



دولة الإمارات العربية المتحدة
الهيئة الاتحادية للكهرباء والماء
Federal Electricity & Water Authority



STANDARD TECHNICAL SPECIFICATIONS FOR ELECTRIC WORKS

TRANSFORMERS / REACTORS / RESISTORS

(SPECIFICATION)

FILTER REACTORS (GAPPED-IRON CORE, INDOOR TYPE)

FEWA STANDARD : S-TRAFO-FR-G (REV.0-2010)



TRANSFORMERS / REACTORS / RESISTORS
Filter Reactors (Gapped-Iron Core, Indoor Type)

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1 GENERAL

This part of the Specifications covers the design, manufacture, factory testing, transport, marking, packing, shipping, delivery to site, unloading and storage at site, erection, commissioning and handing over in satisfactory operating condition of the filter reactors.

The reactors shall be designed and arranged in full compliance with all applicable Sections, Articles, Technical Data Sheets and latest international standards.

1.1 Equipment Identification and Color Codes

Concerning Reactor identification and color codes please refer to latest international standards.

2 TECHNICAL DESCRIPTION

2.1 General Design

The design of the reactors shall be based on the following requirements:

- The reactors shall be designed for indoor operation at ambient temperatures up to a maximum of 50°C
- The maximum permissible winding average temperature rise shall not exceed 90 K at highest operation voltage, i.e. at 110% at specified rated continuous current for neutral grounding reactors
- The reactors shall be naturally air-cooled (AN)
- Filter reactors shall be capable of withstanding short-circuits of for at least 2 seconds.

Furthermore, each reactor shall comply with the stipulations of the following Articles.

2.2 Windings

All reactor windings shall have uniform insulation. The insulation levels of the reactor windings shall not be less than LI: 75 kV, AC: 38 kV.

Particular values for insulation and test levels shall be obtained from the description of the Scope of Work / Scope of Supply and the Technical Data Sheets of these Specifications.

Copper or aluminium of a high conductivity and insulation material of high quality shall be used. Insulation shall be given tropical and fungicidal treatment suitable for hot, humid climate, The thermal class in accordance with IEC 60085 and IEC 60726 shall be "F". However the temperature rise limit shall not exceed 90 K for windings designed for thermal class "F" at 110% of rated current.



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The insulation material of windings and connections shall be of resin impregnated encapsulation, free from insulation compounds subject to shrinking or collapse during service.

The coil etc. shall be completely painted with a high-quality two-pack insulation paint. The dry-film thickness shall be minimum 40 μm .

The coils must be capable of withstanding movement and distortion caused by all operating conditions. All leads or bars from the windings shall be rigidly supported. Stresses on coils and connections must be avoided.

The Bidder/Contractor shall demonstrate the ability of withstanding thermal short circuits for the windings after full load by a calculation in accordance with IEC 60076-5. For this purpose the temperature value shall be assumed with 140°C for class F to be the initial temperature before short circuit. The max. permissible value of the average temperature of the windings after short circuit shall not exceed 250°C for copper windings and is to be limited to 200°C for aluminium windings.

2.3 Magnetic Core

A gapped-iron core form type shall be provided. The magnetic core shall be made of laminations of non-ageing, cold-rolled, grain-oriented, silicon steel of high sufficient permeability without burrs. Each lamination shall be insulated with high quality insulation coating.

The core and its tie rods etc. shall form a rigid unit structure that shall maintain its form and position under the severe stresses encountered during shipment, installation and short circuits.

Care shall be taken to secure uniformly distributed mechanical pressure over all the legs to limit noise and vibrations to a minimum under service conditions.

The maximum magnetic flux density in the legs and yokes of the core of the reactors shall not exceed 1.1 Tesla at highest permissible continuous operation voltage (at least 110% of rated voltage across reactor).

2.4 Structure

The structure shall consist of suitable C-profiles rigidly fixed onto the upper and lower yoke of the core.

Four lifting lugs shall be provided on the upper frame as well as traverses under the bottom as a mounting base.

Bi-directional wheels with blocking facilities shall be provided.

Two earthing terminals of adequate size shall be provided and installed diagonally at the lower part of the reactor.



