Waste Heat Systems
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Comparison Adsorption Chiller VS Absorption Chiller hot water fired

	Adsorption Chiller	Absorption Chiller
Refrigerant	Water	Water
Adsorbent/Absorbent	Silica-Gel	Lithium-Bromide
Adsorbent/Absorbent Costs	is included, does not need to be replaced	$ 1,200.00 for 30 gallons
Vacuum Pump	**Yes (but operates 1 hour out of every 40**	Yes
Refrigerant Pump (Water)	**Runs only when chiller unloads**	Continuous
Absorbent Pump	**not applicable / not required**	Magnetic, continuous operation required
Automatic Valves	**Butterfly Valves (simpler operation)**	3 Way Control Valves
COP	0.7	0.7
Cooling Tower Size	Heat of rejection equals Cooling	Capacity plus amount of heat input
Corrosion	**None !**	**Strong**
Crystallization	**None !**	**Yes !** 1. On low temperature cooling water 2. On air leakage into the machine 3. On power loss/ failure of dilution Malfunction 4. On failure of a pressure-reducing valve
Warm up (Start)	**0 to 7 minutes after long stop**	Loss of Heat source - 30 min.
Dilution Cycle (Stop)	**Not applicable**	Yes 15 min.
Inhibitor	**None required**	Inhibitor with heavy metal, check inhibitors' warning label
Chiller Life Expectancy	**More than 30 years**	7 to 9 years
Frequency of replacement of adsorbent or absorbent	**Not necessary**	Every 4 to 5 years
Replacement issues	**Not applicable** **Not necessary**	Hard to dispose of Li-Br because corrosion inhibitor is a heavy metal and requires a disposal fee. Plus new Li-Br replacement is $1,200.00 per 30 gallons
Heat Exchanger replacement	**Not applicable**	Should be considered due to corrosion
Back Up Boiler/Heater	**Not necessary**	Needed at to maintain 185° F. Add to installation cost since users might notice the machine is being driven by the boiler/heater rather than the waste heat source)
Required Hot Water Temperature	Operates down to 122°F (but no problem if temperature goes below this) 90% output @ 176°F 70% output @ 160°F 45% output @ 122°F	Shut down at 180°F or need back up heater to avoid crystallization only 50% output @ 176°F 0% output @ 160°F or below 0% output @ 160°F or below
Input Condition of Cooling	Fluctuation is no problem The lower the temperature, the higher the refrigeration capacity	Must be stable Need 3 way-control valve to control between 75°F to 85°F. This means a $ 2,000.00 valve and a $ 1,000.00 Control valve must be added to the installation cost

Please contact WHS for a direct 30 year operational financial comparison between adsorption and any other industrial refrigeration system. WHS also conducts steam optimization reviews to extend your plant's existing steam energy.

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Comparison Adsorption Chiller VS Absorption Chiller hot water fired (continued)

	Adsorption Chiller	Absorption Chiller
Chilled capacity control	Built-in 7 step unloading	Need 3 way-control valve to by-pass return water extra cost of $2,000.00 to $6,000 valve, plus $1,000.00 Control /add to installation cost
Chilled Water Temp.	**37.4°F is available as standard**	48°F normal / 41°F for experimental
Maintenance	Very minor service every 3 years 1. Vacuum pump oil level 2. Butterfly Valves Seat **"Set and forget"**	Expect contiuous service tasks & monitoring 1. Liquid analysis (replacement indication) 2. Pumps 3. Controls 4. Back Up Boiler 5. Air Leakage 6. Li-Br exchange 7. Heat exchanger replacement (corrosion) Market comment: Almost all absorption chillers in hospitals and hotels are replaced with power hungry centrifugal chillers due to bothersome and expensive maintenance.)
Complexity	Simple - understandable mechanical operation of common valves and vacuum pump. Refrigerant is only tap water, so pipe or valve work is easy and without hazards.	Complex - Chemical operation which typical facility mechanics do not easily understand the chemical phenomena and its problems and required corrections. Specialists are commonly needed.
Reliable	**Yes - very simple, very reliable**	**No**
Initial Price	Almost the same, but consider installation cost	
Pay back	**less than 2 or 3 years**	**Doubtful**
Summary of Technology and Experience	Silica-Gel Adsorption is a newer technology first applied commercially in 1986 by Nishiyodo, and since then perfected through over one hundred installations primarily in Japan and Germany. ***In July 2003, the first two Nishiyodo North American installations started up in California. Commissioning and start up at these new installations each took less than two days - reflective of the simplicity and ease of operation of this 'new' technology. Through patents Nishiyodo remains the only company providing commercially viable Silica-Gel adsorption systems.***	Lithium-Bromide technology has more experience from different sources and a good number of installations. But due to its basic Li-Br chemistry in general it has gained a much less than positive perception by operators, with many bad experience stories of crystallization available within the marketplace. ***Alternatively, with the stated advantages of Silica-Gel adsorption, facilities will enjoy significant operating and energy cost advantages - causing Silica-Gel adsorption to eclipse Li-Br absorption as the preferred method for reliable low temperature waste heat waste recovery.***

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