SUNBELT TRANSFORMER POWER REPAIR SPECIFICATIONS

1.0 General

It is the intent to have the listed transformer repaired or redesigned and remanufactured by the latest application ANSI, IEEE, EEI and NEMA Standards

The transformer is to be repaired or rebuilt to the original nameplate voltage (including taps), KVA rating, and temperature rise (See item 2.0 for design options). Original impedance (see 4.3) and losses will be maintained.

Engineering meetings will be held as required to facilitate agreement on repair or redesign details.

2.0 Design Options

During the initial period of the redesign process, the supplier's design engineer will determine if a reduction in load losses or an increase in KVA rating is possible. If either option exists, and it is economically favorable to CUSTOMER, the engineer will advise the CUSTOMER transformer repair representative to determine his interest in pursuing the improvement. If the offer is acceptable, a quotation affirming the degree of improvement and its additional cost will be submitted to the CUSTOMER transformer repair representative for final approval.

The increase in KVA rating will be accepted on the basis of the supplier's design engineer calculations unless later field tests during the warranty period indicate that the expected increase in capacity was not attained. If this happens the supplier and CUSTOMER will negotiate a settlement.

3.0 Short Circuit Design Criteria

After remanufacture, the transformer shall meet the short circuit withstand requirements of ANSI/IEEE C57.11122.00-1987 or latest revision.

All windings are to be redesigned to minimize the short circuit forces. A computer short circuit analysis shall be made to determine the maximum short circuit forces by use of the Anderson Program. The mechanical structure of the windings, supporting elements, clamping rings, and bracing devices shall be upgraded to current standards for new transformers of similar size and design. Included in the mechanical redesign but not limited to, are the following:

3.1 Full nonmetallic high density top clamping ring of sufficient size to restrain the static and short circuit pressures and to give full radial spacer support; full coil spacer support on the bottom.

3.2 Sufficient high-density radial spacers to limit mechanical stress in the winding conductors to acceptable values.

3.3 Jack bolts, lock irons, and tie rods shall be added or modified as required to restrain the static and short circuit forces.

3.4 Additional gussets and bracing to top and bottom mechanical structures as required.

3.5 All internal thyrites used for winding and tap protection shall be eliminated, if possible.

4.0 Windings

All windings shall be redesigned using rectangular copper conductor with thermally upgraded insulation; coil shape shall be cylindrical.

4.1 Winding Insulation Materials: All winding cylinders shall be pre-compressed high-density material. All radial spacers shall be of pre-compressed high-density material with rounded edges.

4.2 Temperature Rise: The average winding temperature rise by resistance of the transformer shall be specified in the Engineering data. All windings shall meet the guaranteed temperature rise.

4.3 Impedance: The new design shall result in an impedance that is within 7.5% of the original nameplate impedance unless specified by CUSTOMER.

5.0 Core

The core shall be thoroughly cleaned and inspected for damage. If core damage is found and the repair will increase the cost of remanufacture, the supplier will provide a firm price quotation for these repairs to the CUSTOMER transformer repair representative.

5.1 Core Bolts: All core bolts in the Legs shall be eliminated. The core shall be sufficiently blocked to prevent movement of the core laminations.

5.2 Core Insulation: All core insulation material shall be replaced with new insulation.

5.3 Core Ground: The core ground connection shall be brought out of the transformer tank through an appropriate method so that core ground readings may be taken without having to remove a manhole cover. The core grounding bushing shall be clearly labeled on the transformer and shall be shown on the outline drawing.

6.0 Coil Stack Insulation

All insulation in the core opening (interphase barriers) shall be new. Materials subject to high mechanical stresses shall be high density.

7.0 Mechanisms

The No Load Tap Changer (NLTC) and/or the Load Tap Changer (LTC) mechanism shall be thoroughly cleaned. Defective or worn parts shall be inspected and tested for proper operation before reassembly. If any mechanism items are found defective, the CUSTOMER transformer repair representative will be notified with a cost of repair quote. No repair of the mechanisms is included if not specifically stated.