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2.5 Terminals and Insulators

The windings shall be equipped with suitable terminal link strips. All necessary bi-metallic and/or other parts required for proper connection of all conductors to be connected shall be included in the supplies.

Support insulators, if any, shall be of top quality electrical grade cast resin and shall be of a uniform shade of brown.

2.6 Cooling

The reactor shall be provided with a self-cooled type of cooling system (AN).

2.7 Name Plates and Other Designation Plates

The following plates made of engraved polished stainless steel of top quality, such as V4A, INOX A4 or equivalent Cr-Ni-Mo-Ti alloyed stainless steel, shall be supplied:

- A rating plate in accordance with IEC 60726 and IEC 60289
- A diagram plate showing in an approved manner the connections and, in addition, a plan view of the reactor giving the correct physical relationship of the terminals.

2.8 Drawings and Documents

To be provided by the bidder / contractor.

- Technical data sheets (with diagram for minimum magnetic clearances, including closed loops)
- Post insulators and mounting facilities.

3 TESTING AND INSPECTION

3.1 General

Each of the reactors shall be subjected to inspections and acceptance tests to be performed at the manufacturer's premises (recognised and certified at least by ISO 9001) and at site, as specified hereinafter in order to verify their conformity with the guaranteed and other design data.

The Bidder/Contractor is obliged to submit a detailed test program - including detailed test connections for all dielectric tests - for approval in due time, prior to the tests (at the latest three months before testing).

Detailed test schedules separately for each unit showing working-day-wise when each of the witness tests will be carried out shall be submitted for approval along with the test program as above.

During all applicable witness tests the applied test frequency has to be supervised and to be stated in the test reports.



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The reactors shall be completely assembled in every respect. All of the tests shall be performed with all original bushings installed.

The tests shall be performed in accordance with the latest issues of the Recommendations of the International Electrotechnical Commission (IEC-standards) supplemented by these Specifications.

The following tests shall be performed in the presence of FEWA.

3.2 Factory Tests

3.2.1 Routine Tests

- Measurement of winding resistance
- Determination of inductance
- Measurement of the continuous voltage across filter reactors at rated continuous current
- Measurement of losses
- Lightning impulse tests with positive polarity on the incoming and outgoing terminals of all reactors. The test voltages shall be measured via appropriate voltage dividers and shall be clearly indicated by peak-voltmeters and/or in oscillographic or digital records
- Separate source AC voltage withstand test in accordance with IEC 60076-3, sub-clause 11, after impulse tests
- Measurement of Q-factor.

3.2.2 Type Tests and Special Tests

- Steady state temperature rise test at rated continuous current.

3.3 Site Tests (minimum requirements)

The following site tests shall be performed at site as a minimum requirement:

- Measurement of winding resistance
- Measurement of the insulation resistance at 5000 V, DC
- Visual checks.

4 CORROSION PROTECTION

For Corrosion Protection measures, reference shall be made to latest international standards.

5 CAPITALISATION OF LOSSES

When evaluating the individual tenders received from the various tenderers reactor total losses will be capitalised as follows by AED 5,000.00 per kW.



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6 GUARANTEED VALUES AND PENALTIES

The guaranteed values tendered by the Bidder/Contractor in the Technical Data Sheets will be strictly observed by both the Bidder/Contractor and FEWA.

For the guarantee data not mentioned hereinafter tolerances in accordance with IEC 60076 and IEC 60289 shall apply.

If the total losses the reactors exceed the guaranteed value, the sum of the load losses in excess of all ordered reactors of this type will be considered and an amount of AED 5,000.00 per kW for each full kW in excess will be deducted from the Contract Price.

It is thereby understood that values of 0.5 kW and above will be rounded up to the next full kW.

7 REJECTION

ADWEA shall have the right to reject any reactor if the actual values are in excess of the guaranteed values by more than the margins specified hereunder (including the tolerances):

• Total losses	+ 10%
• Temperature rise limit	+ 0.0 K.

For all of the other values the margins stated in IEC standards are applicable, unless specified otherwise elsewhere in these Specifications.

8 TRANSPORT

The reactors shall be transported and shipped in a moisture-proof, sea-worthy packing in accordance with the usual international standard.