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Consulting, Design, Monitoring and Implementation of Air Conditioning Systems (HVAC) by FEPC & EPC Method – Facilities & Equipment for Marine, Petroleum Refinery, Gas and Petrochemical, Power Station Industries, Central Heating System- Industrial, Commercial & Domestic Fan - Smoke Extraction and Ventilation Systems.

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REVOLUTIONARY ENERGY SAVINGS

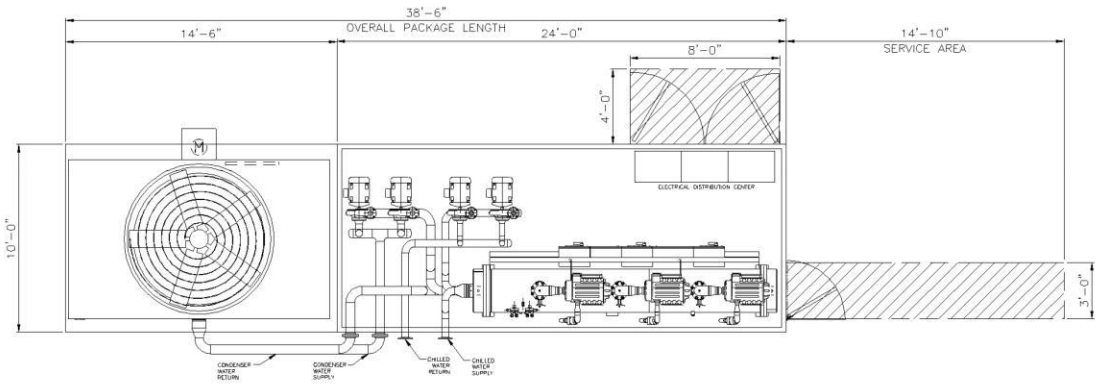
Packaged Chiller Plant Systems from Smardt Chiller Group

SMARDT

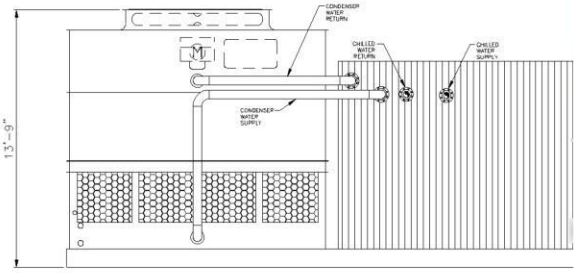
TD - 0096
25 May 2011

PACKAGED CHILLER PLANT SYSTEMS **4**
FEATURES AND BENEFITS **5**
The Chillers 5
The Plant 5
Servicability 5
Custom Design and Production Capacity 5
Redundancy 6
Controls and Monitoring 6
PACKAGED CHILLER PLANT - MODEL SM-S1S 110 – 420 NOMINAL TONS - 480V/3PH/60 HZ **7**
Performance 7
Oil-free Centrifugal Chillers 7
Cooling Tower Water System 7
Two Close Coupled In-Line Chilled Water Pumps 7
Two Close Coupled In-Line Condenser Water Pumps 7
Low Voltage (480 Volt) Electrical Distribution Center 7
Kiltech Controller for Chiller Plant Control 7
Equipment Enclosure 7
Miscellaneous 7
One (1) Year Parts & Labor Warranty 7
Major Equipment Tested at Equipment Manufacturer's Facility 7
Installation Assistance by Houston Service 7
MODEL NUMBER INSTALLED TONNAGE **8**
SM-S1S PACKAGED CHILLER PLANT **9**
SM-S1L PACKAGED CHILLER PLANT **10**
SM-S2L PACKAGED CHILLER PLANT **11**
SM-D2L PACKAGED CHILLER PLANT **12**
SM-T3L PACKAGED CHILLER PLANT **13**
END SUCTION PUMPS **14**
COOLING TOWERS **17**

PACKAGED CHILLER PLANT SYSTEMS



PLAN VIEW



ELEVATION VIEW

SMARDT's Packaged Chilled Water Plants – 100 TR through 2400 TR - are designed for a 30-year operating life, with lifetime operating costs the lowest in the market.

FEATURES AND BENEFITS

THE CHILLERS

No oil, flooded shell-and-tube evaporation, low power consumption, low maintenance costs (even lower with remote monitoring), and high reliability with only one main moving part.

As members of the SMARDT Chiller Group, SMARDT and PowerPax work hard to achieve simplicity of design and operation – reflected in low operating costs and supported by the integration of PowerPax electronic expansion valves and the optional use of load balancing valves at very low loads.

Field reliability since introduction in 2002, has been outstanding. Not surprising when one considers that some 80% of all chiller problems in the field are due to failures in compressor oil return; and SMARDT chillers use no oil.

The growing fraternity of Turbocor-trained engineers and technicians suggests that total maintenance costs for oil-free chillers run at well under half the costs of traditional lubricated chillers; and this assessment may be very conservative.

THE PLANT

The balance of the chiller plant continues the SMARDT tradition by using only the most efficient systems available. Our variable primary flow controls optimize every chilled water system for lowest overall operating costs, and our cooling tower optimization routine continually improves the chiller's operating point for year round efficiency.

We use "best in class" pumps, cooling towers, valves and components to guarantee the entire plant is the most efficient on the market. Your plant also comes completely ASHRAE 90.1 compliant for all climates in North America.

SERVICABILITY

Always important in minimizing operating costs, service access is swift and simple, as is access to operating history through remote monitoring. Operating history and compressor and chiller set points are all accessible remotely by trained and authorized service personnel.

CUSTOM DESIGN AND PRODUCTION CAPACITY

The group's design engineers are happy to resolve special equipment design challenges for you, but please allow some extra time and, possibly, some extra cost for these.

High-efficiency direct expansion condensing units and heat recovery and free cooling applications can all be supplied competitively, as can special materials for use in aggressive environments.

Marine water boxes, corrosion protection, and other options are available and can be explored on request.

