UNITED TECHNOLOGIES CARRIER	Commercial Division Carrier Corporation	BULLETIN: CA-SB-19-D-65-26 DATE: 4/14/65 PAGE: 1 OF: 4
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SUBJECT: NON LINEAR THROTTLING RANGE BARBER-COLMAN CONTROLS, 19D		

PURPOSE: To transmit information concerning a change to Barber-Colman chilled water modules which will produce non-linear throttling range.

MACHINES AFFECTED: All 19D machines with console serial number 35650 and higher having Barber-Colman controls.

PROCEDURE: The Barber-Colman control systems used in the past on the 19D machines utilized linear throttling range to improve control stability. Linear throttling range is shown in Figure 1, Curve A.

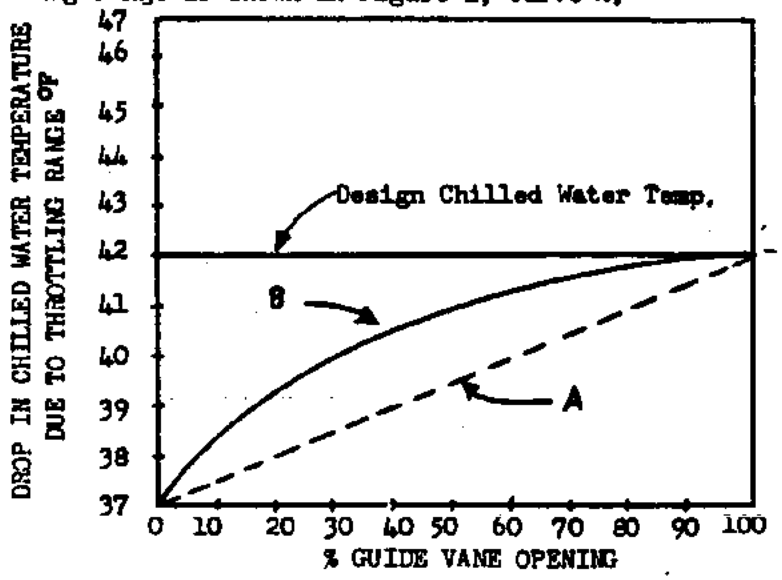

FIGURE 1

EFFECT OF THROTTLING RANGE ON CHILLED WATER TEMPERATURE

It has been found, experimentally, that there is further improvement in control stability by making the throttling range non-linear. This is illustrated in Curve B.

Control stability improves with non-linear throttling range because the effect of changes in guide vane opening on machine capacity is non-linear as shown in Figure 2.

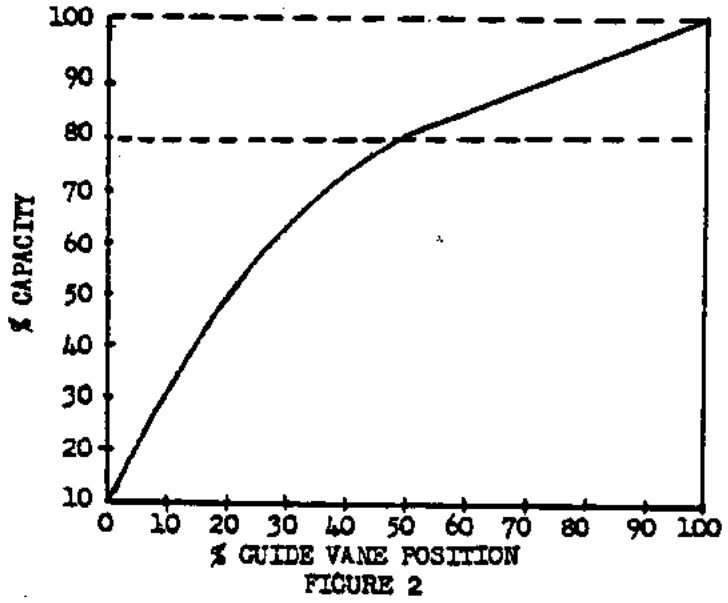

FIGURE 2

EFFECT OF VANE POSITION ON MACHINE CAPACITY

Non-linear throttling range follows this non-linear relationship between per cent guide vane opening and machine capacity during machine operation and quickly stabilizes the controls after changes in cooling load.

