OPERATING YOUR CHILLER EFFICIENTLY

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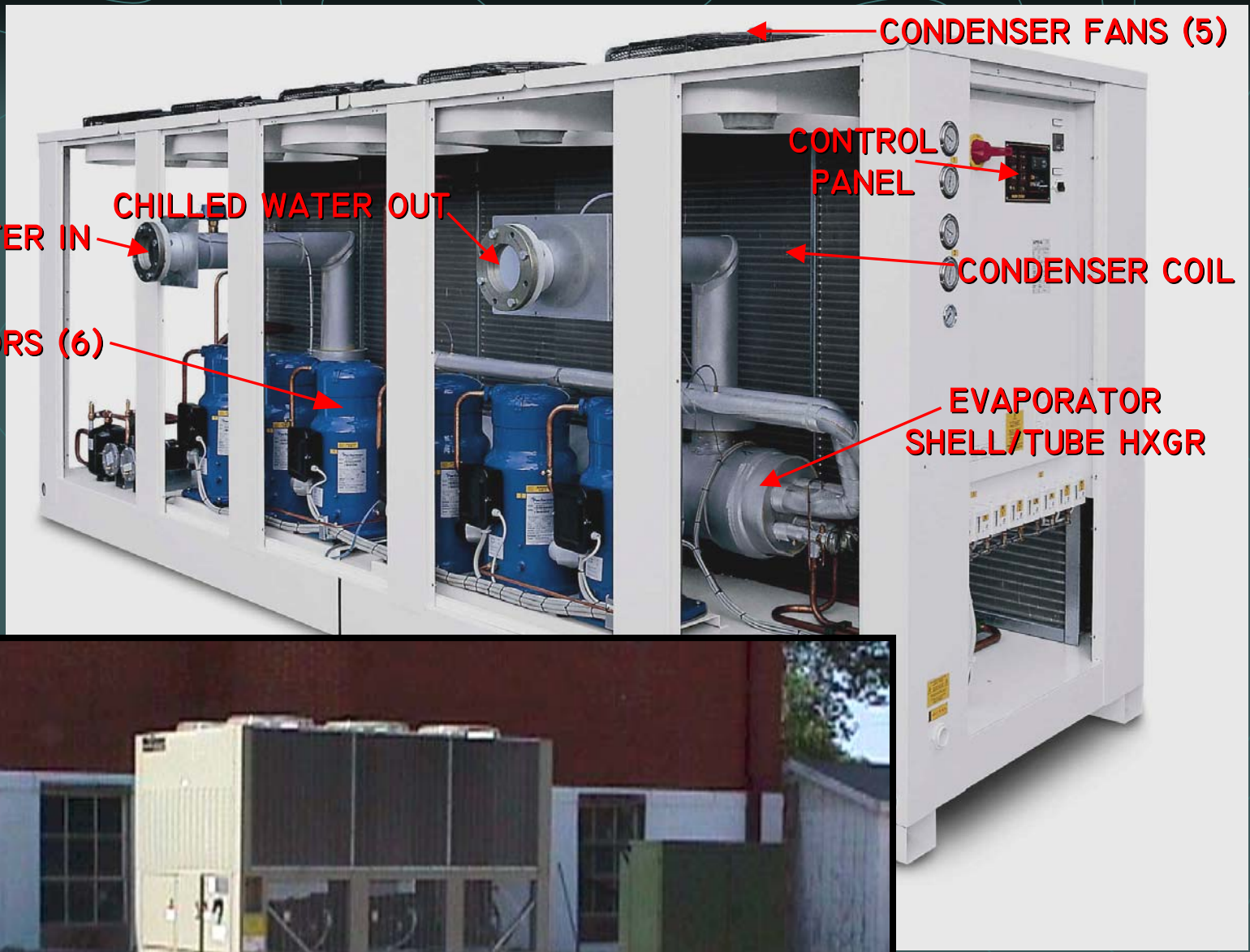
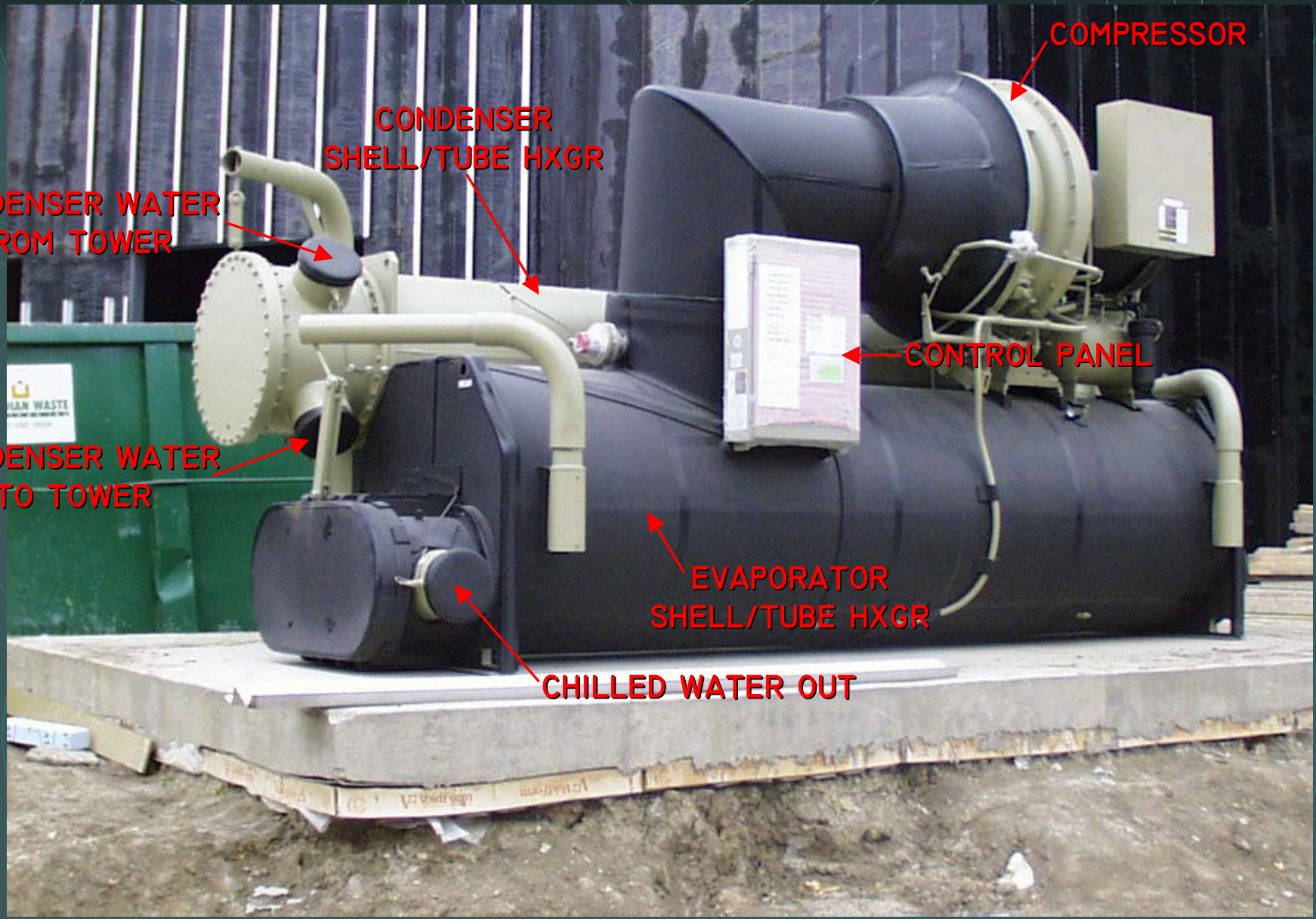
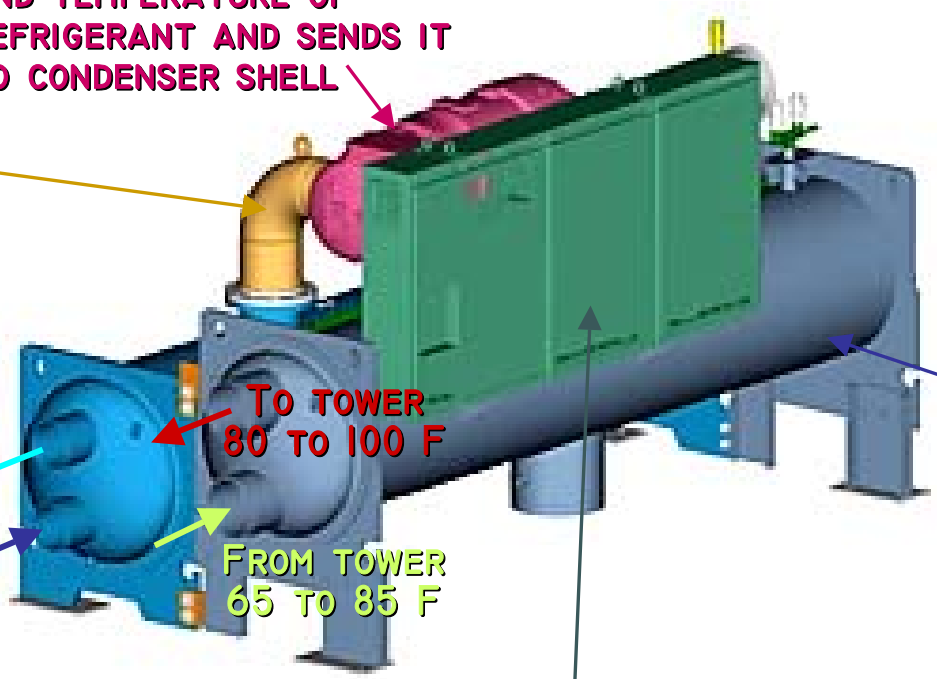
Advantek Consulting