REDUNDANCY

Use of multiple compressors allows unusual redundancy safeguards. However, if multiple circuits are indicated, these can be designed in and supplied.

CONTROLS AND MONITORING

SMARDT's Kiltech controller is very user-friendly, highly intuitive, and allows optimization of both single and multiple compressor operation, while enabling a rich array of communication options.

The compressor's onboard digital controller proactively manages compressor operation while allowing external control and web-enabled monitoring of performance and reliability information.

The Group's world-wide installation experience has been used to generate the state-of-the-art controls software that is used to maximize operating efficiencies and minimize maintenance and operating costs.

This system provides several access levels for plant operators and commissioning, and offers a wide variety of options for flexible operation and optimization of power consumption; thus maximizing operation at compressor sweet spots.

PACKAGED CHILLER PLANT – MODEL SM-S1S 110 – 420 NOMINAL TONS - 480V/3PH/60 HZ

PERFORMANCE

- Cooling Capacity: 110 to 420 Tons Refrigeration Total (TR)
- Chilled Water Temperatures: 44°F Supply, 54°F Return
- Chilled Water Pressure: 100 ft wg tdh
- Condenser Water Temperatures: 85°F Supply, 95°F Return

OIL-FREE CENTRIFUGAL CHILLERS

- Unit Mounted Low Voltage (480V) Wye-Delta Starter for Each Chiller
- Performance Test on All Chillers at Chiller Manufacturers Facility

COOLING TOWER WATER SYSTEM

- One (1) Evapco AT-Series Counter – Flow Cooling Tower
  - Galvanized Cold Water Basin, Steel Casing and Fan Support
  - PVC Fill and Hot Water Distribution System
  - Service Platform with Ladders, Basin Heater
- Galvanized Cooling Tower Support Structure Provided to Support Cooling Tower
- Condenser Water Piping – Lot of Large Bore Condenser Water Piping/Header Run
- Outside Boundaries of Modular System. Piping is Siloxane Epoxy Coated on the Outside to Prevent Corrosion

TWO CLOSE COUPLED IN-LINE CHILLED WATER PUMPS

- Sized for 100% of Chiller Plant Capacity

TWO CLOSE COUPLED IN-LINE CONDENSER WATER PUMPS

- Sized for 100% of Chiller Plant Capacity

LOW VOLTAGE (480 VOLT) ELECTRICAL DISTRIBUTION CENTER

- Variable Speed Drives for Chiller & Condenser Water Pumps and Cooling Tower Fans
- Power Panel (480 – To - 120V Transformer) for Lighting, Receptacles and Control
- 65 KAIC Main Circuit Breaker
- One (1) 480V Feed Required for Chiller & Balance of the Package (by Others)

KILTECH CONTROLLER FOR CHILLER PLANT CONTROL

- HMI for Local Operation
- Programming of System for Complete Chilled Water System Operation
- Instrumentation Provided, Installed and Wired to Main Control Panel

EQUIPMENT ENCLOSURE

- 12” Galvanized Structural Steel Base (Coated With Ameron PSX700 Siloxane Epoxy)
- Double Sided Steel Wall & Slope Roof Panels, with 2” Foam Insulation
- Doors for Access, Maintenance, and Chiller Tube Removal
- Ventilation Fan, Convenience Outlets and Internal Lighting

MISCELLANEOUS

- Air Relief Valves
- Air Separator
- Climate Control Equipment (Maintain Proper Equipment Temperature)
- Expansion Tank: Bladder Style
- Insulation: Chilled Water Piping Insulation with 1” Armaflex (within package)
- Lakos Filtration Unit
- Pot Feeder
- Refrigerant Monitoring System

ONE (1) YEAR PARTS & LABOR WARRANTY

MAJOR EQUIPMENT TESTED AT EQUIPMENT MANUFACTURER’S FACILITY

INSTALLATION ASSISTANCE BY HOUSTON SERVICE

MODEL NUMBER INSTALLED TONNAGE

Installed Tonnage	# of Chillers	Model Number
110 - 280	1	SM - S1S - 0280
280 - 360	1	SM - S1S - 0360
360 - 420	1	SM - S1S - 0420

Installed Tonnage	# of Chillers	Model Number
280 - 390	1	SM - S1L - 0390
290 - 500	1	SM - S1L - 0500
500 - 610	1	SM - S1L - 0610
610 - 720	1	SM - S1L - 0720
720 - 810	1	SM - S1L - 0810

Installed Tonnage	# of Chillers	Model Number
560 - 660	2	SM - S2L - 0660
660 - 760	2	SM - S2L - 0760
760 - 850	2	SM - S2L - 0850

Installed Tonnage	# of Chillers	Model Number
280 - 430	2	SM - D2L - 0430
430 - 580	2	SM - D2L - 0580
580 - 730	2	SM - D2L - 0730
730 - 880	2	SM - D2L - 0880
880 - 1030	2	SM - D2L - 1030
1030 - 1180	2	SM - D2L - 1180
1180 - 1330	2	SM - D2L - 1330
1330 - 1480	2	SM - D2L - 1480
1480 - 1620	2	SM - D2L - 1630

Installed Tonnage	# of Chillers	Model Number
840 - 1040	3	SM - T3L - 1040
1040 - 1240	3	SM - T3L - 1240
1240 - 1440	3	SM - T3L - 1440
1440 - 1640	3	SM - T3L - 1640
1640 - 1840	3	SM - T3L - 1840
1840 - 2040	3	SM - T3L - 2040
2040 - 2240	3	SM - T3L - 2240
2240 - 2430	3	SM - T3L - 2430

Simplex — Single skid, single and dual chiller options.
850 tons maximum.
Model #'s will be SM-S1 or S2 based on number of chiller.

Duplex — Dual skid that connects side by side.
Fits all chiller models in 13' 6" wide skids.
All are dual chiller models.

