THE UNIVERSITY OF MICHIGAN

COLLEGE OF ENGINEERING
Department of Mechanical Engineering

Interim Report

COMPARATIVE RATINGS OF TWO FREON (F-12) AIR-COOLED CONDENSERS OF DIFFERENT DESIGN

(Frederick Kent)

Frederick K. Boutwell
Assistant Professor of Mechanical Engineering

R. Clay Porter
Professor of Mechanical Engineering

Frederick J. Vesper
Assistant Professor of Mechical Engineering

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OBJECTIVE

The objective of this report is to present the results of a single phase of the research program now in progress for the Karmazin Products Company. Specifically, it describes the heat-transfer characteristics of two air-cooled refrigerant condensers when tested in accordance with a given standard.

PROGRAM

As a part of The University of Michigan Research Institute Project 2940, the units described below were tested according to the following standard test conditions.

Dry-bulb temperature entering unit	95°F
Dry-bulb temperature of ambient air	95°F
Saturation temperature of refrigerant vapor entering condenser	105°F
Actual temperature of refrigerant vapor entering condenser	170°F ± 10
Liquid refrigerant sub-cooling at condenser outlet	5°F max

The condenser units are identified in this report as follows:

Unit A	Unit B
3/8-in.-diameter tube	11/32-in.-diameter tube
66 fins	62 fins
10 x 10-5/16-in. face dimension	10 x 10-5/16-in. face dimension
1-15/16-in. depth	1-15/16-in. depth

Under the conditions of the test, the two units were tested individually, each with the same air fan and cowling to establish common air flow through the condenser sections.

TEST SETUP AND PROCEDURE

A complete refrigeration system consisting of a reciprocating compressor, refrigerant temperature control, condenser, receiver, expansion valve, and evaporator was set up for this test. The components are shown schematically in Fig. 1.

To make a test, the system is bled thoroughly to remove all traces of air, the compressor is started, and the flow rate and temperature controls are regulated until equilibrium conditions are insured for the test conditions specified in the program. When equilibrium conditions have been established, a data run is made.

A data run consists of a period of maintaining test conditions within the allowable limits for a period of from 50 to 90 minutes without interruption. Data are recorded for every 10-minute interval.

During a run the freon is condensed in the test unit and is drained into a receiver mounted on the platform scales. A fixed liquid level is maintained in the sight glass (see Fig. 1) by adjustment of the condensate drain valve. Since the lines leaving the condenser unit are well insulated, only that liquid condensed in the condenser is weighed. Since the weight and time for collection is known, the pounds per hour of freon condensed can be calculated, and from this, by use of tables of freon properties, the heat-removal rating of the condenser units can be evaluated.

RESULTS

The results of these tests are as follows:

Unit A	Unit B
3/8-in.-diameter tube	11/32-in.-diameter tube
66 fins	62 fins
711 Btu/hr	775 Btu/hr
10.6 lb/hr, freon condensed	11.45 lb/hr, freon condensed

CONCLUSIONS

These results indicate:

(a) Unit B (11/32-in.-diameter tube, 62 fins) has a higher condensing rate by almost 8 to 10%.

(b) Unit B should operate with a lower compressor head pressure than Unit A when under the same refrigeration load on a given system.

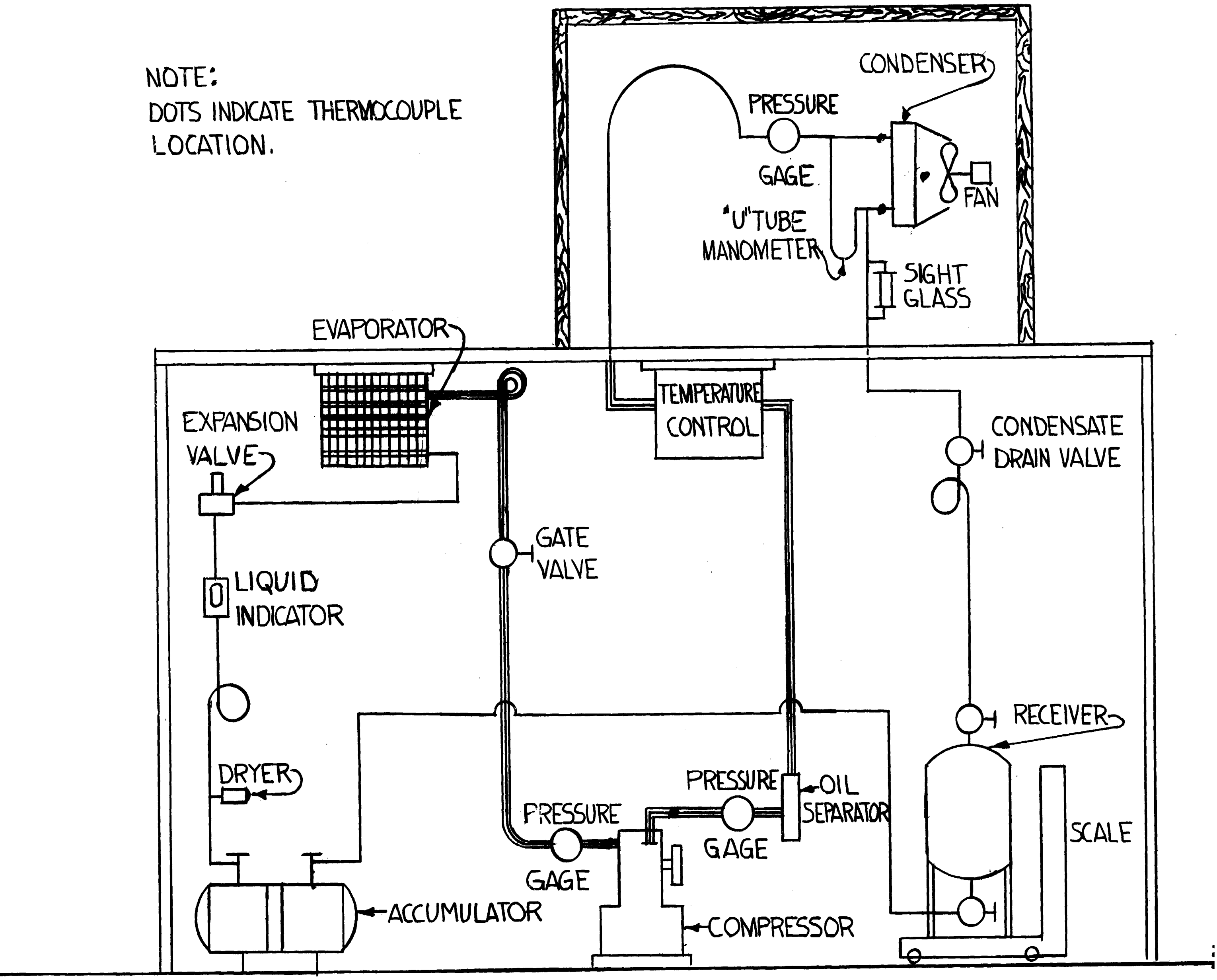
NOTE:
DOTS INDICATE THERMOCOUPLE LOCATION.
CONDENSER
PRESSURE
GAGE
FAN
"U" TUBE
MANOMETER
SIGHT GLASS
EVAPORATOR
EXPANSION VALVE
TEMPERATURE CONTROL
CONDENSATE DRAIN VALVE
GATE VALVE
LIQUID INDICATOR
RECEIVER
DRYER
PRESSURE
OIL SEPARATOR
PRESSURE
GAGE
GAGE
SCALE
ACCUMULATOR
COMPRESSOR

FIGURE 1

EB