CONDENSER FANS (5)
CONTROL PANEL
CHILLED WATER OUT
RETURN WATER IN
CONDENSER COIL
COMPRESSORS (6)
EVAPORATOR SHELL/TUBE HXGR


COMPRESSOR
CONDENSER
SHELL/TUBE HXGR
CONDENSER WATER
FROM TOWER
CONTROL PANEL
CONDENSER WATER
TO TOWER
EVAPORATOR
SHELL/TUBE HXGR
CHILLED WATER OUT

How it Works



Compressor raises pressure and temperature of refrigerant and sends it to condenser shell

Refrigerant evaporates in shell and absorbs heat which chills water flowing in tubes.

To tower
80 to 100 F

Chilled water out
50 to 55 F

Return from AHUs
60 to 65 F

From tower
65 to 85 F

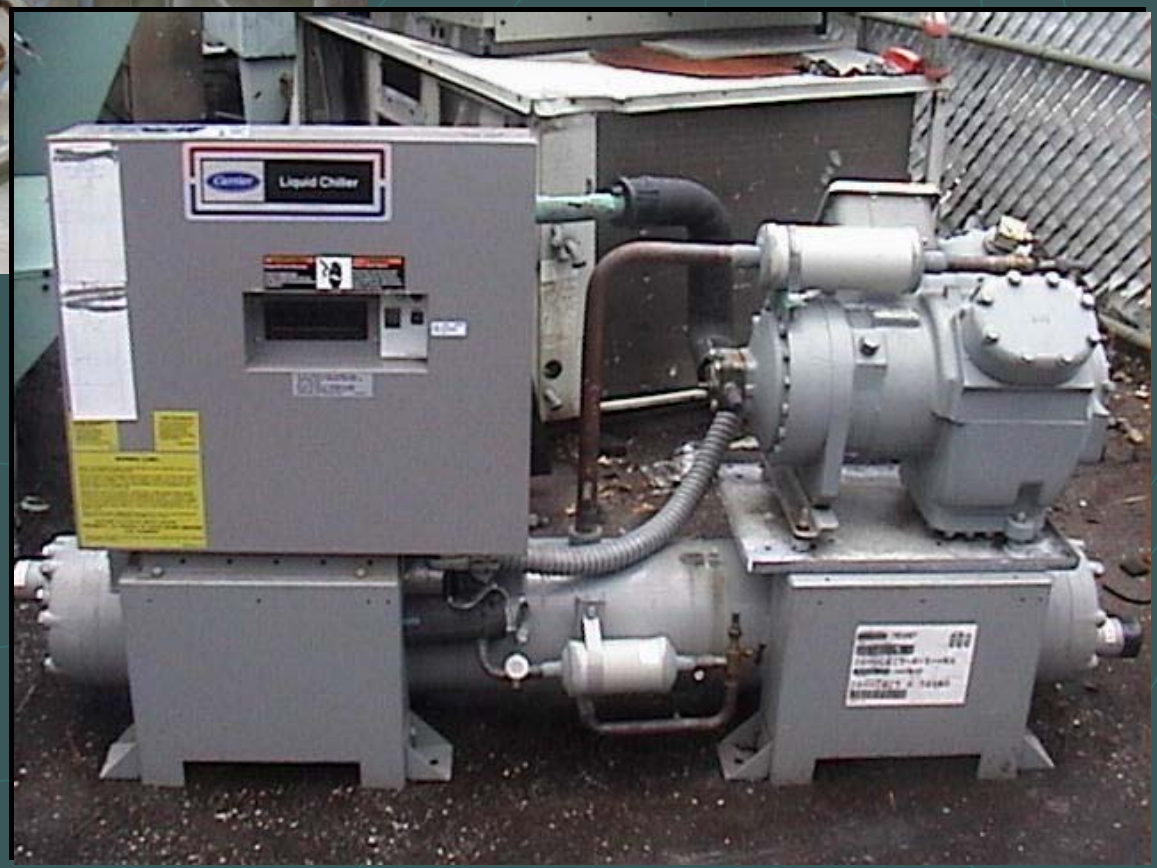
Refrigerant condenses on tubes and releases heat which is taken taken by condenser water to the cooling tower.

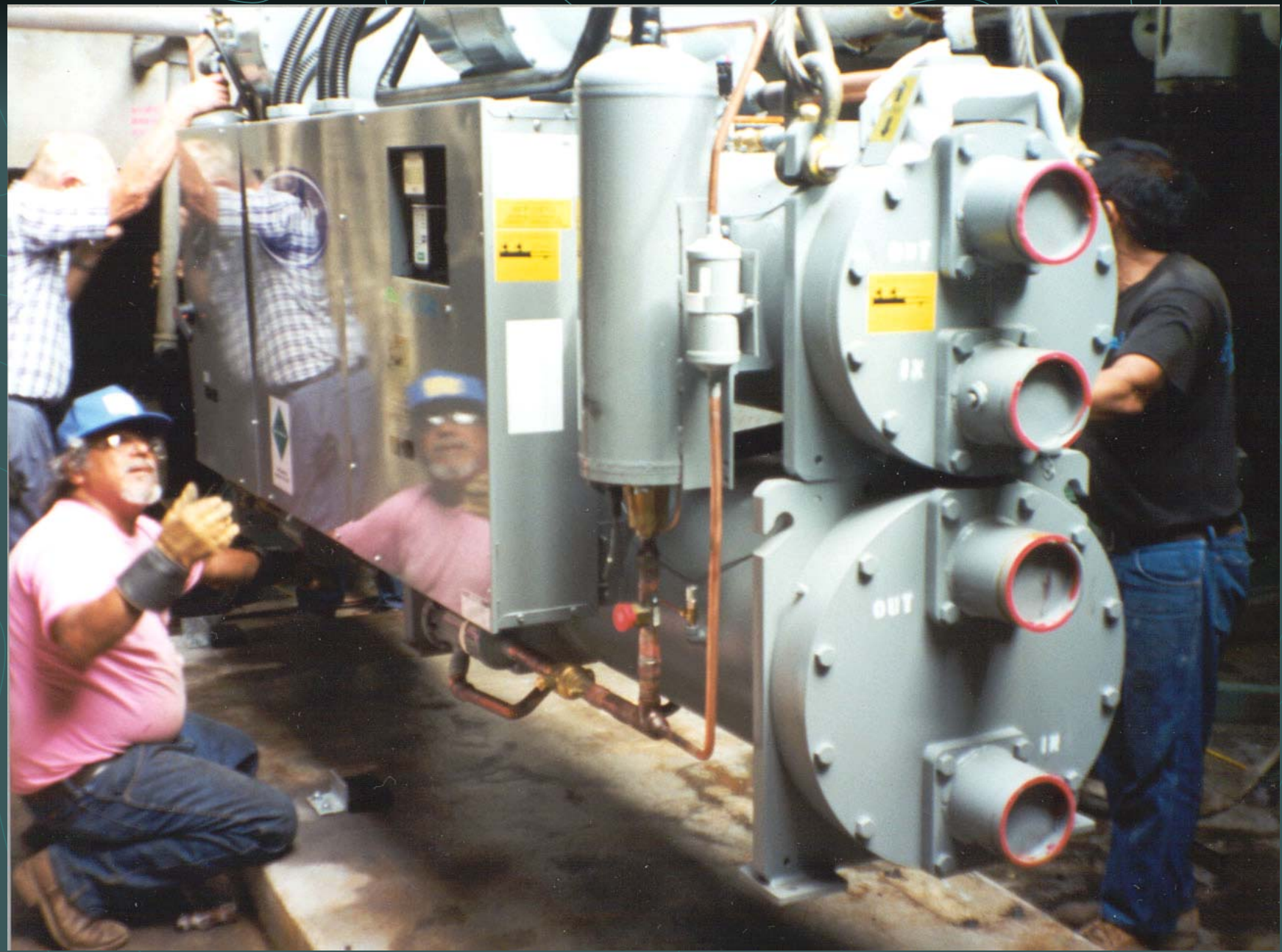
Control panel for setting
- Chilled water temperature
- Demand limit
- Staging

