Frigoboat BD35 and BD50 Refrigerant Charge

General

Each Frigoboat BD35 and BD50 system component is charged individually during fabrication with a very precise amount of refrigerant under laboratory-like conditions. This allows customers to select different components from the available range of condensing units and evaporators, and then once the components are coupled together, the completed system will contain the correct amount of refrigerant. Because of the wide range of possible system configurations, plus the problems of weighing in such a small amount of refrigerant, especially on a moving boat, there are no published weights of refrigerant available for these systems. There are no published ideal system pressures available either, as these are constantly changing dependent on a wide range of factors and so are impossible to predict, but an experienced technician will be able to interpret system pressures. By far the easiest and most accurate method of determining the correct refrigerant charge level in capillary tube (cap tube) systems is by the ***Frost Line*** method. This requires no tools, no special equipment, no knowledge of refrigeration, just your eyes and your ears.

Warning!

Never use, or allow a technician to use, anything other than pure refrigerant R134a in a Frigoboat system. Cans of refrigerant R134a with additives must never be used, nor must stand-alone additives be introduced into the system. These additives include but are not limited to: leak detecting fluid, leak stopper, dye, extra oil, conditioner, etc. Serious damage can result from the use of such products, which are designed for use only in auto air conditioning, and not in low temperature refrigeration systems.

Symptoms of correct and incorrect charge using the Frost Line method

Correctly charged system

Frigoboat BD35 and BD50 systems are capillary tube systems, and require a very precise amount of refrigerant to work at maximum efficiency. Too much or too little refrigerant will result in a system that will have some cooling effect, but will not be working to its full potential. In a capillary tube system, the temperature of the evaporator is directly related to the amount of refrigerant in the system. There should be enough refrigerant in the system so that the last drop of liquid is evaporating (boiling, but at a very low temperature) back to a vapor at the very end of the series of raised channels in the evaporator, just as it connects to the suction tube back to the compressor. After running for a time, there should be a slight coating of frost all over the surface of the evaporator, but no condensation or frost on the bare copper tube back to the compressor. If the system has been installed correctly, the short length (typically 1m) of foam pipe insulation will be positioned on the copper tube starting where it exits the refrigerated box. This insulation, supplied with the evaporator, is required to prevent any nuisance condensation caused by cold tubing leaving a refrigerated box and being exposed to warmer, humid air. No further pipe insulation is required, and any extra that has been installed will only cause the system to run at less than maximum efficiency and may conceal symptoms of an overcharge. In a properly charged system, there should be a “tinny gurgling” sound in the evaporator.

Slightly undercharged system

If there is too little refrigerant in the system, it will have all evaporated back to a vapor before it reaches the end of the evaporator. Some of the evaporator surface will have a coating of frost, but on from the point where the refrigerant has turned all to vapor, the surface will be just cold and sweating. The frost will begin at the point where the liquid refrigerant is fed into the evaporator. The evaporator will probably sound similar to a properly charged system.

Seriously undercharged system

If the system is seriously undercharged, the refrigerant exists in the system only as a vapor, and so there will be no frosting on the evaporator, just a slight sweating and coldness to the touch. This could indicate either a seriously undercharged or seriously overcharged system. If it is undercharged there will be a hissing in the evaporator and there will be no sweat on the tubing back to the compressor.

Slightly overcharged system

Too much refrigerant in the system will result in liquid still evaporating back to a gas past the end of the evaporator and inside the tubing going back to the compressor. This means that there is still some of the refrigeration process going on inside the tubing, and there will be a build-up of frost or ice on the exposed section. If additional insulation has been added, it may be concealing this symptom and should be removed. The evaporator may appear and sound normal, but will be at a higher temperature than designed, resulting in poor efficiency and longer than expected run times.

Seriously overcharged system

If so much refrigerant exists in the system that it raises the temperature of the evaporator above 32 deg F, the surface will be sweating and cold to the touch, also resembling a seriously undercharged condition. But the copper lines leading back to the compressor, and maybe even the compressor itself, will also be cold and sweating, and there will probably be a sound similar to a mountain stream coming from the evaporator. This is a potentially damaging condition as liquid refrigerant could enter the compressor where it can damage the valves.

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