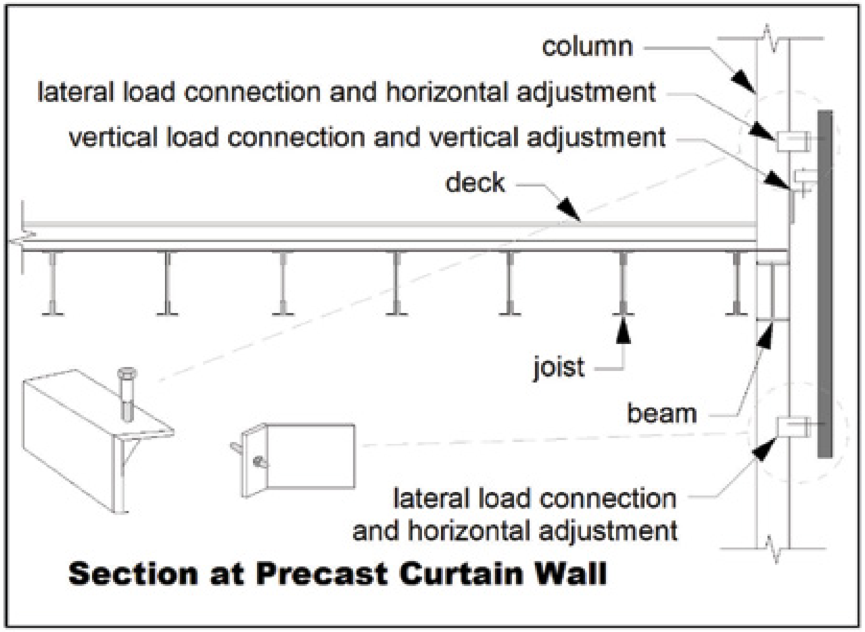


Figure 25. Method of support for a precast concrete curtain wall.

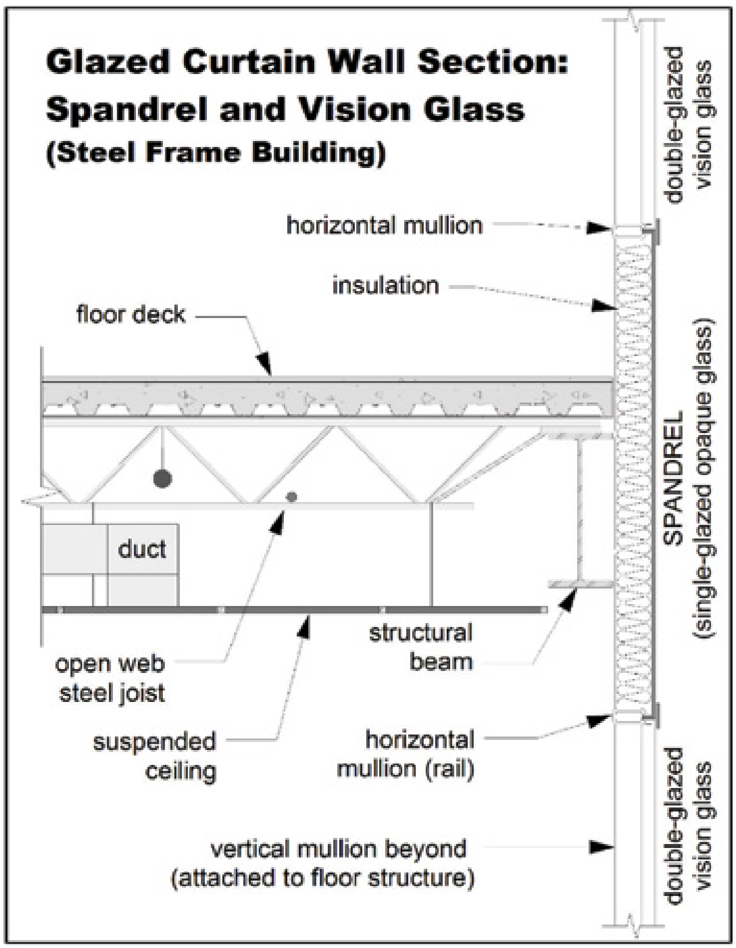


Figure 26. Glass curtain wall section – spandrel glass and vision glass.