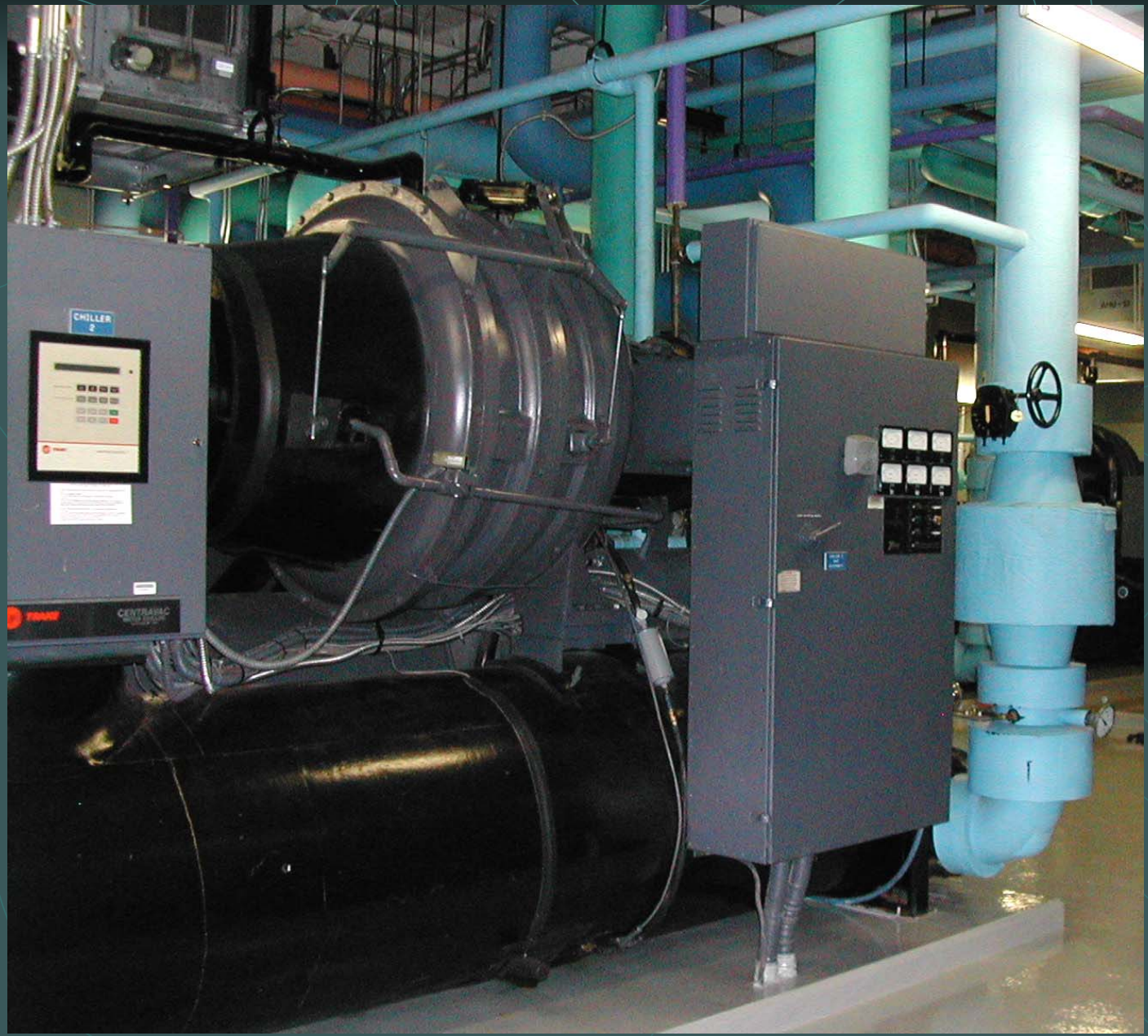
COMPRESSOR TYPES

- **Reciprocating** (pistons)
  - Up to 100 tons - 0.84 to 1.2 kW/ton
- **Scroll**
  - Up to 50 tons - 0.70 to 1.0 kW/ton
- **Centrifugal**
  - 90 to 10,000 tons – 0.34 to 0.70 kW/ton
- **Rotary Screw**
  - 20 to 2000 tons – 0.42 to 0.80 kW/ton

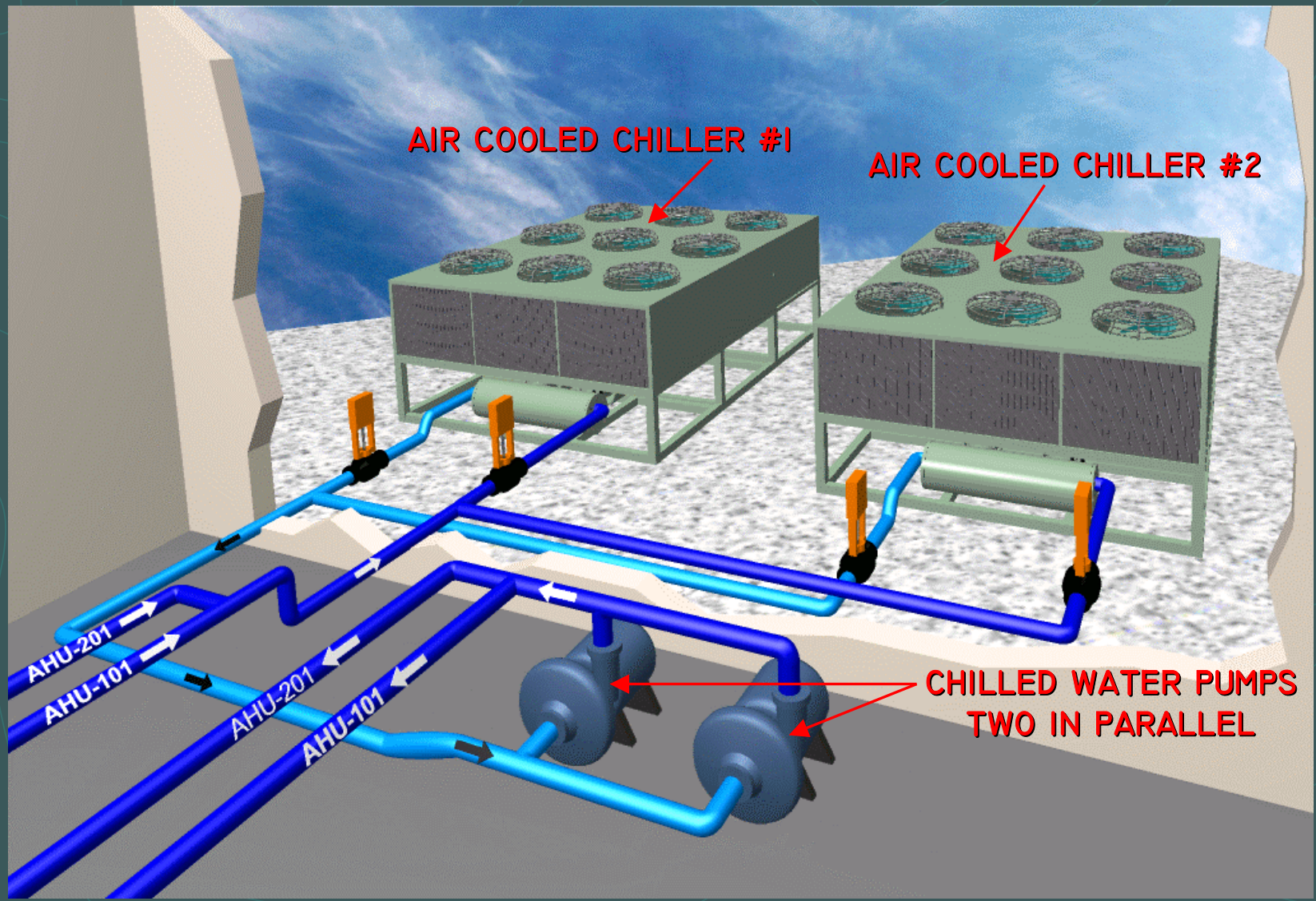
- Compressor and motor in welded can (Hermetic) -or-
- Separate compressor and motor (Semi-hermetic)


