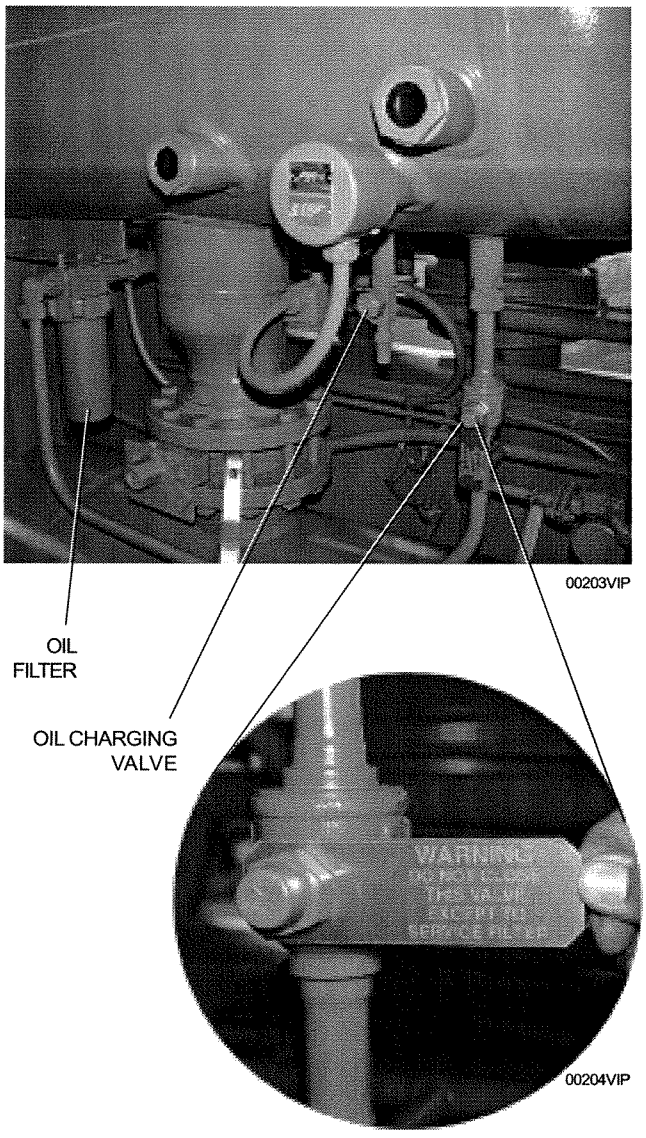


FIG. 17 – OIL FILTER LOCATION

The oil pressure transducer is located at the SB-2 manifold. The differential pressure is measured as the difference between the Oil Pressure Transducer at SB-2 and the Filter Pressure Transducer located in the oil separator. This value is compared to the limits in the control panel logic. If the oil filter differential reaches 20 PSID, a warning message is displayed by the control panel display. If the oil filter reaches 25 PSID, a safety shutdown is initiated. See Figure 18.

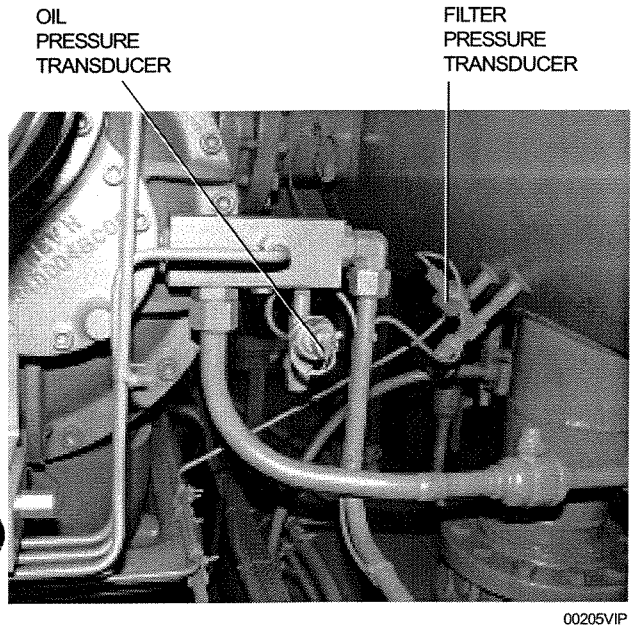


FIG. 18 – OIL AND FILTER PRESSURE TRANSDUCERS

An oil supply line from the manifold at SB-2 is piped to the capacity control directional valve at Port P. The 4-way capacity control solenoid (directional) valve directs oil pressure against one side or the other of the slide valve piston. The opposite side of the slide valve is relieved to suction pressure at compressor port SC-11. The differential pressure between the P port and the suction pressure at Compressor Port SC-11 is what provides the force to load or unload the slide valve and provide capacity control. Refer to Fig. 26, Capacity Control Schematic Diagram.

Oil flows from the oil manifold at SB-2 to the brazed plate, refrigerant cooled oil cooler. Cool oil leaving the brazed plate heat exchanger flows to the eductor block manifold. The oil circuit is separate from the eductor oil management system. See Figure 19.

The eductor block manifold oil circuit contains the Seal Oil Pressure Transducer and a High Oil Temperature

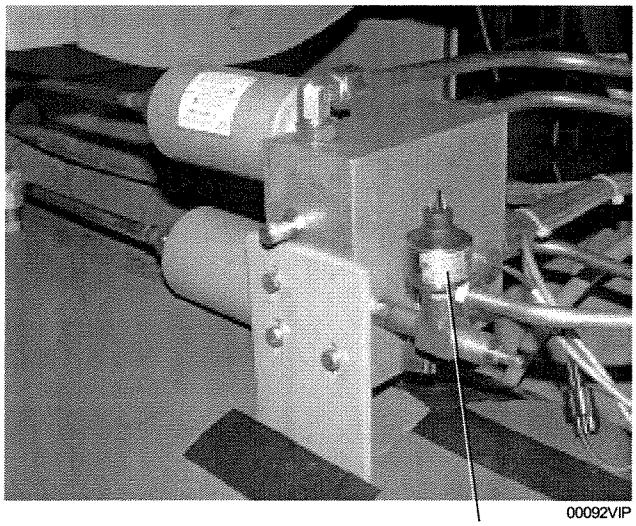


FIG. 19 – EDUCTOR BLOCK

Safety sensor. The Seal Oil Pressure is monitored by the control panel. The differential pressure between the Seal Oil Pressure and the Evaporator Pressure Transducer is calculated and compared to the control panel logic. If the differential reaches the set point (30 PSID for R-22 and 20 PSID for R-134a, the control panel will initiate a safety shutdown. A high oil temperature safety shutdown will be initiated at 170°F (77°C).

The oil leaving the oil eductor manifold block flows into the compressor at compressor port SB-3 to lubricate the compressor bearings and shaft seal. All of the oil that is injected into the compressor mixes with refrigerant gas during compression. The oil and refrigerant gas is discharged into the oil separator, where it is separated and returned to the oil sump. A high discharge temperature safety is located in the discharge line, between the compressor and oil separator. This safety will initiate a safety shutdown at 210°F (99°C).

Oil is separated from the refrigerant gas in the oil separator in a three step process.

In the first stage of oil separation, high velocity oil and refrigerant gas in the compressor discharge line under goes a rapid reduction in velocity as it enters the large diameter oil separator. Most of the oil drops out of the refrigerant gas stream due to the reduction in velocity. The oil falls by gravity into the oil reservoir located in the bottom of the oil separator.

The second stage of oil separation is accomplished by directing the refrigerant gas through mesh pads that have an extended surface area. Smaller liquid oil drop-

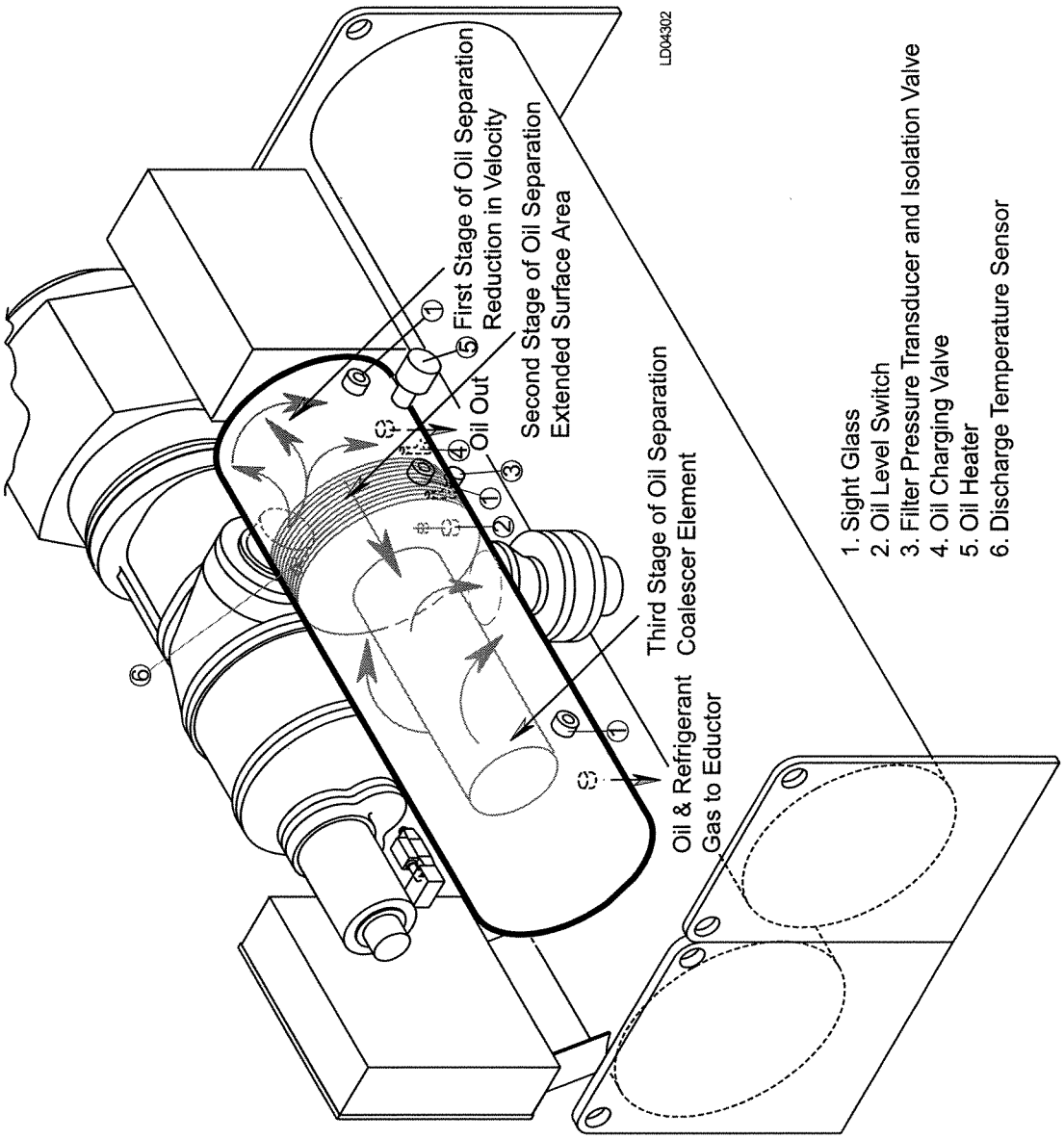


FIG. 20 – YS SCREW CHILLER OIL SEPARATOR SCHEMATIC – DESIGN LEVEL "E"

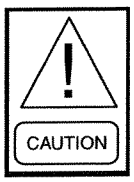
lets are collected on the extended surface area of the wire mesh pads where the oil falls by gravity into the oil reservoir.

The third and final stage of oil separation is achieved in the oil coalescing element section of the oil separator. The oil mixed with the refrigerant entering the coalescer element is a very fine aerosol mist about the size of cigarette smoke particles. These small aerosol mist particles wet the coalescer element media and form larger oil droplets which fall by gravity to the bottom of the coalescer element section. The oil collected in the coalescer section is drained from the oil separator with a small amount of refrigerant gas. This provides the high pressure "gas drive" for the eductors to return oil from the evaporator. Refer to section titled "Oil Eductor Circuit", page 41.

Three sight glasses are provided in the oil separator for monitoring the oil level and verifying performance of the coalescer element. Liquid oil should be visible in the top glass of the oil separator when the chiller is off. During operation, oil may be higher or lower due to system load and operating conditions.

A low oil level safety switch is provided in the bottom of the oil separator. A safety shutdown will be initiated if the oil level is below the switch setting for 30 continuous seconds after the chiller has been running for 3 minutes.

An oil drain and charging valve is located on the bottom of the oil separator. A 5/8 inch male flare connection is provided for ease of connecting a hose to quickly drain used oil into a EPA approved recovery cylinder or tank. Oil can be added into the oil reservoir with the chiller in service.



Do not add oil. YORK YS Chiller packages are pre-charged with the correct amount of YORK oil during functional testing after manufacture. Refer to the Table 6, YORK Oil Types, in the Maintenance Section.

Oil loss is most often the result of operating conditions at loads under 10% of the chillers rated capacity and with condensing water that is too cold for load and operating condition.

The oil is not "lost" but has migrated into the refrigerant charge and is most likely in the evaporator. Excessive amounts of oil in the evaporator will result in operational problems.

Oil management problems result if the compressor discharge superheat is not maintained at the values listed in Table 9. Compressor discharge superheat is the difference between the compressor discharge temperature and the saturated condenser temperature. Compressor discharge superheat is used in conjunction with the evaporator approach to determine the most efficient refrigerant charge.

Should the control panel display EXCESS CHARGE WARNING this is most likely the result of excessive amounts of oil in the evaporator. Excess amounts of oil in the refrigerant will cause foaming. The oil foam carries liquid refrigerant into the compressor. This results in lowering the compressor discharge superheat to low levels. If the compressor discharge superheat falls to within 10°F of the saturated condensing temperature the control panel will display EXCESS CHARGE WARNING. Compressor loading will be inhibited while the EXCESS CHARGE WARNING is displayed. The inhibit loading will remain in effect until the compressor discharge superheat increases to 15°F. Refer to "Oil Recovery Procedure" in the Maintenance section on page 56.

OIL EDUCTOR CIRCUIT

An oil eductor circuit is provided to properly manage the amount of oil in the refrigerant charge. A small amount of oil is normal in the refrigerant charge and will be found in the evaporator. If not properly managed the oil will accumulate and have adverse consequences regarding chiller performance.

The oil eductor circuit consists of three refrigerant and oil filter driers, two "jet pump" eductors and the interconnecting piping. Refer to Figures 21 and 22.

