

Refrigeration spring/summer check, shutdown and checkup/maintenance by ACT/BTU.

While system is still operating in spring/summer run:

- Are all compressors running? (if multiple), you can lower temp setpoint to make sure your system is calling for all ref circuits to run. Any of the units sound different? (possible issue)
- If running for at least 15-20 minutes – you should have all units running by then, if you notice one unit starting and stopping frequently when calling for all units to run it may be a sign of a refrigerant charge issue (in normal operation refrigeration units will stage up and down and that maybe normal as long as not too frequently).
- Inspect condenser coil- outdoor coil for dirt and lint from grass/trees (this last one can quickly clog up the coils – you can use soft brush to brush that away even while system is running , condenser coils even withing 1-2 weeks can get stuffed up with lint, so check them on weekly basis if you have an area that causes clogging of the condenser). You want to look at upstream side/intake air side of the condenser coil.
- Look around the refrigeration lines, compressor, cooling coils (if accessible) other devices to see if any signs of dirt, oil or sort of wet dirt (that is oily), it is likely sign of refrigeration leak – those can be costly – refrigerant is not cheap and the performance of your unit will be poor as well while short of refrigerant – quick check if you are running a full charge is to touch smaller line coming out of the ref unit – that is a liquid line – it supposed to be warm/lukewarm – if it is hot to touch there is not enough refrigerant in the system/also your condenser maybe dirty and it is not compressing enough liquid to push down the line.
- If the condenser is dirty springtime is the time to wash it – see outdoor unit wash procedures document from ACT/BTU for instructions on how. You can do it “in house” or have it done by a professional – ask you service provider for instructions or have them show you how. You generally don’t need chemicals just water to clean it – beware – electrical has to be disengaged/off and el equipment secured/covered with plastic so it does not take on any water – units are made to be outside in a rain but not secured enough to have stream of water in certain areas. Check to make sure no water has penetrated any electrical before powering unit back on, if it was off just for 1-2 hours you should be fine to restart, if not sure or longer let it sit for an hour or so powered up before re-starting.
- Check if your condenser fans are all running – best is to check that on a hot day at peak temperature, system will naturally call for them all to run then.
- Temperature check – properly designed units will pull 1-3 deg F (avg 2 deg) between return temperature and plenum (feed temp), if you running at 0 differential or negative check your fresh air intake to make sure it is closed – if yes then ref unit is not operating as it should – go thru the above list first – temperature check should be done if you are not holding your setpoint within a 1 deg F – e.g. sp is 60 and plenum temp is 61 deg F.

Benefits of refrigeration check/spring-summer maintenance while operating.

- You keep the unit efficient in operation – easier on equipment running, less costly to operate, you will extend the life of the equipment

- Refrigeration amounts to more than half of the operating cost of your storage - power wise so you want it to run efficiently, dirty condenser can cost 10-20% more in energy to operate anytime, dirty cooling coil about the same
- Compressors are the most costly refrigeration part – they should run for a long time since they are not a combustion type engine – low refrigerant charge or dirty condenser both cause overheating of the compressor, both can be can cause premature failure of the compressor, compressor cost – about \$300-500 per hp.
- Refrigerant will cost from 10-35\$ per lb depending on type of refrigerant used, so leaks cost money – 15hp compressor will likely require 105 lbs of refrigerant total so it can cost you \$1050 to \$3500 for a full charge, professional leak check is a must once per year
- Few minutes of your time can save you a lot of maintenance cost, check your units as mentioned above every two weeks – it pays to keep an eye on it – just like you check your fields
- Best time to check for overall efficiency is when outdoor temperatures reach above 90-95 deg F, this is the ultimate test for refrigeration unit performance or its lack of and time to be proactive
- It is a good practice to have your professional check your systems in the spring before it gets hot, **preventive maintenance saves money and it does not take much time to do it**

Refrigeration shutdown and maintenance.