Carrier
Liquid Chiller

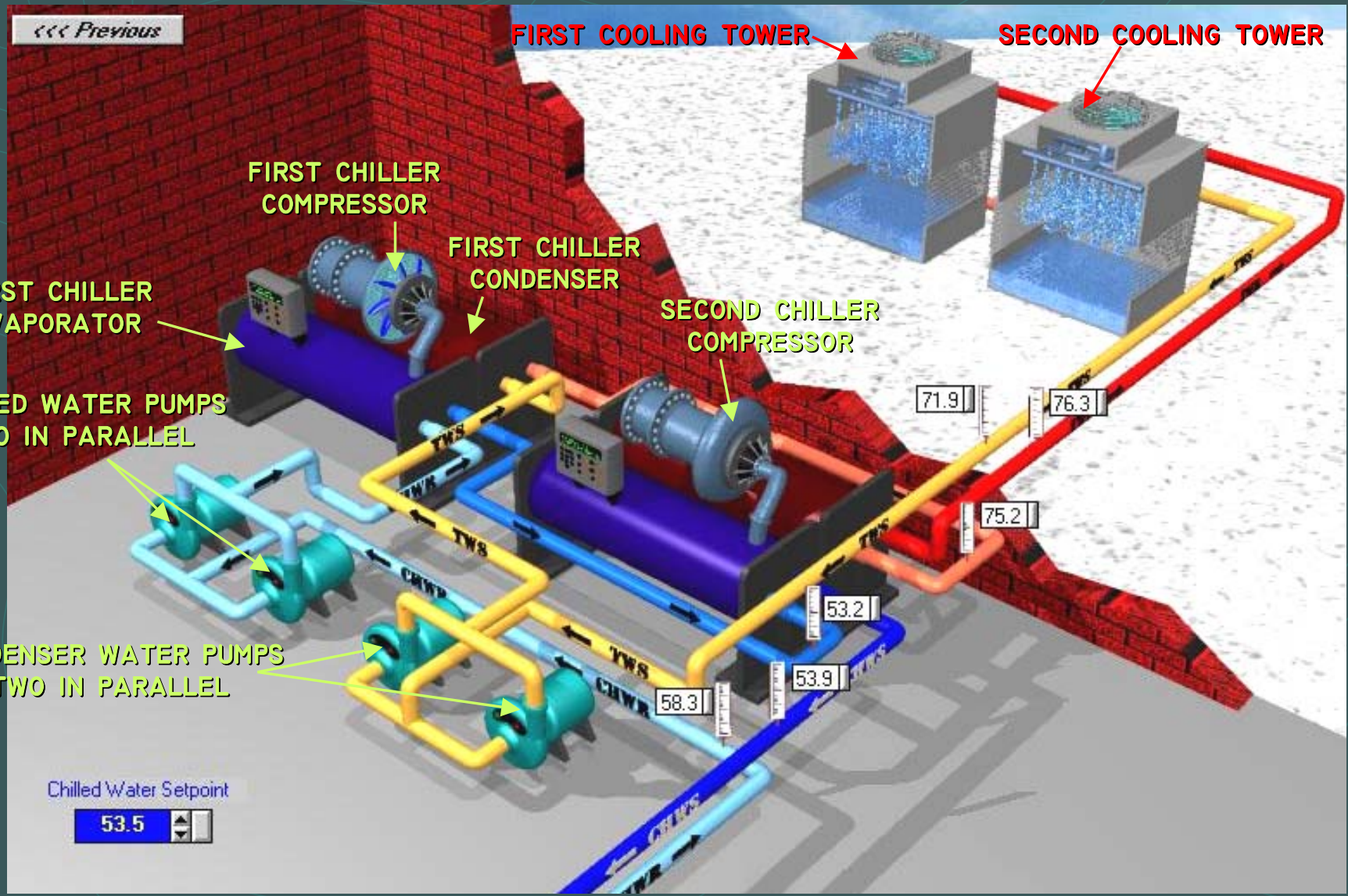

OUT
IN
OUT
IN


CHILLER
2
TRANE
CENTRAVAC

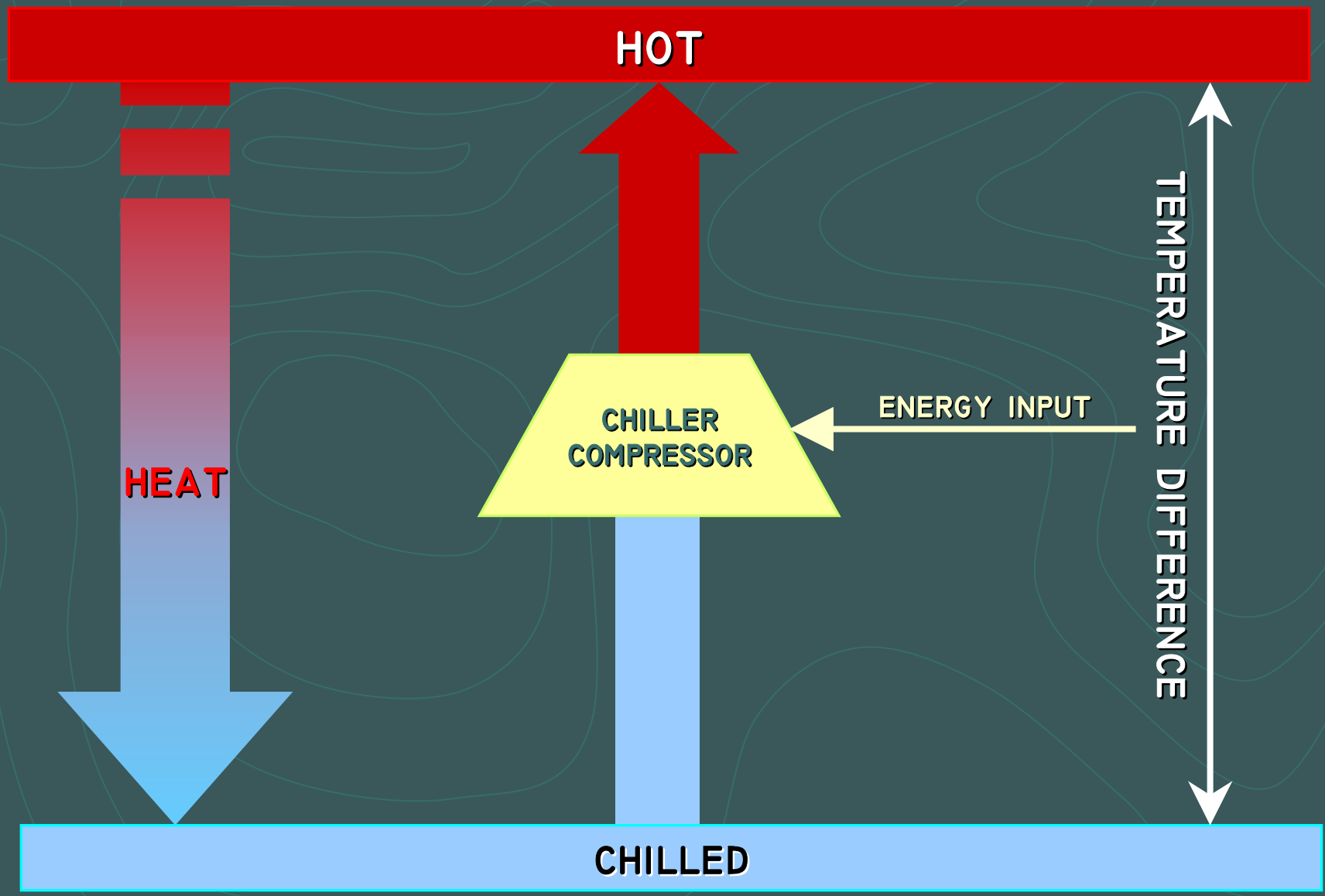
Parallel Air-Cooled



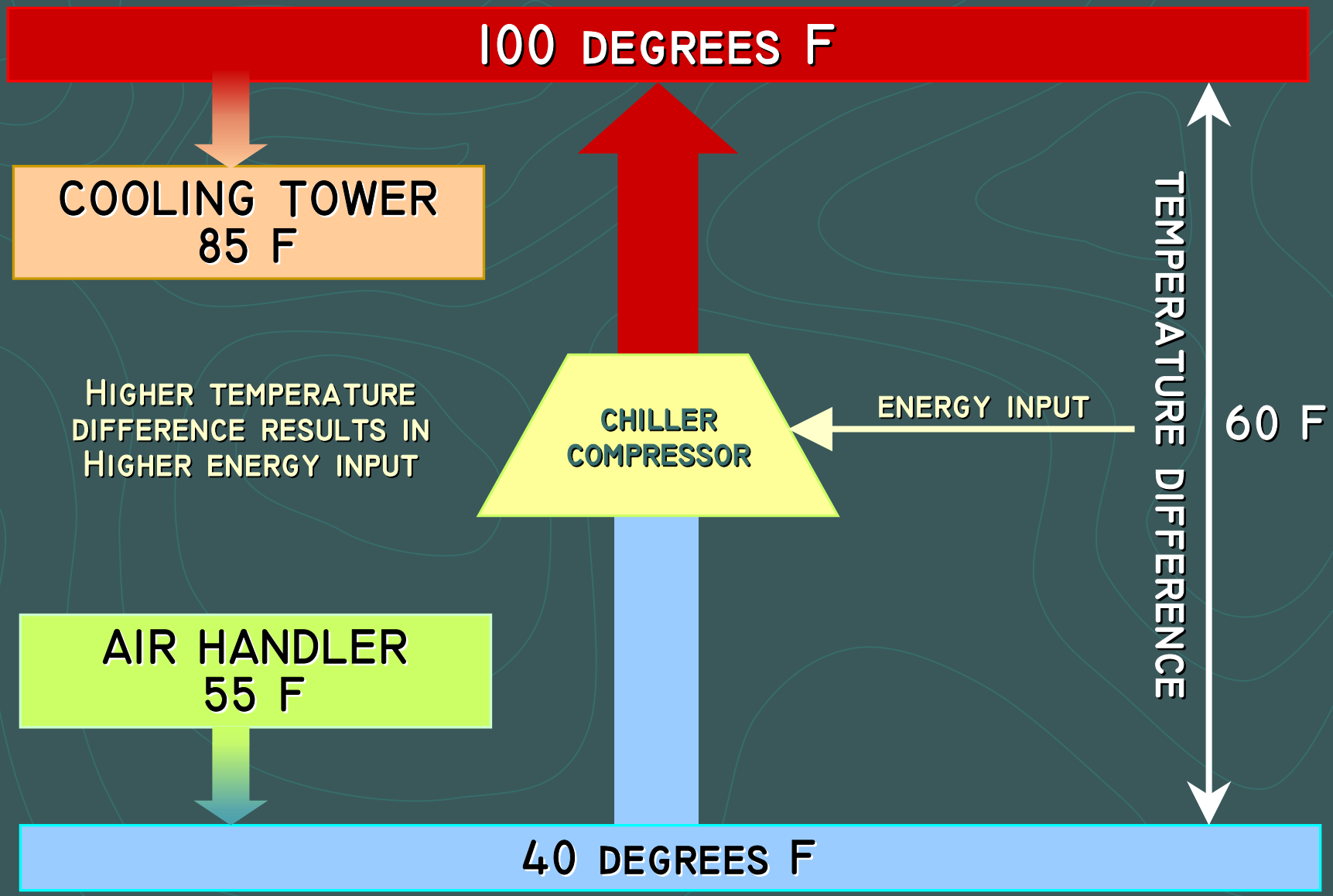
Series Water-Cooled



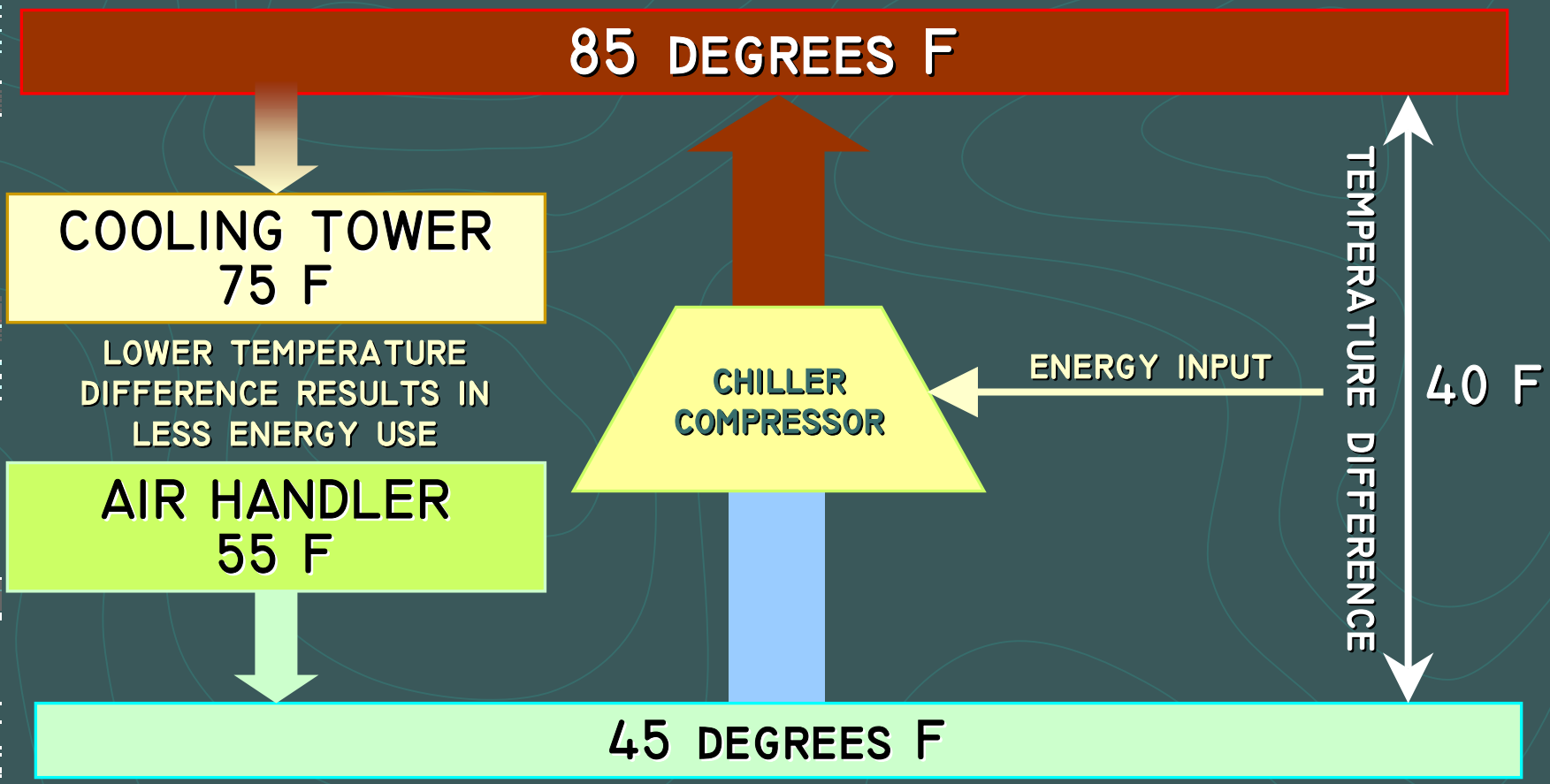
SAVINGS 101


HOT
HEAT
CHILLER
COMPRESSOR
ENERGY INPUT
TEMPERATURE DIFFERENCE
CHILLED

SAVINGS 102


100 DEGREES F
COOLING TOWER
85 F
HIGHER TEMPERATURE DIFFERENCE RESULTS IN HIGHER ENERGY INPUT
CHILLER COMPRESSOR
ENERGY INPUT
TEMPERATURE DIFFERENCE
60 F
AIR HANDLER
55 F
40 DEGREES F