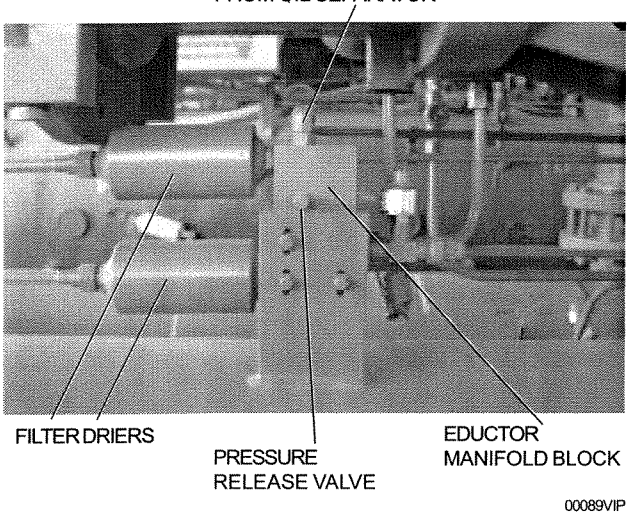


FIG. 21 – FILTER DRIERS AND OIL EDUCTOR

The eductors operate using the "jet pump" principle. Discharge pressure gas and oil flows through a filter dryer located at the bottom of the oil separator. YS Chillers are supplied with a variable orifice arrangement. The reduced pressure (pumping action) is created by the velocity of the discharge pressure gas and oil flowing through the orifice and nozzle. This creates a reduced pressure area that allows the oil-rich refrigerant and oil to flow from the evaporator into the compressor.

Oil-rich refrigerant flows into the eductor block through the filter drier from the evaporator. The oil rich refrigerant mixes with the discharge pressure gas and flows into the compressor suction line.

A second eductor flows oil, which may have collected in the evaporator trough through the second filter drier located on the eductor block. This oil mixes with the discharge gas in the eductor block and flows to the compressor at port SC-5.

The filter driers should be changed annually or when excessive amount of oil is indicated in the refrigerant charge.

LIQUID REFRIGERANT CIRCUIT

Liquid refrigerant flows from the condenser into the evaporator by differential pressure. Sub-cooled liquid refrigerant flows out of the condenser into the liquid line. A metering orifice is installed in the liquid line to control the rate liquid refrigerant flows into the evaporator. The orifice is selected based upon the operating conditions of the chiller. Refer to Figure 23.

YS Chillers are supplied with a variable orifice arrangement. In parallel with the metering orifice is a solenoid valve and hand-throttling valve. The solenoid is energized open by the DIFFERENTIAL PRESSURE set point that is field programmable from the panel. The differential pressure between condensing pressure and evaporating pressure is compared to the set point value. When the differential pressure is at or less than the setpoint, the solenoid valve is energized open. The solenoid valve is de-energized closed when the differential pressure is equal to or greater than the setpoint plus 10 PSIG. A hand-throttling valve is provided to adjust the refrigerant flow rate through the solenoid valve to match the system operating conditions.

Dual Service Chillers – Ice duty and comfort cooling air conditioning applications will require the solenoid valve to be energized open in the air conditioning mode of operation since this represents the low differential pressure mode of operation.

The differential pressure setpoint is field programmable within the ranges specified in Table 5 for different refrigerants and EPROM version S.01F.17 and later. See YORK Service Bulletin 160.47-M2 (SB18) for programming instructions.

TABLE 5 – VARIABLE ORIFICE PRESSURE DIFFERENTIAL SETPOINTS

REFRIGERANT	DIFFERENTIAL PRESSURE RANGE
R-22	25 - 150 PSID
R-134A	15 - 110 PSID

A liquid line hand-isolation valve is located between the condenser and the metering orifice plate. This valve, in combination with the hand isolation valve between the

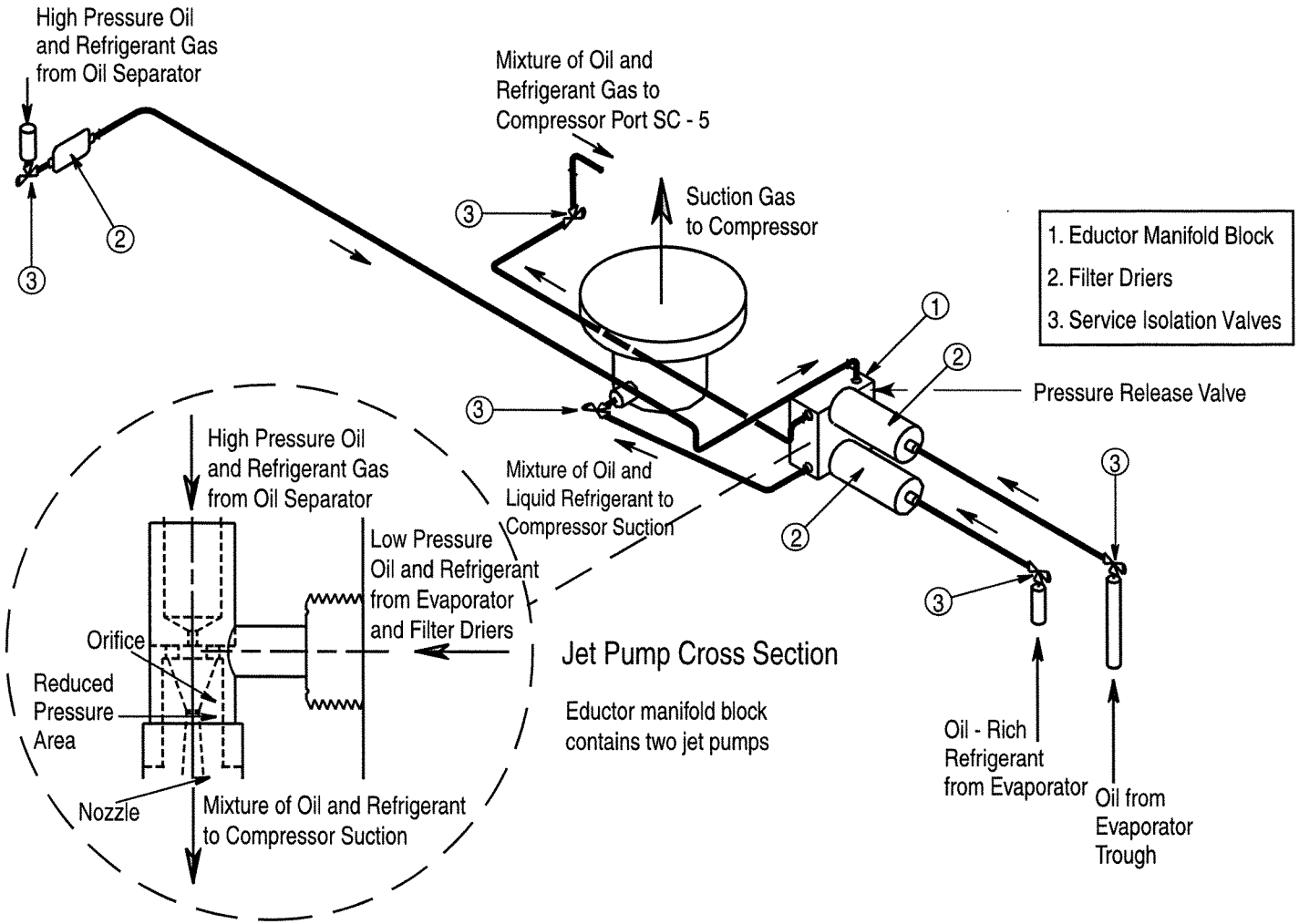


FIG. 22 – YS SCREW CHILLER OIL EDUCTOR SCHEMATIC – DESIGN LEVEL "E"

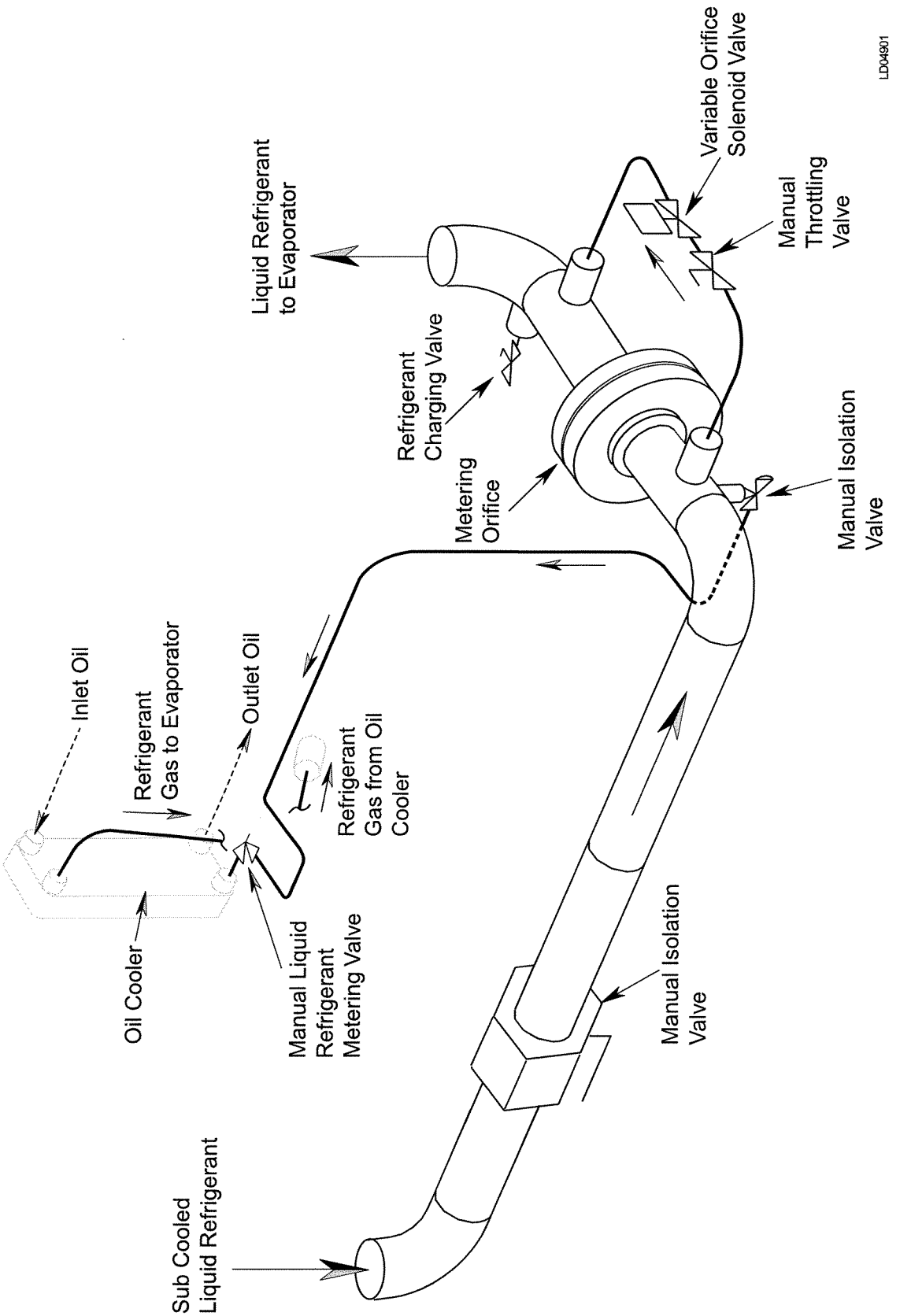


FIG. 23 – YS SCREW CHILLER REFRIGERANT SCHEMATIC – DESIGN LEVEL "E"

oil separator and the condenser, allows all of the refrigerant charge to be stored in the condenser.

A ½ inch liquid refrigerant supply is piped from the bottom of the liquid line to the refrigerant cooled oil cooler. The refrigerant gas from the oil cooler is piped directly into the evaporator.

A liquid refrigerant-charging valve is piped into the liquid line between the evaporator and the metering orifice. A ¾ inch male flare connection is provided for connecting hoses or transfer lines.

CAPACITY CONTROL

Refer to the Capacity Control Piping Schematic piping, Fig. 26.

Capacity control is accomplished by using differential pressure to move the slide valve. As the slide valve is moved axially between the compressor rotors the volume of gas pumped by the compressor is changed to match the system requirements.

Leaving evaporator fluid temperature is continuously monitored by the microprocessor. The Leaving Evaporator fluid temperature is compared to the Leaving Evaporator fluid Set Point. When the leaving evaporator fluid temperature is beyond the range of the set point value a signal is sent to the relay output board. A signal is sent from the relay output board to energize the 4-way valve directional solenoid valves.

When Solenoid Valve B is energized the slide valve begins to move in the load direction. The 4-way directional valve opens Port P to Port B and Port A to Port T. Oil pressure from the oil circuit flows into the 4-way solenoid valve sub-plate manifold at Port P. Oil pressure flows through the sub-plate manifold block and out Port B to Compressor Port SC-2. Simultaneously, oil flows out of Compressor Port SC-1 into Port A on the sub-plate manifold, through the sub-plate manifold block and out of the sub-plate manifold block at Port T to suction pressure.

When the Solenoid Valve A is energized, the slide valve will move in the unload direction. The 4-way directional valve opens Port P to Port A and Port B to Port T. See Figure 24. High pressure oil flows into Compressor Port SC-1 and oil is relieved out of Compressor Port SC-2 to suction pressure.

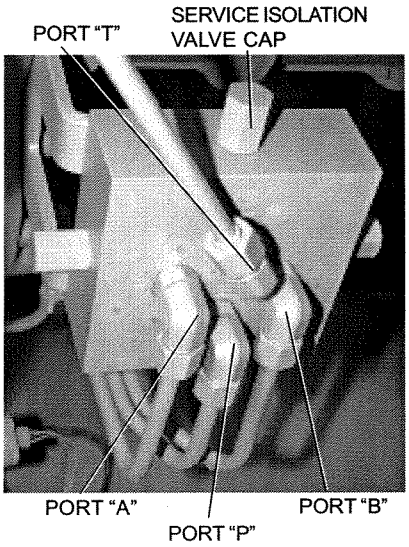


FIG. 24 – 4-WAY DIRECTIONAL VALVE SUBPLATE

A slide valve potentiometer is used to provide feedback to the microprocessor to display slide valve position as a percentage of full load. See Fig. 25.

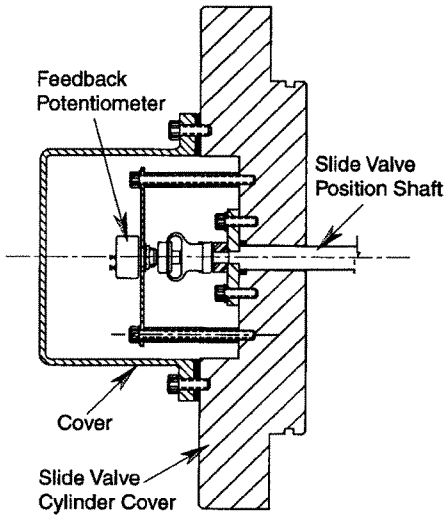


FIG. 25 – SLIDE VALVE POTENTIOMETER

Four manual isolation valves are incorporated into the 4-way solenoid sub-plate to isolate the 4-way directional valve for service. Remove the steel hexagonal caps to gain access to the service valve stem. Use a refrigeration service valve wrench to close or open the valves.