- Before you shut down the system it is good to recheck the unit as mentioned in this document, please try to do it just few days before the storage is empty
- If you want to turn off power to the unit when not in use, please make sure that compressor is disabled so when you turn power back on it won't start – it can fill with liquid refrigerant when off – since its internal heater is off, when power is back on compressor needs at least 3-6 hours to warm up to boil off refrigerant inside- check with your service provider on how to secure compressor form starting on power up, you can check bottom of the compressor if warm after an hour or two if should feel warm to touch
- Wash condenser coil and cooling coil as needed
- Have your service tech check your system
- If you have computer system in your ref unit, it relies on temperature sensors/pressure transducers to run at optimum – they need to be checked for accuracy and replaced as needed
- Compressor starting contactors – if the unit has a lot of use thru the season compressor contactors should be inspected every couple of years and replaced – major cause of compressor failures is bad contactors, that also applies to condensing fan contactors but those will last much longer if properly sized – oversizing starting contactors is a good practice – they last longer and may not cost much more than original size– so when needed to be replaced ask to upsize them
- Condensing units/outdoor units can have fair amount of vibration – electrical connections should be checked annually or every second year if they are tight – Copeland Compressor manufacturer estimated that 80% of compressor failures are due to electrical issues and loose wires are part of it
- If you use unit coolers inspect the fans and give them a good wash thru, it is highly recommended that you use hot water wash (can use steam cleaner with low pressure wand to produce 180-200 deg F hot water instead of steam) – hot water will remove dirt, mineral residue, bacteria and mold –

same procedure as condenser coil wash is applied to cooling coil, dirty unit cooler can reduce cooling efficiency by 30-50% - so take your time to clean them. When filling and curing in storage try to use auxiliary booster fans if you need to run air so the unit coolers don't clog up with dust right away diminishing your capacity – you will need it after the cure or in the spring and it will be very hard if not impossible to clean them later

- If you have compressor/condenser fan VFD's – they need to be cleaned annually – blow them out with compressed air (use air compressor – no liquid compressed that can cause condensation since it comes out very cold) or nitrogen to clean heatsinks, also the cabinet
- Some electrical enclosures – especially containing computers/ VFD's have cooling fans and filters to cool enclosure down – they need to be cleaned and inspected 1-2 times per year – spring/fall)
- **Ask your service provider what can you do in house and how – it will save you money and extend the life of your equipment, as in your home this is the most expensive piece of machinery in your storage – with proper maintenance it will last much longer**

Global warming issue affecting refrigeration systems.

Mainly a periodic occurrence on Earth, we do contribute to it, but the fact is - **our climate is shifting.**

Spring is cooler, summer gets hotter and last longer, fall is warmer and winters slip past Christmas for most of us. This poses new challenges for the refrigerated storages already.

Here are few things you can do to help alleviate refrigeration under-capacity issues due to weather.

- 1) Keep up the maintenance and cleaning – that is number one ally you have
- 2) For new units ask for higher ambient temperature design of 100 or 105 Deg F ambient for the condenser (basically oversized condenser), most units today are sized for 85-95 deg F, but they lose efficiency by as much as 20% at 95 deg F or above - basically they get de-rated – the only remedy is to upsize condenser and ask for 15-20 delta T design (temp gain across the condenser coil). This will keep your unit at full capacity at higher temperatures – small price to pay but when you need it - priceless - and you will use less energy, less breakdowns of course
- 3) If you are planning to cool hot product down (75-85 deg F) your refrigeration may not be designed for it, it comes down to excessive gas pressure due to high storage temperature (they are directly related), compressors are made to pull gas at certain pressure range, above that range amps increase and compression decreases while compressor will start to overheat as well, CPR valves can be installed to limit return pressure of the gas to safeguard your compressor from stopping, when CPR is active and regulating you will loose some capacity but your system will run, new units should have them installed if you want to cool hot product down, they can be added to existing units also but need to properly sized – planning is everything in design
- 4) **Second issue with cooling hot product down is the design of the condensing coil mentioned above, for existing units you already have, there are two approaches to consider:**
 - a) Add swamp cooler in front of the condensing coil, if your unit is large you may need more than one, swamp cooler/evaporative coolers can reduce air temperature by as much as 20-25 deg F, that

would make a big difference since we can keep incoming air 70-80 deg when outdoor temps are 90-95 deg F- you basically regain capacity and keep the unit running

- b)** Sometimes condensing fans can be upgraded with higher air flow – that requires some engineering to size it properly – new generation fans are more efficient, it can gain us 10-15%
- c)** Do not spray water into the coils – mineral deposit will settle in it and it will be very hard to remove it – mineral deposit also is an insulator, so it inhibits heat transfer and “eats” aluminum
- d)** In some cases, refrigerant can be replaced to more efficient – that requires engineering thought
- e)** Proper design is the key, 1 ton of refrigeration per 1000 Bu no less, will keep you out of trouble

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