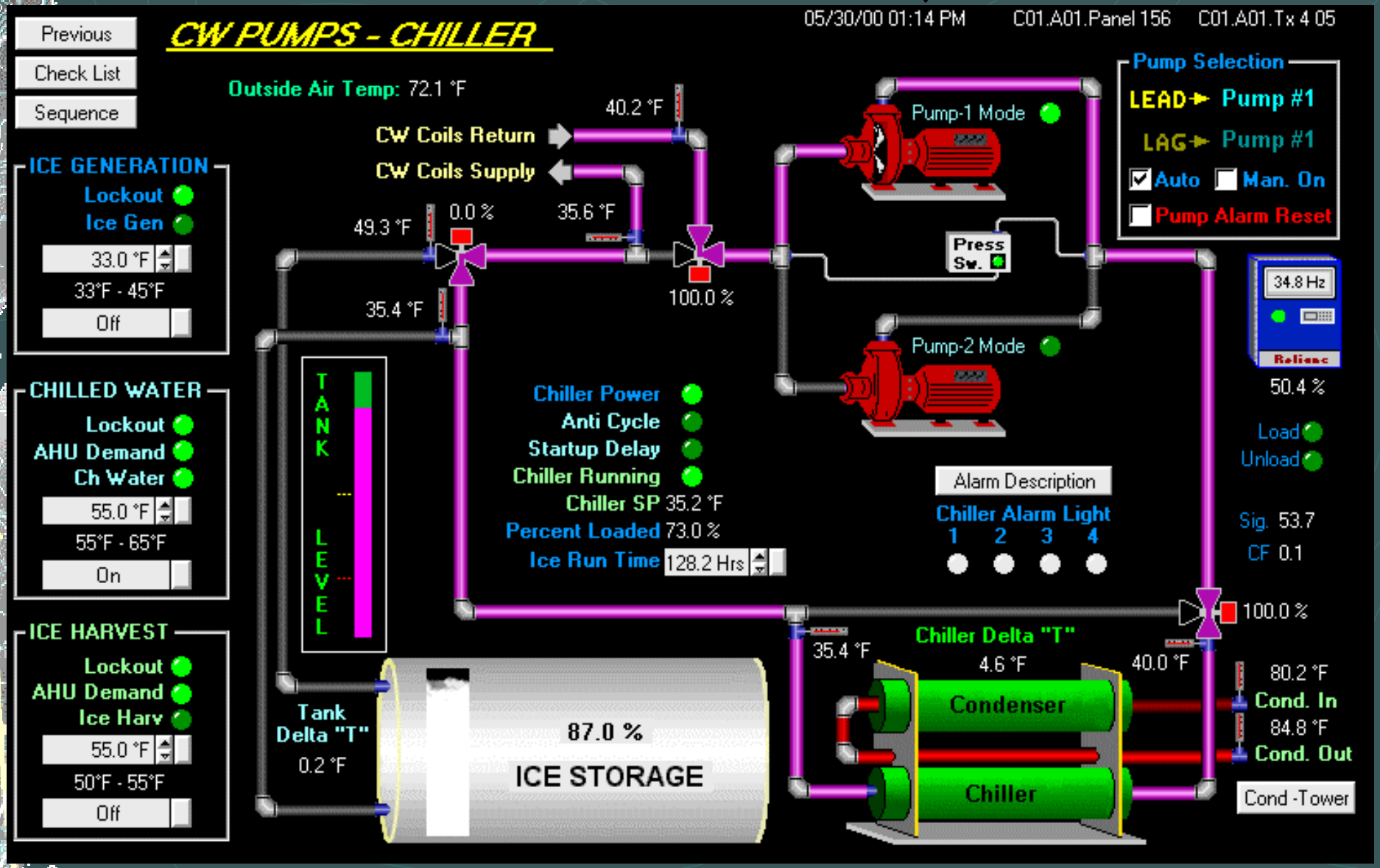
SAVINGS 103


85 DEGREES F
COOLING TOWER
75 F
LOWER TEMPERATURE DIFFERENCE RESULTS IN LESS ENERGY USE
AIR HANDLER
55 F
CHILLER COMPRESSOR
ENERGY INPUT
TEMPERATURE DIFFERENCE
40 F
45 DEGREES F

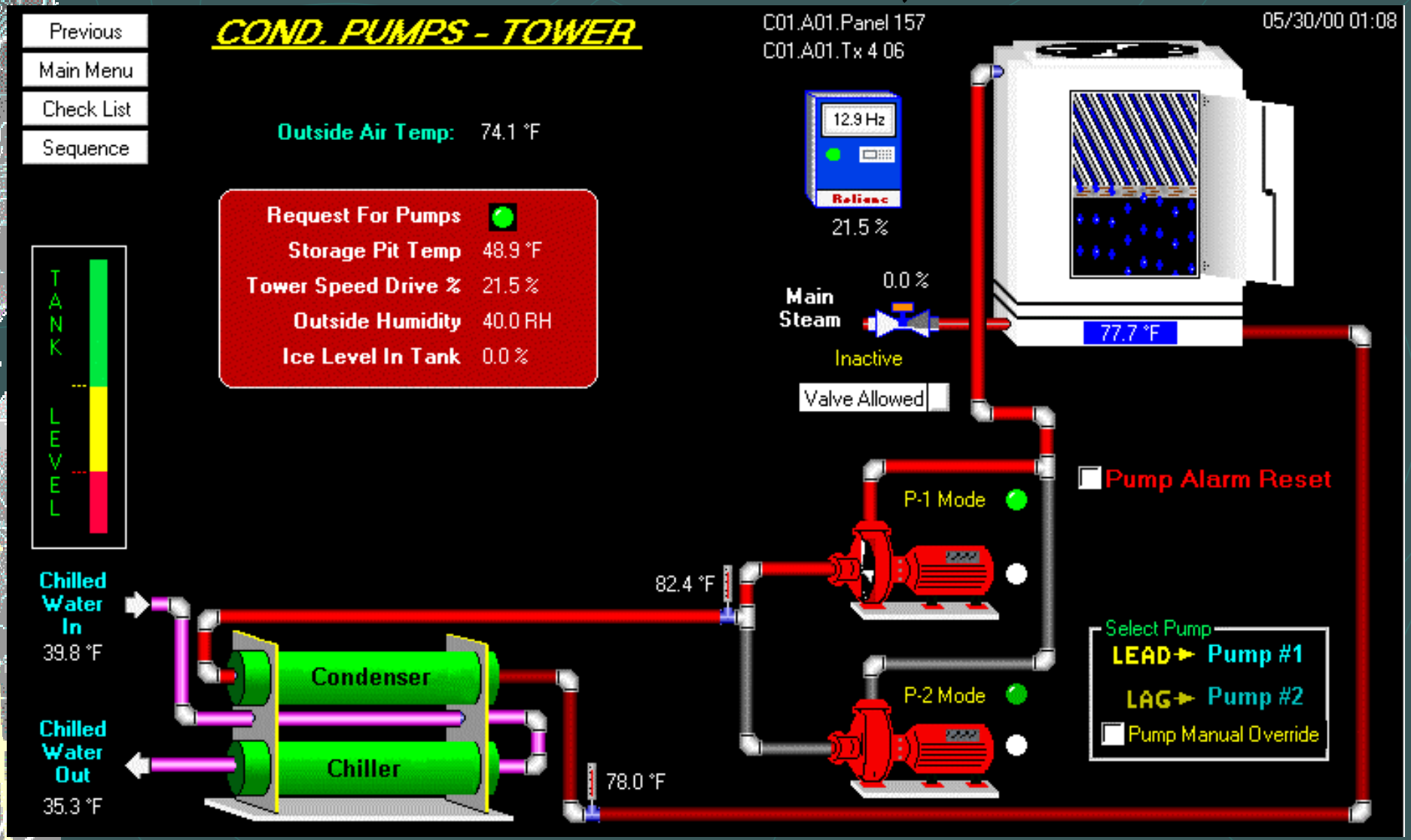
Control Features that Save

1. Automatic chilled water temperature reset
2. Cooling tower temperature reset
3. Automatic chiller kW-demand limiting
4. Variable primary chilled water pumps
5. Start-stop staging optimization
6. Purge and monitoring
7. Variable speed compressor
8. Variable speed tower fan
9. “Free” Cooling cycle