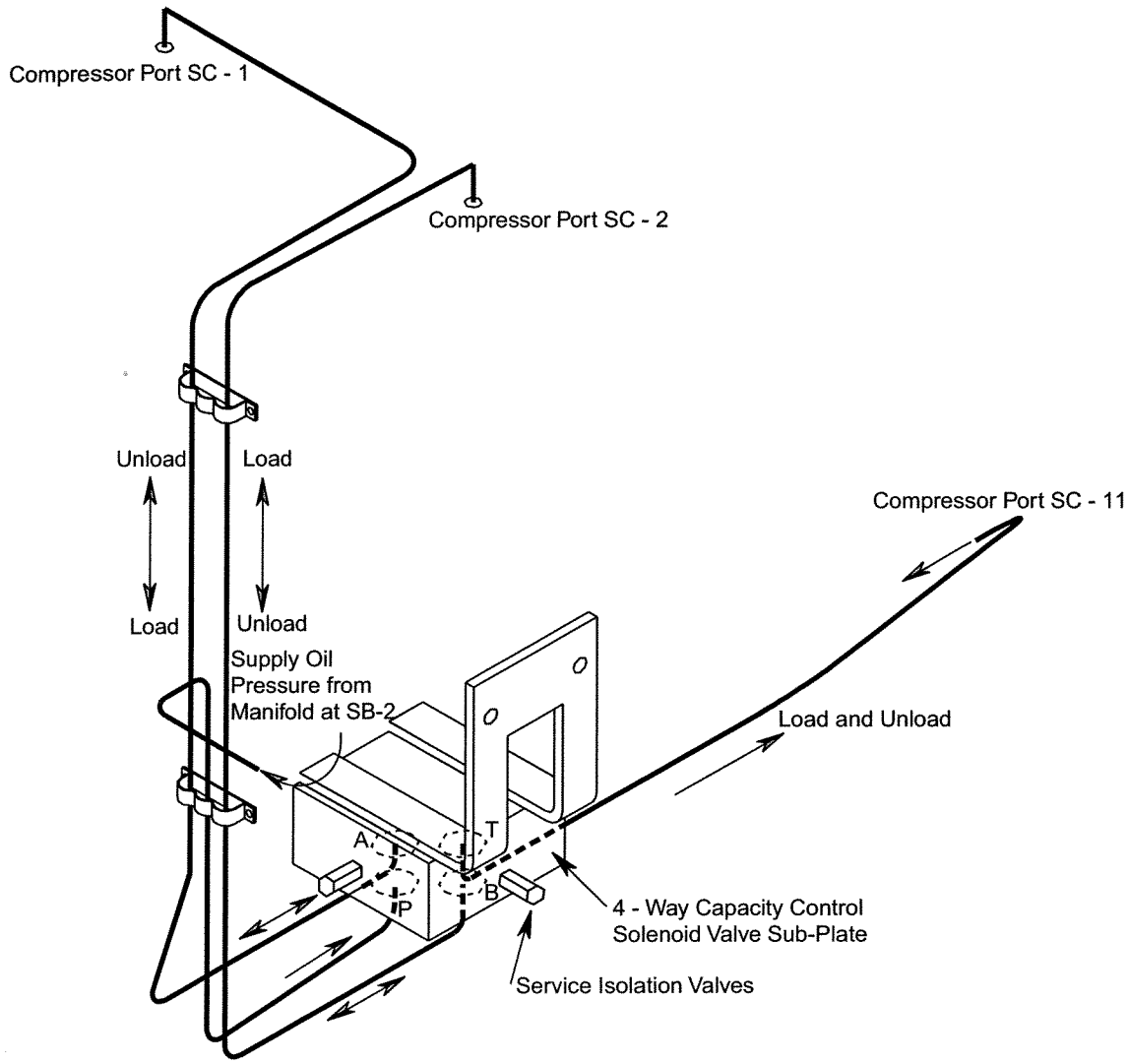


FIG. 26 – YS SCREW CHILLER CAPACITY CONTROL PIPING SCHEMATIC – DESIGN LEVEL "E"

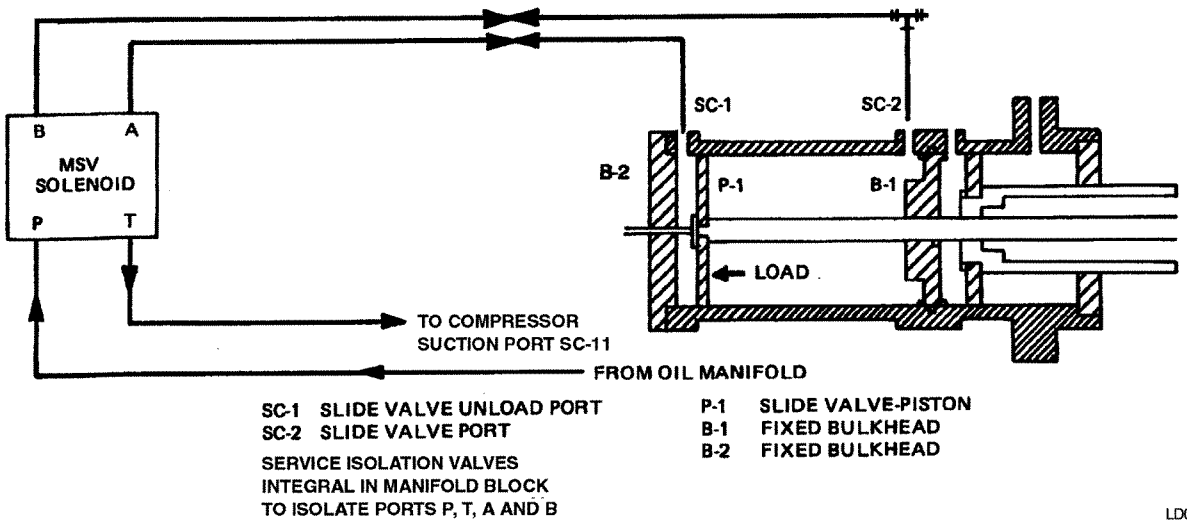


FIG. 27 – DOUBLE PURPOSE HYDRAULIC CYLINDER

SECTION 4 – MAINTENANCE

GENERAL

The maintenance requirements for YS Chillers is shown on the following page. The procedure is given in the left- hand column and the frequency required is marked with an "X" shown in the right-hand columns. Refer to the note at the bottom of the form to maintain warranty validation.

COMPRESSOR OIL

YORK oil types approved for YS Chillers and the quantity of oil required is listed in Table 6.

TABLE 6 – YORK OIL TYPES

CHILLER SIZE	R-22 OIL TYPE	R-134a OIL TYPE	SYSTEM QUANTITY (GAL)
S0	C	H	10
S1	C	H	10
S2	C	H	10
S3	S	H	10
S4	S	H	15
S5	S	H	15

YORK "C" Oil is a mineral oil. YORK "P" and "H" oil are polyolester (POE) oils. Polyolester oil is very hygroscopic and will absorb moisture from the atmosphere if it is not handled properly. Polyolester oil should be stored in metal containers. Plastic containers should not be used because they allow moisture to permeate into the oil.

Yearly oil analysis is recommended to verify the continued use of the compressor oil.

It is very important to take the oil sample after the oil filter. The slide valve cylinder has two pressure service ports that are ideal for drawing the oil sample. The oil sample should not be left open to the atmosphere for more than 15 minutes since it will absorb moisture from the atmosphere and may yield erroneous results.

Compressor oil should be changed when the oil analysis indicates the oil has moisture and acid numbers are in excess of the limits set in Table 7.

TABLE 7 – COMPRESSOR OIL LIMITS

YORK OIL TYPE	MOISTURE CONTENT (by Karl Fisher) ppm	TAN (Total Acid Number) mgKOH/ml
C	LESS THAN 50 PPM	LESS THAN 0.05
H	LESS THAN 300 PPM	LESS THAN 0.5
S	LESS THAN 300 PPM	LESS THAN 0.5

The YORK YS Chiller Compressors use rolling element bearings (ball and roller bearings); no sleeve bearings are used. Oil analysis that include metals may cause confusion when the results are compared to other equipment that utilize different bearing types. Iron and copper are examples of metals, which will appear in oil analysis that include metals. Other metals that may appear are Titanium, Zinc, Lead, Tin and Silicon. These metals should be ignored and are acceptable in quantities of less than 100 ppm. If a oil analysis should indicate high levels of Iron (more than 300 ppm) combined with Chromium and Nickel (more than 50 ppm), consult your local YORK Service Office – this could indicate bearing damage and wear.

The immersion oil heater will maintain the oil temperature between 105°F (40°C) and 115°F (46°C). The immersion oil heater is interlocked with the oil level float and will be de-energized when the oil level float drops to the low oil safety set point. See Figure 28.

Changing Compressor Oil

Compressor oil is changed by draining oil from the oil separator into a refrigerant recovery container. The oil separator is under positive pressure at ambient temperatures. Connect one end of a 5/8 inch refrigeration charging hose to the service valve located at the bottom of the oil separator; connect the other end to an approved refrigerant recovery cylinder. Open the valve and drain the oil from the oil separator.

Weigh the empty refrigerant recovery cylinder (compressor oil weighs 7 lb/gallon). Calculate the number of gallons of oil that has been removed from the oil separator by weighing the refrigerant recovery cylinders with the oil in them.

Use a hand or electric oil pump to pump new oil into the oil separator. Pump oil into the oil separator until the oil is approximately half way in the upper sight glass. The

amount of oil removed from the oil separator should equal the amount of new oil pumped into the oil separator.

Oil Level

A visual check is sufficient to verify the oil level. Two sight glasses are part of the oil separator and should be used to determine the proper operating oil level.

The upper sight glass should have liquid oil visible in the sight glass with the chiller off and the oil at 105°F (40°C) and 115°F (46°C). When the chiller is in operation, the oil level may be different from the standby condition, due to the turbulence created by the discharge gas in the oil separator. See Figure 28.

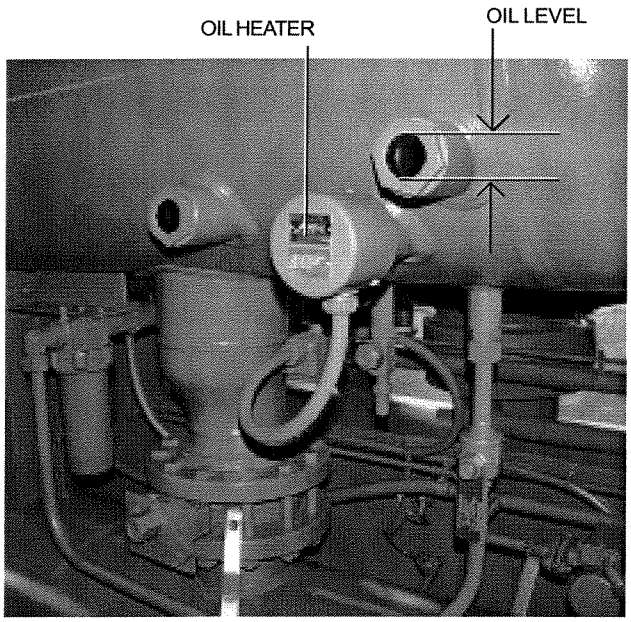


FIG. 28 – OIL HEATER AND SIGHT GLASSES

OIL FILTER

A single oil filter is provided as standard equipment and dual oil filter arrangements are available as optional equipment. The oil filter(s) are a replaceable 3 micron cartridge type oil filter. Use only YORK approved oil filter elements. See Figure 17.

The oil filter element should be changed after the first 200 hours of operation and then as necessary thereafter. Change the oil filter element before the differential pressure reaches 20 PSID. Always replace the oil filter element and o-ring on a yearly maintenance schedule.

The YORK control panel will automatically display the message "DIRTY OIL FILTER" when the differential pressure reaches 20 PSID across the oil filter. A safety shutdown will be initiated if the oil pressure differential pressure reaches 25 PSID. The control panel will display the message "CLOGGED OIL FILTER"

OIL FILTER REPLACEMENT

Single Oil Filter

The chiller must be OFF. Turn the rocker switch to the OFF position; turn the circuit breaker to the OFF position to prevent the chiller from being accidentally started.

1. Close the hand isolation valves on the inlet and outlet oil lines going to and from the oil filter.
2. Relieve the refrigerant pressure and oil in the oil filter and the oil lines through the pressure access port fitting, located on the top of the filter housing. Connect a refrigeration pressure hose to the pressure access port and drain the oil and refrigerant into a suitable refrigerant recovery container.
3. Position a container to collect the oil (less than 2 quarts, 1.9 liters). Loosen and remove the drain nut at the bottom of the oil filter housing; drain the oil into the container.
4. Unscrew the oil filter bowl.
5. Remove the oil filter element.
6. Install a new element.
7. Install a new O-ring on the top of the oil filter bowl.
8. Tighten the oil filter bowl.
9. Evacuate the air from the oil filter to 500 microns PSIG.
10. Open the hand isolation valves.
11. The chiller is ready to be restarted.

Dual Oil Filters

The dual oil filter option allows one oil filter to be isolated and changed with the chiller in operation.

1. Open the hand isolation valves on the idle filter.
2. Close the hand isolation valves on the filter to be changed.
3. Follow the instructions for changing the single oil filter beginning at step #2.
4. This can now be the idle filter and the chiller can be operated with the current oil filter.

MAINTENANCE REQUIREMENTS FOR YORK YS CHILLERS

TABLE 8 – MAINTENANCE REQUIREMENTS FOR YORK YS CHILLERS

PROCEDURE	DAILY	WEEKLY	MONTHLY	QUARTERLY	YEARLY	EVERY 50,000 HOURS
Record Operating Pressures and Temperatures	X					
Check Oil and Refrigerant Levels		X				
Check Operation of Oil Heater			X			
Check 3-Phase Voltage and Current Balance				X		
Leak Check and Repair Leaks ***				X		
Calibrate Safety Controls					X	
Check Slide Valve Operation and Calibrate Slide Valve Potentiometer					X	
Lubricate Motor Bearings (per Motor Manufacturer's Recommendation) & Clean Motor					X	
Mechanically Brush Condenser Tubes					X (or as necessary)	
Megohm Motor					X	
Perform Oil Analysis on Compressor Lube Oil ***					X	
Remove Condenser Water Box(s) and Inspect Tube Sheets					X	
Replace Filters/Driers					X	
Replace Oil Filter(s) ****						X
Verify Evaporator and Condenser Water Flow Rates vs. Design Conditions					X	
Vibration Analysis					X	
Compressor Internal Inspection ***						X

*** These procedures must be performed at the specified time interval by an Industry Certified Technician, who has been trained and qualified to work on this type of YORK equipment. A record of this procedure being successfully carried out must be maintained on file by the equipment owner, should proof of adequate maintenance be required at a later date for warranty validation purposes.

