Carrier CORPORATION, Syracuse, New York

OPERATION AND MAINTENANCE

of

REFRIGERATION PLANT

installed at

ALTITUDE WIND TUNNEL

CLEVELAND, OHIO

Government Contract Number NAW 1460
Pittsburgh-Des Moines Steel Co. No. P-43
Carrier Corporation Number 2N 1135

BOOK No. 1

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INDEX OF DRAWINGS AND CHARTS

Book No. 2 is a separate and complete collation of the catalogues and instruction leaflets furnished by all of the vendors who supplied equipment used on the Carrier Contract. The book is bound in a separate cover.

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SECTION ONE

GENERAL DESCRIPTION OF SYSTEM

The refrigerating system serving the Altitude Tunnel is a combination flash and flooded system in that the latent heat of the liquid is utilized in absorbing the heat in the tunnel and because there is an excess of sub-cooled refrigerant circulated through the evaporator at all times. This system is comparable to a flash cooler type plant having a main flash cooler in which the refrigerant is 100% sub-cooled before it is pumped through the evaporator by liquor pumps.

Except for a few special auxiliaries, the system is basically similar to any flooded system. Special features, such as hot gas by-pass valves, float tank, liquid distribution valve, etc., are necessary for the special functions of de-frosting and proper distribution of refrigerant with variable flow. Essentially, the system includes the compressors or heat pumps, condensers, economizers, flash cooler, pumps and evaporator. The basic refrigeration cycle is as follows: Refrigerant vapor from the evaporator and from the flash cooler is drawn through throttling or suction dampers into a suction manifold from which the fourteen four-stage compressors pump the gas and compress this vapor before discharging it to the water cooled condensers. The gas in the condensers is at a condition of temperature and pressure which will produce condensation, after which the condensed gas or liquid passes through a high side or a condenser float valve into the two stage economizers or is returned directly to the flash cooler depending upon the operating conditions.