Chiller Control Example



Tower Control Example



O&M that Saves

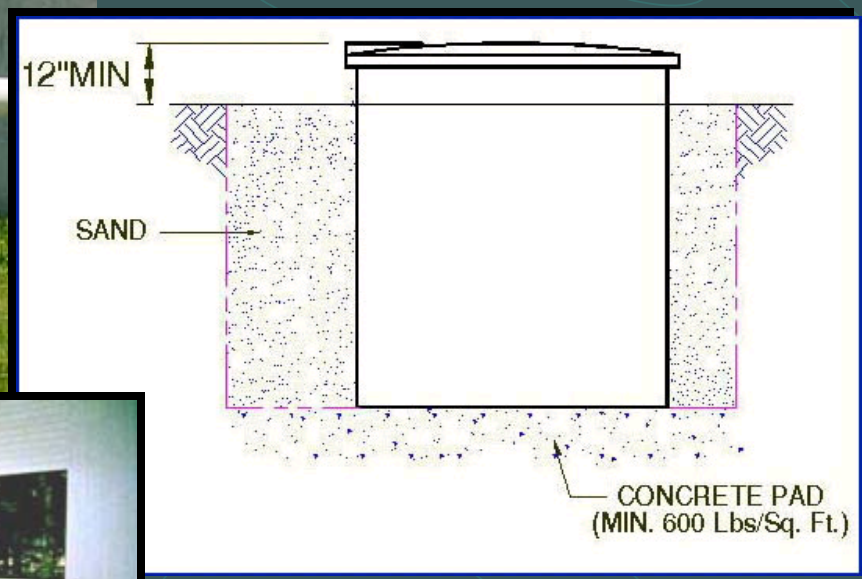
1. Treat and filter chilled water and tower water
2. Check calibration of sensors and control logic
3. Clean heat exchanger tubes regularly or automatically
4. Keep cooling tower clean
5. Clean and treat condenser coil fins
6. Adjust tower temperature to lowest practical
7. Adjust chilled water temperature for humidity control
8. Verify air purge is operating properly
9. Stage chillers to run at lowest kW per Ton

Equipment and System Savings

1. **Use condenser heat**
   - for potable hot water
   - for hot-water reheat (if used)
2. **Ice Storage – make ice during off-peak rate hours**
3. **Additional cooling tower capacity**
4. **Retrofit water cooling to air-cooled chillers**
5. **Retrofit constant speed pumps with 2-speed motors**
6. **Replace oversized pumps**