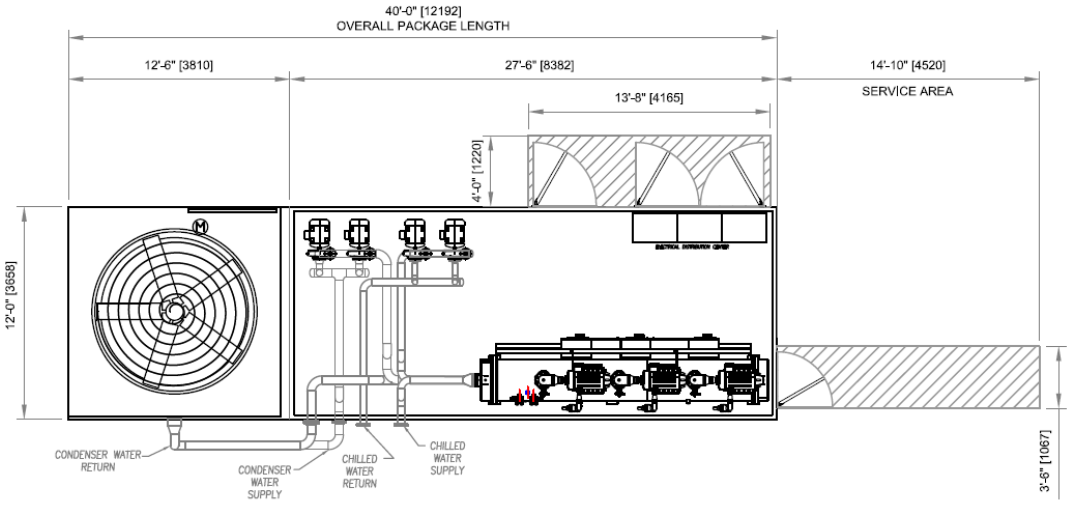
Triplex — Three section skid that connects side by side.
Fits all chiller models in 13' 6" wide skids.
All are three chiller models.

	Tons	WA088	WA096	WA125	WA140	WA190	WA280
SM- S1S	280 - 420	o	o	o	o		
SM- S1L	280 - 810	o	o	o	o	o	o
SM- S2	560 - 850	o	o	o	o		
SM- D2	280 - 1620	o	o	o	o	o	o
SM- T3	840 - 2430	o	o	o	o	o	o

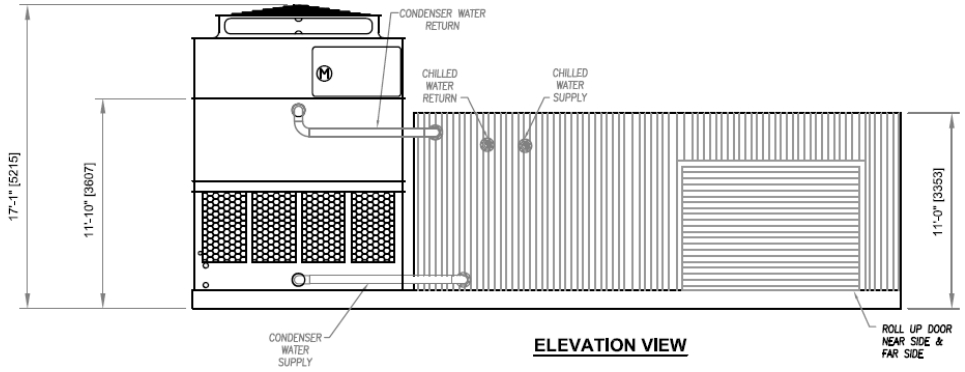
SM-S1S PACKAGED CHILLER PLANT

Water-Cooled Centrifugal Compressor System

Nominal Cooling Capacity Range:	110 to 420 Tons (387 to 1,476 KW)	Voltage / Phase / Frequency:	480V / 3Ph / 60 Hz
Nominal Chilled Water Flow Rate:	264 to 1,008 GPM (17 to 64 LPS)	Nominal Chilled Water Temperature Differential:	10 / 12 / 14°F (5.6 / 6.7 / 7.8°C)
Nominal Condenser Water Flow Rate:	330 to 1,260 GPM (21 to 79 LPS)	Nominal Condenser Water Temperature Differential:	10 / 15°F (5,6 / 8,3°C)



PLAN VIEW



ELEVATION VIEW

EQUIPMENT		SHIPPING WEIGHT, LB (KG.)		SHIPPING DIMENSIONS, FT. [MM]			EST. FOUNDATION WEIGHTS, LB (KG.)	
ITEM	QTY.	UNIT WT.	TOTAL WEIGHT	LENGTH	WIDTH	HEIGHT	ITEM	OPERATING WEIGHT
CHILLER SECTION	1	43,000 (19,522)	43,000 (19,522)	40'-0" [12,192]	12'-0" [3,658]	11'-10" [3,607]	CHILLER PACKAGE	56,000 (25,424)
CT UPPER SECTION	1	2,500 (1,135)	2,500 (1,135)	12'-0" [3,658]	11'-10" [3,607]	6'-0" [1,829]		

NOTES:

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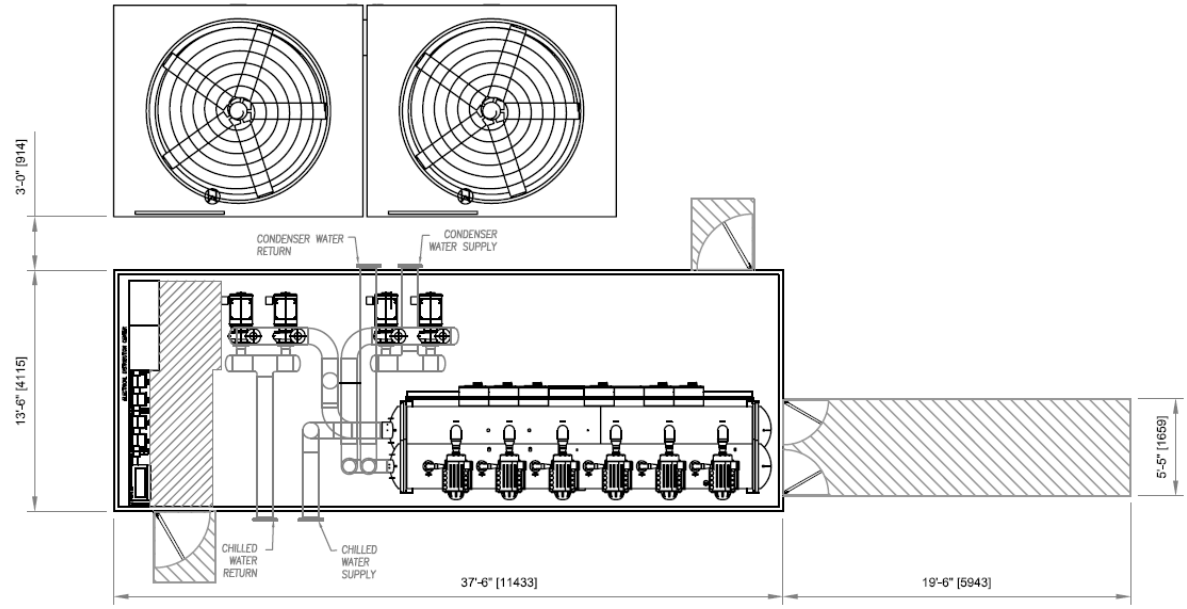
3. DIMENSIONS SHOWN IN [ ] ARE IN MILLIMETERS.
4. WEIGHTS SHOWN IN ( ) ARE IN KILOGRAMS.

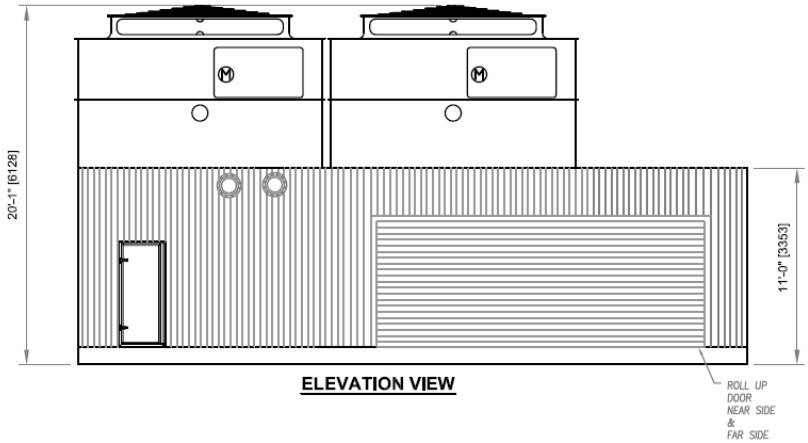
SM-S1L PACKAGED CHILLER PLANT

Water-Cooled Centrifugal Compressor System

Nominal Cooling Capacity Range:	290 to 810 Tons (984 to 2,846 KW)	Voltage / Phase / Frequency:	480V / 3Ph / 60 Hz
Nominal Chilled Water Flow Rate:	672 to 1,944 GPM (42 to 123 LPS)	Nominal Chilled Water Temperature Differential:	10 / 12 / 14°F (5.6 / 6.7 / 7.8°C)
Nominal Condenser Water Flow Rate:	840 to 2,430 GPM (53 to 153 LPS)	Nominal Condenser Water Temperature Differential:	10 / 15°F (5.6 / 8.3°C)



PLAN VIEW



ELEVATION VIEW

EQUIPMENT		SHIPPING WEIGHT, LB (KG.)		SHIPPING DIMENSIONS, FT. [MM]			EST. FOUNDATION WEIGHTS, LB (KG.)	
ITEM	QTY.	UNIT WT.	TOTAL WEIGHT	LENGTH	WIDTH	HEIGHT	ITEM	OPERATING WEIGHT
CHILLER SECTION	1	53,000 (24,062)	53,000 (24,062)	37'-6" [11,430]	14'-0" [4,267]	11'-0" [3,353]	CHILLER PACKAGE	61,000 (27,694)

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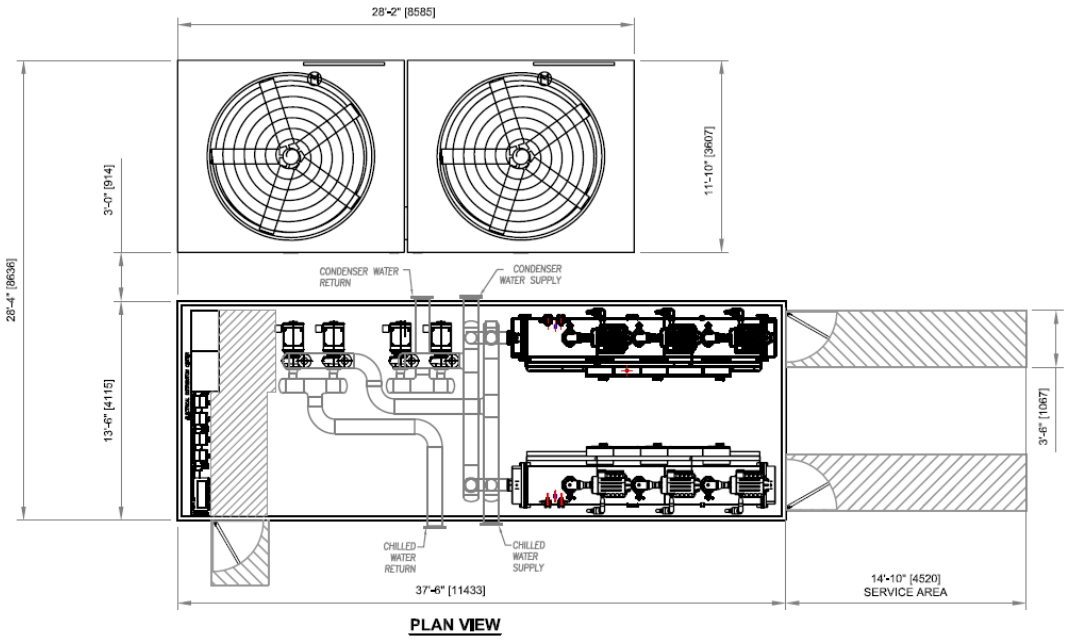
SM-S2L PACKAGED CHILLER PLANT

