We have not specified any specific direction of power flow in the specification. Hence can we expect that the transformer is suitable for bi-directional power flow?

6.4.3 Functional specification

This type of specification is intended to allow the purchaser to specify operational requirements and not the category of voltage variation or which winding is to be tapped.

This method of specification is not applicable to separate-winding transformers up to and including 2 500 kVA with a tapping range not exceeding ±5 %.

The following information shall be given by the purchaser in the enquiry in addition to the rated voltage and rated power defined in Clause 5:

a) Direction of power flow (can be both directions).

b) The number of tapping steps and the size of the tapping step expressed as a percentage of the rated voltage at the principal tapping. If the tapping range is not symmetrical about the principal tapping then this shall be indicated. If the tapping steps are not equal across the range then this shall be indicated.

NOTE 1 It may be that the range of variation and the number of steps is more important than achieving the exact voltage at the principal tap. In this case the range of variation and the number of steps may be specified. For example +5 % to –10 % in 11 steps.

c) Which voltage shall vary for the purpose of defining rated tapping voltage.

NOTE 2 The rated tapping voltage is needed to determine the impedance base for each tap. Where the functional method of specification is adopted, the rated tapping voltage cannot be used to determine the rated tapping power.

d) Any requirements for fixing the ratio of turns between two particular windings on a more than two winding transformer.

e) Minimum full load power factor (this affects the voltage drop of the transformer).

f) Whether any tapping or range of tappings can be reduced power tappings.

The manufacturer will choose the arrangement of windings, the winding or windings that are tapped. The transformer shall be able to supply the rated current on the secondary winding on all tapping positions consistent with the above operating conditions, without exceeding the temperature rise requirements defined by IEC 60076-2.

The transformer shall be designed to withstand without damage the voltages and fluxes arising from the above specified loading conditions (including any specified overload conditions). A calculation showing that this condition is satisfied shall be supplied to the purchaser on request.

An example is given in Annex B (example 4).

Alternatively, the user may submit a set of loading cases with values of active and reactive power (clearly indicating the direction of power flow), and corresponding on-load voltages. These cases should indicate the extreme values of voltage ratio under full and reduced power (see "the six-parameter method" of IEC 60076-8). Based on this information, the manufacturer will then select the tapped winding and specify rated quantities and tapping quantities in his tender proposal. An agreement shall be reached between the manufacturer and the purchaser on the design tapping quantities.

6.5 Specification of short-circuit impedance

For transformers with no tappings exceeding a voltage variation of ±5 % from the principal tapping, the short-circuit impedance of a pair of windings shall be specified at the principal tapping only, either in terms of ohms per phase Z or in percentage terms z referred to the rated power and rated voltage of the transformer (see 3.7.1). Alternatively, the impedance may be specified in accordance with one of the methods below.

For transformers with tappings exceeding a voltage variation of ±5 % from the principal tapping, impedance values expressed in terms of Z or z shall be specified for the principal