Ice Storage

7 FEET DIAMETER
8 FEET DEEP
1655 GALLONS
190 TON HOURS
23 TONS FOR 8 HOURS

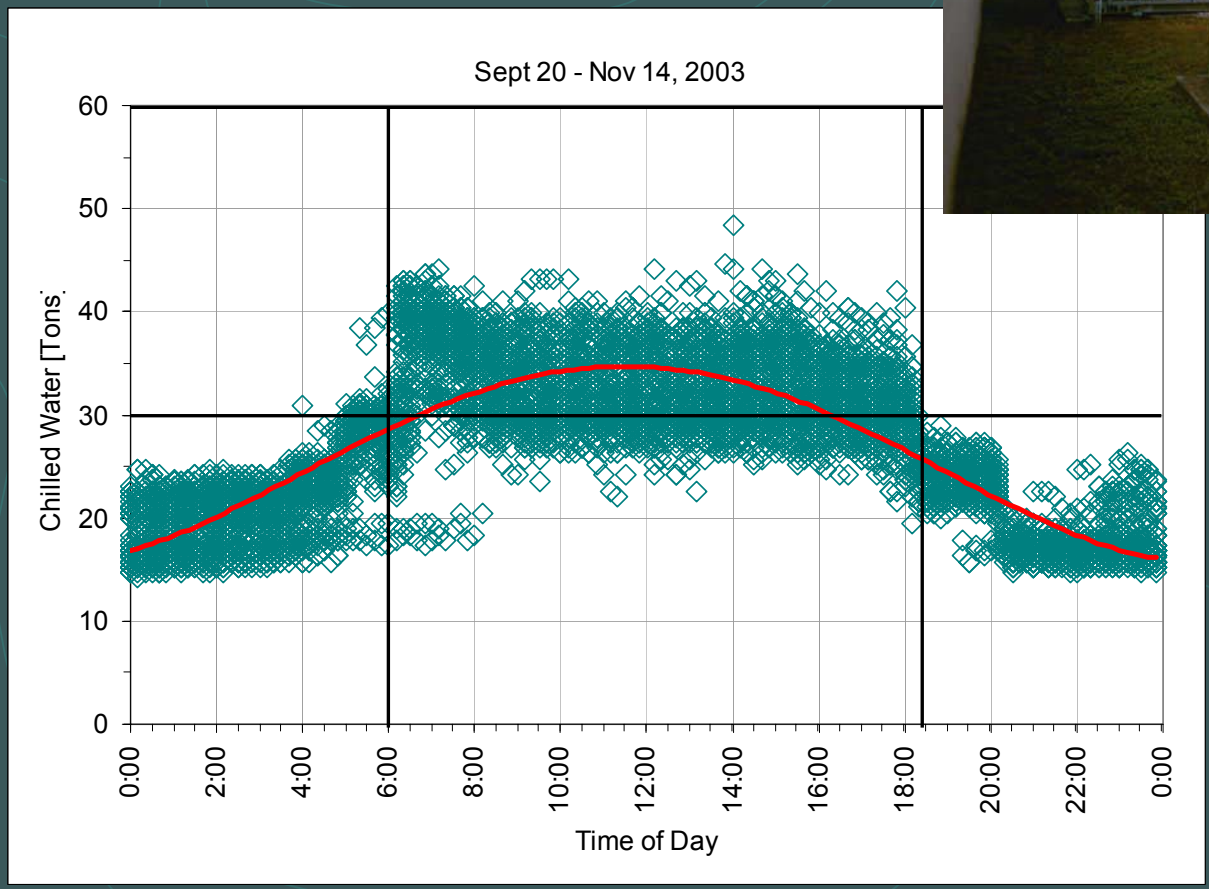


Example Trend Log – Tons

60-ton air-cooled 4-stage chiller c.2000

Cooling load only 40 tons

Operating KW per TON over 1 month = 0.73

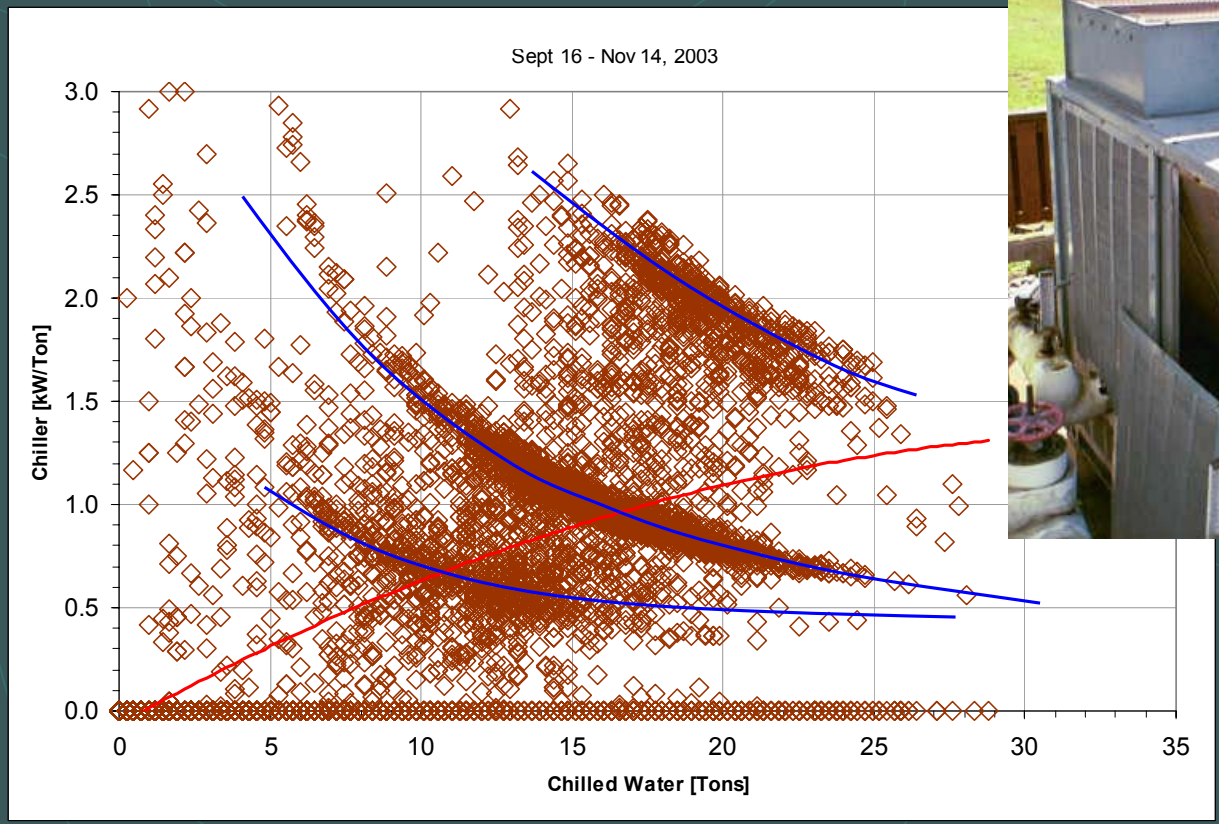


Example Trend Log – kW/ton

30-ton air-cooled 2-stage chiller c.1991

Cooling load 25 tons

Operating kW per ton over 1 month = 0.87



New Chiller Product

Carrier "AquaSnap" Chillers

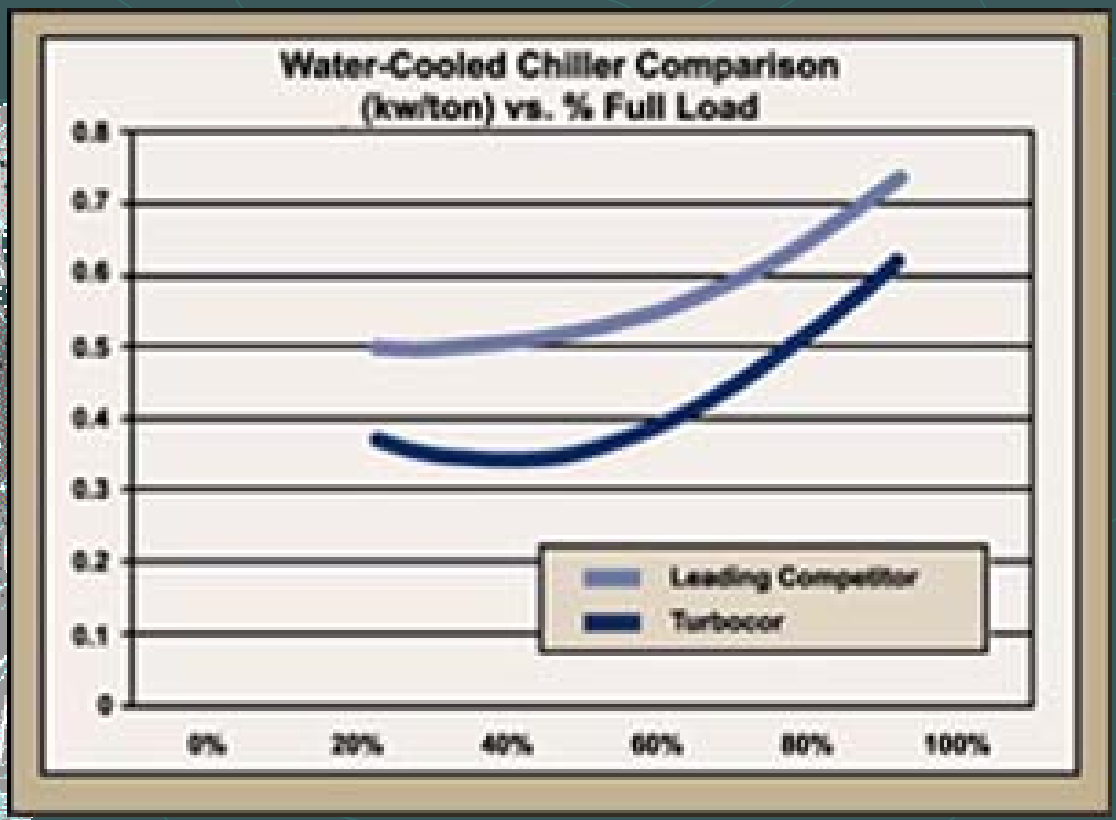
- Compact all-in-one design includes pumps
- Reduces installed cost of chilled water system
- EER of 10.1 and part-load ratings as high as 14.2
- Ultra-quiet scroll compressors and fans
- 10 to 55 tons
- Low profile cabinet 4'-4" tall

New Chiller Technology

McQuay frictionless water-cooled chiller

Uses two **Turbocor** TT-300 75-ton compressors

ARI-certified 550/590

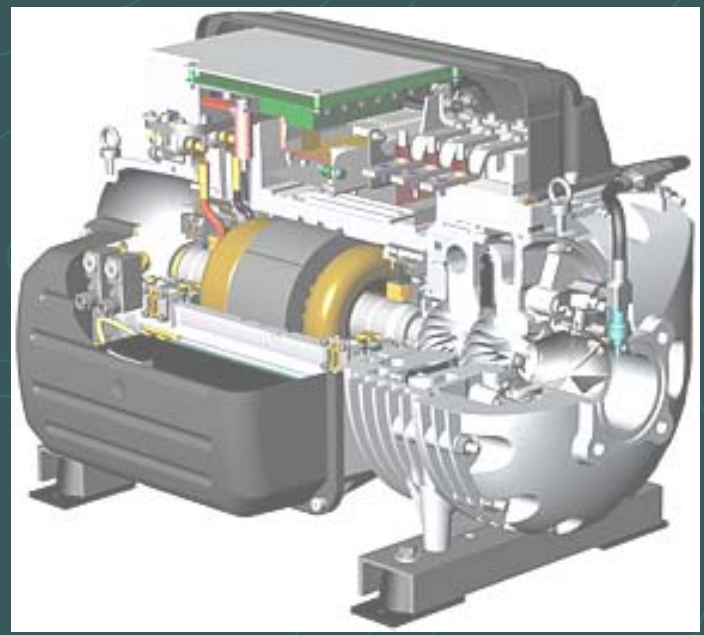


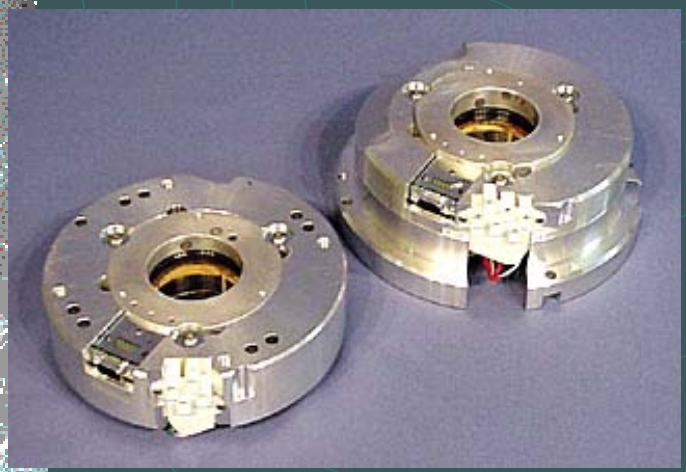
New Chiller Technology

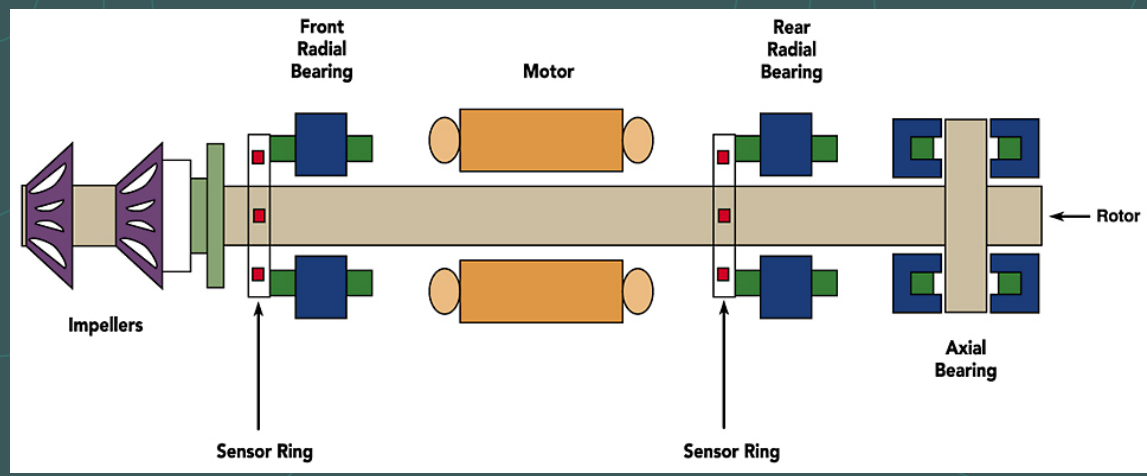
Turbocor Compressor

The magnetic bearings have less than 0.2% the friction loss compared to conventional bearings

Magnetic bearings and sensors keep the shaft properly centered







New Chiller Products

Carrier Evergreen VSS

- Variable-speed screw (standard) 200 to 1500 tons
- Full-load below 0.52 kW per ton
- IPLV estimated at 0.30 kW per ton
- Power Factor is 0.99

Broad Spectrum Absorption

- Simultaneous cooling, heating, and hot water
- Size range: 33 - 2,600 tons
- COP 1.34 MBH cooling per MBH fuel input
- Natural gas or Oil

THANK YOU !

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AdvanTek