Water-Cooled Centrifugal Compressor System

Nominal Cooling Capacity Range:	560 to 650 Tons (1,968 to 2,987 KW)	Voltage / Phase / Frequency:	480V / 3Ph / 60 Hz
Nominal Chilled Water Flow Rate:	1,344 to 2,040 GPM (85 to 129 LPS)	Nominal Chilled Water Temperature Differential:	10 / 12 / 14°F (5.6 / 6.7 / 7.8°C)
Nominal Condenser Water Flow Rate:	1,680 to 2,550 GPM (106 to 161 LPS)	Nominal Condenser Water Temperature Differential:	10 / 15°F (5.6 / 8.3°C)



EQUIPMENT		SHIPPING WEIGHT, LB (KG.)		SHIPPING DIMENSIONS, FT. [MM]			EST. FOUNDATION WEIGHTS, LB (KG.)	
ITEM	QTY.	UNIT WT.	TOTAL WEIGHT	LENGTH	WIDTH	HEIGHT	ITEM	OPERATING WEIGHT
CHILLER SECTION	1	59,000 (26,786)	59,000 (26,786)	37'-6" [4,115]	14'-0" [4,267]	11'-0" [3,353]	CHILLER PACKAGE	67,000 (30,418)

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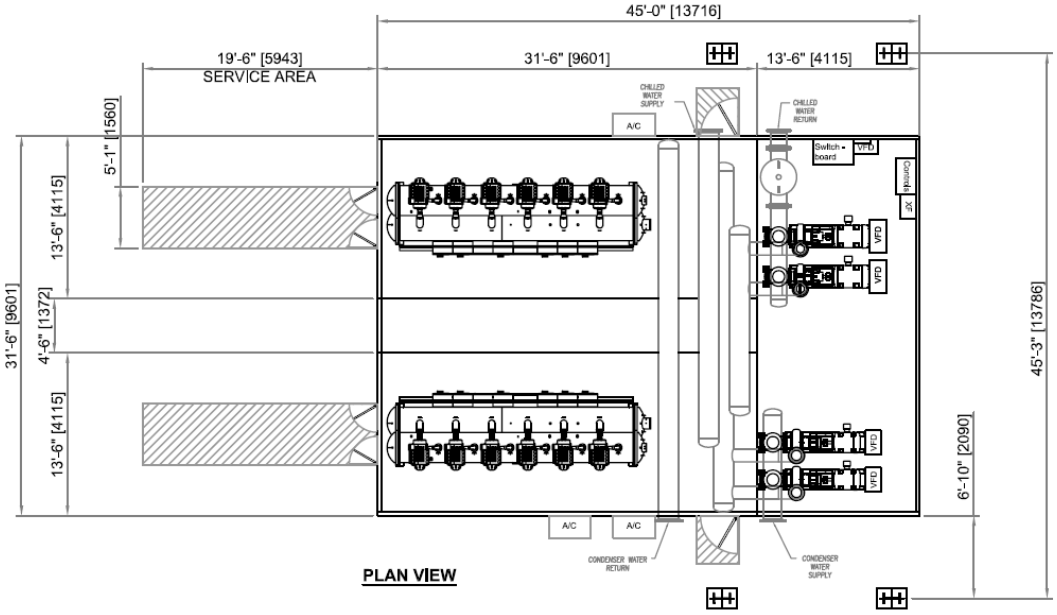
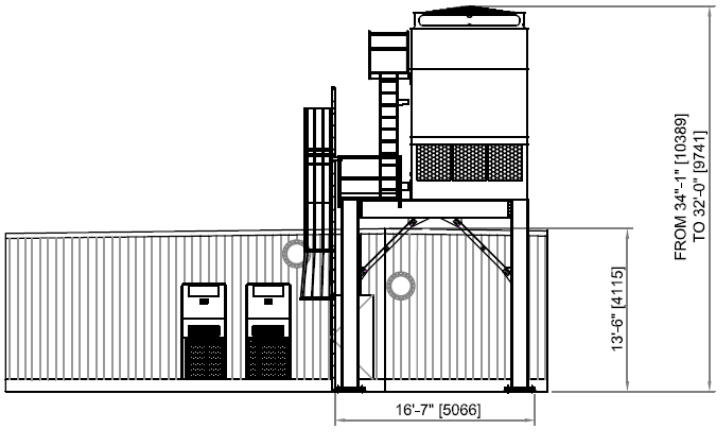
SM-D2L PACKAGED CHILLER PLANT

Water-Cooled Centrifugal Compressor System

Nominal Cooling Capacity Range:	280 to 1,620 Tons (984 to 5,693 KW)	Voltage / Phase / Frequency:	480V / 3Ph / 60 Hz
Nominal Chilled Water Flow Rate:	672 to 3,888 GPM (42 to 245 LPS)	Nominal Chilled Water Temperature Differential:	10 / 12 / 14°F (5.6 / 6.7 / 7.8°C)
Nominal Condenser Water Flow Rate:	840 to 4,860 GPM (53 to 307 LPS)	Nominal Condenser Water Temperature Differential:	10 / 15°F (5.6 / 8.3°C)