**** Change oil filter(s) elements after the first 200 hours of operation.

FILTER DRIER REPLACEMENT

The filter driers should be changed annually or when excessive amount of oil is indicated in the refrigerant charge.

When the filter driers require changing the chiller must be shut off.

1. Close the (5) service isolation valves identified in schematic drawing, Figure 23.
2. Carefully remove the insulation on the (2) filter driers located on the eductor block.
3. Relieve the pressure from the circuit using the pressure access fitting located on the side of the eductor block. Connect a refrigeration pressure hose to the pressure access port and drain the oil and refrigerant into a suitable refrigerant recovery container.
4. Loosen the Rota-Lock® Nuts at each end of the (3) filter driers. Remove the filter driers.
5. Teflon® seal washers are used to seal the filter drier connections. These washers must be replaced when the filter driers are replaced.
6. Tighten the Rota-Lock® Nuts at each end of the three filter driers to a torque of 60 ft-lb.
7. Evacuate the air from the oil filter to 500 microns PSIG.
8. Open the five hand isolation valves. The chiller is now ready to be placed back into service.

MOTOR

Inspect the motor at regular intervals. Keep the motor clean and vent openings clear. Follow the original motor manufacturer recommendation for lubricating the motor bearings. If the chiller is exposed to dusty and dirty conditions during installation, lubricate the motor bearings ahead of the suggested schedule.

DETERMINING CORRECT REFRIGERANT CHARGE LEVEL

The refrigerant charge level is correct when the measured evaporator approach and discharge refrigerant gas superheat are within the values listed in Table 9.

IMPORTANT: The chiller must be at design operating conditions and full load operation before the correct refrigerant charge level can be properly determined.

TABLE 9 – REFRIGERANT CHARGE LEVEL

CONDITION	R-22 REFRIGERANT	R-134a REFRIGERANT
COMFORT COOLING APPLICATIONS		
EVAPORATOR APPROACH	1°F-5°F	1°F-5°F
DISCHARGE SUPERHEAT	35°F-45°F	12°F-18°F
BRINE (ICE MAKING) APPLICATIONS		
EVAPORATOR APPROACH	4°F-8°F	4°F-8°F
DISCHARGE SUPERHEAT	45°F-65°F	24°F-36°F

Liquid refrigerant will be visible in the evaporator sight glass. The refrigerant level cannot be properly determined by viewing the liquid refrigerant level in the evaporator sight glass.

All YS Chillers shipped Form 1 are charged with the correct amount of refrigerant. Under some operating conditions the chiller may appear to be overcharged or undercharged with refrigerant. Consult with the YORK Factory prior to removing or adding refrigerant. The liquid line isolation valve may have to be partially throttled to prevent overfeeding the evaporator in some applications and under certain operating conditions.

Definitions:

Evaporator Approach = (S.E.T) - (L.E.L.T)
Discharge Superheat = (C.D.G.T) - (S.C.T)

Where:

S.E.T. = Saturated Evaporator Temperature
L.E.L.T. = Leaving Evaporator Liquid Temp.
C.D.G.T. = Compressor Discharge Gas Temp.
S.C.T. = Saturated Condensing Temperature

These values can be obtained from the Graphic Control Center. Refer to Graphic Control centerOperating Instructions, Form 160.80-O1.

REFRIGERANT CHARGING

Should it become necessary to add refrigerant charge to a YORK YS Chiller; add charge until the evaporator approach and refrigerant gas discharge superheat are at within the values listed in Table 9.

A charging valve is located in the liquid line below the evaporator. The size of the charging connection is ¾ inch male flare. Purge air and non-condensables from the charging hose. Only add new refrigerant, or refrigerant that has been tested and certified to meet American Refrigeration Institute Standard (ARI-700).

REFRIGERANT LEAK CHECKING

Periodic refrigerant leak checking must be part of a comprehensive maintenance program. Leak check the entire chiller using a calibrated electronic leak detector.

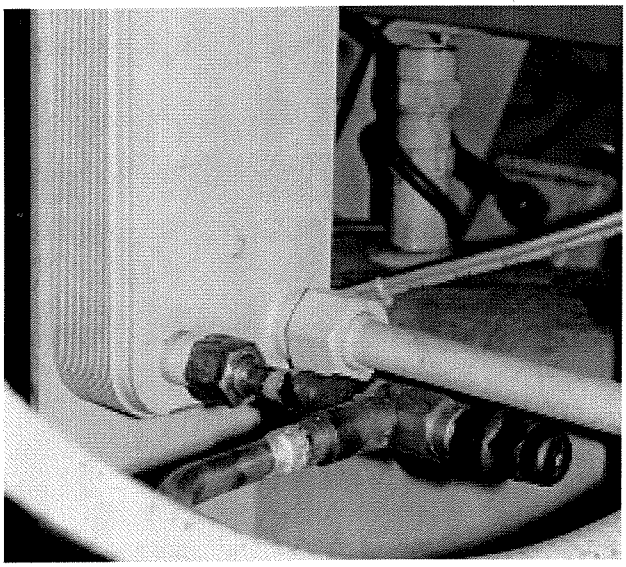
Confirm leaks with soap bubbles that are found using the electronic leak detector.

Check refrigerant relief valve piping and tube rolled joints as part of the comprehensive refrigerant leak checking program.

Repair leaks before adding refrigerant.

OIL TEMPERATURE CONTROL

A valve has been added to the liquid refrigerant line supply liquid refrigerant to the oil cooler (See Fig. 29). This valve has been added beginning with design level "E" chillers. The purpose of the valve is to regulate the amount of liquid refrigerant being supplied to the oil cooler. Set the valve to maintain oil temperature at 80°F to 100°F. *Note the most sever oil cooling load is when the chiller is unloaded.* Allow the chiller to operate for a period of time while monitoring the oil temperature. The valve may require as little as 1/2 turn open for some applications.



00207VIP

FIG. 29 – OIL COOLER VALVE

PRESSURE CONNECTIONS

All threaded pressure connections used on the YORK YS Chillers are SAE straight thread, O-ring face seal type fittings or Primore Rotalock® fittings.

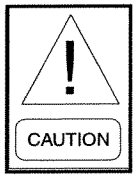
The O-ring straight thread fittings and O-ring face seal fittings are designed and used in accordance with SAE J1926 and J1453. Should it become necessary to remove a fitting, the O-ring(s) should be replaced. Make certain to use only neoprene replacement O-rings. O-rings can be ordered from the local YORK Service Office.

Pipe sealant compounds are not required with SAE type O-ring fittings. The O-ring seal accomplishes the pressure sealing. Lubricate the O-ring with compressor oil prior to assembly.

All filter driers and angle shut off valves use Primore Rotalock® fittings. These fittings use a Teflon® fiber seal washer. The Teflon® fiber seal washers should be replaced each time the filter driers are changed.

CONDENSER TUBES

The standard condenser tubes used in YORK YS Chillers are internally enhanced copper tubes.



If the equipment is located in an unheated area that is susceptible to freezing, the water must be drained from the condenser to prevent tube failure from freezing.

Proper condenser water treatment can eliminate or significantly reduce the formation of scale on the waterside of the condenser tubes.

Maintain a minimum condenser water flow rate through the tubes of at least 3.33 ft/sec. (1 meter/sec.). Through tube water velocity should not exceed 12 ft/sec. (3.6 meter/sec.).

Condenser tubes must be maintained to provide proper chiller operation. Condenser Approach Temperature is a useful tool to monitor the performance of the condenser. By recording and logging the Condenser Approach Temperature as part of the chiller maintenance program, this will provide a warning that the waterside condenser tubes are fouled and require cleaning.

Condenser Approach Temperature is the difference between the Condenser Leaving Water Temperature and the Saturated Condensing Temperature.

If the approach increases above 10°F (5.6°C), or during the annual condenser inspection and the tubes are observed to be fouled, the tubes will require cleaning. For

condenser fluids other than water consult with the local YORK Field Service Office for the correct condenser approach.

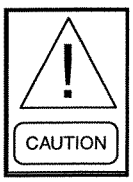
CONDENSER WATER SIDE TUBE CLEANING PROCEDURE

Two methods are used for waterside tube cleaning to remove the scale; chemical and mechanical cleaning procedures. The composition of the scale will determine which method will be most effective to remove the scale and dirt.

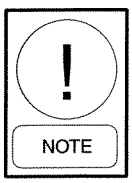
Consult with the local YORK Field Service Office for a recommendation of the method(s) used in the local area.

Chemical Cleaning Procedure

Chemical cleaning is an effective method to remove scale from internally enhanced copper tubes. However, a company knowledgeable with the chemical cleaning procedure should be contracted or consulted. Follow the chemical cleaning company recommendations concerning solution cleaning strength and time duration of the cleaning process.



Serious damage to the condenser tubes will result if the chemical cleaning procedure is improperly applied.



Mechanical tube cleaning must always follow a chemical cleaning procedure.

When chemical cleaning of the condenser tubes is required, it may be necessary to calculate the internal volume of the waterside condenser tubes. This information is necessary to properly mix the correct concentration of cleaning solution.

Standard materials of construction for YORK YS Chiller condensers is copper tubes and mild carbon steel water boxes.

The internal volume (waterside) of the condenser can be calculated as follows:

$$\text{Volume (in}^3\text{)} = N * L * 0.30680 \text{ in}^3\text{/in}$$

Where: N = Number of Condenser Tubes
L = Length of each Tube in inches

To covert in^3 to gallons, divide the Volume (in^3) by 231 in^3/gallon.

Mechanical Cleaning Procedure

1. Drain the water from the condenser.
2. Remove the water boxes from both ends of the condenser. Use proper lifting equipment when removing the water boxes. Use caution not to damage the threads on the mounting studs that are welded to the tube sheet.
3. Select a tube cleaning brush for 5/8 inch I.D copper condenser tubes. If tubes other than 5/8 inch copper are used, select a tube cleaning brush that is made for the tube size. Generally, brushes made of hard plastic or brass bristled wires are preferred for cleaning copper tubes.
4. Attach the tube cleaning brush to the end of a cleaning machine or cleaning rod.
5. Flush the condenser with clean water to remove the debris.
6. Replace the water box gasket with a new gasket and reassemble the water boxes onto the condenser.

EVAPORATOR TUBES

The standard evaporator tubes used in YORK YS Chillers are internally enhanced copper tubes.

If the equipment is located in an unheated area that is susceptible to freezing, the water must be drained from the evaporator to prevent tube damage from freezing.

Maintain evaporator water or brine flow rates through the evaporator tubes that the chiller was designed for. Refer to the engineering data on the sales order form for the correct flow rates.

Generally, the water or brine that is circulated through the evaporator is part of closed loop circuit that is treated with chemicals to prevent the formation of scale and debris.

If cleaning of the evaporator tubes is required, follow the condenser cleaning procedure.

MEGOHM THE MOTOR

Make certain that the motor disconnect switch (circuit breaker) is in the open position. Megohm the motor as follows:

1. Use a megohm meterto verify the minimum motor and wiring insulation resistance. Megohm between phases and each phase to ground, refer to Fig. 30, Diagram, Megohm Motor Windings. Refer to Fig. 31, Motor Stator Temperature and Insulation resistances.
2. If insulation resistance values fall to the left of the curve, remove external leads from the motor and repeat test.

NOTE

Motor is to be megged with the starter at ambient temperature after 24 hours of idle standby.

