TRANE® AIR CONDITIONING

FILE INFORMATION:
DIVISION TAB-TRANE REFRIGERATION PRODUCTS
PRODUCT TAB-MISCELLANEOUS
LITERATURE ITEM-GENERAL SERVICE BULLETIN

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GENERAL SERVICE BULLETIN

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SUBJECT: AMPERAGE UNBALANCE DETECTION IN 3 PHASE, 3 WIRE ELECTRIC MOTORS

INTRODUCTION

Three phase, three wire electric motor applications occasionally encounter a current unbalance condition. This bulletin provides a means of determining whether the unbalance is caused by the supply (line), motor (load) or a combination of both. This bulletin applies to all products with this motor application.

DISCUSSION

Designate the currents read in the supply line as A, B, C.

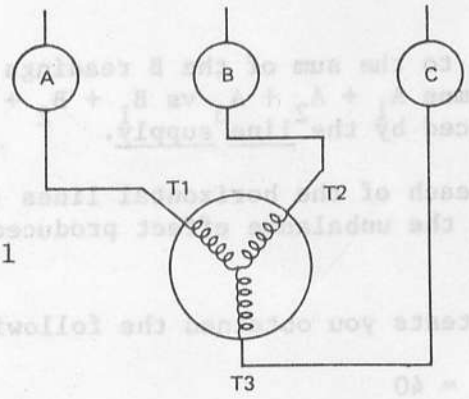

FIGURE 1

Run the motor and record the amperage readings in supply lines A, B, C. Designate the readings obtained as A_1, B_2, C_3.

NOTE: In a motor-compressor installation maintain a sustained load when recording currents.

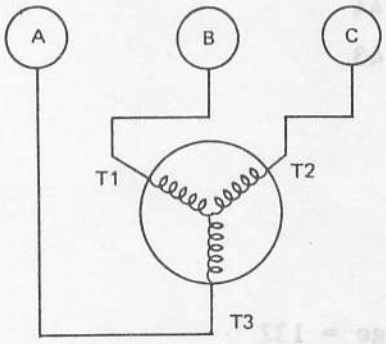

FIGURE 2

Reconnect T_1 to B, T_2 to C and T_3 to A. (Figure 2) Run the motor and record the amperage readings as A_3, B_1, C_2.

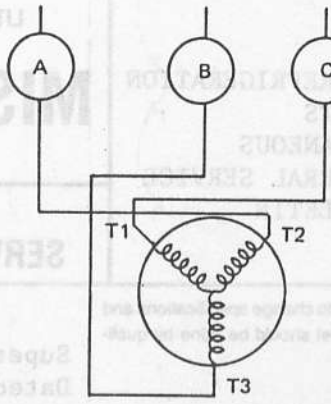

FIGURE 3

Reconnect T_1 To C, T_2 to A, T_3 to B. (Figure 3) Run the motor and record the amperage readings as A_2, B_3, C_1.

RESULTS

Tabulation of the previous readings obtained will explain the unbalance effect.

Record the readings as follows:

	A	B	C	
1.	A_1	B_1	C_1	Total $(A_1 + B_1 + C_1)$ =
2.	A_2	B_2	C_2	Total $(A_2 + B_2 + C_2)$ =
3.	A_3	B_3	C_3	Total $(A_3 + B_3 + C_3)$ =

Total Vertical:

Comparing the sum of the A readings to the sum of the B readings or the sum of the C readings in the vertical columns $A_1 + A_2 + A_3$ vs $B_1 + B_2 + B_3$ vs $C_1 + C_2 + C_3$ gives the unbalance effect produced by the line supply.

Comparing the sum of the totals in each of the horizontal lines ($A_1 + B_1 + C_1$ vs $A_2 + B_2 + C_2$ vs $A_3 + B_3 + C_3$) gives the unbalance effect produced by the motor (load).

Example #1: Assume by running the tests you obtained the following readings:

1st run: $A_1 = 50$ $B_2 = 45$ $C_3 = 40$

2nd run: $A_3 = 44$ $B_1 = 49$ $C_2 = 44$

3rd run: $A_2 = 41$ $B_3 = 40$ $C_1 = 43$

Tabulate the data as follows:

	A	B	C		Total	
1.	50	49	43	=	142	
2.	41	45	44	=	130	Average = 132
3.	44	40	40	=	124	
	135	134	127	-	Total	

Average = 132

Unbalance due to line supply =

$$\frac{\text{Max-Min}}{\text{Average}} = \frac{135-127}{132} = \frac{8}{132} = 6\%$$

Unbalance in motor lead =

$$\frac{142-124}{132} = 13\%$$

In this example we would conclude that the motor is the major source of unbalance.

Example #2:

1st run: $A_1 = 49$ $B_2 = 44$ $C_3 = 39$
2nd run: $A_3 = 48$ $B_1 = 44$ $C_2 = 44$
3rd run: $A_2 = 44$ $B_3 = 39$ $C_1 = 44$

Tabulating:

	A	B	C		Total	
1.	49	44	44	=	137	
2.	44	44	44	=	132	Average = 131.7
3.	48	39	39	=	126	
	141	127	127	-	Total	

Average 131.7

Unbalance due to line supply =

$$\frac{141-127}{131.7} = 10.7\%$$

Unbalance in motor load =

$$\frac{137-126}{131.7} = 8.3\%$$

In this example we would conclude that the major source of unbalance is due to the line supply.

While the method previously described neglects to account for interaction effects, it is sufficiently ample for most field analyses and provides an easy method for determining the source of major difficulty in many motor applications where current unbalance is prevalent.