PLAN VIEW



ELEVATION VIEW

EQUIPMENT		SHIPPING WEIGHT, LB (KG.)		SHIPPING DIMENSIONS, FT. [MM]			EST. FOUNDATION WEIGHTS, LB (KG.)	
ITEM	QTY.	UNIT WT.	TOTAL WEIGHT	LENGTH	WIDTH	HEIGHT	ITEM	OPERATING WEIGHT
CHILLER SECTION	2	48,000 (21,792)	96,000 (43,584)	31'-6" [9,601]	14'-0" [4,267]	13'-6" [4,145]	CHILLER PACKAGE	173,000 (78,542)
PUMP/ELEC SECTION	1	37,000 (16,798)	37,000 (16,798)	32'-0" [9,754]	13'-6" [4,145]	13'-6" [4,145]		

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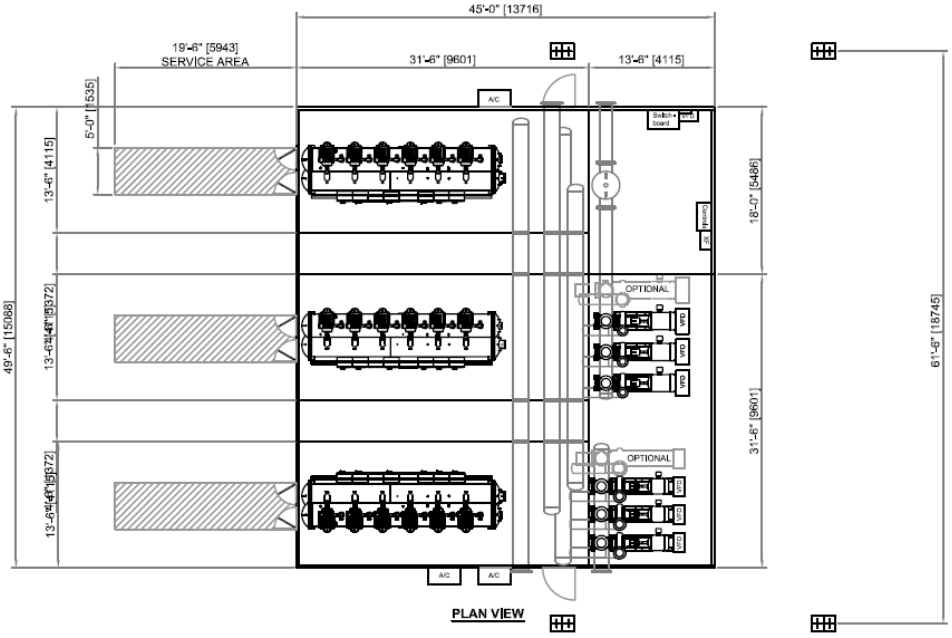
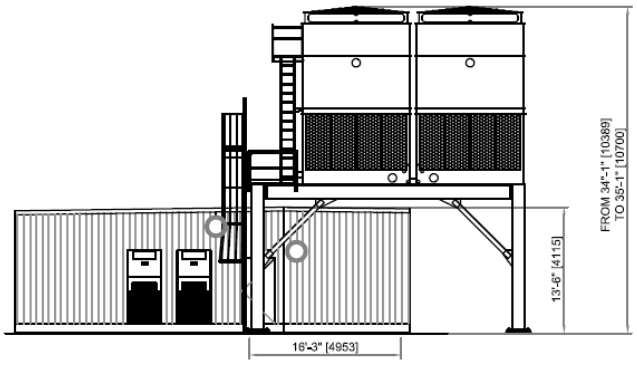
SM-T3L PACKAGED CHILLER PLANT

Water-Cooled Centrifugal Compressor System

Nominal Cooling Capacity Range:	840 to 2,430 Tons (2,952 to 8,539 KW)	Voltage / Phase / Frequency:	480V / 3Ph / 60 Hz
Nominal Chilled Water Flow Rate:	2,016 to 5,832 GPM (127 to 368 LPS)	Nominal Chilled Water Temperature Differential:	10 / 12 / 14°F (5.6 / 6.7 / 7.8°C)
Nominal Condenser Water Flow Rate:	2,520 to 7,290 GPM (159 to 460 LPS)	Nominal Condenser Water Temperature Differential:	10 / 15°F (5.6 / 8.3°C)





EQUIPMENT		SHIPPING WEIGHT, LB (KG.)		SHIPPING DIMENSIONS, FT. [MM]			EST. FOUNDATION WEIGHTS, LB (KG.)	
ITEM	QTY.	UNIT WT.	TOTAL WEIGHT	LENGTH	WIDTH	HEIGHT	ITEM	OPERATING WEIGHT
CHILLER SECTION	3	48,000 (21,792)	144,000 (65,376)	31'-6" [9,601]	14'-0" [4,267]	13'-6" [4,145]	CHILLER PACKAGE	264,000 (119,856)
PUMP SECTION	1	43,000 (19,522)	43,000 (19,522)	32'-0" [9,754]	13'-6" [4,145]	13'-6" [4,145]		
ELEC SECTION	1	18,500 (8,399)	18,500 (8,399)	18'-6" [5,486]	13'-6" [4,145]	13'-6" [4,145]		

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END SUCTION PUMPS

END SUCTION PUMPS

Type LF (Frame Mounted)

Type LC (Close Coupled)

Type LCV (Vertically Mounted Close Coupled)

Grundfos CBS Inc. is fully committed to advancing pump technology and providing its customers with the most efficient pumps in the market.

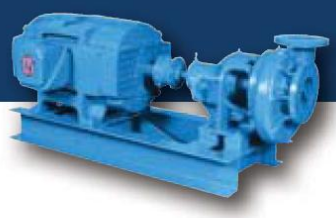
The PACO line of end suction, single stage pumps serves as the industry standard in performance, quality, and durability. With an expanded selection of 32 sizes available, the PACO line of pumps are the smart choice for a number of reasons:

- Low life-cycle costs
- High efficiency for reduced operation costs
- Compensated double-volute design for reduced radial loads, minimized shaft deflection, and prolonged seal life and bearing life
- Mechanical design for reduced maintenance and minimal downtime
- Back pull out design for ease of maintenance and servicing
- Range of sizes to meet precise application requirements
- Quiet operation

Advanced features incorporated as standard on PACO end suction pumps ensure optimum performance and reliability. These features, as well as optional features that meet specialized needs, are available on the broadest line of high-efficiency pumps offered to the industry.