Difference between single phase and three-phase power

Single-phase power

Single-phase power is what we are used to working with on a typical home inspection. Power is supplied at 240 volts (range 220V to 240V). The voltage fluctuates from +120V to –120V. The voltage at any point in time could be any value from +120 to –120. The voltage could be 10 volts, 50 volts or zero volts! The voltage fluctuates at a rate of 60 cycles per second (hertz). The frequency is fast enough that we don't notice that the voltage is fluctuating. Household appliances work well in this mode although the voltage may be zero at points in time.

Three-phase power

Machinery that requires lots of power will "notice" the peaks and valleys in single-phase power. "Full power" is only exerted at the top and bottom of the cycle.

Three-phase power is actually three separate power transmissions. Each of the three transmissions is similar to a single-phase transmission (it fluctuates at 60 hertz, etc.). Each of the transmissions is set up to be "out of phase" with each other. When one of the three transmissions is at a very low voltage, one of the others would be at a much higher voltage. In other words, when one of the phases is not supplying much power, there will be another phase kicking in to even things out.

The three power transmissions are out of phase by the maximum amount possible, that is, 120 degrees (one-third of a full 360-degree cycle).

What's the significance?

Three-phase power is much more "even." The machinery will not notice the fluctuations. The total power supplied is much greater.

Where do you see three-phase power?

Most commercial buildings will have three-phase power even if there is no machinery. Anywhere that a large amount of power may be required, three-phase power will generally be present.

Just because three-phase power enters the building, it does not mean that you can't run single-phase equipment. You can split-off any single phase from the three-phase source.

How do you recognize three-phase power?

Single-phase cables

A single-phase power source will have two "hot wires" and a neutral wire. When you look at the cables coming into the home or building, you will see two "non-white" cables entering the service mast and one white or bare cable (only bare as a service drop from the electric utility – not inside the service mast or the panel). These two cables provide a potential difference of 240 volts with a single phase – voltage fluctuates from -120 to +120. There will be a third cable called the neutral – this cable maintains a potential of zero (or ground potential) so that if you tap from neutral to any one of the two hot cables you get a 120-volt source.

Three-phase cables

A three-phase power source will have three hot wires — three non-white cables. You may or may not have a neutral cable depending on the transmission type. For example, a 600-volt service can have three hot wires with a neutral (four-wire) or without a neutral (three-wire). Modern three-phase transmissions will have a neutral cable and hence four wires.

Most modern installations are underground services (service laterals)

♦ Cooling towers

The basic job of the cooling tower is to dissipate the heat collected at the water chiller. This is done by spraying the warmed water over baffles (wet deck surface) and blowing outdoor air across the baffles to carry away the heat. The blowing and spraying effect also causes some of the water to evaporate, which carries away additional latent heat. Latent heat is the heat absorbed by the water, as it changes state from a liquid to a gas.

A water makeup assembly is required at the cooling tower to account for water that does evaporate. Water treatment is required to minimize the potential for corrosion, scale and algae buildup.

On older units, the baffles are made of wood and are prone to rot. Newer units have wet deck surfaces made of PVC. Drain pan heaters may be required if operating the system when the outdoor temperature is below freezing.

Two-pipe versus four-pipe systems

Most cooling towers are two-pipe systems. That is, one pipe carries water to the tower, water is sprayed and loses heat and one pipe carries water back to the chiller.