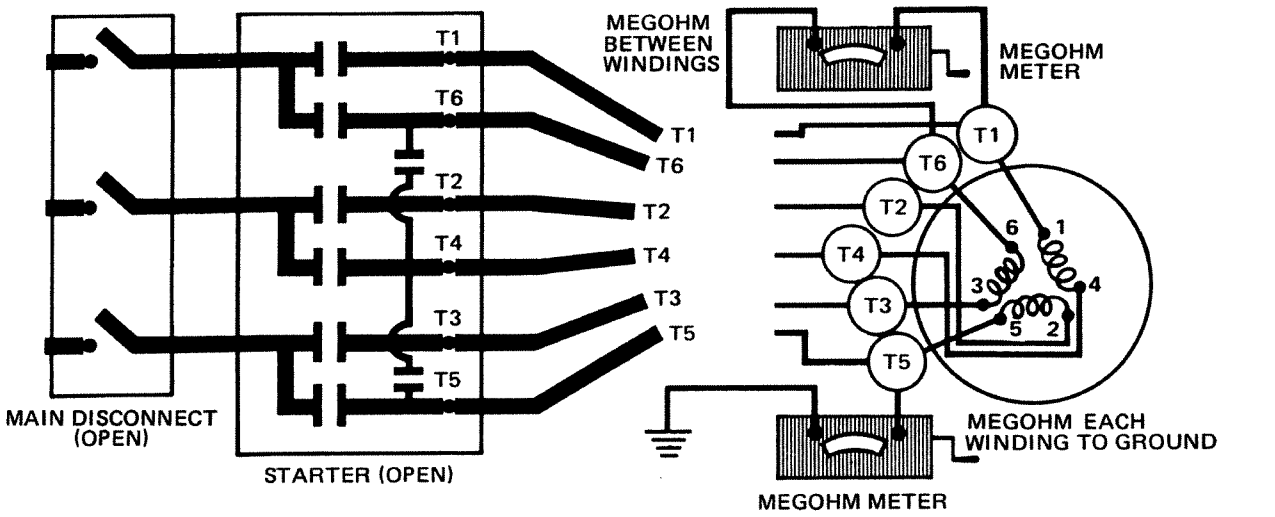


FIG. 30 – DIAGRAM, MEGOHM MOTOR WINDINGS

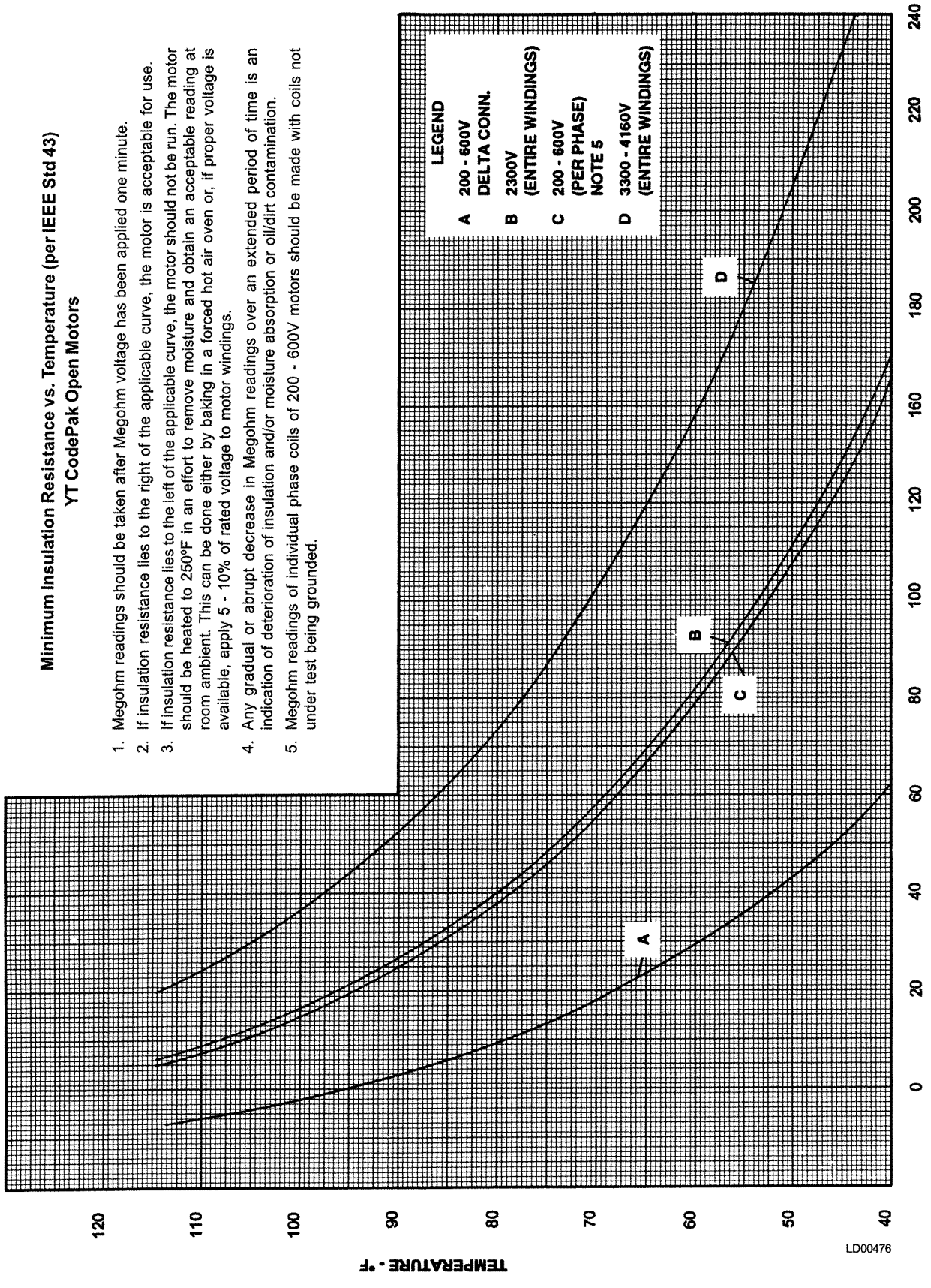


FIG. 31 – MOTOR STATOR TEMPERATURE AND INSULATION RESISTANCES

4

VIBRATION ANALYSIS

Vibration analysis performed at yearly intervals is a useful diagnostic that can detect internal damage to rotating machinery and component parts. This service should be performed by a skilled technician trained in the use and operation of the equipment. Fig. 32 is provided to properly locate the transducer measurement points. Locating the transducers at these locations will enable the data to be analyzed against a large database of sound and vibration data.

Note the natural or pumping frequency of the YORK YS compressor is 238 HZ (14,280 CPM) at 60 HZ and 198 HZ (11,880 CPM) at 50 HZ operation.

SPECTRAL ALARM BANDS FOR 4/6 LOBE TWIN SCREW CHILLERS

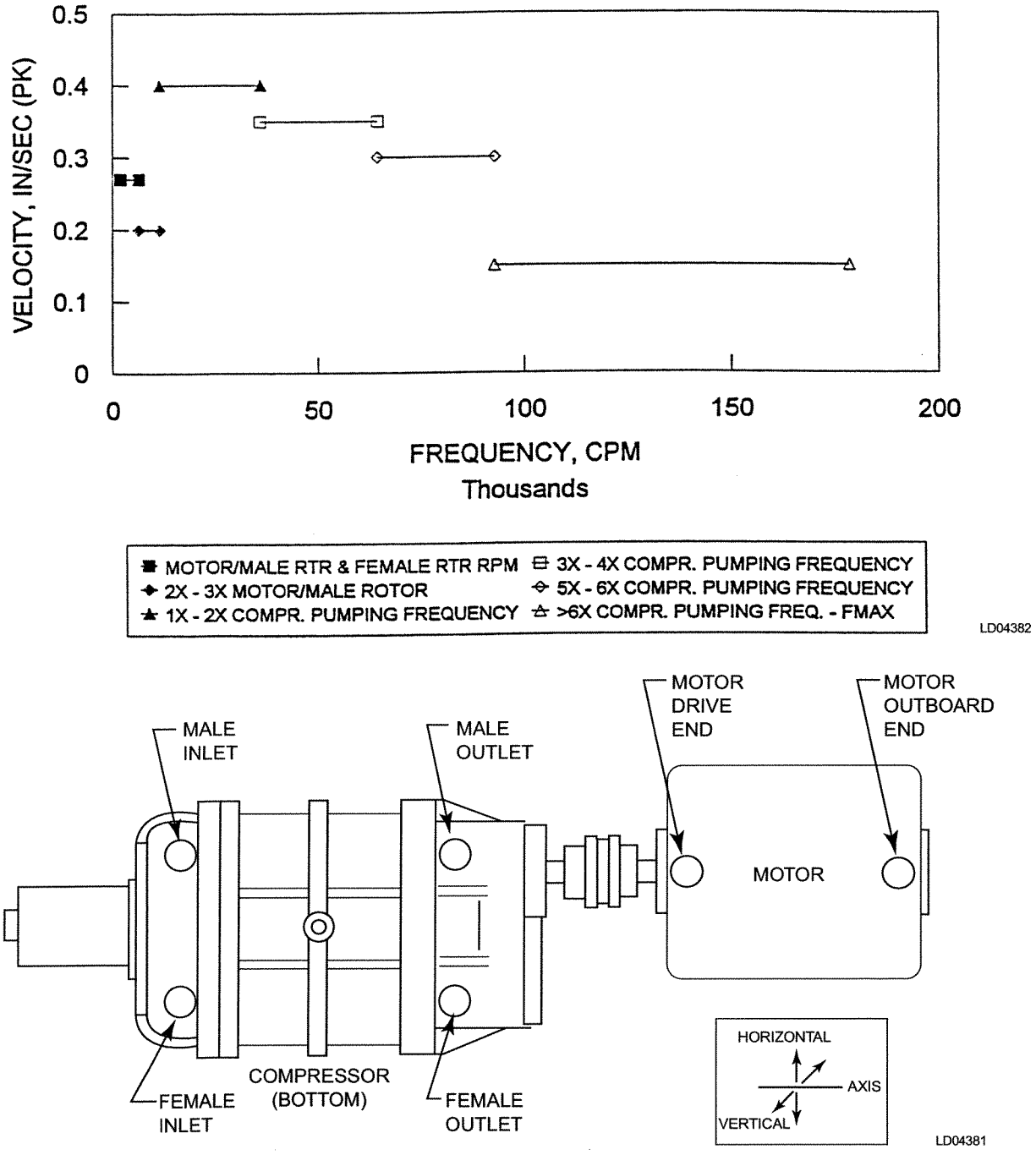


FIG. 32 – TRANSDUCER MEASUREMENT POINTS

SPECTRAL ALARM BANDS FOR 4/6 LOBE TWIN SCREW CHILLERS

Reference: Proven method for specifying spectral band alarm levels and frequencies using today's predictive maintenance software systems

James E. Berry, Technical Associates of Charlotte, Inc.

OVERALL LEVEL	OA	0.500	IN/SEC (0-PK)	
MTR/MALE RTR RPM	MTR	3570	RPM =	59.5 HZ
4/6 LOBE RATIO	LR	0.67		
FEMALE ROTOR	IDLE	2380	RPM =	39.7 HZ
MALE ROTOR LOBES	LOB	4		
PUMPING FREQUENCY	BPF	14280	CPM =	238.0 HZ
FREQUENCY MAX	FMAX	178500	CPM =	2,975.0 HZ

ITEM	BAND 1	BAND 2	BAND 3	BAND 4	BAND 5	BAND 6
BAND LOWER FREQ., CPM	1,904	6,426	11,424	35,700	64,260	92,820
BAND UPPER FREQ., CPM	6,426	11,424	35,700	64,260	92,820	178,500
BAND LOWER FREQ., HZ	32	107	190	595	1,071	1,547
BAND UPPER FREQ., HZ	107	190	595	1,071	1,547	2,975
BAND ALARM LEVEL	0.27	0.2	0.4	0.35	0.3	0.15

4

DESCRIPTION OF BAND COVERAGE

BAND 1 MOTOR/MALE RTR & FEMALE RTR RPM

BAND 2 2X - 3X MOTOR/MALE ROTOR

BAND 3 1X - 2X COMPR. PUMPING FREQUENCY

BAND 4 3X - 4X COMPR. PUMPING FREQUENCY

BAND 5 5X - 6X COMPR. PUMPING FREQUENCY

BAND 6 >6X COMPR. PUMPING FREQUENCY - FMAX.

NOTES:

1. Assume measurements by accelerometer or velocity pickup as close as possible to Bearing Housing, see Fig. 32.
2. Assume machine NOT mounted on vibration isolators (for isolated machinery - set alarm levels 50% higher).
3. Set motor levels same as compressor given above.
4. Chiller must be at a consistent condition (not only motor amps) when measurements are taken. Monitor and record all performance parameters.
5. Aerodynamic noise (pressure pulsation) sources dominate mechanical sources at pumping frequency and harmonics and does not represent energy transmitted through bearings.
6. Set danger levels 50% higher than alarm levels.
7. Another set of data with much higher Fmax can be used to detect additional stages of bearing failure using techniques described in Preventative Maintenance literature.

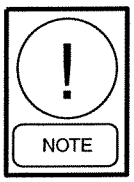
OIL RECOVERY

YS Chiller Best Practice Oil Recovery Method

A skilled service technician can recover oil from the refrigerant charge in the evaporator in less than 60 minutes.

Before starting the chiller, print a **History** print. This will help you determine the reason for the oil loss. The operating conditions are stored in memory in a history buffer file. Connect a printer and press the **History** print key.

1. If the chiller was shut off on **LOW OIL LEVEL** safety: Place a jumper wire between terminals 1 and 18 to satisfy the control circuit.
2. Start the chiller in **AUTO** mode of operation.
3. As soon as the chiller starts, remove the jumper wire from between terminals 1 and 18. (This was installed in Step 1.)
4. In the automatic mode of operation, the slide valve will be force loaded to establish differential pressure. A minimum pressure differential of 30 PSID (oil supply pressure relative to evaporator pressure) must be met within the first three minutes of chiller operation or the chiller will be shut off on a **LOW PRESSURE** safety.



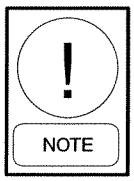
If the entering condenser water is cold, turn off the condenser pump or regulate that amount of water flowing through the condenser to establish the necessary pressure differential. Recommended, entering condenser water temperature should be at least 15°F or greater than the leaving chilled water temperature.

5. Press the FILTER PRESSURE key and monitor the DIFF PRESS as soon as the 30 PSID pressure differential has been established. Press the UNLOAD key to unload the slide valve.
6. Calculate the compressor discharge superheat (DSH).

   Compressor DSH =
   (Condenser Discharge Temperature)
   – (Saturated Condensing Temperature

Monitor the compressor DSH. When the compressor DSH is equal to, or greater than, 15°F, press the LOAD key for one second and then press the HOLD key.

7. Recalculate the compressor DSH. Do not increase the slide valve position until the compressor DSH is equal to, or greater than, 15°F.



Refer to Figure 33. This is a comparison of the compressor DSH vs. Time and Slide Valve Position vs. Time. This plot is from a YSBBBBS1-CHD chiller. Three additional gallons of oil were added and all the oil was transferred from the oil separator into the evaporator until the chiller shut off on LOW OIL LEVEL safety. Use this chart as a guide for oil recovery. Actual field conditions will determine how large the slide valve incremental increase can be to maintain compressor DSH of 15°F or greater.

The process of recovering oil from the refrigerant charge is dependent on compressor DSH, time and slide valve position.

During the initial phase of the oil recovery process, the slide valve position can not be increased more than 2% - 3% without lowering the compressor DSH to below 10°F. If the slide valve position is increased too rapidly, the increase in compressor suction velocity will entrain oil/refrigerant foam with the suction gas. The entrained oil/refrigerant foam will lower the compressor discharge temperature and the compressor DSH to less than 10°F. If the compressor DSH is less than 10°F, an EXCESS CHARGE OVERRIDE protection is initiated and the slide valve will be automatically unloaded. Further loading of slide valve will be inhibited until the compressor DSH increases to above 15°F.

Notice the sequence of events that begin at the nine-minute interval on Figure 33. The technician increases the slide valve position from 8% to 13%. This incremental change was too large - notice the compressor DSH is reduced from 17.8°F to 9.9°F. Since the EXCESS CHARGE OVERRIDE threshold of 10°F was exceeded, the slide valve was automatically unloaded to 0%. Beginning at the eleven-minute interval, the technician was careful to maintain compressor DSH at higher levels until the oil was recovered.

As more oil is removed from the refrigerant, larger incremental slide valve increases are possible, and the compressor DSH will remain above 15°F. **Be patient, let**

the compressor DSH be your guide. Moving the slide valve in increments that are too large will only result in the oil recovery process taking longer than necessary.

8. When the slide valve position is at least 40% and the compressor DSH is above 25°F, the chiller can be placed in the AUTO mode of operation. Press the AUTO key.
9. Press the STATUS key. The message WARNING – EXCESS CHARGE will appear. To clear this message, press the WARNING RESET key.
10. Determine the reason for the OIL LOSS/REFRIGERANT CHARGE messages and take necessary action to prevent reoccurrence.

