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Brief Resume Low Charge Pressure Receiver

Introduction.

The LCLP receiver has been designed to allow refrigerating systems to operate with much smaller refrigerant charges than direct expansion / pumped circulation systems.

The escalating costs of refrigerants associated with the production limitations stipulated in the Montreal Protocol mean that considerable savings can be made by designing our plant to hold minimal charge.

Designing for minimal charge is also seen as environmentally beneficial.

Liquid Sub-Cooling.

This design includes a heat exchanger normally mounted below the main vessel. The refrigerant liquid from the condenser is sub-cooled by heat exchange with the overfeed of liquid from the wet suction return. The refrigerant vapour passes from the heat exchanger up through the main receiver, which has been sized to allow good droplet separation.

The HP float switch is before the heat exchanger and the expansion device is after the heat exchanger to aid sub-cooling by ensuring that there is a full bore of liquid through the heat exchanger.

In the working state there will be negligible charge in the main vessel, however the vessel must be sized to act as a receiver for all the liquid refrigerant, which could return to it (50-60% of the total charge depending on complexity of the system).

Oil Rectification on Fluorocarbon Plant.

An external (condensing) type, oil recovery heater is used to recover oil. This may be liquid or hot gas operated.

On smaller jobs, if hot gas is used, then the condensed high pressure liquid is "bled off" from the oil rectifier via an orifice directly into the liquid sub-cooler.
On larger jobs, if hot gas is used, then in place of the orifice we would use a Danfoss OUB float valve.

Reduced Compressor Discharge Temperatures

There is no upper heat exchanger. The full flow area is available for droplet separation. Operating with minimal suction superheat means lower compressor discharge temperatures which much reduces mechanical / oil degeneration.

Summary of advantages with the low Pressure receiver over other systems.

Compared to DX Systems.

- Enhanced efficiency.
- Lower compressor discharge temperatures.
- Better use of evaporator surface. (flooded operation)
- Excellent distribution in evaporator due to substantial sub-cooling.
- Receiver can store excess refrigerant.
- Higher reliability and eliminates risk of compressor damage due to any liquid carry-over symptomatic of other systems.
- All control valves on the packaged unit if required.
- Can combine easily with reversed cycle defrost. (4-Way CardioValve-J.Semiras Design)
- Improved efficiency in low ambient conditions.
- Longer life and lower maintenance costs.
- Minimum site work required during install.
- Closer approach temperature in evaporator (no superheat).
- Automatic oil return from evaporator.
- Performance not adversely affected by pressure drop in liquid line.
- Better control under part load conditions.

The above describes some of the advantages over D.X. systems without pumped circulation complexity and cost.

Compared toPumped Systems.

- Much reduced refrigerant charge. (typically 70-80% less). (eg. 470 kW Duty / 35kg) Charge R717
- Reduced capital cost.
- Simplicity of operation.
- No power required for refrigerant pumps.
- Easier to maintain so greatly reducing maintenance costs.
- Less pressure drop in wet suction line.
- Smaller suction and liquid lines.
- Simpler and more efficient defrost system. (Typically one quarter of the time). • Simpler control system.

• Compressor/receiver packages easily built in factory so less site work needed. • Improved safety - with fewer flanges in the roof void and/or store with reverse • cycle defrost compared to hot gas defrost.

- Less chance for gas leakage from the HP side to the LP side.

Resume.

The above states a few advantages as compared to a pumped circulation system. One huge advantage is the capability to keep the design single stage operation without penalties.

There is no restriction regarding refrigerants. All types can be used, even refrigerants with high glide characteristics.

Another possible selling point is the retrofitting potential for installing an LPSS to an existing D.X system. (Pending examination of existing coolers.)

The above design has no duty size restrictions, so very small packs can be provided.

I have also built some very large plate heater/chiller systems using this design. One advantage is not needing a gravity head to the plates. (surge drum (H) over (PHX).

There are a lot more advanatges, we would be pleased to provide more information if required.

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