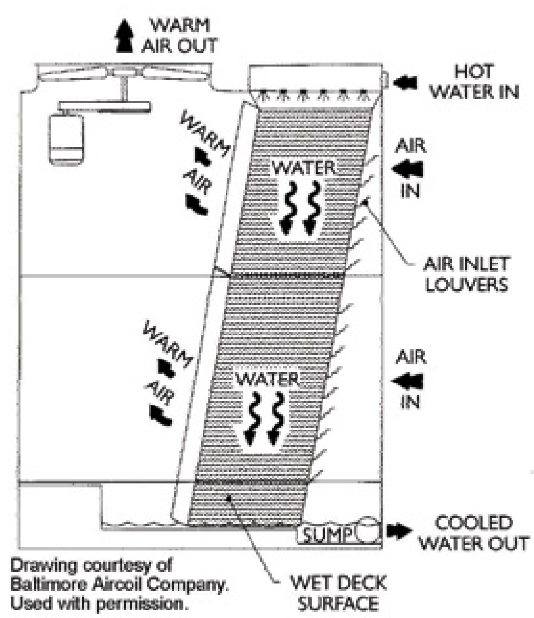
In a four-pipe system, the water from the chiller does not get exposed to the exterior air. Instead, the chiller condenser water is run throughout a heat- exchanger, to remove the heat. Water from the pan is sprayed over the heat exchanger.

The advantage of the four-pipe system is that the condenser water is in a closed loop and, therefore, there are less problems with corrosion, scale and algae.

Inspection procedure

Since cooling towers are used in conjunction with central chiller systems, the inspection of this component should be carried out by your specialist. General inspection procedures include the following:

- Look for inoperative dampers
- Look for corrosion of steel framing
- Check circulation pump and piping
- Check float valve and water supply
- Check baffles for rot, damage and buildup
- Check fan and motor for corrosion
- Check drain pan for corrosion
- Check internals for algae and mold
- Check drain pan heater (if so equipped)



Principle of operation of a cooling tower

One thing that should be done is to keep track of cost estimates you prepare for future projects. Similarly, when owners, clients, contractors, etc, show you proposals or receipts for work done, you should be making note of the scope of work and breaking the cost down on a per unit basis. This information should be kept in a data base and referred back to for future projects.

Cost Estimating Example - Reroofing a Building

Let's use an example of reroofing a single storey warehouse building in Cleveland, Ohio. The building is currently covered with a conventional built-up asphalt and gravel membrane. There is good access around the building and the work can be carried out during regular business hours. You have estimated that the building measures approximately 100 feet by 200 ft or 20,000 square feet of roof membrane is being replaced. The recommendation is to remove the old membrane first and to replace, not re-use, the metal flashing.

Unit Pricing

The different steps involved and the various components in the roof assembly must be considered individually. After that, the individual costs for each item can then be added together.

Remove and dispose of existing membrane and flashing.

The following table from RSMeans shows the data for estimating demolition work – removal and disposing of the old materials. From line number 1010 on insert page number 33, we note that the cost per square foot for deconstruction of a built-up roof assembly is given at $1.62. On page 31, the dump charges for building materials are given on line 0100 as $90/ton. Assume that the existing roof materials weigh 4 lbs/sq ft.

Insulation

The cost for new insulation is given on page 166, line 1715 as$ 1.16/sqft for 1 ½ inch polyisocyanurate; because of the hot roof being applied, there will be a ½ inch fibreboard insulation applied on top of the polyisocyanurate (from line 0110 on page 165 add $0.79/sqft).

New Membrane

Page 177 lists the different variations for built-up asphalt membranes. There are many options here. At the top, lines 0120 and 0140 tell us that system includes an asphalt flood coat with gravel/slag surfacing, but does not include insulation, flashing or wood nailers. While there are many options for the built up roofing systems, the costs are fairly close, ranging from $2.50 to $4.00 per sqft. For this example, we will use line 3800 which is $3.05 per sqft.

Metal Flashing

Page 183 lists various options for roof flashing materials. At the top, line 0011 allows that there would be up to 4 bends in the metal. For this example we will choose line 9320 – 20 gauge galvanized steel. The cost given is $5.65 per sqft of metal (not roof area). We will assume that