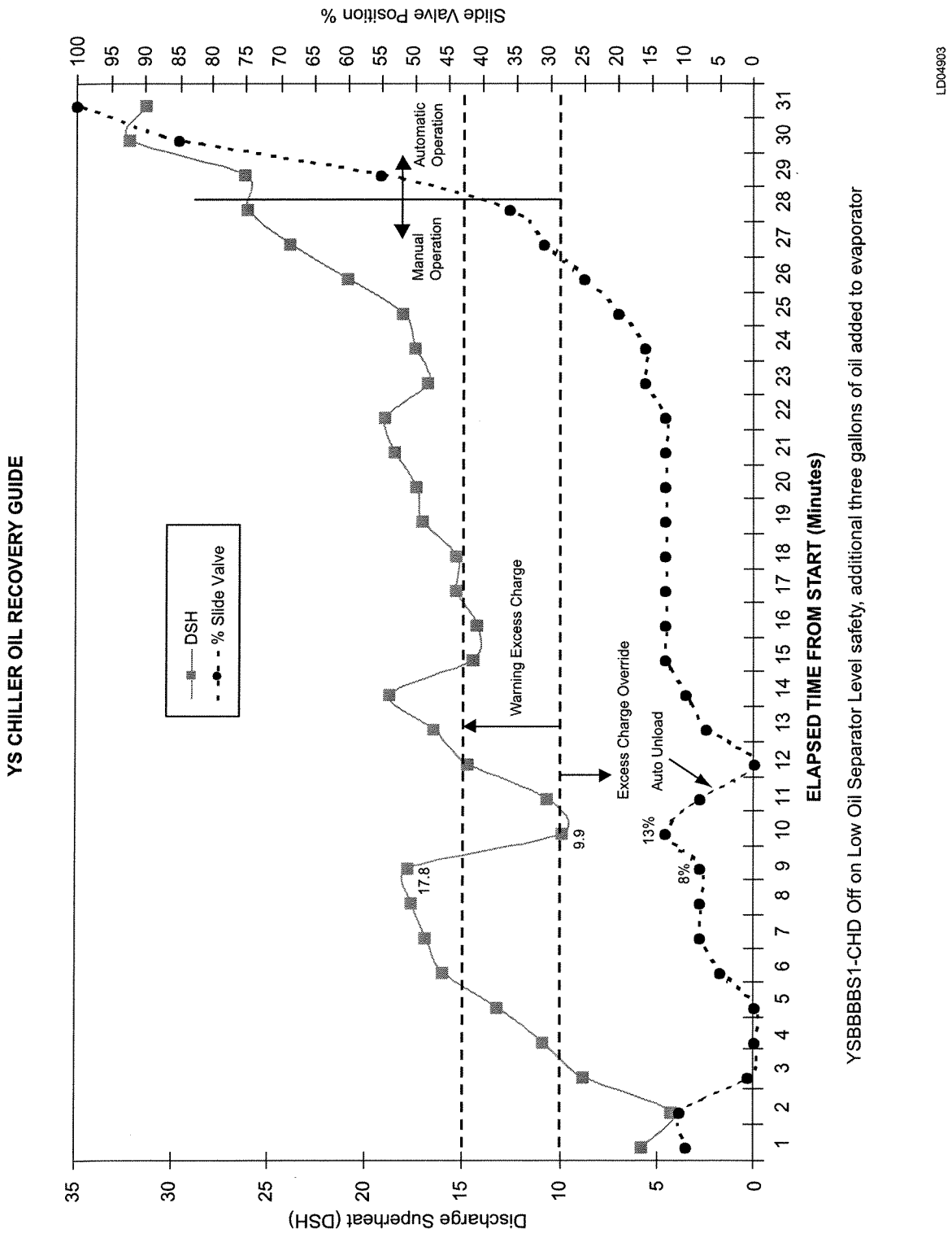


FIG. 33 – YS CHILLER OIL RECOVERY GUIDE

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VACUUM DEHYDRATION

Should the chiller be opened to the atmosphere for lengthy repair or service, follow the Vacuum Dehydration Guidelines in Form 160.47-N3.1 (1099), Field Re-Assembly for Form 3 & Form 7 Shipment of Model YS Chillers, to ensure that all air, moisture and non-condensable gases are removed prior to placing the chiller into service.

NOTES

P.O. Box 1592, York, Pennsylvania USA 17405-1592

Form 160.80-NOM1 (1199)
Supersedes: Nothing

STANDARDS OF COMFORT

The following guidelines outlined in the latest edition of the SBBC Maintenance & Electrical Design Criteria are used to determine the following standards of comfort:

Summer Design Parameters

Indoor Design = 75 Degree Fdb and 50% RH

Winter Design Parameters

Indoor Design = 68 Degree Fdb and 50% RH

Noise levels due to air conditioning unit fan, ventilating equipment, ducts, grilles, diffusers and air system pressure reducing devices shall conform to the RC Noise Rating Procedure outlined in the latest edition of the ASHRAE HVAC Applications Handbook. **Classrooms and all spaces, other than those listed below shall be designed for maximum noise criteria level of RC-30 (N).** The exceptions shall be:

Corridor, Lobbies	RC-40	Chiller Rooms	RC-60 (N)
Storage, Toilets, Custodial	RC-45 (N)	Mechanical Rooms	RC-45 (N)
Gymnasium	RC-45 (N)	Kitchens	RC-40 (N)

Lighting Levels will conform to the following[1]:

AREA	AVE	(MULTIPLE LEVELS)
Classroom	60-Foot Candle	
Laboratories	70-Foot Candle	
Teaching Auditoriums		30-70 Foot Candle
Media Center	70-Foot Candle	
Principals and Asst. Principals	70-Foor Candle	
Clerical		50-60 Foot Candle
Physical Education (Gym) [2]		30-50 Foot Candle
Interior Corridors	30-Foot Candle	
Computer Labs [2]		30-50 Foot Candle

1 - If the existing lighting level is below that specified here, lighting levels will be maintained at the either the existing level or increased by the project.

2 - Multiple level switching will be utilized if existing prior to project imp

ESCO's Maintenance Responsibilities

Maintenance and Warranty Items for Installed Equipment Phase III Schools

T-8 Fluorescent Lamps

Siemens Building Technologies will provide an initial stock of four boxes of 30 lamps each (120 lamps). Thereafter, the school will obtain replacement lamps from normal SBBC stock channels.

Electronic Ballasts

Siemens Building Technologies will provide Osram-Sylvania's five-year warranty on electronic ballasts installed under the project. Failed ballasts must be retained by the school and given to Siemens Building Technologies or Osram-Sylvania for exchange in order to receive new ones during the five-year warranty period.

In addition, Siemens Building Technologies will provide an initial stock of six (6) of each type of electronic ballast installed at the school for emergency availability.

Automated Irrigation & Flow Sensors

Standard manufacturer's warranties will apply.

Plumbing Fixtures

Standard manufacturer's warranties will apply.

Chiller

Siemens to provide 10 year preventative maintenance including annual servicing & quarterly inspections (see following page & schedule M) plus parts & labor service coverage.

The following tasks listed herein for each equipment type will be performed at the intervals planned. These tasks are designed to place the equipment into prime operating condition so that the equipment will operate effectively, reliably, and efficiently.

Centrifugal Chillers

Shut Down Inspection (1 per year)

A. Record pertinent system temperatures, pressures and electrical readings necessary to determine the existing operating conditions of the system.
B. Check refrigerant charge.
C. Isolate refrigerant charge
D. Lockout and tagout compressor motors
E. Verify oil sump heater operation as applicable
F. Provide a thorough servicing of the purge system, including cleaning and testing of all purge components (annual and semi-annual) as applicable
G. Check condition of starter contacts for wear, pitting, etc.
H. Check and calibrate safety controls.
I. Meg compressor motor and oil pump motor. Record readings.
J. Tighten all starter terminals and check contacts for wear. Check and calibrate overloads. Record trip amps.
K. Tighten motor terminals and control panel terminals.
L. Tighten oil heater leads.
M. Check operation of vane positioner as applicable
N. Take oil samples and have them analyzed for acid, moisture and wears metals content. Change oil as indicated by oil analysis.
O. Clean oil strainer, replace filter and gasket where required.
P. Visually inspect condenser tubes and brush tubes clean once yearly. *Note: Does not include chemical cleaning.*
Q. Report any uncorrected deficiencies noted & recommend improvements.

Operating Inspections (4 per year)

A. Adjust operating and safety controls.
B. Check refrigerant charge.
C. Record pertinent system temperatures, pressures and electrical readings necessary to determine the existing operating conditions of the system.
D. Check operation of purge system.
E. Check operation of lubrication system including oil pump and oil pressure regulator.
F. Check operation of motor and starter.
G. Check customer's log with operator, discuss operation of the machine generally.
H. Report any uncorrected deficiencies noted & recommend improvements.

Refrigerant Monitoring System & Exhaust Fan

Operating Inspection (2 per year)

A. Inspect refrigerant alarm system & check for proper operation.
B. Inspect fan wheels.
C. Lubricate as required.
D. Inspect drive sheaves.
E. Check motor operating voltage and amperages.
F. Check bearing and motor mounting
G. Report any uncorrected deficiencies noted & recommend improvements.

Service Coverage:

Comprehensive Parts & Labor Coverage.

1. **Preventative Maintenance:** We will perform preventive maintenance in accordance with a program of standard maintenance routines as specified. Routines shall be determined by our experience, equipment application and location, and the manufacturer's recommendations.

2. **Corrective Maintenance and Component Replacement; Labor and Material Costs Included.** We will repair or replace failed or worn components to minimize obsolescence and to maintain your system in peak operating condition. We will upgrade equipment by systematically modernizing existing components as may be necessary in our judgment. Components that are suspected of being faulty may be repaired or replaced in advance to prevent system failure. Labor and material costs for such repairs are included within the scope of this contract.

   NOTE 1 -*Refrigerant*: We will supply 10% of the total system charge on an annual basis as part of this agreement. Any additional refrigerant required will be sold to The School Board of Broward County at cost plus 10%.

Emergency Services.

1) **Response Window-Monday through Sunday, 24 Hours per Day.** We will provide emergency service between scheduled preventive maintenance calls, Monday through Sunday, including holidays, 24 hours per day to minimize downtime. Emergencies will be determined by The School Board of Broward County and Siemens, Inc.

2) **On-Site Response Within** 4 **Hours.** We will be on-site to provide emergency service within 4 hours. Non-emergency calls, as determined by The School Board of Broward County and Siemens, Inc., will be incorporated into the next scheduled preventive maintenance visit.

SCHEDULE L - SBBC's Maintenance Responsibilities

The following details the SBBC's maintenance responsibilities for equipment installed under this project.

Lighting

SBBC shall replace burned out lamps from stock.

SBBC shall replace fuses in fixtures as required.

SBBC shall replace ballasts as needed from stock.

SBBC shall replace failed out-of-warranty LED exit sign kits.

SBBC shall replace out-of-warranty failed occupancy sensors as required.

Chiller Plant

SBBC shall maintain and service the chiller plant components including:

Chilled water pumps
Condenser water pumps
Isolation valves
Piping
Cooling towers
New chiller Installed by SBBC Maintenance Department
Chilled and condenser water treatment

Siemens shall maintain and service the chiller plant components including:
New chiller installed by Siemens Building Technologies

Water Conservation

SBBC shall maintain plumbing and fixtures.

ESCO: Siemens Building Technologies

SCHOOL BOARD OF BROWARD COUNTY

EDUCATION TECHNOLOGY SERVICES

Sunrise Middle School			Dated and Initialed by Service Provider											
Energy Conservation Measure	Maintenance Tasks	Visits per Year	January	February	March	April	May	June	July	August	September	October	November	December
NEW CHILLER	1. Meg ohm motor from starter and record	One												
	2. Record ambient temp and meg-ohm reading	One												
	3. Change oil filter element	One												
	4. Change oil return filter drier	One												
	5. Check operation of auxiliary oil pump	One												
	6. Check operation of oil reservoir heater	One												
	7. Drain and flush oil and refrigerant from the purge unit shell	One												
	8. Change purge filter-drier	One												
	9. Clean purge system orifices	One												
	10. Inspect and clean foul gas check valve	One												
	11. Clean exterior of compressor	One												
	12. Electronically leak check unit	One												
	13. Report any needed repairs or operational adjustments	One												
	14. Remove compressor oil sample	One												
	15. Send in for spectrochemical analysis	One												
	16. Test operation of high pressure cutout and calibrate as necessary	One												
	17. Test operation of evaporator low temp cutout and calibrate as necessary	One												
	18. Test operation of low water temp cutout and calibrate as necessary	One												
	19. Test operation of high oil temp cutout and calibrate as necessary	One												
	20. Test operation of low oil press cutout and calibrate as necessary	One												
	21. Test operation discharge temp and calibrate as necessary	One												
	22. Change purge filter-drier (schedule for middle of run season)	One												
	23. Drain, clean, and brush condenser tubes	One												
	24. Record pertinent system temperatures, pressures and electrical readings necessary to de	Four												
	25. Check operation of vane positioner.	Four												
	26. Check operation of motor and starter. ,	Four												
	27. Check logbook for system history.	Four												
	28. Report any uncorrected deficiencies noted.	Four												
	29. Check for bearing noise.	Four												
	30. Perform visual inspection of the chiller and include any finding in the report	Four												
ALL MEASURES	Measurement and Verification	Twelve												

SCHEDULE "M"

FACILITY MAINTENANCE CHECKLIST

ESCO's Training Responsibilities:

Siemens Building Technologies (SBT) will provide the following training for the Facility Improvement Measures that it will implement at the schools incorporated into the Phase III project.

A. ENERGY EFFICIENT LIGHTING

SBT will provide four (4) hours of on-site training as to the proper selection of lamps and ballasts to replace those which may burn out or fail during operation. SBT will also provide instruction on the application of the warranty for lighting components, and the process for service calls.

B. NEW CHILLERS

SBT will provide twelve (12) hours of training as to the proper operation of the selected chiller, including the process for emergency or service calls. Training will be conducted both on site at the school and at the School Board District Maintenance Office if necessary. This training will include collaboration with the School Board Maintenance Department for coordinating operations and maintenance issues.

