

## **Cascade Condensing Units**

ESS, Inc. has developed Cascade Condensing refrigeration systems for use in its proprietary Mechanically Refrigerated Thermal Platform Systems (MRTP). Cascade systems are able to reach very low temperatures (down to -75° Celsius). This technology is now available for sale as a complete condensing unit module for use in any system requiring low temperatures.

Conventional single compressor, mechanical refrigeration system condensing units are capable of achieving temperatures of about -40° Celsius. If lower temperatures are required then cascade refrigeration systems must be used. A two-stage cascade system uses two refrigeration systems connected in series to achieve temperatures of around -85° Celsius. There are single compressor systems that can achieve temperatures colder than -100° Celsius but they are not widely used. These systems are sometimes referred to as "auto cascading" systems. The main disadvantage of the auto cascading system is that it requires the use of a proprietary blend of refrigerant. This characteristic generates three service-related problems. Firstly, since the refrigerant blend is made up of different types of refrigerant with different boiling points, a leak in the system can cause the loss of only some of the refrigerant making up the blend, resulting in an imbalance in the ratio of the remaining refrigerants. In order to return the system to proper operation, all of the remaining refrigerant must be replaced with a new and potentially costly charge to insure a proper blend ratio. Secondly, since the blend is proprietary, it is not readily available from the traditional refrigerant supply sources and therefore may be hard to obtain and costly. Thirdly, because these

types of systems are not widely used, qualified field service personnel that are familiar with repair and maintenance procedures are sometimes hard to find. These and other issues can cause undesirable expense and downtime.

A cascade condensing unit uses two refrigerating systems that we will refer to as system A and system B. The condenser of system A, called the "first" or "high" stage, is usually fan cooled by the ambient air. In some cases a water supply may be used but air-cooling is much more common. The evaporator of system A is used to cool the condenser of system B called the "second" or "low" stage. The unit that makes up the evaporator of system A and the condenser of system B is often referred to as the "inter-stage or cascade condenser". Cascade systems use two different refrigerants, one in each stage. One type is used for the low stage and a different one for the high stage. The reason that two refrigeration systems are used is that a single system cannot economically achieve the high compression ratios necessary to obtain the proper evaporating and condensing temperatures.



## Options

<i>uP based digital control system</i>
<i>Scroll compressors</i>
<i>Hot gas bypass</i>
<i>Liquid injection</i>
<i>EIA 232 and IEEE-488 GPIB interfaces</i>
<i>Water cooled condenser</i>