An innovative pump and impeller design produces a higher operating efficiency – up to 91 percent – and provides a wider band of best operating efficiency, even during conditions of off-design operation.

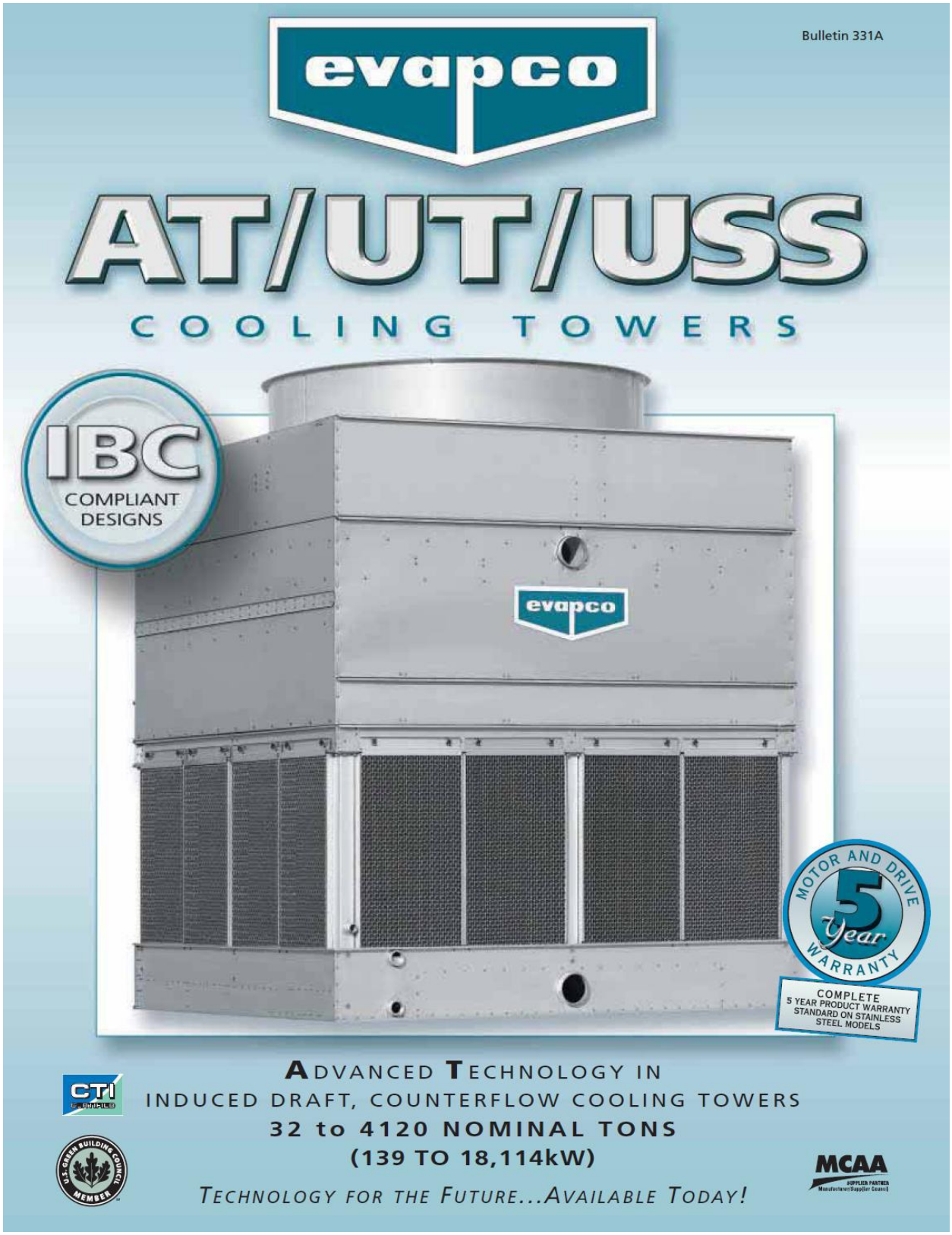
Quite simply, the PACO line of pumps is the smart choice for lower initial cost, longer pump life, reduced operating and maintenance costs, maximum reliability, and quieter operation.



FEATURES AND BENEFITS

PACO LF FRAME MOUNTED END SUCTION PUMP	
Footed Bearing Frame	› Enhances ease of maintenance and provides proper support of rotating equipment during servicing
Footless Volute	› Establishes single point support for reducing alignment restrictions, which extend seal and bearing life › Permits discharge orientation flexibility › Minimizes the effects (misalignment, flange strain) of thermal expansion on volute
Permanently Sealed for Life Bearings	› Reduce environmental contaminants and pump maintenance
Machined Mounting Surfaces and Fabricated Base Plate	› Aid in alignment
Choice of Motor Enclosures	› Increases flexibility of design
Back Pull-Out Design	› Enables maintenance without disturbing piping
Double Volute Design	› Reduces radial loads, internal recirculation, and turbulence, which increases efficiency, lowers life cycle costs, and prolongs seal and bearing life
Large Seal Chamber	› Allows for various seal configurations and customization
Integrally Cast Diffuser Vane	› Reduces turbulence and pre-rotation by providing laminar flow into oversized impeller eye, resulting in decreased need for extended horizontal suction pipe runs, elbows, or suction guides
Francis Vane Impeller Design	› Increases efficiency and reduces NPSHr
Bronze Case Wear Rings	› Extend pump life and increase pump efficiency (included as standard) › Provide simple and inexpensive renewal of "like new" operating tolerances, even after years of operation
Impellers	› Trimmed to exact customer specifications for customization › Static and dynamically balanced to ISO 1940-G3 for reduced noise and vibration › Hydraulically balanced to decrease thrust loads and prolong seal and bearing life
PACO LC/LCV CLOSE COUPLED END SUCTION PUMPS	
Close Coupled Design	› Provides compact construction and space savings
Registered Fit	› Eliminates machine tolerance stacking › Provides positive placement of components for permanent rigid pump to motor alignment
Permanent Rigid Alignment	› Eliminates need for alignment › Prolongs seal and bearing life
Industry-Standard JM Frame Motor	› Simplifies motor replacement
Type LCV Pump	› Offers vertical mounting of close coupled design for increased space savings
No Grouting Requirements	› Makes installation easy
Francis Vane Impeller Design	› Increases efficiency and reduces NPSHr
Impellers	› Trimmed to exact customer specifications for customization › Static and dynamically balanced to ISO 1940-G3 for reduced noise and vibration › Hydraulically balanced to decrease thrust loads and prolong seal and bearing life