Schedule O: ECM Annual Cash Flow

Solutions

SIEMENS

Cash Flow Analysis

YEAR	1	2	3	4	5	6	7	8	9	10	TOTAL
PROGRAM SAVINGS											
Energy Savings	$ 200,651	$ 202,658	$ 204,685	$ 206,732	$ 208,799	$ 210,887	$ 212,996	$ 215,126	$ 217,277	$ 219,450	$ 2,099,261
Water Savings	$ 86,303	$ 90,618	$ 95,149	$ 99,906	$ 104,901	$ 110,146	$ 115,653	$ 121,436	$ 127,508	$ 133,883	$ 1,085,503
Operational Savings	$ 36,686	$ 37,787	$ 38,921	$ 40,089	$ 41,292	$ 42,531	$ 43,807	$ 45,121	$ 46,475	$ 47,869	$ 420,578
Construction Savings	$ -										
Annual Gross Savings	**$ 323,640**	**$ 331,063**	**$ 338,755**	**$ 346,727**	**$ 354,992**	**$ 363,564**	**$ 372,456**	**$ 381,683**	**$ 391,260**	**$ 401,202**	**$ 3,605,342**
Cumulative Savings	*$ 323,640*	*$ 654,703*	*$ 993,458*	*$ 1,340,185*	*$ 1,695,177*	*$ 2,058,741*	*$ 2,431,197*	*$ 2,812,880*	*$ 3,204,140*	*$ 3,605,342*	
ANNUAL CONTRIBUTION											**$ -**
PROGRAM COSTS											
Principal & Interest	$ 251,974	$ 251,974	$ 251,974	$ 251,974	$ 251,974	$ 251,974	$ 251,974	$ 251,974	$ 251,974	$ 251,974	$ 2,519,740
Ongoing Support	$ 71,571	$ 75,150	$ 78,908	$ 82,853	$ 86,996	$ 91,346	$ 95,913	$ 100,709	$ 105,744	$ 111,031	$ 900,221
Annual Gross Costs	**$ 323,545**	**$ 327,124**	**$ 330,882**	**$ 334,827**	**$ 338,970**	**$ 343,320**	**$ 347,887**	**$ 352,683**	**$ 357,718**	**$ 363,005**	**$ 3,419,961**
Cumulative Costs	*$ 323,545*	*$ 650,669*	*$ 981,551*	*$ 1,316,378*	*$ 1,655,348*	*$ 1,998,668*	*$ 2,346,555*	*$ 2,699,238*	*$ 3,056,956*	*$ 3,419,961*	
CASH FLOW											
Annual Net Cash Flow	**$ 95**	**$ 3,939**	**$ 7,873**	**$ 11,900**	**$ 16,022**	**$ 20,244**	**$ 24,569**	**$ 29,000**	**$ 33,542**	**$ 38,197**	**$ 185,381**
Cumulative Net Cash Flow	*$ 95*	*$ 4,034*	*$ 11,907*	*$ 23,807*	*$ 39,829*	*$ 60,073*	*$ 84,642*	*$ 113,642*	*$ 147,184*	*$ 185,381*	*$ 185,381*

Financial Summary	
Program Cost	$ 2,112,361
Rebates	$ 38,400
Downpayment	$ -
Amount Financed	$ 2,073,961
Annual Program Savings	$ 323,640
Simple Payback (years)	6.5
	$ 0
Annual Interest Rate	4.0%
Finance Period	10
Payments per Year	12
Energy Escalation	1.0%
Water Escalation	5.0%
Operational Escalation	3.0%
Ongoing Support Escalation	5.0%

Customer Program Summary

9/3/2006

SBBC Phase III

	Cash Flow	FIM ID	Building or Facility	Description	Simple Payback	Energy Savings Electric	Energy Savings Gas	Energy Savings Fuel	Energy Savings Other	Operational Savings L & M	Operational Savings Other	Total Savings	Project Costs	On-going Support	Rebate / Grant
1	✓	1.00	Northeast High School		6.7	$ 55,623	$ -	$ 16,724	$ -	$ 6,749	$ -	$ 79,096	$ 529,350	$ 18,045	$ 13,250
2	✓	2.00	Sunrise Middle		6.4	$ 59,828	$ -	$ 12,292	$ -	$ 6,116	$ 5,500	$ 83,736	$ 532,832	$ 17,988	$ 5,900
3		3.00	Oakland Park Elementary												
4	✓	4.00	Wilton Manors		2.4	$ -	$ -	$ 7,340	$ -	$ -	$ -	$ 7,340	$ 17,740	$ 1,831	$ -
5		5.00	Bayview												
6	✓	6.00	James Rickard Middle		6.1	$ 22,744	$ -	$ 9,374	$ -	$ 3,124	$ -	$ 35,242	$ 214,005	$ 8,011	$ 2,900
7		7.00	Dillard												
8	✓	8.00	Sunland Park Elementary		6.5	$ 14,319	$ -	$ 7,505	$ -	$ 3,386	$ -	$ 25,210	$ 164,423	$ 5,443	$ 4,000
9	✓	9.00	Floranda		7.0	$ -	$ -	$ 3,585	$ -	$ -	$ -	$ 3,585	$ 25,221	$ 894	$ -
10	✓	10.00	Virginia Young Elementary		6.8	$ 14,013	$ -	$ 8,462	$ -	$ 2,957	$ -	$ 25,432	$ 174,163	$ 5,606	$ 3,550
11	✓	11.00	New River Middle		7.0	$ 19,150	$ -	$ 12,763	$ -	$ 6,358	$ -	$ 38,271	$ 268,131	$ 7,960	$ 5,000
12	✓	12.00	Broward Estates Elementary		7.0	$ 14,973	$ -	$ 5,003	$ -	$ 2,496	$ -	$ 22,473	$ 156,791	$ 4,983	$ 3,800
13		13.00	(N/A) Measure & Verification												
14		14.00	(N/A) Audit and Design												
15		15.00	(N/A) Old Sunrise												
16	✓	16.00	Arthur Ashe Middle		9.1	$ -	$ -	$ 3,255	$ -	$ -	$ -	$ 3,255	$ 29,705	$ 812	$ -
17		17.00	(N/A) Bennett - Closing												
100															
				Total	6.5	$ 200,651	$ -	$ 86,303	$ -	$ 31,186	$ 5,500	$ 323,640	$ 2,112,361	$ 71,571	$ 38,400

LIST OF SUBCONTRACTORS

The following are the subcontractors which Siemens Building Technologies may utilize for the projects of Phase II:

Electrical Subcontractor:

Malanczyn Electric
PO Box 8176
Port St. Lucie, FL 34985-8176
(561) 335-4608
Contact: John Malanczyn

Countywide Electric
8085 Northwest 98th Street
Hialeah Gardens, Florida 33016
(305) 556-0278
Contact: Steve Rogers

Lighting Subcontractor(s):

Advanced Energy Management Inc.
3006 Sterling Road
Hollywood, Florida 33021
(954) 962-0707
Contact: John Davidson

Chem Light Plus Inc.
7010 NW 23 Way
Gainesville, Florida 32653
(352) 371-2436
Contact: E.J. Rabell

Lighting Resources USA, Inc.
945 Fatio Road
Deland, FL 32720

L+S Enterprises, LLC.
4186 Dairy Court, Suite D
Port Orange, FL 32127

Quarry System Inc.
2400 S.W. 57th Way
Hollywood, FL 33023
(954) 981-4802
Contact: Jeff Gowens

Sylvania Lighting Services
207-A Kelsey Lane
Tampa, FL 33619
(813) 623-1443
Contact: Brooks Satterwhite

Innovative Power Solutions
One Innwood Circle, Suite 220
Little Rock, Arkansas 72211-2448
(501) 907-4774
Contact: Glenn Thomas

Water Conservation Subcontractor(s):

Conservation Resource Group, Inc.
145 Glen Holly Drive
Roswell GA 30076
(770) 640-9706 Off
Contact: Mr. Shawn Hunsburger

Pedal Valve, Inc.
13625 River Road
Luling, LA 70070

Retrotech Systems
999 Genius Drive
Winter Park, FL 32789

USI
9290 McDonough Drive, Suite 1
Norcross, GA 30093
(770) 242-2565, Ext. 298
Contact: Mr. Glen Roland

Energy Services/Engineers/Consultants:

Energy Conservation Engineering
2567 Bordeaux Ct.
Palm Beach Gardens, FL 33410

Formey Engineering
5213 4th Avenue, Circle E
Bradenton, FL 34208

Ingamel S.A. Design Build Engineering Company
20871 Johnson Street
Suite 15
Pembroke Pines, FL 33029
(954) 318-2264
Contact: Hernan Morales

Gnan Engineering Services
3521 Wild Eagle Run
Oviedo, FL 32766

Kamm Consulting
947 Clint Moore Road
Boca Raton, FL 33487
(561) 995-8636
Contact: Brad Brown

Spillis Candela DMJM
800 Douglas Entrance
Coral Gables, FL 33134
(305) 444-4691
Contact: Igor Gonzalez

ProCon Engineering Inc.
7232 S.W. 39th Terrace
Miami, Florida 33155
(305) 262-7630
Contact: Fernando Anzoategui

Mechanical Subcontractor(s):

Hill York Corporation
2125 S. Andrews Avenue
Fort Lauderdale, FL 33136
(954) 525-2971
Contact: Chip Lafferty

Fax to: 1-847-941-6810

Telephone: 212-837-0760
Fax: 212-809-7895
Website: www.willis.com
E-mail: @willis.com

September 8, 2006

Siemens Building Technologies, Inc.

Re: PRF8860275/82058619
The School Board of Broward County

I am pleased to enclose the necessary Bond executed per your request.

The Bond must be signed by an authorized representative of your company and sealed with the corporate seal. Also, if required by the obligee, the attached corporate acknowledgement must be completed in the same name and notarized. Discard the form if it is not required.

I urge that you review the bond for all signatures, amounts, and dates to avoid any delay before forwarding to the Obligee.

If you have any additional questions or need further assistance please do not hesitate to contact your servicer.

Sincerely,

Jeannette Perrini

Willis New York, Inc
7 Hanover Square
New York, NY 10004-2594.

Rush

SIEMENS

Willis of New York, Inc.
7 Hanover Square, 12th Floor
New York, NY 10004

Org.-ID applicant:	A1203982

Name:	White Anthony
Department:	Siemens Building Technologies Inc., BAU/HVP/FIS Sales L3
Location:	Buffalo Grove, IL
Date:	September 6, 2006

Guarantee – order no. 143128

PRF8860275/82058619

Please issue a guarantee containing the following data in *english* language.
The conditions concerning the guarantees have been agreed upon.
Fax no. (212) 809-7896

1. kind of guarantee:	*Performance/ Payment Bond*
2. applicant:	Siemens Building Technologies Inc., BAU/HVP/FIS Sales L3
3. beneficiary:	The School Board of Broward County 1700 SW 14th Court, Fort Lauderdale, FL 33312 United States of America
4. currency and guarantee amount:	**USD 2,112,361.00**
5. contract price:	USD 2,112,361.00
6. contract date (bid date for bid bonds):	September 6, 2006
7. duration unlimited:	yes
8. expiration date:	September 5, 2007
9. invitation ref: 216 - coming contract no.: offer no.:	term of warranty: 1 year liquidated damages: na
offer for / delivery of (in above mentioned language): The School Board of Broward County, FL Phase III	
10. the guarantee must be issued by:	Insurance
11. Please hand the guarantee over immediately, ***via registered mail*** to: (giving us 1 copy) Person, Siemens Building Technologies, Inc., 10111 Business Drive, Miramar, FL, United States of America 33025	
12. special remarks: 100% Performance and Payment bond.Customer's forms required. Emailed to Ray and Anna. **RUSH - please return bond by 9/8/2006.**	

Siemens Financial Services, Inc.

Approved SFS (PEF) *G-ID: 143128*

1st Signature _____ 2nd Signature _____

Date Date 9-6-06

Postal address: Giarratana Anna

Siemens Financial Services
170 Wood Avenue South
Iselin, NJ 08830

Tel.: +1 (732) 476-3580
Fax: 732-732-590-2578
Email: anna.giarratana@siemens.com

Bond No. PRF8860275/82058619

The School Board of Broward County, Florida
Facilities and Construction Management Division
1700 SW 14th Court
Fort Lauderdale, FL 33312 (954) 765-6390

Document 00600: Performance Bond Form

Project No:

Project Title:

Facility Name:

Description of Project: **The School Board of Broward County, FL Phase III**

KNOW ALL PERSONS BY THESE PRESENTS, that

Siemens Building Technologies, Inc. Address **10111 Business Drive, Miramar, FL 33025**
Phone **1(732) 476-3580**

as Principal, and

Fidelity and Deposit Company of Maryland & Federal Insurance Company **1400 American Lane, Schaumburg, IL 60196 & 15 Mountain View Road, Warren, NJ 07059**
Address
Phone **1(201) 837-0760**

a corporation duly authorized to transact business in the State of Florida, as Surety, are held and firmly bound unto the School Board of Broward County, Florida, a body Corporate and politic under the laws of Florida, in the sum of:

Two Million One Hundred Twelve Thousand Three Hundred Sixty One and 00/100ths Dollars **$2,112,361.00**
(Written Amount) (Figures)

good and lawful money of the United States, well and truly to be paid, and for the payment whereof, we the undersigned, Principal and Surety, jointly and severally, hereby firmly bind ourselves, our heirs, assigns, successors, and legal representatives.

WHEREAS, the above bounded Principal did on

September 6 , 2006 ,

enter into a Contract with the said The School Board of Broward County, Florida, a body corporate and politic as aforesaid, in and by which the said above bounded Principal did undertake and agree to furnish all labor, implements, machinery, equipment, tools and materials necessary therefore and to install, build, erect, construct the project named above in accordance with the certain plans and specifications prepared by:

to which plans and specifications and said contract reference is here made and all thereof made a part hereof as if fully set forth herein.

WHEREAS, it was one of the conditions of the award of said contract with The School Board of Broward County, Florida that these presents should be executed.

NOW, THEREFORE, the conditions of this obligation are such that if the above bounded Principal shall in all aspects fully comply with, carry out and perform the terms and conditions of said contract and his obligations thereunder, including the Specifications, Proposal, Plans and Contract Documents therein referred to and made a part hereof, and therein provided for and shall indemnify and save harmless School Board of Broward County, Florida against and from all costs, expenses, damages, injury, or that are imposed by reason of any wrongdoing, misconduct, want of care or skill, negligence, or default, including patent infringement on the part of said Principal or his agents, employees or subcontractors, in the execution or performance of said contract and shall promptly pay all just claims for damages or injury to property and for all work done or skill, tools, and machinery, supplies, labor, and materials furnished and debts incurred by said Principal in or about the construction or improvements or additions contracted for, then this obligation to be void, otherwise, to remain in full force and effect.

In the event that the Principal shall fail to comply fully with, carry out and perform the terms and conditions of said specifications, proposal, plans, guarantees and contract documents therein referred to and made a part hereof, and the Surety shall have failed to correct such default(s) within a reasonable time after written demand by the Owner, the Owner shall be entitled to enforce any remedy against the Surety, available to the Owner. Such remedies shall include but not be limited to, the recovery of consequential damages for the cost of the completion of the construction contract and correction of defective work before or after completion of the construction contract; such liquidated damages as the contract may provide; additional legal, design professional and delay costs resulting from the Principal's default and/or resulting from the actions or inactions or failure to act of the Surety; actual damages caused by delayed performance or non-performance of the Principal and all costs incident to ascertaining the nature and extent of the Principal's default, including engineering, accounting and legal fees

And the said Surety to this Bond, for value received, hereby stipulates and agrees that no change, extension of time, alterations or additions to the terms of the contract or to the work to be performed thereunder or the specifications accompanying same shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extensions of the time, alteration or addition to the terms of the contract or to the work or to the specifications.

