Temperature Rise Test of Transformer Filled with Envirotemp FR3 Fluid

XYZ Inc. has built and tested a power transformer filled with FR3 fluid.

Transformer ratings: 24/32/40 MVA

HV winding: 69GrdY/39.84 kV
LV winding: 13.8 kV delta

HV winding: disk winding, 80 sections
20 keyspacer rows
keyspacer thickness = 0.1875 in.
keyspacer width = 1.5 in.
inner and outer axial duct = 0.375 in.
axial corrugated duct = 0.1875 in.

LV winding: disk winding, 62 sections
16 keyspacer rows
keyspacer thickness = 0.1875 in.
keyspacer width = 1.5 in.
inner and outer axial duct = 0.375 in.
7 oil flow washers

Total losses:
ONAN: 84.8 kW
ONAF: 207.2 kW

The total volume of the fluid in the transformer = 3150 gal (11920 L).
Transformer had 5 radiators (36 plates, 96 in. x 20.5 in.) and 8 fans (1/3 HP each)

Table 1. Calculated and tested temperature rise values in °C

	ONAN (24 MVA)		ONAF (40MVA)	
	Calculated	Tested	Calculated	Tested
Top oil rise	47.0	49.2	56.8	52.6
Mean oil rise	40.2	36.5	39.9	33.5
Bottom oil rise	33.5	23.5	23.0	14.3
LV rise	46.7	40.0	54.4	47.1
HV rise	46.2	45.0	53.7	52.0
LV gradient	6.5	3.8	14.5	13.6
HV gradient	6.0	8.5	13.8	18.5