COOLING TOWERS



evapco

THE ADVANCED TECHNOLOGY DESIGN PROVIDING

AT/UT/USS

EVAPCO, Inc., continues its dedication to advancements in induced draft, counterflow cooling tower technology and easy maintenance with the Advanced Technology Cooling Tower...The EVAPCO AT!

The AT is the result of decades of engineering success based on easy maintenance, durable construction and a highly efficient design. The AT brings marquee features that make it the better choice in cooling towers. These features are presented in this exclusive AT Marketing brochure.

† CTI CERTIFIED

Since its founding in 1976, EVAPCO, Inc. has become a world-wide leader in supplying quality cooling equipment for thousands of customers in both the commercial and industrial markets.

EVAPCO's success has been the result of a continual commitment to product improvement, quality workmanship and a dedication to providing unparalleled service.

Our emphasis on research and development has led to many product innovations – a hallmark of EVAPCO through the years.

The ongoing R & D Program enables EVAPCO to provide the most advanced products in the industry – technology for the future, available today.

With 16 facilities in seven countries and over 170 sales offices in 42 countries world-wide, EVAPCO is ready to assist in all your equipment needs.

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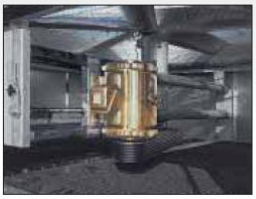

Totally Enclosed Fan Motors

- Motors positioned for external access.
- Assures long life.
- Motor location allows for easy accessibility and serviceability.
- Five (5) Year motor warranty.

EVAPCO Power-Band Drive System

- The AT Cooling Tower features the highly successful, easy maintenance, heavy duty Power-Band Drive System.
- Standard heavy-duty pillow block bearings with a minimum L10 life of 75,000 hours.
- Extended lube lines.
- External motor/belt adjustment.
- Aluminum Alloy Sheaves, Solid-Back Multi-Groove Power-Band Belts and Totally Enclosed motors are standard.
- Five (5) Year Motor and Drive Warranty.

NEW!

Louver Access Door

- Hinged access panel with quick release mechanism
- Allows easy access to perform routine maintenance and inspection of the makeup assembly, strainer screen and basin
- Available on models with 5 ft. and 6 ft. tall louver sizes

NEW!

Easy Field Assembly

- A new field assembly seam design which ensures easier assembly and reduced potential for field seam leaks
- Self-guided channels guide the fan casing section into position improving the quality of the field seam
- Eliminates up to 66% of fasteners

EVAPCOAT Corrosion Protection System

- G-235 Galvanized Steel Construction and Stainless Steel Strainers–EVAPCO set the standard with 2.35oz. of zinc per square foot of surface area.
- Another EVAPCO standard–the stainless steel suction strainer eliminates excessive wear and corrosion.
- Non-corrosive PVC Water Distribution System, Drift Eliminators and Inlet Louvers.
- This system provides maximum corrosion protection as standard.

† Mark owned by the Cooling Technology Institute

EASIER SOLUTIONS AND BETTER CHOICES

evapco AT

Available in 55 Cross Sections and a capacity range of 32 to 4120 Nominal Tons (139 to 18,114 kW)! The AT has a model for every application.

If there is an application for which the standard catalog product line does not work, EVAPCO will make a cooling tower that will fit your requirement! Consult your local EVAPCO Representative or the factory for all your cooling tower needs.

CTI Certified-Standard 201

- Independent Certification.
- Eliminates necessity for costly field performance tests.

Optional Motor Davit and Working Platform

Motor Davit
- Motor davit and bracket option for easy motor removal.
- Also available for Gearbox removal.

Platform
- Platform and ladder arrangement available as an option.
- Provides additional working surface for the service mechanic.

Exclusive 5 Year Motor & Drive Warranty

- Covers the complete drive system, including the motor.
- Covers all drive components on belt or gear drive units.
- Standard on all AT Models.
- Upgraded 5 year Complete Product warranty on models with optional stainless steel construction.

Smooth Flow Fan

- Soft-connect blade to hub design.
- VFD-friendly
- Eliminates critical blade passing frequencies at any speed.

(Not available on 4 ft. wide models)

MOTOR AND DRIVE 5 Year WARRANTY

EVAPCO unequivocally guarantees the thermal performance of the AT cooling tower product line.

NEW! EvapJet™ Nozzle

Water Distribution System

- Non-corrosive PVC construction with new EvapJet™ nozzles.
- Large orifice nozzles prevent clogging and are threaded for easy removal and positive positioning.
- 66% fewer nozzles!
- System branches have threaded end caps to assist with debris removal.

Quick Connect Piping System

- All inlet and outlet piping connections are beveled for welding and grooved to accept a mechanical coupling device as standard.
- Facilitates easy pipe connections for quick installation.
- Flanged connections are available as an option. *(See page 10 Optional Equipment)*

Clean Pan Sloped Basin Design

- Designed to completely drain the cold water basin.
- Helps prevent buildup of sediment and biological film.
- Eliminates standing water after drain down.

(See details of design on page 6)

3

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