Section III- Chillers

Summary:

- Types:
  - Reciprocating
  - Screw
  - Centrifugal
  - Scroll
- May be air or water cooled.
- COPs range from 3 to 9. (EER 10 to 30)
Narration:

Chillers have bundles of heat exchangers, which transfer the heat from refrigerant to water. Then the water is exhausted out to a rooftop or pad mounted heat exchanger, which is the cooling tower, while the other bundle releases cold water, which gets sent to a coil on the other side of the building. When comparing chillers to direct expansion units, the process is quite similar. The fundamental difference is that chillers pump water instead of pumping refrigerant, but they're both essentially the same thermodynamic process. One of the benefits of pumping water is that you don't need to worry about refrigerant leaking out, and it is easier to pump. Chiller can also be quite large, and you can have one high capacity unit rather than multiple rooftop units.

There are several different types of compressors, and some of these technologies are applicable to direct expansion units. The air or water can be cooled outside by blowing air across the coil or dripping water across the coil, which makes it heat faster. Although water-cooling is more efficient, the added application and treatment of water requires more time. Therefore, only larger buildings with maintenance staff tend to have these systems.

- **Isolation Valves**: reduce heat loss in idle units and reduce pumping energy.
In this particular instance, isolation valves were installed so they did not need both chillers at the same time. If they isolate one chiller, then they aren’t wasting energy by cooling off all the extra mass, and then it was bleeding some of that heat out. And I think it reduced the pumping energy as well.

This chiller was 8.9 COP. In this case, it was rated an IPOV of .4, so kilowatts per ton. Their estimated savings was 300, and so $30,000 per year. It cost them about $300,000 to put in, and they got an incentive of $102,000. So this is an example of how an incentive helps pay for an expensive piece of equipment in that can save a substantial amount of money.
• **Water-Cooled Chillers:**

   **Magnitude™ Water-Cooled Frictionless Centrifugal Chillers—145 to 550 Tons**

   - Energy savings with part load performance as low as 0.31 kW/ton IPLV; full load performance as low as 0.52 kW/ton
   - Quietest sound levels in the industry with sound pressure ratings as low as 76 dBA per ARI Standard 575
   - Lower maintenance costs because the frictionless, magnetic bearing compressor design eliminates the oil support system
   - R-134a refrigerant with no ozone depletion potential or phase-out schedule
   - Controls flexibility—MicroTech® II controls with our Open Choices™ feature for easy integration with the BAS of your choice

For more detail, refer to Catalog 602. For the most current information, refer to www.mcquay.com.
**Air Cooled Reciprocating Chiller:**

- 1967 Carrier reciprocating chiller with a 100 HP motor
- Air cooled cooling tower
- Likely a COP of 1.5-2

This old high school had a well-maintained reciprocating chiller. They had an air cooled tower outside, so there’s no water. The COP was likely very low, possibly 1.5 to 2.

A COP of 1 would actually be non-functional… That would be putting as much energy in as you’re moving out.

So in this case, the chiller could be much more efficient.