Sizing a Condenser

A condenser is properly sized when its capacity to transfer heat from the system is equal to the cooling load, plus the extra heat generated by the work of compressing the gas. This total is called the Total Heat of Rejection.

There are some proven rules of thumb for sizing that can get you in the ball park. For air-conditioning or a high back pressure system, it's safe and convenient to size by nominal horsepower.

High Back Pressure System (air conditioning)

Size by nominal horsepower

1 HP = 12,000 Btu per ton plus 3,000 Btu for heat compression = 15,000 Btu

Sizing by Nominal hp

In the condenser specification section of the catalog, note that most Standard condensers are rated by nominal horsepower in a fouled condition. An SST-750A for example will provide 7.5 hp after being in use for some time and fouled. It will provide 12 hp when new. This means that there is additional condensing or total heat rejection capacity, available when new.

It is often possible to size a condenser by matching nominal horsepower to compressor horsepower in commercial or high temperature systems when manufacturer's information is not available. You can estimate the total heat of rejection by multiplying motor horsepower by (3000) to find the heat of compression, and then adding the load. In the following example, the nominal horsepower of the compressor will match the nominal tonnage of the air-conditioning system and the Total Heat of Rejection.

A 15 hp compressor in a 15 ton system, produces 225,000 Btu per hour total heat of rejection, That's 3,000 Btu for heat of compression, plus 12,000 Btu of load for each ton.

Heat of Compression: 15 hp x 3000 Btu/hp = 45,000 Btu

Evaporating Capacity: 15 ton x 12,000 Btu/hr = 180,000 Btu

Estimated Total Heat Rejection: (45,000) + (180,000) =225,000 Btu

Once you have determined the total heat of rejection and the corresponding condenser capacity, you are ready to refer to the Standard performance data to make the proper selection.

In looking at the capacity data for the SST you will note that total heat of rejection, gpm, and pressure drop in psi are provided for various Initial Temperature Differentials from 15°F to 40°F. You can now look for a Total Heat of Rejection that exceeds the 225,000 Btu requirement, and read the corresponding flows and gpm. An SST-1500A (2 pass) will provide the desired performance with 44 gpm and an ITD of 20°F or, 24 gpm and an ITD of 30°F. You will notice that models through an SST-4505A would also perform well. However, they will cost much more. An SST-1500A, 15 hp condenser, is the ideal choice since the Total Heat of Rejection required falls in the middle of its performance window.

City Water = 75°

Condensing Temp. = 105°

However, matching nominal horsepower can result in over-sizing for low and very low temperature applications, and over-sizing costs more. While sizing by matching nominal compresser horsepower to condenser horsepower is often accurate, the best practice is to begin by calculating the actual total heat of rejection.

Sizing by Total Heat of Rejection

For example, total heat of rejection for a system with the following performance characteristics would be calculated like this:

Compressor Performance from manufactures published data.

110°F condensing temperature
10°F evaporating temperature
75°F incoming water temperature
Refrigerant R-22
Evaporating Watts = 6500
Evaporating Load: 40,200 Btu

Watts x 3.4 = Heat of Compression
Heat of Compression + Evaporating Load = Total Heat of Rejection

6500 watts x 3.4 = 22,100 Btu
Heat of Compression = 22,100 Btu
Evaporating Load = 40,200 Btu
Total Heat of Rejection = 62,300 Btu

Tower Water = 85°

Condensing Temp. = 105°

Although the refrigerant is R–22, the condensing temperature is not the same as the ARI standard of 105°F which means that the Standard catalog cannot be used to make your selection. In this case, you can call your local representative or one of Standard's sales engineers for a computer generated selection. In this case, a SST–200A (4 Pass) will perform with 7.27 gpm and a pressure drop of 1.75 psi. The 62,300 Btu load would normally require a 5 hp (SST–500A) at the usual ARI rating point of 85°F, 105°F condensing, and R–22. The SST–500A would work in this application although it is three times larger than necessary.

Heat of Rejection
Air Conditioning or
Refrigeration Load
+
Heat of Compression
=
Total Heat of Rejection

You should always compare performance data when your application conditions vary from normal operating conditions, in order to arrive at the best match for your application.

Other Considerations

Remember to consider all of the factors that affect performance; not just flow rates, TD, fouling, pressure drop, and types of fluid, but also the pull–down factor and pumpdown capacity. Higher loads under pull–down conditions call for an additional ten percent capacity if a very short pull–down time is required, or if slight increases in head pressure or water flow are unacceptable. In a 66,000 Btu system, you must add an additional 6,600 Btu for a total condenser sizing requirement of 72,600 Btu. Pumpdown requirements relate to the amount of refrigerant storage available in a condenser during operation or servicing. A pumpdown capacity of three pounds of refrigerant per ton of capacity will be sufficient for most systems. However, commercial refrigeration systems may require up to seven pounds per ton because of long refrigerant lines. Standard rates its condenser pumpdown capacities at 80% of the total volume.

In addition to selection tables, you can also utilize Standard's computerized selection service. Just complete the information in our heat exchanger specification form and mail or fax it to our sales engineering department, or sales representative's office.

We are happy to build customized condensers if an application calls for a modified condenser with additional valves, water or refrigerant fittings, special mounting brackets, or other accessories.