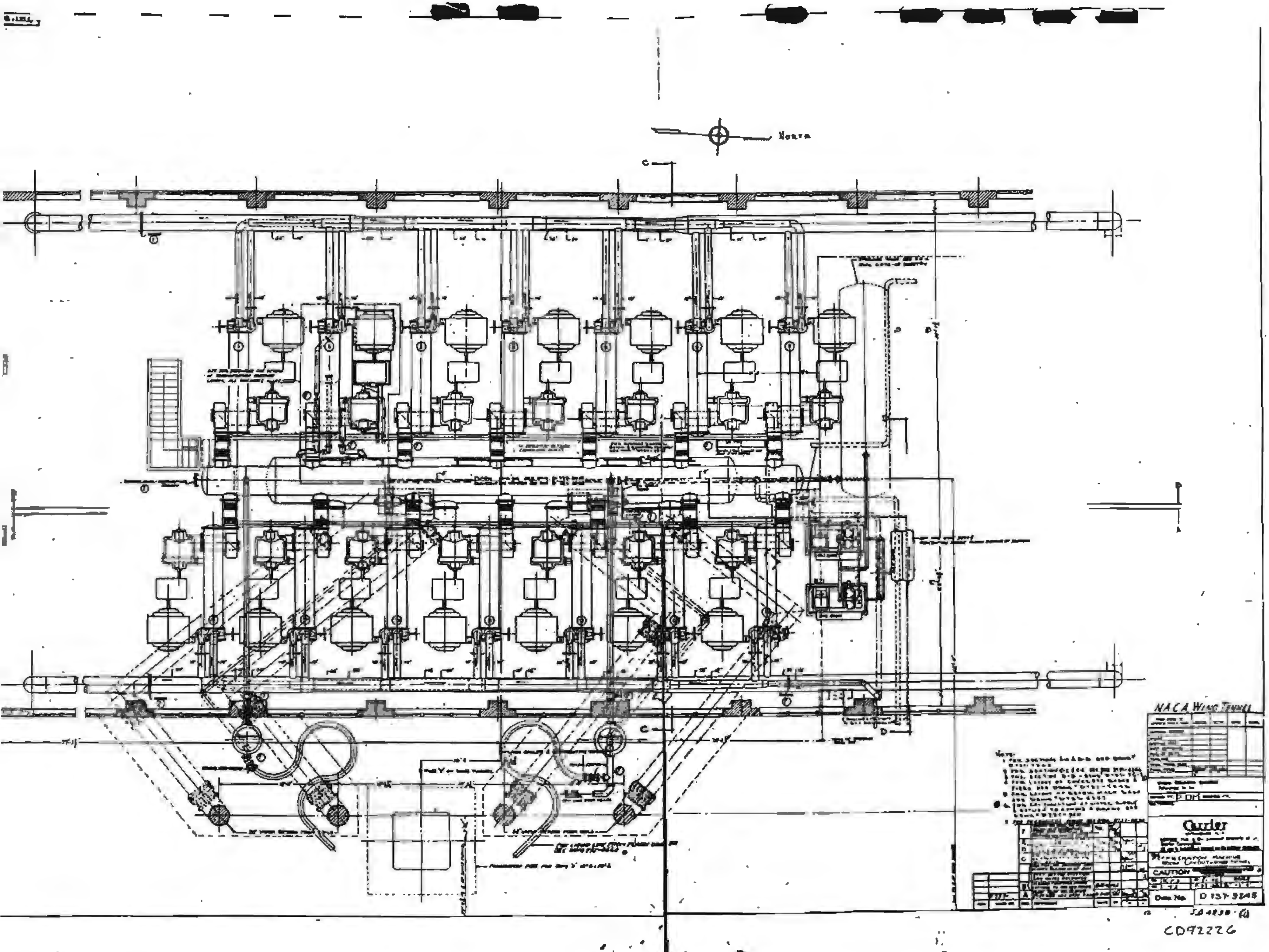
If evaporator conditions are such that the liquid enters the economizers the refrigerant is then flashed through two stages of pressure in which it is sub-cooled and the excess vapor returned to the 2nd and 3rd stages of the compressor. Liquid leaving the economizer, therefore, is at a temperature corresponding to the 1st stage discharge temperature of the machine. As it leaves the low stage of the economizer it flashes once again to evaporator temperature and the flash gas returns to the compressor. Sub-cooled liquid refrigerant is circulated by two main liquor pumps to the evaporator in the tunnel. Distribution of the liquid refrigerant to the various levels of the evaporator is maintained in the correct proportions by liquid distribution valves located at each level of the tunnel. These liquid distribution valves or weighted check valves, have counterweights which compensate for the static head at each level and thus admit the correct amount of refrigerant to each level regardless of quantity being circulated.

After entering the evaporator, approximately 60% of the refrigerant is evaporated and returned as vapor to the flash cooler while the excess liquid returns through the same lines.

During the de-frosting cycle, the hot gas from the compressor by-passes the condenser and is introduced to the flash cooler through special de-superheater tubes immersed in the refrigerant. The heat of compression, therefore, is used to heat the refrigerant in the cooler, thus raising the vapor pressure until there is a reversal of flow. Liquor pumps, of course, are shut down: consequently, hot gas flows in a reverse direction through the suction line to the evaporator where it is condensed and the condensed liquid returns through the liquid line to the float tank. In this vessel a special modulating float valve maintains a definite suction pressure on the evaporator. This supplementary pressure assists in returning the condensed refrigerant to the cooler. The mixture, returning from the evaporator, separates in the float tank where excess gas is drawn off to the suction header through the defrost line. During the de-frosting cycle, the condensed liquid by-passes the liquid distribution valves at each level of the tunnel.

After de-frosting has been completed, the liquor pumps are again put into operation, the hot gas by-pass valve on the condenser is closed and cooling of the refrigerant takes place in the conventional manner.

The auxiliary equipment required to make this system more flexible and to maintain proper conditions during shut down and during service, will be explained in more detail in another section of this Manual.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