Referring to Figure 3, the change to the Barber-Colman chilled water module to make the throttling range non-linear is as follows:

1. Addition of a 47 ohm 1/2 watt resistor between terminals TC and TB on the chilled water module.

2. Addition of a 1500 ohm 1/2 watt resistor between terminals V and W on the chilled water module.

3. Addition of a 220 ohm 1/2 watt resistor between terminals TB on the chilled water module and Jones plug pin connection #6.

B-C controls on 19D machines with consoles having serial number 35650 and higher have the changes listed above.

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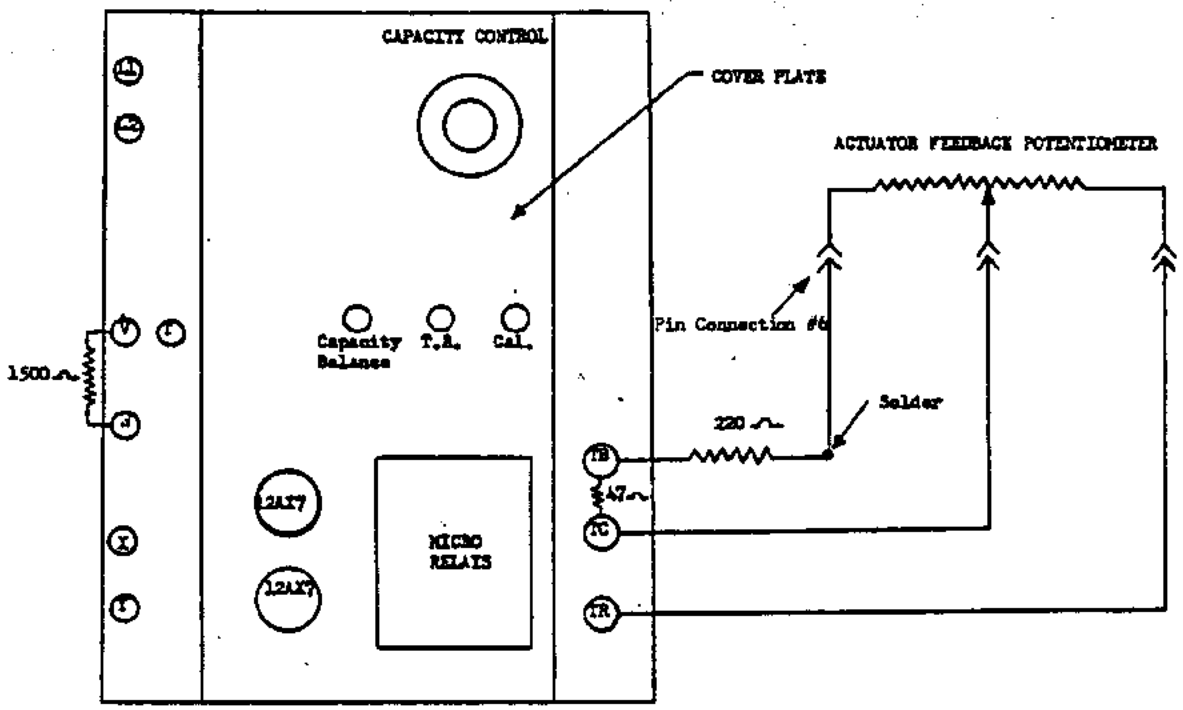

FIGURE 3

SCHEMATIC OF NON-LINEAR FEEDBACK MODIFICATION

If an existing field 19D machine not having the non-linear modification experiences "hunting", the non-linear modification should be installed only after standard calibration and trouble-shooting procedures fail. Figure 3 illustrates how this must be done.

Replacement modules ordered from Service Parts after 1/20/64 and/or modules repaired and exchanged with Barber-Colman have the non-linear modification already installed. The only difference between replacing the module without the modification with one having the modification is that the 220 ohm resistor connected to terminal TB on the modified module must be soldered to the wire that went to terminal TB on the module replaced.

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Normally, full load on the 19D machine occurs at less than 100% guide vane position. Slightly more throttling range, therefore, will have to be added to the control system than is desired to obtain the correct amount of effective throttling range. For example, if machine full load occurs at 70% guide vane position and 3° of effective throttling range is desired for control stability, approximately 5° of total throttling range will have to be added. The reason for this is that the guide vane movement will cover a small per cent of the total available throttling range on the vane actuator feedback potentiometer.