8.0 Miscellaneous

8.1 Auxiliary Transformer: When applicable, the series transformer, preventive autotransformer, all CT's within the tank and all other auxiliary windings within the tank shall be thoroughly flushed, cleaned, dried, and tested. If any auxiliary items are found

defective, the CUSTOMER transformer repair representative will be notified with a cost of repair quote. No repair of auxiliary transformers shall be made until approved by CUSTOMER.

8.2 Lead Support Structures: The lead support shall be thoroughly cleaned and inspected for damage before reusing. Damaged materials shall be replaced.

8.3 Accessories: All gauges, valves and accessories shall be inspected and checked for proper operation. All bushings shall be inspected and preliminary tests made before reuse. If any accessory items are found defective, the CUSTOMER transformer repair representative will be notified with a cost of repair quote. No repair of accessories shall be made until approved by CUSTOMER.

8.4 Gaskets: All gaskets used for air or oil seal shall be replaced. This is to include, where applicable, gaskets in the LTC panel between the main tank and the TLC housing.

8.5 Tank and Radiators: Before retanking the core & coil assembly, the tank and radiators (if applicable) shall be straightened (as required), thoroughly flushed, cleaned and dried. The tank and radiators shall be properly prepared for painting.

8.6 Leaks: The transformer tank and all gasketed equipment shall be thoroughly tested and checked for leaks. All leaks are to be repaired.

8.7 Paint: One (1) primer coat to be applied over properly prepared metal surfaces and one (1) finish coat of ANSI #70 GRAY. Option to paint the inside of the transformer shall be separate bid.

8.8 Shipment: The transformer shall be shipped filled with NEW oil, and nitrogen. Supplier shall install a pressure/vacuum gauge on the transformer tank before shipment to show whether or not adequate pressure or vacuum has been maintained during shipment.

8.9 Nameplate: All units shall be equipped with an auxiliary nameplate or a new nameplate, as required, to indicate changes and date of remanufacture. If a nameplate change is required, a reproducible nameplate drawing shall be supplied. Reproducible drawing size shall be 8.5" x 11".

8.10 Modification can be made to the LTC to utilize a digital Beckwith controller. Sunbelt can provide firm prices for this service.

9.0 Dry out

The transformer core and coil assembly shall be vacuum dried. The insulation power factor shall be monitored during dry out.

10.0 Tests

The following tests are to be performed on the remanufactured transformer by the latest revision of ANSI or IEEE specifications (ANSI C57.12.00, ANSI C57.12.90):

10.1 Ratio and Polarity tests - With the LTC on neutral position, make ratio tests on each position of the NLTC selector switches. With the NLTC on nameplate voltage tap, make a ratio test on each phase on each LTC position.

10.2 Resistance - all winding at rated voltage position and all tap extremes.

10.3 Power Factor - insulation by ANSI C57.12.90-73, Method II (not to exceed 0.5% corrected to 20 degrees C).

10.4 Polarity and phase rotation tests.

10.5 No Load Loss - no load loss and percent excitation current at 100% and 110% voltage before and after impulse tests.

10.6 Load Loss - load loss and percent impedance at rated KVA with all windings at rated voltage position and tap extremes.

10.7 Induced potential tests.

10.8 Applied potential tests.

10.9 Megger - core insulation resistance.

10.10 Dew point (immediately before shipment) if shipped without oil.

10.11 Impulse - performed at Sunbelt facility.

10.12 Temperature rise - option (supplier is to make a separate quote).

A certified test report shall be supplied which includes results of the above tests and winding connections as shipped.

NEW non-PCB oil will be used to refill the unit.

11.0 Inspection

11.1 Supplier will notify the CUSTOMER transformer repair representative when the faulted transformer is available for inspection.

11.2 Supplier will provide the CUSTOMER transformer repair representative with sufficient advance notice so an option to inspect the rebuilt windings can be exercised before drying and tanking.

11.3 Supplier will notify the CUSTOMER transformer repair representative several days in advance of when testing will commence so the CUSTOMER transformer repair representative can make arrangements to be at the plant to witness all testing.

12.0 Work Progress Reports

12.1 Within thirty (30) days following receipts of CUSTOMER'S purchase order for the transformer repair, the supplier will submit a detailed "Work Progress Schedule". The schedule will show each work activity by months in a bar chart or similar format.