Principal shall give written notice to Owner of any alleged default by the Owner under the Construction Contract. Owner shall have not less than ninety (90) days after receipt of such notice to cure such default before the surety is allowed to assert the default as a defense against Owner. The only types of default that may be asserted against Owner shall be monetary defaults. Changes in the Construction Contract shall not release the surety. The surety waives any defense of timeliness of completion if time extensions are granted by the Owner to the Principal.

No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors or assigns. Any suit under this Bond must be instituted within five (5) years from the date the cause of action accruedor as provided by Florida Law, whichever is greater.

IN TESTIMONY WHEREOF, the Principal and Surety have caused these presents to be duly signed in quintuplicate, at Fort Lauderdale, Broward County, Florida, this

8th day of September , 2006.

:

Principal
Siemens Building Technologies, Inc.

By: (Signature) SEAL
DARRYL L. PEAKE
ASSISTANT SECRETARY

COUNTERSIGNED

By: Resident Agent
FLORIDA
James W. Dunn

Surety:
Fidelity and Deposit Company of Maryland &
Federal Insurance Company

By: (Signature) SEAL
Jeannette Porrini
Attorney-in-Fact
Address: 1400 American Lane
Schaumburg, IL 60196
&
15 Mountain View Road
Warren, NJ 07059

NOTE: PRINCIPAL SHALL RECORD THIS BOND IN THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA

Bond No. PRF8860275/82058619

The School Board of Broward County, Florida
Facilities and Construction Management Division
1700 SW 14th Court
Fort Lauderdale, FL 33312 (954) 765-6390

Document 00610: Payment Bond Form

Project No:

Project Title:

Facility Name:

Description of Project: The School Board of Broward County, FL Phase III

BY THIS BOND, pursuant to Section 255.05, Florida Statutes,

We, Siemens Building Technologies, Inc., as Principal, located at <address> <phone> and Fidelity and Deposit Company of Maryland & Federal **, a corporation, as Surety, located at <address> <phone> are bound to The School Board of Broward County, Florida, herein called "Owner", in the sum of : **Insurance Company

Two Million One Hundred Twelve Thousand Three Hundred Sixty One and 00/100ths Dollars $ 2,112,361.00

(Written Amount) (Figures)

for the payment of which we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally.

THE CONDITION OF THIS BOND is that if Principal:

1. Promptly makes payments to all claimants, as defined in Section 255.05 (1), Florida Statutes, supplying Principal with labor, materials, services and/or supplies, used directly or indirectly by Principal in the prosecution of the work provided in the contract dated,

   September 6, 2006

   between Principal and Owner for construction of the Project named above, the contract being made a part of this bond by reference, at the times and in the manner prescribed in the contract; and

2. Pays Owner all losses, damages, expenses, costs, and attorney's fees, including appellate proceedings, that Owner sustains because of default by Principal under the contract referred to in paragraph 1 of this bond;

then this bond is void; otherwise, it remains in full force and effect.

The School Board of Broward County, Florida
Facilities and Construction Management Division
1700 SW 14th Court
Fort Lauderdale, FL 33312 (954) 765-6390

Document 00610: Payment Bond Form

Any changes in or under the contract documents and compliance or noncompliance with any formalities connected with the contract or the changes does not affect Surety's obligation under this bond.

Claimants to this bond must adhere to the notice and time limitation provisions of Section 255.05(2), Florida Statutes.

Dated on: September 8 : 2006

Principal's Name **Siemens Building Technologies, Inc.**

Principal's signature

DARRYL L. PEAKE SEAL
ASSISTANT SECRETARY

Fidelity and Deposit Company of Maryland & Federal Insurance Company
Surety's Name:

By: (Signature)

As Attorney in Fact **Jeannette Porrini**

COUNTERSIGNED
By:
FLORIDA Resident Agent
James W. Dunn

NOTE; THIS BOND SHALL BE POSTED BY THE PRINCIPAL AT THE PROJECT WORK SITE AT ALL TIMES. PRINCIPAL SHALL RECORD THIS BOND IN THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA

Power of Attorney
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY

KNOW ALL MEN BY THESE PRESENTS: That the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, and the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, corporations of the State of Maryland, by THEODORE G. MARTINEZ, Vice President, and GREGORY E. MURRAY, Assistant Secretary, in pursuance of authority granted by Article VI, Section 2, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, does hereby nominate, constitute and appoint **Jeannette PORRINI and Stacy RIVERA, both of Farmington, Connecticut, EACH** as true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the Company at its office in Baltimore, Md., in their own proper persons. This power of attorney revokes that issued on behalf of Jeannette PORRINI, Sara GLOGOWER, Dawn M. GODFREY, dated August 22, 2003.

The said Assistant Secretary does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article VI, Section 2, of the By-Laws of said Companies, and is now in force.

IN WITNESS WHEREOF, the said Vice-President and Assistant Secretary have hereunto subscribed their names and affixed the Corporate Seals of the said FIDELITY AND DEPOSIT COMPANY OF MARYLAND, and the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, this 6th day of August, A.D. 2004.

ATTEST:

FIDELITY AND DEPOSIT COMPANY OF MARYLAND
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY

FIDELITY AND DEPOSIT COMPANY OF MARYLAND — INCORPORATED — 1890 — BALTIMORE

COLONIAL AMERICAN CASUALTY AND SURETY COMPANY — SEAL

By:

Gregory E. Murray Assistant Secretary *Theodore G. Martinez*

State of Maryland }
City of Baltimore } ss:

On this 6th day of August, A.D. 2004, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, came THEODORE G. MARTINEZ, Vice President, and GREGORY E. MURRAY, Assistant Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, and the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and they each acknowledged the execution of the same, and being by me duly sworn, severally and each for himself deposeth and saith, that they are the said officers of the Companies aforesaid, and that the seals affixed to the preceding instrument is the Corporate Seals of said Companies, and that the said Corporate Seals and their signatures as such officers were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

DENNIS R. HAYDEN — HARFORD COUNTY — MARYLAND — NOTARY PUBLIC

Dennis R. Hayden *Notary Public*
My Commission Expires: February 1, 2009

FIDELITY AND DEPOSIT COMPANY

OF MARYLAND
3910 KESWICK ROAD, BALTIMORE, MD 21203

The F&D Companies

Statement of Financial Condition
As Of December 31, 2005

ASSETS

Bonds		$ 145,517,856
Stocks		40,373,936
Cash in Banks and Offices		155,000
Reinsurance Recoverable		14,122,203
Other Accounts Receivable		13,661,802
TOTAL ADMITTED ASSETS		$ 213,830,797

LIABILITIES, SURPLUS AND OTHER FUNDS

Reserve for Taxes and Expenses		$ 801,854
Ceded Reinsurance Premiums Payable		26,186,851
TOTAL LIABILITIES		$ 26,988,705
Capital Stock, Paid Up	$ 5,000,000	
Surplus	181,842,092	
Surplus as regards Policyholders		186,842,092
TOTAL		$ 213,830,797

Securities carried at $33,398,073 in the above statement are deposited as required by law.

Securities carried on the basis prescribed by the National Association of Insurance Commissioners. On the basis of December 31, 2005 market quotations for all bonds and stocks owned, the Company's total admitted assets would be $212,087,289 and surplus as regards policyholders $185,098,584.

I, DAVID A. BOWERS, Corporate Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing statement is a correct exhibit of the assets and liabilities of the said Company on the 31st day of December, 2005.

Corporate Secretary

State of Illinois
City of Schaumburg } SS:

Subscribed and sworn to, before me, a Notary Public of the State of Illinois, in the City of Schaumburg, this 20th day of March, 2006.

Notary Public

OFFICIAL SEAL
MARLO G SARABYN
NOTARY PUBLIC - STATE OF ILLINOIS
MY COMMISSION EXPIRES:11/25/07

Chubb Surety	POWER OF ATTORNEY	Federal Insurance Company Vigilant Insurance Company Pacific Indemnity Company	Attn: Surety Department 15 Mountain View Road Warren, NJ 07059

Know All by These Presents, That FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, and PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, do each hereby constitute and appoint Jeannette Porrini and Stacy Rivera of Farmington, Connecticut----------

each as their true and lawful Attorney- in- Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY have each executed and attested these presents and affixed their corporate seals on this 4th day of October, 2005

Kenneth C. Wendel, Assistant Secretary

John P. Smith, Vice President

STATE OF NEW JERSEY
ss.
County of Somerset

On this 4th day of October, 2005 before me, a Notary Public of New Jersey, personally came Kenneth C. Wendel, to me known to be Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY, the companies which executed the foregoing Power of Attorney, and the said Kenneth C. Wendel, being by me duly sworn, did depose and say that he is Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY and knows the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of the By- Laws of said Companies; and that he signed said Power of Attorney as Assistant Secretary of said Companies by like authority; and that he is acquainted with John P. Smith, and knows him to be Vice President of said Companies; and that the signature of John P. Smith, subscribed to said Power of Attorney is in the genuine handwriting of John P. Smith, and was thereto subscribed by authority of said By- Laws and in deponent's presence.

Notarial Seal
KAREN A. EDER NOTARY PUBLIC NEW JERSEY

KAREN A. EDER
Notary Public, State of New Jersey
No. 2231647
Commission Expires Oct. 28, 2009

Notary Public

CERTIFICATION

Extract from the By- Laws of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY:

"All powers of attorney for and on behalf of the Company may and shall be executed in the name and on behalf of the Company, either by the Chairman or the President or a Vice President or an Assistant Vice President, jointly with the Secretary or an Assistant Secretary, under their respective designations. The signature of such officers may be engraved, printed or lithographed. The signature of each of the following officers: Chairman, President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary and the seal of the Company may be affixed by facsimile to any power of attorney or to any certificate relating thereto appointing Assistant Secretaries or Attorneys- in- Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such power of attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding upon the Company with respect to any bond or undertaking to which it is attached."

I, Kenneth C. Wendel, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY

(the "Companies") do hereby certify that

(i) the foregoing extract of the By- Laws of the Companies is true and correct,
(ii) the Companies are duly licensed and authorized to transact surety business in all 50 of the United States of America and the District of Columbia and are authorized by the U.S. Treasury Department; further, Federal and Vigilant are licensed in Puerto Rico and the U.S. Virgin Islands, and Federal is licensed in American Samoa, Guam, and each of the Provinces of Canada except Prince Edward Island; and
(iii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Warren, NJ this

September 8, 2006

Kenneth C. Wendel, Assistant Secretary

IN THE EVENT YOU WISH TO NOTIFY US OF A CLAIM, VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT ADDRESS LISTED ABOVE, OR BY Telephone (908) 903- 3493 Fax (908) 903- 3656
e-mail: surety@chubb.com

FEDERAL INSURANCE COMPANY

STATEMENT OF ASSETS, LIABILITIES AND SURPLUS TO POLICYHOLDERS

Statutory Basis

DECEMBER 31, 2005

(in thousands of dollars)

ASSETS		*LIABILITIES AND SURPLUS TO POLICYHOLDERS*	
Cash and Short Term Investments	$ 233,177	Outstanding Losses and Loss Expenses	$ 11,102,486
United States Government, State and Municipal Bonds	12,026,711	Unearned Premiums	3,594,949
Other Bonds	2,877,937	Reinsurance Premiums Payable	505,263
Stocks	836,039	Provision for Reinsurance	248,024
Other Invested Assets	1,019,957	Other Liabilities	1,093,720
TOTAL INVESTMENTS	16,993,821	TOTAL LIABILITIES	16,544,442
Investments in Affiliates:			
Chubb Investment Holdings, Inc.	1,864,311	Capital Stock	20,980
Pacific Indemnity Company	1,279,232	Paid - In Surplus	3,106,790
Chubb Insurance Company of Europe	677,231	Unassigned Funds	5,705,305
Executive Risk Indemnity Inc.	656,360		
CC Canada Holdings Ltd.	347,840		
Great Northern Insurance Company	283,968	SURPLUS TO POLICYHOLDERS	8,833,075
Chubb Insurance Company of Australia	130,693		
Vigilant Insurance Company	121,092		
Other Affiliates	188,061		
Premiums Receivable	1,590,888		
Other Assets	1,244,020		
TOTAL ADMITTED ASSETS	$ 25,377,517	TOTAL LIABILITIES AND SURPLUS TO POLICYHOLDERS	$ 25,377,517

Investments are valued in accordance with requirements of the National Association of Insurance Commissioners. Investments valued at $341,275,964 are deposited with government authorities as required by law.

A CORRECT STATEMENT:

[redacted] Attorney-in-Fact
Jeannette Porrini

Form 27-10-0073 (Rev. 5-06)

SCHOOL BOARD OF BROWARD COUNTY
Energy Conservation/Utility Management Department

EXHIBIT II

Project Number: RFP 98-379V

Energy Services Contractor: _____

School Name: _____

School Address: _____

_____

Energy Conservation Measure: _____

Certificate of Acceptance – Installed Equipment

The undersigned certifies that all the ESCO's Work is 100 percent complete, with the exception of the below noted deficiencies, and the ESCO has complied with all conditions precedent to final payment of the Energy Conservation Method.

Deficiencies:	Date to be Completed

ESCO : _____ Date: _____

We, the undersigned, together with a representative of the ESCO employed for the execution of the work, have inspected the above mentioned work, prior to the date of this certificate, and hereby certify that all work on the Energy Conservation Measure has been completed in accordance with the Energy Services Contract, and accordingly recommend that the work included on said ECM be accepted.

SBBC Project Manager : _____ Date: _____

Swander, Brett (SBT US)

From: Joe Fellmeth [joe.fellmeth@browardschools.com]
Sent: Tuesday, September 05, 2006 10:57 AM
To: brett.swander@siemens.com
Subject: Exhibit IIa Letter of Acceptance

Dear Brett:
After review of Siemens Building Technologies revised (August 11th, 2006)Technical Energy Audits, the Energy Conservation / Utiltiy Management Department approve all of the proposed ECMs. Due to budget constraints we will only be able to bring ten of your schools before the Board. They will be:
Arthur Ashe Middle School
Broward Estates Elementary School
Floranada Elementary School
James Richards Middle
New River Middle
Northeast High School
Sunland Park Elementary School
Sunrise Middle School
Virginia Shuman Young School
Wilton Manors Elementary School

Joe Fellmeth, Project Manager II, Energy Conservation Utility Management
Physical Plant Operations Division - "Maintaining Excellence"
Broward County Public Schools
Office - 754-321-4755
Email - joe.fellmeth@browardschools.com

RFP for ESCO Solicitation:

The RFP is on File with the SBBC.

Energy Audit Reports:

The Energy Audit Reports are on File with the SBBC.